# *Tabular Data*

## *Economic Analysis of Devils Lake Alternatives*

*July 2001*

# Tabular Data
# Economic Analysis of Devils Lake Alternatives

## Table of Contents


TD.1.0 Introduction ..... TD.1-1
- TD.1.1 Description of Reports ..... TD.1-1
- TD.1.2 Scenarios ..... TD.1-1
- TD.1.3 Alternatives ..... TD.1-2
- TD.1.4 Tabular Data ..... TD.1-3

TD.2.0 Stochastic Scenario ..... TD.2-1

TD.3.0 Wet Future Scenario ..... TD.3-1

TD.4.0 Moderate Future 1 Scenario: 1450 Peak Lake Level ..... TD.4-1

TD.5.0 Moderate Future 2 Scenario: 1455 Peak Lake Level ..... TD.5-1

TD.6.0 Dry Future Scenario ..... TD.6-1


## List of Tables


Table TD.1 Categories of Traces for Evaluating Impacts of Alternatives and Sensitivity Analyses

Table TD.2 List of Analyses


## Stochastic Scenario

**List of ST-1 Tables (Stochastic - Upper Basin Management)**


Table TD.2.ST-1.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.2.ST-1.2 Sets of Feature Strategies

Table TD.2.ST-1.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.2.ST-1.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.2.ST-1.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.2.ST-1.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.2.ST-1.7 Cost and Benefit Summary: 4 Sets of Feature Strategies


**List of ST-2a Tables (Stochastic – Maximum Infrastructure Protection)**


Table TD.2.ST-2a.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.2.ST-2a.2 Sets of Feature Strategies

## Table of Contents (continued)


Table TD.2.ST-2a.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies

Table TD.2.ST-2a.4 Cost and Benefit Summary with Maximum Infrastructure Protection

**List of ST-2b Tables (Stochastic – Expanded Infrastructure Measures)**

Table TD.2.ST-2b.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.2.ST-2b.2 Sets of Feature Strategies

Table TD.2.ST-2b.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.2.ST-2b.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.2.ST-2b.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.2.ST-2b.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.2.ST-2b.7 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of ST-3 Tables (Stochastic – West Bay 300 cfs Constrained Outlet)**

Table TD.2.ST-3.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.2.ST-3.2 Sets of Feature Strategies

Table TD.2.ST-3.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.2.ST-3.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.2.ST-3.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.2.ST-3.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.2.ST-3.7 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of ST-4 Tables (Stochastic – West Bay 480 cfs Unconstrained Outlet)**

Table TD.2.ST-4.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.2.ST-4.2 Sets of Feature Strategies

Table TD.2.ST-4.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.2.ST-4.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.2.ST-4.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.2.ST-4.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.2.ST-4.7 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of ST-5 Tables (Stochastic – Pelican Lake 300 cfs Constrained Outlet)**

Table TD.2.ST-5.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.2.ST-5.2 Sets of Feature Strategies

Table TD.2.ST-5.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.2.ST-5.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.2.ST-5.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.2.ST-5.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.2.ST-5.7 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of ST-6 Tables (Stochastic – Pelican Lake 480 cfs Unconstrained Outlet)**

Table TD.2.ST-6.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.2.ST-6.2 Sets of Feature Strategies

Table TD.2.ST-6.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.2.ST-6.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.2.ST-6.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.2.ST-6.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.2.ST-6.7 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of ST-7a Tables (Stochastic – Combination 1 – Upper Basin Management and Maximum Infrastructure Protection)**

Table TD.2.ST-7a.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.2.ST-7a.2 Sets of Feature Strategies

Table TD.2.ST-7a.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies

Table TD.2.ST-7a.4 Cost and Benefit Summary with Maximum Infrastructure Protection

**List of ST-7b Tables (Stochastic – Combination 1 – Upper Basin Management and Expanded Infrastructure Measures)**

Table TD.2.ST-7b.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.2.ST-7b.2 Sets of Feature Strategies

Table TD.2.ST-7b.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.2.ST-7b.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.2.ST-7b.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.2.ST-7b.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.2.ST-7b.7 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of ST-8a Tables (Stochastic – Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection)**

Table TD.2.ST-8a.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.2.ST-8a.2 Sets of Feature Strategies

Table TD.2.ST-8a.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies

Table TD.2.ST-8a.4 Cost and Benefit Summary with Maximum Infrastructure Protection

**List of ST-8b Tables (Stochastic – Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures)**

Table TD.2.ST-8b.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.2.ST-8b.2 Sets of Feature Strategies

Table TD.2.ST-8b.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.2.ST-8b.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.2.ST-8b.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.2.ST-8b.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.2.ST-8b.7 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of ST-10 Tables (Stochastic – East End 480 cfs Unconstrained Outlet)**

Table TD.2.ST-10.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.2.ST-10.2 Sets of Feature Strategies

Table TD.2.ST-10.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.2.ST-10.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.2.ST-10.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.2.ST-10.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.2.ST-10.7 Cost and Benefit Summary: 4 Sets of Feature Strategies

## Wet Future Scenario

### List of WF-1 Tables (Wet Future - Upper Basin Management)


Table TD.3.WF-1.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-1.2 Sets of Feature Strategies

Table TD.3.WF-1.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-1.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-1.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-1.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-1.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-1.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-1.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-1.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-1.11 Cost and Benefit Summary: 4 Sets of Feature Strategies


### List of WF-2a Tables (Wet Future – Maximum Infrastructure Protection)


Table TD.3.WF-2a.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-2a.2 Sets of Feature Strategies

Table TD.3.WF-2a.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies

Table TD.3.WF-2a.4 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-2a.5 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-2a.6 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-2a.7 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-2a.8 Cost and Benefit Summary with Maximum Infrastructure Protection


### List of WF-2b Tables (Wet Future – Expanded Infrastructure Measures)


Table TD.3.WF-2b.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-2b.2 Sets of Feature Strategies

Table TD.3.WF-2b.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-2b.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-2b.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-2b.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-2b.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-2b.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-2b.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-2b.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-2b.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of WF-3 Tables (Wet Future – West Bay 300 cfs Constrained Outlet)**

Table TD.3.WF-3.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-3.2 Sets of Feature Strategies

Table TD.3.WF-3.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-3.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-3.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-3.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-3.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-3.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-3.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-3.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-3.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of WF-4 Tables (Wet Future – West Bay 480 cfs Unconstrained Outlet)**

Table TD.3.WF-4.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-4.2 Sets of Feature Strategies

Table TD.3.WF-4.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-4.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-4.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-4.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-4.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-4.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-4.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-4.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-4.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of WF-5 Tables (Wet Future – Pelican Lake 300 cfs Constrained Outlet)**

Table TD.3.WF-5.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-5.2 Sets of Feature Strategies

Table TD.3.WF-5.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-5.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-5.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-5.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-5.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-5.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-5.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-5.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-5.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of WF-6 Tables (Wet Future – Pelican Lake 480 cfs Unconstrained Outlet)**

Table TD.3.WF-6.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-6.2 Sets of Feature Strategies

Table TD.3.WF-6.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-6.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-6.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-6.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-6.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-6.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-6.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-6.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-6.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of WF-7a Tables (Wet Future – Combination 1 – Upper Basin Management and Maximum Infrastructure Protection)**

Table TD.3.WF-7a.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-7a.2 Sets of Feature Strategies

Table TD.3.WF-7a.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies

Table TD.3.WF-7a.4 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-7a.5 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-7a.6 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-7a.7 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-7a.8 Cost and Benefit Summary with Maximum Infrastructure Protection

**List of WF-7b Tables (Wet Future – Combination 1 – Upper Basin Management and Expanded Infrastructure Measures)**

Table TD.3.WF-7b.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-7b.2 Sets of Feature Strategies

Table TD.3.WF-7b.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-7b.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-7b.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-7b.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-7b.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-7b.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-7b.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-7b.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-7b.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of WF-8a Tables (Wet Future – Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection)**

Table TD.3.WF-8a.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-8a.2 Sets of Feature Strategies

Table TD.3.WF-8a.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies

Table TD.3.WF-8a.4 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-8a.5 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-8a.6 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-8a.7 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-8a.8 Cost and Benefit Summary with Maximum Infrastructure Protection

**List of WF-8b Tables (Wet Future – Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures)**

Table TD.3.WF-8b.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-8b.2 Sets of Feature Strategies

Table TD.3.WF-8b.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-8b.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-8b.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-8b.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-8b.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-8b.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-8b.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-8b.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-8b.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of WF-10 Tables (Wet Future – East End 480 cfs Unconstrained Outlet)**

Table TD.3.WF-10.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-10.2 Sets of Feature Strategies

Table TD.3.WF-10.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-10.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-10.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-10.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-10.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-10.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

## Table of Contents (continued)


Table TD.3.WF-10.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-10.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-10.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of WF-11 Tables (Wet Future – Raise Natural Outlet)**

Table TD.3.WF-11.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-11.2 Sets of Feature Strategies

Table TD.3.WF-11.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-11.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-11.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-11.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-11.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-11.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-11.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-11.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-11.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of WF-12 Tables (Wet Future – Outlet Erosion: West Bay 300 cfs Constrained Outlet)**

Table TD.3.WF-12.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-12.2 Sets of Feature Strategies

Table TD.3.WF-12.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-12.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-12.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-12.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-12.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-12.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-12.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-12.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-12.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

## Table of Contents (continued)

**List of WF-13 Tables (Wet Future – Outlet Erosion: West Bay 480 cfs Constrained Outlet)**


Table TD.3.WF-13.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-13.2 Sets of Feature Strategies

Table TD.3.WF-13.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-13.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-13.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-13.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-13.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-13.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-13.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-13.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-13.11 Cost and Benefit Summary: 4 Sets of Feature Strategies


**List of WF-14a Tables (Wet Future – Combination 2 with Outlet Erosion– West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection)**


Table TD.3.WF-14a.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-14a.2 Sets of Feature Strategies

Table TD.3.WF-14a.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies

Table TD.3.WF-14a.4 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-14a.5 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-14a.6 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-14a.7 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-14a.8 Cost and Benefit Summary with Maximum Infrastructure Protection


**List of WF-14b Tables (Wet Future – Combination 2 with Outlet Erosion – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures)**


Table TD.3.WF-14b.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.3.WF-14b.2 Sets of Feature Strategies

Table TD.3.WF-14b.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.3.WF-14b.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.3.WF-14b.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.3.WF-14b.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.3.WF-14b.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.3.WF-14b.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.3.WF-14b.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.3.WF-14b.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.3.WF-14b.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

## Moderate Future 1 Scenario: 1450 Peak Lake Level

**List of M1-1 Tables (Moderate 1 Future – West Bay 300 cfs Constrained Outlet)**

Table TD.4.M1-1.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.4.M1-1.2 Sets of Feature Strategies

Table TD.4.M1-1.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.4.M1-1.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.4.M1-1.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.4.M1-1.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.4.M1-1.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.4.M1-1.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.4.M1-1.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.4.M1-1.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.4.M1-1.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of M1-2 Tables (Moderate 1 Future – West Bay 480 cfs Unconstrained Outlet)**

Table TD.4.M1-2.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.4.M1-2.2 Sets of Feature Strategies

Table TD.4.M1-2.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.4.M1-2.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.4.M1-2.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.4.M1-2.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.4.M1-2.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.4.M1-2.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.4.M1-2.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.4.M1-2.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.4.M1-2.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of M1-3a Tables (Moderate 1 Future – Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection)**

Table TD.4.M1-3a.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.4.M1-3a.2 Sets of Feature Strategies

Table TD.4.M1-3a.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies

Table TD.4.M1-3a.4 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.4.M1-3a.5 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.4.M1-3a.6 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.4.M1-3a.7 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.4.M1-3a.8 Cost and Benefit Summary with Maximum Infrastructure Protection

**List of M1-3b Tables (Moderate 1 Future – Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures)**

Table TD.4.M1-3b.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.4.M1-3b.2 Sets of Feature Strategies

Table TD.4.M1-3b.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.4.M1-3b.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.4.M1-3b.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.4.M1-3b.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.4.M1-3b.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.4.M1-3b.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.4.M1-3b.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.4.M1-3b.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.4.M1-3b.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of M1-5 Tables (Moderate 1 Future – Pelican Lake 300 cfs Constrained Outlet)**

Table TD.4.M1-5.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.4.M1-5.2 Sets of Feature Strategies

Table TD.4.M1-5.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.4.M1-5.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.4.M1-5.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.4.M1-5.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.4.M1-5.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.4.M1-5.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.4.M1-5.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.4.M1-5.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.4.M1-5.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of M1-6 Tables (Moderate 1 Future – Pelican Lake 480 cfs Unconstrained Outlet)**

Table TD.4.M1-6.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.4.M1-6.2 Sets of Feature Strategies

Table TD.4.M1-6.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.4.M1-6.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.4.M1-6.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.4.M1-6.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.4.M1-6.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.4.M1-6.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.4.M1-6.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.4.M1-6.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.4.M1-6.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

## Moderate Future 2 Scenario: 1455 Peak Lake Level

**List of M2-1 Tables (Moderate 2 Future – West Bay 300 cfs Constrained Outlet)**

Table TD.5.M2-1.1 Probability of Reaching Decision/Action Levels at Each Feature

## Table of Contents (continued)


Table TD.5.M2-1.2 Sets of Feature Strategies

Table TD.5.M2-1.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.5.M2-1.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.5.M2-1.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.5.M2-1.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.5.M2-1.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.5.M2-1.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.5.M2-1.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.5.M2-1.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.5.M2-1.11 Cost and Benefit Summary: 4 Sets of Feature Strategies


**List of M2-2 Tables (Moderate 2 Future – West Bay 480 cfs Unconstrained Outlet)**


Table TD.5.M2-2.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.5.M2-2.2 Sets of Feature Strategies

Table TD.5.M2-2.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.5.M2-2.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.5.M2-2.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.5.M2-2.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.5.M2-2.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.5.M2-2.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.5.M2-2.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.5.M2-2.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.5.M2-2.11 Cost and Benefit Summary: 4 Sets of Feature Strategies


**List of M2-3a Tables (Moderate 2 Future – Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection)**


Table TD.5.M2-3a.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.5.M2-3a.2 Sets of Feature Strategies

Table TD.5.M2-3a.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies

Table TD.5.M2-3a.4 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.5.M2-3a.5 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.5.M2-3a.6 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.5.M2-3a.7 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.5.M2-3a.8 Cost and Benefit Summary with Maximum Infrastructure Protection

**List of M2-3b Tables (Moderate 2 Future – Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures)**

Table TD.5.M2-3b.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.5.M2-3b.2 Sets of Feature Strategies

Table TD.5.M2-3b.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.5.M2-3b.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.5.M2-3b.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.5.M2-3b.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.5.M2-3b.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.5.M2-3b.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.5.M2-3b.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.5.M2-3b.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.5.M2-3b.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of M2-5 Tables (Moderate 2 Future – Pelican Lake 300 cfs Constrained Outlet)**

Table TD.5.M2-5.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.5.M2-5.2 Sets of Feature Strategies

Table TD.5.M2-5.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.5.M2-5.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.5.M2-5.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.5.M2-5.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.5.M2-5.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.5.M2-5.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.5.M2-5.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.5.M2-5.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.5.M2-5.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of M2-6 Tables (Moderate 2 Future – Pelican Lake 480 cfs Unconstrained Outlet)**

Table TD.5.M2-6.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.5.M2-6.2 Sets of Feature Strategies

Table TD.5.M2-6.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.5.M2-6.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.5.M2-6.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.5.M2-6.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.5.M2-6.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.5.M2-6.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.5.M2-6.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.5.M2-6.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.5.M2-6.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

## Dry Future Scenario

**List of DR-1 Tables (Dry Future – West Bay 300 cfs Constrained Outlet)**

Table TD.6.DR-1.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.6.DR-1.2 Sets of Feature Strategies

Table TD.6.DR-1.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.6.DR-1.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.6.DR-1.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.6.DR-1.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.6.DR-1.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.6.DR-1.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.6.DR-1.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.6.DR-1.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.6.DR-1.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of DR-2 Tables (Dry Future – West Bay 480 cfs Unconstrained Outlet)**

Table TD.6.DR-2.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.6.DR-2.2 Sets of Feature Strategies

Table TD.6.DR-2.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.6.DR-2.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.6.DR-2.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.6.DR-2.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.6.DR-2.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.6.DR-2.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.6.DR-2.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.6.DR-2.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.6.DR-2.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of DR-3a Tables (Dry Future – Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection)**

Table TD.6.DR-3a.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.6.DR-3a.2 Sets of Feature Strategies

Table TD.6.DR-3a.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies

Table TD.6.DR-3a.4 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.6.DR-3a.5 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.6.DR-3a.6 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.6.DR-3a.7 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.6.DR-3a.8 Cost and Benefit Summary with Maximum Infrastructure Protection

**List of DR-3b Tables (Dry Future – Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures)**

Table TD.6.DR-3b.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.6.DR-3b.2 Sets of Feature Strategies

Table TD.6.DR-3b.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.6.DR-3b.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.6.DR-3b.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.6.DR-3b.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.6.DR-3b.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.6.DR-3b.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.6.DR-3b.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.6.DR-3b.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.6.DR-3b.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of DR-5 Tables (Dry Future – Pelican Lake 300 cfs Constrained Outlet)**

Table TD.6.DR-5.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.6.DR-5.2 Sets of Feature Strategies

Table TD.6.DR-5.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.6.DR-5.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.6.DR-5.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.6.DR-5.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

Table TD.6.DR-5.7 Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities

Table TD.6.DR-5.8 Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users

Table TD.6.DR-5.9 Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features

Table TD.6.DR-5.10 Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Table TD.6.DR-5.11 Cost and Benefit Summary: 4 Sets of Feature Strategies

**List of DR-6 Tables (Dry Future – Pelican Lake 480 cfs Unconstrained Outlet)**

Table TD.6.DR-6.1 Probability of Reaching Decision/Action Levels at Each Feature

Table TD.6.DR-6.2 Sets of Feature Strategies

Table TD.6.DR-6.3 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies

Table TD.6.DR-6.4 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies

Table TD.6.DR-6.5 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)

Table TD.6.DR-6.6 Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies

## Table of Contents (continued)


| | |
|---|---|
| Table TD.6.DR-6.7 | Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities |
| Table TD.6.DR-6.8 | Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users |
| Table TD.6.DR-6.9 | Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features |
| Table TD.6.DR-6.10 | Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users |
| Table TD.6.DR-6.11 | Cost and Benefit Summary: 4 Sets of Feature Strategies |

# Addendum
# to the
# Tabular Data Document
# Economic Analysis of Devils Lake Alternatives
# October 2001

The primary purpose of this Addendum to the Tabular Data Document is to make note of the changes occasioned by the re-evaluation of the Raise Natural Outlet alternative (WF-11). All of the amendments, corrections, and clarifications are given with the reference to the pertinent section number of the Tabular Data Document (to which the reader is referred). Sections of the Tabular Data Document that are not referenced need no revision.

## Raise Natural Outlet: Revisions

### Wet Future Scenario (Section TD.3.0)

#### Table TD.3.WF-11.3

The Annual Strategy Costs and Remaining Annual Damages for features adjacent to the lake were revised for this Raise Natural Outlet alternative, to reflect a portion of the damages as project damages, between elevations 1459 and 1463. This table includes the revised results.

#### Table TD.3.WF-11.4

The Annual Strategy Costs and Remaining Annual Damages for features adjacent to the lake were revised for this Raise Natural Outlet alternative, to reflect a portion of the damages as project damages, between elevations 1459 and 1463. This table includes the revised results.

#### Table TD.3.WF-11.5

The Annual Strategy Costs and Remaining Annual Damages for features adjacent to the lake were revised for this Raise Natural Outlet alternative, to reflect a portion of the damages as project damages, between elevations 1459 and 1463. This table includes the revised results.

#### Table TD.3.WF-11.6

The Annual Strategy Costs and Remaining Annual Damages for features adjacent to the lake were revised for this Raise Natural Outlet alternative, to reflect a portion of the damages as project damages, between elevations 1459 and 1463. This table includes the revised results.

#### Table TD.3.WF-11.11

This table was revised to reflect the project costs for adjacent lake damages between elevations 1459 and 1463 for this Raise Natural Outlet alternative. This table includes the revised results.

# Other Corrections And Clarifications

## Stochastic Analyses (Section TD.2.0)

### Table TD.2.ST-5.7

The Highway 19 Dam construction costs were corrected in the model, and this table includes the revised results.

### Table TD.2.ST-6.7

The Highway 19 Dam construction costs were corrected in the model, and this table includes the revised results.

## Wet Future Scenario (Section TD.3.0)

### Table TD.3.WF-5.11

The Highway 19 Dam construction costs were corrected in the model, and this table includes the revised results.

### Table TD.3.WF-10.6

The Feature 19 Annual Strategy Costs and Remaining Annual Damages were corrected in the model, and this table includes the revised results.

### Table TD.3.WF-10.11

The Feature 19 Annual Strategy Costs and Remaining Annual Damages for the Set of No Flood Protection Strategies were corrected in the model, and this table includes the revised results.

## Table TD.3.WF-11.3

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-11

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $344,200 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $3,586,200 | $2,918,500 | $667,700 | $0 | $0 | $0 | $667,700 |
| 3 | Fort Totten | $40,500 | $40,500 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $397,100 | $397,100 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $76,300 | $76,300 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $565,500 | $0 | $9,200 | $9,200 | $0 | $0 |
| 7 | Grahams Island State Park | $505,700 | $505,700 | $0 | $13,300 | $13,300 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,723,400 | $0 | $3,161,300 | $2,804,700 | $356,600 | $356,600 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $249,500 | $239,000 | $10,500 | $10,500 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $3,638,500 | $2,470,600 | $1,167,900 | $0 | $0 | $0 | $1,167,900 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $763,400 | $1,485,500 | $0 | $0 | $0 | $1,485,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,003,700 | $670,200 | $1,333,500 | $0 | $0 | $0 | $1,333,500 |
| 13 | US Highway 2 | $4,933,600 | $2,063,200 | $2,870,400 | $0 | $0 | $0 | $2,870,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $252,700 | $226,900 | $0 | $0 | $0 | $226,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $667,300 | $739,100 | $0 | $0 | $0 | $739,100 |
| 16 | Highway 281 South of US Highway 2 | $6,015,600 | $4,335,500 | $1,680,100 | $0 | $0 | $0 | $1,680,100 |
| 17 | Highway 281 North of US Highway 2 | $1,442,000 | $1,442,000 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $3,336,600 | $1,581,000 | $1,755,600 | $0 | $0 | $0 | $1,755,600 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $0 | $938,600 | $0 | $0 | $0 | $938,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $440,100 | $395,200 | $0 | $0 | $0 | $395,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $3,629,800 | $3,629,800 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $471,700 | $230,100 | $0 | $0 | $0 | $230,100 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $540,100 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $39,397,500 | $25,906,900 | $13,490,600 | $3,433,300 | $3,066,200 | $367,100 | $13,857,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.3.WF-11.4

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-11

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy In Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy In Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $344,200 | $344,200 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $3,586,200 | $2,918,500 | $667,700 | $0 | $0 | $0 | $667,700 |
| 3 | Fort Totten | $40,500 | $40,500 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $397,100 | $397,100 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $76,300 | $76,300 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $565,500 | $0 | $9,200 | $9,200 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $479,400 | $479,400 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,723,400 | $0 | $3,161,300 | $2,804,700 | $356,600 | $356,600 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $249,500 | $239,000 | $10,500 | $10,500 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $476,900 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $763,400 | $1,485,500 | $0 | $0 | $0 | $1,485,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $389,000 | $0 | $0 |
| 13 | US Highway 2 | $4,933,600 | $2,063,200 | $2,870,400 | $0 | $0 | $0 | $2,870,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $252,700 | $226,900 | $0 | $0 | $0 | $226,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $667,300 | $739,100 | $0 | $0 | $0 | $739,100 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $1,018,700 | $88,100 | $88,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $915,700 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $0 | $898,200 | $898,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $440,100 | $395,200 | $0 | $0 | $0 | $395,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $576,000 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $471,700 | $230,100 | $0 | $0 | $0 | $230,100 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $540,100 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $19,379,700 | $12,764,800 | $6,614,900 | $9,837,000 | $8,483,600 | $1,353,400 | $7,968,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.3.WF-11.5

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-11

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $4,817,300 | $4,817,300 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $439,900 | $439,900 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $9,200 | $9,200 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $13,300 | $13,300 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $3,161,300 | $2,804,700 | $356,600 | $356,600 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $249,500 | $239,000 | $10,500 | $10,500 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $5,379,700 | $5,379,700 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $3,198,900 | $3,198,900 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,602,200 | $2,602,200 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $6,222,100 | $6,222,100 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $581,500 | $581,500 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,738,100 | $1,738,100 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $493,600 | $493,600 | $0 | $1,021,700 | $1,021,700 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $4,124,800 | $4,124,800 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $0 | $938,600 | $0 | $0 | $0 | $938,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $1,012,700 | $1,012,700 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $1,022,500 | $1,022,500 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $47,891,300 | $46,952,700 | $938,600 | $6,030,000 | $5,662,900 | $367,100 | $1,305,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.3.WF-11.6

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-11

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $339,000 | $339,000 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $15,259,300 | $15,259,300 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $36,900 | $36,900 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $831,500 | $831,500 | $0 | $0 |
| 5 | St. Michael | $0 | $0 | $0 | $70,400 | $70,400 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $12,000 | $12,000 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $480,600 | $480,600 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $5,254,600 | $4,898,000 | $356,600 | $356,600 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $261,100 | $250,700 | $10,400 | $10,400 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $476,900 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $2,997,900 | $2,988,100 | $9,800 | $9,800 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $389,000 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $7,109,600 | $7,109,600 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $7,638,900 | $7,638,900 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $5,580,100 | $5,580,100 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $5,214,000 | $5,214,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $1,018,700 | $88,100 | $88,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $915,700 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $898,200 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $7,655,300 | $7,655,300 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $576,000 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $838,700 | $838,700 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $13,073,000 | $13,073,000 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $77,015,500 | $76,550,600 | $464,900 | $464,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.3.WF-11.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario WF-11

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Embankment Construction | $188,356 | $35,186 | $21,807 | $311,718 |
| Embankment Operation and Maintenance | $74 | $74 | $74 | $74 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $0 | $0 | $0 | $0 |
| **Total Costs: Present Value** | $188,431 | $35,260 | $21,882 | $311,793 |
| **Annualized Total Cost** | $12,585 | $2,355 | $1,461 | $20,824 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $7,968 | $1,306 | $465 | $13,858 |
| Downstream Features | $3,441 | $3,441 | $3,441 | $3,441 |
| **Total Annualized Benefit** | $11,409 | $4,747 | $3,906 | $17,299 |
| | | | | |
| **NET BENEFIT** | -$1,176 | $2,392 | $2,444 | -$3,526 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.91 | 2.02 | 2.67 | 0.83 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.63 | 0.55 | 0.32 | 0.67 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 0 | 0 | 0 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.2.ST-5.7

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Analysis ST-5

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $84,180 | $84,180 | $84,180 | $84,180 |
| Outlet Operation and Maintenance | $9,475 | $9,475 | $9,475 | $9,475 |
| Hwy 19 Dam Construction | $1,096 | $1,096 | $1,096 | $1,096 |
| Hwy 19 Dam Operation and Maintenance | $68 | $68 | $68 | $68 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $117,451 | $117,451 | $117,451 | $117,451 |
| **Annualized Total Cost** | $7,844 | $7,844 | $7,844 | $7,844 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $1 | $1 | $1 | $1 |
| Features Adjacent to Devils Lake | $2,012 | $2,787 | $5,211 | $2,770 |
| Downstream Features (weighted average) [5] | $134 | $134 | $134 | $134 |
| **Total Annualized Benefit** | $2,146 | $2,922 | $5,346 | $2,905 |
| | | | | |
| **NET BENEFIT** | -$5,698 | -$4,922 | -$2,499 | -$4,940 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.27 | 0.37 | 0.68 | 0.37 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

[5]For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the annualized benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.32 | 0.44 | 0.82 | 0.44 |
| Traces With BCR>1 | | | | |
| Total Number Out of 10,000 Traces | 788 | 1599 | 3101 | 1387 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.2.ST-6.7

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Analysis ST-6

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $129,230 | $129,230 | $129,230 | $129,230 |
| Outlet Operation and Maintenance | $13,985 | $13,985 | $13,985 | $13,985 |
| Hwy 19 Dam Construction | $762 | $762 | $762 | $762 |
| Hwy 19 Dam Operation and Maintenance | $47 | $47 | $47 | $47 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation (weighted average) [1] | $12,518 | $12,518 | $12,518 | $12,518 |
| Natural Resources Monitoring/Mitigation | $50,432 | $50,432 | $50,432 | $50,432 |
| **Total Costs: Present Value** | $206,974 | $206,974 | $206,974 | $206,974 |
| **Annualized Total Cost** | $13,824 | $13,824 | $13,824 | $13,824 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $2 | $2 | $2 | $2 |
| Features Adjacent to Devils Lake | $2,904 | $3,938 | $8,736 | $3,716 |
| Downstream Features (weighted average) [5] | -$2,290 | -$2,290 | -$2,290 | -$2,290 |
| **Total Annualized Benefit** | $615 | $1,649 | $6,447 | $1,428 |
| | | | | |
| **NET BENEFIT** | -$13,208 | -$12,174 | -$7,376 | -$12,396 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.04 | 0.12 | 0.47 | 0.10 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

[5] For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the costs and benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.30 | 0.41 | 0.91 | 0.39 |
| Traces With BCR>1 | | | | |
| Total Number Out of 10,000 Traces | 703 | 1441 | 3609 | 1310 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.3.WF-5.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario WF-5

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $84,180 | $84,180 | $84,180 | $84,180 |
| Outlet Operation and Maintenance | $17,136 | $17,136 | $17,136 | $17,136 |
| Hwy 19 Dam Construction | $6,377 | $6,377 | $6,377 | $6,377 |
| Hwy 19 Dam Operation and Maintenance | $396 | $396 | $396 | $396 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $130,721 | $130,721 | $130,721 | $130,721 |
| **Annualized Total Cost** | $8,731 | $8,731 | $8,731 | $8,731 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $10,902 | $7,123 | $17,565 | $18,884 |
| Downstream Features | $3,028 | $3,028 | $3,028 | $3,028 |
| **Total Annualized Benefit** | $13,929 | $10,151 | $20,593 | $21,912 |
| | | | | |
| **NET BENEFIT** | $5,199 | $1,420 | $11,862 | $13,181 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 1.60 | 1.16 | 2.36 | 2.51 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 1.51 | 0.99 | 2.43 | 2.62 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 1 | 0 | 1 | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

## Table TD.3.WF-10.6

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-10

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $339,000 | $333,700 | $5,300 | $5,300 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $15,259,300 | $11,971,700 | $3,287,600 | $3,287,600 |
| 3 | Fort Totten | $0 | $0 | $0 | $36,900 | $19,100 | $17,800 | $17,800 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $831,500 | $277,200 | $554,300 | $554,300 |
| 5 | St. Michael | $0 | $0 | $0 | $70,400 | $13,400 | $57,000 | $57,000 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $12,000 | $8,800 | $3,200 | $3,200 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $480,600 | $400,000 | $80,600 | $80,600 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $5,939,900 | $2,783,000 | $3,156,900 | $3,156,900 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $283,900 | $222,300 | $61,600 | $61,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $458,100 | $18,800 | $18,800 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $2,997,900 | $1,206,400 | $1,791,500 | $1,791,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $0 | $389,000 | $389,000 |
| 13 | US Highway 2 | $0 | $0 | $0 | $7,109,600 | $0 | $7,109,600 | $7,109,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $7,638,900 | $0 | $7,638,900 | $7,638,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $5,580,100 | $0 | $5,580,100 | $5,580,100 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $5,214,000 | $4,532,900 | $681,100 | $681,100 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $828,700 | $278,100 | $278,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $0 | $915,700 | $915,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $0 | $898,200 | $898,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $7,655,300 | $0 | $7,655,300 | $7,655,300 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $574,000 | $2,000 | $2,000 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $838,700 | $681,300 | $157,400 | $157,400 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $13,073,000 | $11,639,500 | $1,433,500 | $1,433,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $77,723,600 | $35,950,100 | $41,773,500 | $41,773,500 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.3.WF-10.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario WF-10

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $57,407 | $57,407 | $57,407 | $57,407 |
| Outlet Operation and Maintenance | $525 | $525 | $525 | $525 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $39,644 | $39,644 | $39,644 | $39,644 |
| Natural Resources Monitoring/Mitigation | $50,432 | $50,432 | $50,432 | $50,432 |
| **Total Costs: Present Value** | $148,008 | $148,008 | $148,008 | $148,008 |
| **Annualized Total Cost** | $9,885 | $9,885 | $9,885 | $9,885 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $1 | $1 | $1 | $1 |
| Features Adjacent to Devils Lake | $18,990 | $17,465 | $41,774 | $29,731 |
| Downstream Features | -$1,531 | -$1,531 | -$1,531 | -$1,531 |
| **Total Annualized Benefit** | $17,459 | $15,935 | $40,243 | $28,201 |
| | | | | |
| **NET BENEFIT** | $7,574 | $6,049 | $30,358 | $18,315 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 1.77 | 1.61 | 4.07 | 2.85 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 4.91 | 4.51 | 10.80 | 7.68 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 1 | 1 | 1 | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

## Economic Analysis of Devils Lake Alternatives
**Table II.ST-1**

## Stochastic Scenario Cost and Benefit Comparison
**(costs and benefits in thousands of dollars)**

| Alternative Number | Description of Alternative | Annual Project Costs | Without Downstream Impacts | | | Including Downstream Impacts | | |
|---|---|---|---|---|---|---|---|---|
| | | | Annual Benefits | Net Benefit | BCR | Annual Benefits | Net Benefit | BCR |
| ST-1 | Upper Basin Management | $2,650 | $773 | -$1,877 | 0.29 | NA | NA | NA |
| ST-2b | Expanded Infrastructure Measures | $1,149 | $2,410 | $1,261 | 2.10 | $2,410 | $1,261 | 2.10 |
| ST-3 | West Bay 300 cfs Constrained Outlet | $5,847 | $1,477 | -$2,858 | 0.34 | $1,641 | -$4,205 | 0.28 |
| ST-4 | West Bay 480 cfs Unconstrained Outlet | $11,232 | $3,414 | -$3,527 | 0.49 | $119 | -$11,113 | 0.01 |
| ST-5 | Pelican Lake 300 cfs Constrained Outlet | $7,844 | $2,771 | -$3,562 | 0.44 | $2,905 | -$4,940 | 0.37 |
| ST-6 | Pelican Lake 480 cfs Unconstrained Outlet | $13,824 | $3,718 | -$5,901 | 0.39 | $1,428 | -$12,396 | 0.10 |
| ST-7b | Combination 1 – Upper Basin Management and Expanded Infrastructure Measures | $3,717 | $3,131 | -$586 | 0.84 | NA | NA | NA |
| ST-8b | Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures | $9,446 | $4,197 | -$3,738 | 0.53 | $4,363 | -$5,083 | 0.46 |
| ST-10 | East End 480 cfs Unconstrained Outlet | $7,238 | $3,414 | -$455 | 0.88 | NA | NA | NA |

N.A. - The downstream impacts for the stochastic scenario were computed based on the weighted averages of the sensitivity scenarios. Not all of the alternatives were analyzed in the sensitivity analyses, therefore the downstream impacts are not computable.

Note: These computations assume that the set of Most Likely Action strategies are conducted for all features adjacent to Devils Lake (under both with- and without-project conditions). The costs and damages for the Maximum Infrastructure Protection alternatives without-project conditions assume the features are not protected or are abandoned.

## Economic Analysis of Devils Lake Alternatives
**Table II.WF-1**

### Wet Future Scenario Cost and Benefit Comparison
**(costs and benefits in thousands of dollars)**

| Alternative Number | Description of Alternative | Annual Project Costs | Without Downstream Impacts | | | Including Downstream Impacts | | |
|---|---|---|---|---|---|---|---|---|
| | | | Annual Benefits | Net Benefit | BCR | Annual Benefits | Net Benefit | BCR |
| WF-1 | Upper Basin Management | $2,650 | $2,584 | -$66 | 0.98 | $3,191 | $541 | 1.20 |
| WF-2b | Expanded Infrastructure Measures | $4,063 | $4,301 | $238 | 1.06 | $4,301 | $238 | 1.06 |
| WF-3 | West Bay 300 cfs Constrained Outlet | $6,376 | $16,760 | $11,896 | 3.45 | $19,718 | $13,341 | 3.09 |
| WF-4 | West Bay 480 cfs Unconstrained Outlet | $12,188 | $29,732 | $21,938 | 3.81 | $28,828 | $16,640 | 2.37 |
| WF-5 | Pelican Lake 300 cfs Constrained Outlet | $8,731 | $18,884 | $11,665 | 2.62 | $21,912 | $13,181 | 2.51 |
| WF-6 | Pelican Lake 480 cfs Unconstrained Outlet | $14,668 | $29,943 | $19,512 | 2.87 | $30,198 | $15,530 | 2.06 |
| WF-7b | Combination 1 – Upper Basin Management and Expanded Infrastructure Measures | $6,491 | $6,706 | $214 | 1.03 | $7,313 | $821 | 1.13 |
| WF-8b | Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures | $11,165 | $22,537 | $12,883 | 2.33 | $25,489 | $14,324 | 2.28 |
| WF-9 | NOTE: WF-9 is the base condition – without project future condition. | | | | | | | |
| WF-10 | East End 480 cfs Unconstrained Outlet | $9,885 | $29,732 | $25,863 | 7.68 | $28,201 | $18,315 | 2.85 |
| WF-11 | Raise Natural Outlet | $1,064 | $0 | $0 | 0.00 | $3,441 | $2,377 | 3.24 |

Note: These computations assume that the set of Most Likely Action strategies are conducted for all features adjacent to Devils Lake (under both with- and without-project conditions).

# TD.1.0 Introduction

## TD.1.1 Description of Reports

A tremendous amount of information was generated during this economic analysis, and the details of the study can be overwhelming. To communicate this information effectively to a broad spectrum of people, it was necessary to separate the report into three volumes. A brief description of these reports follows:

- **Main Report**
  The Main Report summarizes the analyses and results of the Economic Analysis. After introductory sections, the report starts by describing the basic approach used to evaluate the economic feasibility of the various alternatives (Section 3). A listing of the economic modeling results, and overall review and comparison of the economic feasibility of the various project alternatives follows (Section 4). Section 5 gives a discussion of how the model results are sensitive to variations in climate assumptions, to assumptions regarding the local infrastructure protection measures, and to assumptions made regarding erosion of the lake's natural outlet. In Section 6, conclusions are drawn regarding the economic feasibility, risks, and effectiveness of the various alternatives.

- **Technical Appendix**
  By comparison to the Main Report, the Technical Appendix gives much more detail regarding the study methodology and results. Part I of the Technical Appendix describes the methodology and general assumptions used in the detailed evaluation for the Economic Analysis. Data and assumptions used in the analysis of the identified features are included in the Part I appendices. Part II of the Technical Appendix compares the economic feasibility of the various alternatives and evaluates the effects of different lake level futures on the results. Complete detailed results for one flood control alternative are also included in Part II, providing an example of how the costs and damages are computed for individual features.

- **Tabular Data**
  The Tabular Data document provides the detailed tabular results of the various alternatives that were analyzed, grouped by analysis (stochastic and scenario-based). The conclusions of the Economic Analysis are founded on the detailed results presented in the Tabular Data document.

## TD.1.2 Analyses

The economic analysis for Devils Lake alternatives requires a prediction of the potential future climatic conditions and lake levels. Devils Lake is a landlocked lake so the range of future fluctuations is more difficult to predict than in a simpler system such as a river. Future lake levels are affected by a variety of climatic factors as well as by the lake level in previous years and the groundwater level. The predictions made for Devils Lake peak levels even one year prior can be highly variable from the actual recorded levels the next year.

Therefore, the economic analysis had to consider various lake level futures. The stochastic analysis provides an average economic estimate based on the probability of future lake levels. Because the recent lake levels have exceeded the predictions that have been based on historical lake levels, the Wet Future Scenario analysis was also evaluated.

- Stochastic Analysis – This economic analysis used a large set of possible future lake levels to determine the likelihood of future lake levels. These were produced from a lake level model created by the United States Geological Survey (USGS). That model created 10,000 "traces" of future lake levels. Each trace shows a 50-year sequence of lake levels.

- Wet Future Scenario Analysis – This economic analysis evaluated one set of 50-year lake levels that is based on recent climatic conditions. The Wet Future Scenario repeats the climatic and hydrologic conditions for the seven highest inflow years in recent history (1993–1999) for three cycles, causing the lake to overflow. The remaining years of the 50-year cycle were defined assuming climatic and hydrologic conditions similar to 1980–1999.

It was necessary to also evaluate the economic feasibility of various alternatives based on average or dry scenarios to define the sensitivity under a wide range of potential futures. This sensitivity analysis evaluated a set of three scenarios that are representative of three categories of future lake levels—a Dry Future and two Moderate Futures. These scenario analyses are representative of various categories within the stochastic traces.

- Dry Future Scenario—The traces represented by this scenario generally show a decreasing pattern in the inflows and lake levels. The Dry Future represents those traces that have an average peak lake level of 1448 (approximately 36% of the stochastic traces). This dry future trace was obtained from within the stochastic traces, as a trace that was representative of this category.

- Moderate Future 1 Scenario—Moderate Future 1 represents those traces that have an average peak lake level of 1450 (approximately 30% of the stochastic traces). This moderate future trace was obtained from within the stochastic traces, as a trace that was representative of this category.

- Moderate Future 2 Scenario—Moderate Future 2 represents those traces that have an average peak lake level of 1455 (approximately 25% of the stochastic traces). This moderate future trace was obtained from within the stochastic traces, as a trace that was representative of this category.

## TD.1.3 Alternatives

The economic analysis for Devils Lake also required evaluation of various alternatives that would reduce the future lake levels and/or protect the downstream waters. For this analysis, a wide range of alternatives was analyzed, ranging from measures within the basin to an outlet.

The alternatives that were analyzed varied depending on the scenario that was being analyzed. Table TD.2 lists the alternatives that were analyzed for at least one of the scenarios.

## TD.1.4 Tabular Data

The tables presented in this report are grouped first by analysis and then by alternative. The analyses are separated by tabs — Stochastic, Wet Future, Moderate Future 1, Moderate Future 2, and Dry Future.

The tables at the start of each section list the table numbers and a brief description of the tables included in that section. Since only certain alternatives were analyzed for each analysis, each analysis may include different tables. If no table is included, the alternative was not analyzed for that analysis.

**Table TD.1**

**Categories of Traces for Evaluating Impacts of Alternatives**

| Scenario | Peak lake level during 2001-2050, with no outlet | Percent of traces (out of 10,000) | Average peak lake level |
|---|---|---|---|
| Dry | 1,447.0 to 1,449.0 | 35.6 | 1,448.1 |
| Moderate 1 | 1,449.1 to 1,452.0 | 29.9 | 1,450.2 |
| Moderate 2 | 1,452.1 to 1,459.0 | 25.0 | 1,454.9 |
| Wet | 1,459.1 to 1,465.0 | 9.5 | 1,461.1 |

**Table TD.2**

**List of Alternatives and Sensitivity Analyses Analyzed**

| |
|---|
| Upper Basin Management |
| Maximum Infrastructure Protection |
| Expanded Infrastructure Measures |
| West Bay 300 cfs Constrained Outlet |
| West Bay 480 cfs Unconstrained Outlet |
| Pelican Lake 300 cfs Constrained Outlet |
| Pelican Lake 480 cfs Unconstrained Outlet |
| Combination 1 – Upper Basin Management and Maximum Infrastructure Protection |
| Combination 1 – Upper Basin Management and Expanded Infrastructure Measures |
| Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection |
| Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures |
| East End 480 cfs Unconstrained Outlet |
| Raise Natural Outlet |
| Outlet Erosion: West Bay 300 cfs Constrained Outlet |
| Outlet Erosion: West Bay 480 cfs Constrained Outlet |
| Combination 2 with Outlet Erosion – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection |
| Combination 2 with Outlet Erosion – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures |

# TD.2.0 Stochastic Scenario

The following table lists the stochastic alternatives or sensitivity analyses for which tables are included in this section. Note that there are several tables that are included for each alternative. The last digit of each table number (x) reflects a variable number for each of the tables.

| Table Number | Alternative Number | Description of Alternative |
|---|---|---|
| TD.2.ST-1.x | ST-1 | Upper Basin Management |
| TD.2.ST-2a.x | ST-2a | Maximum Infrastructure Protection |
| TD.2.ST-2b.x | ST-2b | Expanded Infrastructure Measures |
| TD.2.ST-3.x | ST-3 | West Bay 300 cfs Constrained Outlet |
| TD.2.ST-4.x | ST-4 | West Bay 480 cfs Unconstrained Outlet |
| TD.2.ST-5.x | ST-5 | Pelican Lake 300 cfs Constrained Outlet |
| TD.2.ST-6.x | ST-6 | Pelican Lake 480 cfs Unconstrained Outlet |
| TD.2.ST-7a.x | ST-7a | Combination 1 – Upper Basin Management and Maximum Infrastructure Protection |
| TD.2.ST-7b.x | ST-7b | Combination 1 – Upper Basin Management and Expanded Infrastructure Measures |
| TD.2.ST-8a.x | ST-8a | Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection |
| TD.2.ST-8b.x | ST-8b | Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures |
| TD.2.ST-10.x | ST-10 | East End 480 cfs Unconstrained Outlet |

The following table lists the seven individual tables that are included for the majority of the alternatives: Upper Basin Management (ST-1), Expanded Infrastructure Measures (ST-2b, ST-7b and ST-8b), and various outlets (ST-3, ST-4, ST-5, and ST-6).

| Last Digit of Each Table Number | Table Description |
|---|---|
| 1 | Probability of Reaching Decision/Action Levels at Each Feature |
| 2 | Sets of Feature Strategies |
| 3 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies |
| 4 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies |
| 5 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) |

| Last Digit of Each Table Number | Table Description |
|---|---|
| 6 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies |
| 7 | Cost and Benefit Summary: 4 Sets of Feature Strategies |

The following table lists the four individual tables that are included for the Maximum Infrastructure Protection sensitivity analysis (ST-2a, ST-7a, and ST-8a).

| Last Digit of Each Table Number | Table Description |
|---|---|
| 1 | Probability of Reaching Decision/Action Levels at Each Feature |
| 2 | Sets of Feature Strategies |
| 3 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies |
| 4 | Cost and Benefit Summary with Maximum Infrastructure Protection |

*ST-1 Tables*
*(Stochastic - Upper Basin Management)*

## Table TD.2.ST-1.1

## Economic Analysis of Devils Lake Alternatives

### Analysis ST-1
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | | | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rec. | 7 Graham Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Without Outlet % / With Outlet % | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 | Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 59 / 54 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | | |
| 1447 | 100 / 100 | | ■ | | ■ | | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | | |
| 1448 | 83 / 80 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 64 / 60 | | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 51 / 46 | | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 41 / 36 | | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 34 / 30 | | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 29 / 25 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 25 / 21 | | | | | | | ■ | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 20 / 17 | | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 17 / 14 | | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 14 / 12 | | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 12 / 10 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 9 / 8 | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 7 / 6 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 4 / 4 | | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 2 / 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 1 / 0.8 | | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.2.ST-1.2

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-1
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | A* | Relocation of Structures: Then Temporary Closure | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.2.ST-1.3

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $333,700 | $300 | $0 | $0 | $0 | $300 |
| 2 | City of Devils Lake | $836,100 | $756,300 | $79,800 | $0 | $0 | $0 | $79,800 |
| 3 | Fort Totten | $11,200 | $10,400 | $800 | $0 | $0 | $0 | $800 |
| 4 | City of Minnewaukan | $112,200 | $101,700 | $10,500 | $0 | $0 | $0 | $10,500 |
| 5 | St. Michael | $20,200 | $18,900 | $1,300 | $0 | $0 | $0 | $1,300 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $260,000 | $8,200 | $4,700 | $4,600 | $100 | $8,300 |
| 7 | Grahams Island State Park | $128,500 | $116,600 | $11,900 | $11,600 | $11,600 | $0 | $11,900 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $921,800 | $18,500 | $1,148,200 | $1,078,800 | $69,400 | $87,900 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,700 | $300 | $120,000 | $114,200 | $5,800 | $6,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $934,400 | $856,700 | $77,700 | $0 | $0 | $0 | $77,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $255,900 | $38,200 | $0 | $0 | $0 | $38,200 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $223,300 | $190,100 | $33,200 | $0 | $0 | $0 | $33,200 |
| 13 | US Highway 2 | $585,100 | $499,400 | $85,700 | $0 | $0 | $0 | $85,700 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $52,500 | $8,800 | $0 | $0 | $0 | $8,800 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $148,400 | $25,100 | $0 | $0 | $0 | $25,100 |
| 16 | Highway 281 South of US Highway 2 | $2,413,200 | $2,309,600 | $103,600 | $0 | $0 | $0 | $103,600 |
| 17 | Highway 281 North of US Highway 2 | $308,600 | $271,900 | $36,700 | $0 | $0 | $0 | $36,700 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $411,600 | $351,900 | $59,700 | $0 | $0 | $0 | $59,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $65,100 | $12,600 | $0 | $0 | $0 | $12,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $91,500 | $15,300 | $0 | $0 | $0 | $15,300 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,970,300 | $1,925,500 | $44,800 | $0 | $0 | $0 | $44,800 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $143,200 | $14,800 | $0 | $0 | $0 | $14,800 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $140,200 | $9,600 | $0 | $0 | $0 | $9,600 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $10,521,400 | $9,824,000 | $697,400 | $1,284,500 | $1,209,200 | $75,300 | $772,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## TableTD.2.ST-1.4

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $333,700 | $300 | $0 | $0 | $0 | $300 |
| 2 | City of Devils Lake | $836,100 | $756,300 | $79,800 | $0 | $0 | $0 | $79,800 |
| 3 | Fort Totten | $11,200 | $10,400 | $800 | $0 | $0 | $0 | $800 |
| 4 | City of Minnewaukan | $112,200 | $101,700 | $10,500 | $0 | $0 | $0 | $10,500 |
| 5 | St. Michael | $20,200 | $18,900 | $1,300 | $0 | $0 | $0 | $1,300 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $260,000 | $8,200 | $4,700 | $4,600 | $100 | $8,300 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $93,800 | $85,400 | $8,400 | $8,400 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $921,800 | $18,500 | $1,148,200 | $1,078,800 | $69,400 | $87,900 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,700 | $300 | $120,000 | $114,200 | $5,800 | $6,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $217,900 | $19,700 | $19,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $255,900 | $38,200 | $0 | $0 | $0 | $38,200 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $36,600 | $6,300 | $6,300 |
| 13 | US Highway 2 | $347,400 | $300,200 | $47,200 | $182,300 | $150,400 | $31,900 | $79,100 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $52,500 | $8,800 | $0 | $0 | $0 | $8,800 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $148,400 | $25,100 | $0 | $0 | $0 | $25,100 |
| 16 | Highway 281 South of US Highway 2 | $239,600 | $239,500 | $100 | $1,797,000 | $1,656,400 | $140,600 | $140,700 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $142,500 | $21,100 | $21,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $101,600 | $18,000 | $18,000 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $42,100 | $9,000 | $9,000 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $91,500 | $15,300 | $0 | $0 | $0 | $15,300 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $683,300 | $13,400 | $13,400 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $143,200 | $14,800 | $0 | $0 | $0 | $14,800 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $140,200 | $9,600 | $0 | $0 | $0 | $9,600 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $4,059,200 | $3,780,400 | $278,800 | $4,657,500 | $4,313,800 | $343,700 | $622,500 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-1.5

### Economic Analysis of Devils Lake Alternatives
### Analysis ST-1

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $349,800 | $349,800 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $2,210,300 | $2,081,700 | $128,600 | $0 | $0 | $0 | $128,600 |
| 3 | Fort Totten | $59,600 | $59,600 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $143,300 | $130,700 | $12,600 | $0 | $0 | $0 | $12,600 |
| 5 | St. Michael | $116,300 | $116,300 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,578,300 | $1,578,100 | $200 | $4,700 | $4,600 | $100 | $300 |
| 7 | Grahams Island State Park | $1,126,300 | $1,126,200 | $100 | $11,600 | $11,600 | $0 | $100 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $1,148,200 | $1,078,800 | $69,400 | $69,400 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,700 | $300 | $120,000 | $114,200 | $5,800 | $6,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,468,500 | $2,324,900 | $143,600 | $0 | $0 | $0 | $143,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $717,200 | $640,000 | $77,200 | $0 | $0 | $0 | $77,200 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $438,100 | $378,600 | $59,500 | $0 | $0 | $0 | $59,500 |
| 13 | US Highway 2 | $1,047,700 | $905,400 | $142,300 | $0 | $0 | $0 | $142,300 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $97,900 | $84,600 | $13,300 | $0 | $0 | $0 | $13,300 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $292,700 | $252,900 | $39,800 | $0 | $0 | $0 | $39,800 |
| 16 | Highway 281 South of US Highway 2 | $1,484,000 | $1,483,800 | $200 | $1,569,300 | $1,569,100 | $200 | $400 |
| 17 | Highway 281 North of US Highway 2 | $132,700 | $119,800 | $12,900 | $265,900 | $240,200 | $25,700 | $38,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $694,500 | $600,200 | $94,300 | $0 | $0 | $0 | $94,300 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $65,100 | $12,600 | $0 | $0 | $0 | $12,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $170,500 | $147,300 | $23,200 | $0 | $0 | $0 | $23,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $404,400 | $373,100 | $31,300 | $0 | $0 | $0 | $31,300 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $24,193,300 | $23,401,300 | $792,000 | $3,119,700 | $3,018,500 | $101,200 | $893,200 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-1.6

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,300 | $333,100 | $200 | $200 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $5,607,400 | $5,232,600 | $374,800 | $374,800 |
| 3 | Fort Totten | $0 | $0 | $0 | $10,200 | $9,500 | $700 | $700 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $170,700 | $151,900 | $18,800 | $18,800 |
| 5 | St. Michael | $0 | $0 | $0 | $19,400 | $18,100 | $1,300 | $1,300 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $35,300 | $31,900 | $3,400 | $3,400 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $94,000 | $85,600 | $8,400 | $8,400 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $2,265,900 | $2,173,700 | $92,200 | $92,200 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $124,200 | $118,100 | $6,100 | $6,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $217,900 | $19,700 | $19,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $375,000 | $323,500 | $51,500 | $51,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $36,600 | $6,300 | $6,300 |
| 13 | US Highway 2 | $0 | $0 | $0 | $666,400 | $564,800 | $101,600 | $101,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $703,000 | $594,600 | $108,400 | $108,400 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $523,000 | $442,500 | $80,500 | $80,500 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,612,800 | $2,466,000 | $146,800 | $146,800 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $142,500 | $21,100 | $21,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $101,600 | $18,000 | $18,000 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $42,100 | $9,000 | $9,000 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $709,000 | $599,800 | $109,200 | $109,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $683,300 | $13,400 | $13,400 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $172,400 | $152,800 | $19,600 | $19,600 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,394,700 | $9,048,000 | $346,700 | $346,700 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $25,128,200 | $23,570,500 | $1,557,700 | $1,557,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.2.ST-1.7

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Analysis ST-1

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $0 | $0 | $0 | $0 |
| Outlet Operation and Maintenance | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $39,681 | $39,681 | $39,681 | $39,681 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $0 | $0 | $0 | $0 |
| **Total Costs: Present Value** | $39,681 | $39,681 | $39,681 | $39,681 |
| **Annualized Total Cost** | $2,650 | $2,650 | $2,650 | $2,650 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $623 | $893 | $1,558 | $773 |
| Downstream Features (weighted average) [5] | NA | NA | NA | NA |
| **Total Annualized Benefit** | NA | NA | NA | NA |
| | | | | |
| **NET BENEFIT** | NA | NA | NA | NA |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | NA | NA | NA | NA |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

[5] For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the annualized benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

If the weighted average is "NA", this type of scenario was not run for the the wet, moderate-wet, moderate-dry and dry conditions.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.23 | 0.34 | 0.59 | 0.29 |
| Traces With BCR>1 | | | | |
| Total Number Out of 10,000 Traces | 433 | 863 | 1719 | 617 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

## *ST -2a Tables*
## *(Stochastic - Maximum Infrastructure Protection)*

## Table TD.2.ST-2a.1

## Economic Analysis of Devils Lake Alternatives

### Analysis ST-2a
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rese. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churches Ferry to Cando | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 59 / 59 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 83 / 83 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 64 / 64 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 51 / 51 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 41 / 41 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 34 / 34 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 29 / 29 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 25 / 25 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 20 / 20 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 17 / 17 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 14 / 14 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 12 / 12 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 9 / 9 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 7 / 7 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 4 / 4 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 2 / 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 1 / 1 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.2.ST-2a.2

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-2a
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Maximum Infrastructure Protection Strategies WITHOUT PROJECT | | Based on Set of Maximum Infrastructure Protection Strategies WITH PROJECT | |
|---|---|---|---|---|---|
| | | Name | Description | Name | Description |
| 1 | Churchs Ferry | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.2.ST-2a.3

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-2a

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Infrastructure Protection (MIP) Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,300 | $0 | $333,300 | $333,300 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $5,607,400 | $0 | $5,607,400 | $5,607,400 |
| 3 | Fort Totten | $0 | $0 | $0 | $10,200 | $0 | $10,200 | $10,200 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $170,700 | $0 | $170,700 | $170,700 |
| 5 | St. Michael | $0 | $0 | $0 | $19,400 | $0 | $19,400 | $19,400 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $35,300 | $4,700 | $30,600 | $30,600 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $94,000 | $11,600 | $82,400 | $82,400 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $2,265,900 | $1,142,800 | $1,123,100 | $1,123,100 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $124,200 | $120,000 | $4,200 | $4,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $0 | $237,600 | $237,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $375,000 | $0 | $375,000 | $375,000 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $0 | $42,900 | $42,900 |
| 13 | US Highway 2 | $0 | $0 | $0 | $666,400 | $0 | $666,400 | $666,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $703,000 | $0 | $703,000 | $703,000 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $523,000 | $0 | $523,000 | $523,000 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,612,800 | $0 | $2,612,800 | $2,612,800 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $0 | $163,600 | $163,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $0 | $119,600 | $119,600 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $0 | $51,100 | $51,100 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $709,000 | $0 | $709,000 | $709,000 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $0 | $696,700 | $696,700 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $172,400 | $0 | $172,400 | $172,400 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,394,700 | $0 | $9,394,700 | $9,394,700 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $0 | $0 | $0 | $25,128,200 | $1,279,100 | $23,849,100 | $23,849,100 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The maximum infrastructure protection strategies analyzed include temporary closure of roads and rail lines without the project.

· With the project feature were assumed to be incremental protected or relocated.

· The costs and damages for without the project assume the feature are not protected or are abandoned.

· The costs with the project assume incremental protection of all the feature and are included as a project cost in Table TD.2.ST-2a.4

· The damages with the project assume incremental protection of all the feature.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
## Table TD.2.ST-2a.4

### Cost and Benefit Summary with Maximum Infrastructure Protection

Analysis ST-2a

| (in thousands of dollars) | |
|---|---|
| **COSTS** | |
| Outlet Construction | $0 |
| Outlet Operation and Maintenance | $0 |
| Hwy 19 Dam Construction | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 |
| Maximum Infrastructure Protection (MIP) | $136,702 |
| MIP Operation and Maintenance | $2,037 |
| Expanded Infrastructure Measures (EIM) | $0 |
| EIM Operation and Maintenance | $0 |
| Upper Basin Management | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 |
| Natural Resources Monitoring/Mitigation | $0 |
| **Total Costs: Present Value** | $138,739 |
| **Annualized Total Cost** | $9,266 |
| | |
| **ANNUALIZED BENEFITS** | |
| Annual Cost Savings and Damages Prevented: | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 |
| Features Adjacent to Devils Lake[2] | $23,849 |
| Downstream Features (weighted average)[1] | $0 |
| **Total Annualized Benefit** | $23,849 |
| | |
| **NET BENEFIT** | $14,583 |
| | |
| **BENEFIT-COST RATIO (BCR)** | 2.57 |

[1]For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the annualized benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

[2]The Annual Cost Savings and Damages Prevented values for the features adjacent to Devils Lake for the with-project condition are for the Most Likely Action strategies. The costs and damages for the without-project condition are no protection strategies.

Note: Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.
The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | |
|---|---|
| Benefit-Cost Ratio (BCR) | 2.57 |
| Traces With BCR>1 | |
| Total Number Out of 10,000 Traces | 10000 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.
The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*ST-2b Tables*
*(Stochastic - Expanded Infrastructure Protection)*

## Table TD.2.ST-2b.1

## Economic Analysis of Devils Lake Alternatives

### Analysis ST-2b
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mil. Rec. | 7 Graham's Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Alions US Hwy 2 | 12 BNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 59 / 59 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 83 / 83 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 64 / 64 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 51 / 51 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 41 / 41 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 34 / 34 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 29 / 29 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 25 / 25 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 20 / 20 | ■ | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1456 | 17 / 17 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 14 / 14 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 12 / 12 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 9 / 9 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 7 / 7 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 4 / 4 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 2 / 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 1 / 1 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.2.ST-2b.2

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-2b
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | A* | Relocation of Structures: Then Temporary Closure | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(2)A | 2 Incremental Road Raise:Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.2.ST-2b.3

### Economic Analysis of Devils Lake Alternatives
### Analysis ST-2b

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Most Likely Action Strategies
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $334,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $836,100 | $836,100 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $11,200 | $11,200 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $112,200 | $112,200 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $20,200 | $0 | $20,200 | $0 | $0 | $0 | $20,200 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $268,200 | $0 | $4,700 | $4,700 | $0 | $0 |
| 7 | Grahams Island State Park | $128,500 | $128,500 | $0 | $11,600 | $11,600 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $629,600 | $310,700 | $1,148,200 | $1,142,800 | $5,400 | $316,100 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $3,000 | $0 | $120,000 | $120,000 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $934,400 | $934,400 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $294,100 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $223,300 | $223,300 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $585,100 | $585,100 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $61,300 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $173,500 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $2,413,200 | $2,413,200 | $0 | $0 | $0 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $308,600 | $308,600 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $411,600 | $411,600 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $77,700 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $106,800 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,970,300 | $46,500 | $1,923,800 | $0 | $0 | $0 | $1,923,800 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $158,000 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $0 | $149,800 | $0 | $0 | $0 | $149,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $10,521,400 | $8,116,900 | $2,404,500 | $1,284,500 | $1,279,100 | $5,400 | $2,409,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-2b.4

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-2b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $334,000 | $334,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $836,100 | $836,100 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $11,200 | $11,200 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $112,200 | $112,200 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $20,200 | $0 | $20,200 | $0 | $0 | $0 | $20,200 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $268,200 | $0 | $4,700 | $4,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $93,800 | $93,800 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $629,600 | $310,700 | $1,148,200 | $1,142,800 | $5,400 | $316,100 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $3,000 | $0 | $120,000 | $120,000 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $237,600 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $294,100 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $42,900 | $0 | $0 |
| 13 | US Highway 2 | $347,400 | $347,400 | $0 | $182,300 | $182,300 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $61,300 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $173,500 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $239,600 | $239,600 | $0 | $1,797,000 | $1,797,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $163,600 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $119,600 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $51,100 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $106,800 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $46,500 | -$46,500 | $696,700 | $0 | $696,700 | $650,200 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $140,500 | $17,500 | $0 | $10,600 | -$10,600 | $6,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $0 | $149,800 | $0 | $0 | $0 | $149,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $4,059,200 | $3,607,500 | $451,700 | $4,657,500 | $3,966,000 | $691,500 | $1,143,200 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-2b.5

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-2b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $349,800 | $349,800 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $2,210,300 | $2,210,300 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,600 | $59,600 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $143,300 | $143,300 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,300 | $0 | $116,300 | $0 | $0 | $0 | $116,300 |
| 6 | Gilbert C. Grafton State Military Res. | $1,578,300 | $1,578,300 | $0 | $4,700 | $4,700 | $0 | $0 |
| 7 | Grahams Island State Park | $1,126,300 | $1,126,300 | $0 | $11,600 | $11,600 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,002,400 | $409,900 | $1,148,200 | $1,142,800 | $5,400 | $415,300 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $3,000 | $0 | $120,000 | $120,000 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,468,500 | $2,468,500 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $717,200 | $717,200 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $438,100 | $438,100 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $1,047,700 | $1,047,700 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $97,900 | $97,900 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $292,700 | $292,700 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,484,000 | $1,484,000 | $0 | $1,569,300 | $1,569,300 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $132,700 | $132,700 | $0 | $265,900 | $265,900 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $694,500 | $694,500 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $77,700 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $170,500 | $170,500 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $75,800 | $6,850,900 | $0 | $0 | $0 | $6,850,900 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $404,400 | $404,400 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $0 | $1,241,500 | $0 | $0 | $0 | $1,241,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $24,193,300 | $15,574,700 | $8,618,600 | $3,119,700 | $3,114,300 | $5,400 | $8,624,000 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-2b.6

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-2b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,300 | $333,300 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $5,607,400 | $5,607,400 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $10,200 | $10,200 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $170,700 | $170,700 | $0 | $0 |
| 5 | St. Michael | $0 | $0 | $0 | $19,400 | $19,400 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $35,300 | $35,300 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $94,000 | $94,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $2,265,900 | $1,950,600 | $315,300 | $315,300 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $124,200 | $124,200 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $237,600 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $375,000 | $375,000 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $42,900 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $666,400 | $666,400 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $703,000 | $703,000 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $523,000 | $523,000 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,612,800 | $2,612,800 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $163,600 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $119,600 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $51,100 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $709,000 | $709,000 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $696,700 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $172,400 | $172,400 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,394,700 | $9,394,700 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $25,128,200 | $24,812,900 | $315,300 | $315,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.2.ST-2b.7

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Analysis ST-2b

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $0 | $0 | $0 | $0 |
| Outlet Operation and Maintenance | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $15,172 | $15,172 | $15,172 | $15,172 |
| EIM Operation and Maintenance | $2,037 | $2,037 | $2,037 | $2,037 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $0 | $0 | $0 | $0 |
| **Total Costs: Present Value** | $17,209 | $17,209 | $17,209 | $17,209 |
| **Annualized Total Cost** | $1,149 | $1,149 | $1,149 | $1,149 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $1,143 | $8,624 | $315 | $2,410 |
| Downstream Features (weighted average) [5] | $0 | $0 | $0 | $0 |
| **Total Annualized Benefit** | $1,143 | $8,624 | $315 | $2,410 |
| | | | | |
| **NET BENEFIT** | -$6 | $7,475 | -$834 | $1,261 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.99 | 7.50 | 0.27 | 2.10 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

[5] For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the annualized benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.99 | 7.50 | 0.27 | 2.10 |
| Traces With BCR>1 | | | | |
| Total Number Out of 10,000 Traces | 2156 | 6436 | 325 | 5162 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

## *ST-3 Tables*
## *(Stochastic - West Bay 300 cfs Constrained Outlet)*

## Table TD.2.ST-3.1

## Economic Analysis of Devils Lake Alternatives

### Analysis ST-3
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churches Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham's Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churches Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19 / Devils Lake to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20 / Devils Lake to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 59 / 54 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 83 / 81 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 64 / 61 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 51 / 45 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 41 / 35 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 34 / 28 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 29 / 22 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 25 / 18 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 20 / 14 | ■ | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1456 | 17 / 11 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 14 / 9 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 12 / 7 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 9 / 5 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 7 / 4 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 4 / 3 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 2 / 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 1 / 0.6 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.2.ST-3.2

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-3
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | A* | Relocation of Structures: Then Temporary Closure | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.2.ST-3.3

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-3

## Annual Benefits of Project for Features Adjacent to Devils Lake Based on Set of Most Likely Action Strategies (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $333,500 | $500 | $0 | $0 | $0 | $500 |
| 2 | City of Devils Lake | $836,100 | $700,700 | $135,400 | $0 | $0 | $0 | $135,400 |
| 3 | Fort Totten | $11,200 | $9,800 | $1,400 | $0 | $0 | $0 | $1,400 |
| 4 | City of Minnewaukan | $112,200 | $98,800 | $13,400 | $0 | $0 | $0 | $13,400 |
| 5 | St. Michael | $20,200 | $17,400 | $2,800 | $0 | $0 | $0 | $2,800 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $250,500 | $17,700 | $4,700 | $4,500 | $200 | $17,900 |
| 7 | Grahams Island State Park | $128,500 | $108,800 | $19,700 | $11,600 | $11,500 | $100 | $19,800 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $906,300 | $34,000 | $1,148,200 | $1,030,400 | $117,800 | $151,800 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,700 | $300 | $120,000 | $112,800 | $7,200 | $7,500 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $934,400 | $815,300 | $119,100 | $0 | $0 | $0 | $119,100 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $211,700 | $82,400 | $0 | $0 | $0 | $82,400 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $223,300 | $146,900 | $76,400 | $0 | $0 | $0 | $76,400 |
| 13 | US Highway 2 | $585,100 | $393,000 | $192,100 | $0 | $0 | $0 | $192,100 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $42,100 | $19,200 | $0 | $0 | $0 | $19,200 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $118,000 | $55,500 | $0 | $0 | $0 | $55,500 |
| 16 | Highway 281 South of US Highway 2 | $2,413,200 | $2,231,200 | $182,000 | $0 | $0 | $0 | $182,000 |
| 17 | Highway 281 North of US Highway 2 | $308,600 | $238,100 | $70,500 | $0 | $0 | $0 | $70,500 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $411,600 | $279,800 | $131,800 | $0 | $0 | $0 | $131,800 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $45,100 | $32,600 | $0 | $0 | $0 | $32,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $73,400 | $33,400 | $0 | $0 | $0 | $33,400 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,970,300 | $1,882,200 | $88,100 | $0 | $0 | $0 | $88,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $134,500 | $23,500 | $0 | $0 | $0 | $23,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $130,000 | $19,800 | $0 | $0 | $0 | $19,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $10,521,400 | $9,169,800 | $1,351,600 | $1,284,500 | $1,159,200 | $125,300 | $1,476,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-3.4

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-3

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $333,500 | $500 | $0 | $0 | $0 | $500 |
| 2 | City of Devils Lake | $836,100 | $700,700 | $135,400 | $0 | $0 | $0 | $135,400 |
| 3 | Fort Totten | $11,200 | $9,800 | $1,400 | $0 | $0 | $0 | $1,400 |
| 4 | City of Minnewaukan | $112,200 | $98,800 | $13,400 | $0 | $0 | $0 | $13,400 |
| 5 | St. Michael | $20,200 | $17,400 | $2,800 | $0 | $0 | $0 | $2,800 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $250,500 | $17,700 | $4,700 | $4,500 | $200 | $17,900 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $93,800 | $78,900 | $14,900 | $14,900 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $906,300 | $34,000 | $1,148,200 | $1,030,400 | $117,800 | $151,800 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,700 | $300 | $120,000 | $112,800 | $7,200 | $7,500 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $218,600 | $19,000 | $19,000 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $211,700 | $82,400 | $0 | $0 | $0 | $82,400 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $27,700 | $15,200 | $15,200 |
| 13 | US Highway 2 | $347,400 | $254,800 | $92,600 | $182,300 | $93,600 | $88,700 | $181,300 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $42,100 | $19,200 | $0 | $0 | $0 | $19,200 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $118,000 | $55,500 | $0 | $0 | $0 | $55,500 |
| 16 | Highway 281 South of US Highway 2 | $239,600 | $239,600 | $0 | $1,797,000 | $1,590,200 | $206,800 | $206,800 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $117,400 | $46,200 | $46,200 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $80,100 | $39,500 | $39,500 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $26,100 | $25,000 | $25,000 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $73,400 | $33,400 | $0 | $0 | $0 | $33,400 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $685,500 | $11,200 | $11,200 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $134,500 | $23,500 | $0 | $0 | $0 | $23,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $130,000 | $19,800 | $0 | $0 | $0 | $19,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $4,059,200 | $3,527,300 | $531,900 | $4,657,500 | $4,065,800 | $591,700 | $1,123,600 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-3.5

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-3

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $349,800 | $349,800 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $2,210,300 | $2,101,200 | $109,100 | $0 | $0 | $0 | $109,100 |
| 3 | Fort Totten | $59,600 | $59,600 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $143,300 | $129,700 | $13,600 | $0 | $0 | $0 | $13,600 |
| 5 | St. Michael | $116,300 | $116,300 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,578,300 | $1,578,100 | $200 | $4,700 | $4,500 | $200 | $400 |
| 7 | Grahams Island State Park | $1,126,300 | $1,126,200 | $100 | $11,600 | $11,500 | $100 | $200 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $1,148,200 | $1,030,400 | $117,800 | $117,800 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,700 | $300 | $120,000 | $112,800 | $7,200 | $7,500 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,468,500 | $2,346,600 | $121,900 | $0 | $0 | $0 | $121,900 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $717,200 | $587,200 | $130,000 | $0 | $0 | $0 | $130,000 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $438,100 | $321,400 | $116,700 | $0 | $0 | $0 | $116,700 |
| 13 | US Highway 2 | $1,047,700 | $768,500 | $279,200 | $0 | $0 | $0 | $279,200 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $97,900 | $71,800 | $26,100 | $0 | $0 | $0 | $26,100 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $292,700 | $214,700 | $78,000 | $0 | $0 | $0 | $78,000 |
| 16 | Highway 281 South of US Highway 2 | $1,484,000 | $1,483,800 | $200 | $1,569,300 | $1,569,200 | $100 | $300 |
| 17 | Highway 281 North of US Highway 2 | $132,700 | $115,300 | $17,400 | $265,900 | $231,100 | $34,800 | $52,200 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $694,500 | $509,500 | $185,000 | $0 | $0 | $0 | $185,000 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $45,100 | $32,600 | $0 | $0 | $0 | $32,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $170,500 | $125,100 | $45,400 | $0 | $0 | $0 | $45,400 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $404,400 | $374,600 | $29,800 | $0 | $0 | $0 | $29,800 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $24,193,300 | $23,007,700 | $1,185,600 | $3,119,700 | $2,959,500 | $160,200 | $1,345,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-3.6

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-3

## Annual Benefits of Project for Features Adjacent to Devils Lake Based on Set of No Flood Protection Strategies (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,300 | $333,000 | $300 | $300 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $5,607,400 | $5,167,900 | $439,500 | $439,500 |
| 3 | Fort Totten | $0 | $0 | $0 | $10,200 | $8,900 | $1,300 | $1,300 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $170,700 | $138,200 | $32,500 | $32,500 |
| 5 | St. Michael | $0 | $0 | $0 | $19,400 | $16,800 | $2,600 | $2,600 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $35,300 | $24,600 | $10,700 | $10,700 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $94,000 | $79,000 | $15,000 | $15,000 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $2,265,900 | $2,105,800 | $160,100 | $160,100 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $124,200 | $116,700 | $7,500 | $7,500 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $218,600 | $19,000 | $19,000 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $375,000 | $245,700 | $129,300 | $129,300 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $27,700 | $15,200 | $15,200 |
| 13 | US Highway 2 | $0 | $0 | $0 | $666,400 | $383,800 | $282,600 | $282,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $703,000 | $397,900 | $305,100 | $305,100 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $523,000 | $299,600 | $223,400 | $223,400 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,612,800 | $2,403,700 | $209,100 | $209,100 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $117,400 | $46,200 | $46,200 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $80,100 | $39,500 | $39,500 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $26,100 | $25,000 | $25,000 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $709,000 | $402,900 | $306,100 | $306,100 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $685,500 | $11,200 | $11,200 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $172,400 | $136,900 | $35,500 | $35,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,394,700 | $8,951,000 | $443,700 | $443,700 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $25,128,200 | $22,367,800 | $2,760,400 | $2,760,400 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.2.ST-3.7

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Analysis ST-3

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $58,540 | $58,540 | $58,540 | $58,540 |
| Outlet Operation and Maintenance | $6,365 | $6,365 | $6,365 | $6,365 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $87,537 | $87,537 | $87,537 | $87,537 |
| **Annualized Total Cost** | $5,847 | $5,847 | $5,847 | $5,847 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $1,124 | $1,346 | $2,760 | $1,477 |
| Downstream Features (weighted average) [5] | $164 | $164 | $164 | $164 |
| **Total Annualized Benefit** | $1,288 | $1,510 | $2,925 | $1,641 |
| | | | | |
| **NET BENEFIT** | -$4,559 | -$4,336 | -$2,922 | -$4,205 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.22 | 0.26 | 0.50 | 0.28 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

[5] For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the annualized benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.26 | 0.31 | 0.64 | 0.34 |
| Traces With BCR>1 | | | | |
| Total Number Out of 10,000 Traces | 564 | 901 | 2059 | 1002 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*ST-4 Tables*
*(Stochastic - West Bay 480 cfs Unconstrained Outlet)*

## Table TD.2.ST-4.1

## Economic Analysis of Devils Lake Alternatives

### Analysis ST-4
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Church Ferry to Cando | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1439 | 59 / 35 | Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1447 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1448 | 83 / 71 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1449 | 64 / 44 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1450 | 51 / 29 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1451 | 41 / 20 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1452 | 34 / 15 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1453 | 29 / 11 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1454 | 25 / 9 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1455 | 20 / 7 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1456 | 17 / 6 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1457 | 14 / 4 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 12 / 3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1459 | 9 / 3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1460 | 7 / 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1461 | 4 / 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1462 | 2 / 0.8 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 1 / 0.3 | | | | | | | | | | | | | | | | | | | | | | | | | |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.2.ST-4.2

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-4
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | R(1)A* | Relocation of Structure at First and Second Action Levels:1 Road Raise: Then Temporary Closure During Floods | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.2.ST-4.3

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-4

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $334,000 | $332,900 | $1,100 | $0 | $0 | $0 | $1,100 |
| 2 | City of Devils Lake | $836,100 | $463,500 | $372,600 | $0 | $0 | $0 | $372,600 |
| 3 | Fort Totten | $11,200 | $7,700 | $3,500 | $0 | $0 | $0 | $3,500 |
| 4 | City of Minnewaukan | $112,200 | $69,000 | $43,200 | $0 | $0 | $0 | $43,200 |
| 5 | St. Michael | $20,200 | $14,300 | $5,900 | $0 | $0 | $0 | $5,900 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $228,200 | $40,000 | $4,700 | $4,100 | $600 | $40,600 |
| 7 | Grahams Island State Park | $128,500 | $76,600 | $51,900 | $11,600 | $11,400 | $200 | $52,100 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $858,200 | $82,100 | $1,148,200 | $843,300 | $304,900 | $387,000 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $1,800 | $1,200 | $120,000 | $94,400 | $25,600 | $26,800 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $934,400 | $608,400 | $326,000 | $0 | $0 | $0 | $326,000 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $122,000 | $172,100 | $0 | $0 | $0 | $172,100 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $223,300 | $81,800 | $141,500 | $0 | $0 | $0 | $141,500 |
| 13 | US Highway 2 | $585,100 | $218,900 | $366,200 | $0 | $0 | $0 | $366,200 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $23,500 | $37,800 | $0 | $0 | $0 | $37,800 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $65,700 | $107,800 | $0 | $0 | $0 | $107,800 |
| 16 | Highway 281 South of US Highway 2 | $2,413,200 | $1,946,600 | $466,600 | $0 | $0 | $0 | $466,600 |
| 17 | Highway 281 North of US Highway 2 | $308,600 | $143,500 | $165,100 | $0 | $0 | $0 | $165,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $411,600 | $155,900 | $255,700 | $0 | $0 | $0 | $255,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $25,000 | $52,700 | $0 | $0 | $0 | $52,700 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $40,900 | $65,900 | $0 | $0 | $0 | $65,900 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,970,300 | $1,755,500 | $214,800 | $0 | $0 | $0 | $214,800 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $95,200 | $62,800 | $0 | $0 | $0 | $62,800 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $105,200 | $44,600 | $0 | $0 | $0 | $44,600 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $10,521,400 | $7,440,300 | $3,081,100 | $1,284,500 | $953,200 | $331,300 | $3,412,400 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-4.4

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-4

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $332,900 | $1,100 | $0 | $0 | $0 | $1,100 |
| 2 | City of Devils Lake | $836,100 | $463,500 | $372,600 | $0 | $0 | $0 | $372,600 |
| 3 | Fort Totten | $11,200 | $7,700 | $3,500 | $0 | $0 | $0 | $3,500 |
| 4 | City of Minnewaukan | $112,200 | $69,000 | $43,200 | $0 | $0 | $0 | $43,200 |
| 5 | St. Michael | $20,200 | $14,300 | $5,900 | $0 | $0 | $0 | $5,900 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $228,200 | $40,000 | $4,700 | $4,100 | $600 | $40,600 |
| 7 | Grahams Island State Park | $3,500 | $60,200 | -$56,700 | $93,800 | $20,400 | $73,400 | $16,700 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $858,200 | $82,100 | $1,148,200 | $843,300 | $304,900 | $387,000 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $1,800 | $1,200 | $120,000 | $94,400 | $25,600 | $26,800 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $150,200 | $87,400 | $87,400 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $122,000 | $172,100 | $0 | $0 | $0 | $172,100 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $14,700 | $28,200 | $28,200 |
| 13 | US Highway 2 | $347,400 | $142,300 | $205,100 | $182,300 | $49,800 | $132,500 | $337,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $23,500 | $37,800 | $0 | $0 | $0 | $37,800 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $65,700 | $107,800 | $0 | $0 | $0 | $107,800 |
| 16 | Highway 281 South of US Highway 2 | $239,600 | $239,400 | $200 | $1,797,000 | $1,071,800 | $725,200 | $725,400 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $61,000 | $102,600 | $102,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $41,900 | $77,700 | $77,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $13,800 | $37,300 | $37,300 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $40,900 | $65,900 | $0 | $0 | $0 | $65,900 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $598,600 | $98,100 | $98,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $95,200 | $62,800 | $0 | $0 | $0 | $62,800 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $105,200 | $44,600 | $0 | $0 | $0 | $44,600 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $4,059,200 | $2,870,000 | $1,189,200 | $4,657,500 | $2,964,000 | $1,693,500 | $2,882,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-4.5

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-4

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $349,800 | $349,600 | $200 | $0 | $0 | $0 | $200 |
| 2 | City of Devils Lake | $2,210,300 | $1,682,300 | $528,000 | $0 | $0 | $0 | $528,000 |
| 3 | Fort Totten | $59,600 | $59,500 | $100 | $0 | $0 | $0 | $100 |
| 4 | City of Minnewaukan | $143,300 | $92,500 | $50,800 | $0 | $0 | $0 | $50,800 |
| 5 | St. Michael | $116,300 | $116,300 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,578,300 | $1,577,600 | $700 | $4,700 | $4,100 | $600 | $1,300 |
| 7 | Grahams Island State Park | $1,126,300 | $1,125,900 | $400 | $11,600 | $11,400 | $200 | $600 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $1,148,200 | $843,300 | $304,900 | $304,900 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $1,800 | $1,200 | $120,000 | $94,400 | $25,600 | $26,800 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,468,500 | $1,878,800 | $589,700 | $0 | $0 | $0 | $589,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $717,200 | $345,100 | $372,100 | $0 | $0 | $0 | $372,100 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $438,100 | $179,400 | $258,700 | $0 | $0 | $0 | $258,700 |
| 13 | US Highway 2 | $1,047,700 | $428,900 | $618,800 | $0 | $0 | $0 | $618,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $97,900 | $40,100 | $57,800 | $0 | $0 | $0 | $57,800 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $292,700 | $119,800 | $172,900 | $0 | $0 | $0 | $172,900 |
| 16 | Highway 281 South of US Highway 2 | $1,484,000 | $1,483,300 | $700 | $1,569,300 | $1,568,700 | $600 | $1,300 |
| 17 | Highway 281 North of US Highway 2 | $132,700 | $74,100 | $58,600 | $265,900 | $150,100 | $115,800 | $174,400 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $694,500 | $284,400 | $410,100 | $0 | $0 | $0 | $410,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $25,000 | $52,700 | $0 | $0 | $0 | $52,700 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $170,500 | $69,800 | $100,700 | $0 | $0 | $0 | $100,700 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $404,400 | $281,500 | $122,900 | $0 | $0 | $0 | $122,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $24,193,300 | $20,796,200 | $3,397,100 | $3,119,700 | $2,672,000 | $447,700 | $3,844,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-4.6

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-4

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,300 | $332,600 | $700 | $700 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $5,607,400 | $4,004,600 | $1,602,800 | $1,602,800 |
| 3 | Fort Totten | $0 | $0 | $0 | $10,200 | $7,000 | $3,200 | $3,200 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $170,700 | $89,600 | $81,100 | $81,100 |
| 5 | St. Michael | $0 | $0 | $0 | $19,400 | $13,900 | $5,500 | $5,500 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $35,300 | $16,400 | $18,900 | $18,900 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $94,000 | $55,400 | $38,600 | $38,600 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $2,265,900 | $1,859,000 | $406,900 | $406,900 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $124,200 | $97,000 | $27,200 | $27,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $150,200 | $87,400 | $87,400 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $375,000 | $123,100 | $251,900 | $251,900 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $14,700 | $28,200 | $28,200 |
| 13 | US Highway 2 | $0 | $0 | $0 | $666,400 | $192,600 | $473,800 | $473,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $703,000 | $197,500 | $505,500 | $505,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $523,000 | $149,300 | $373,700 | $373,700 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,612,800 | $1,766,600 | $846,200 | $846,200 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $61,000 | $102,600 | $102,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $41,900 | $77,700 | $77,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $13,800 | $37,300 | $37,300 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $709,000 | $200,200 | $508,800 | $508,800 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $598,600 | $98,100 | $98,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $172,400 | $76,500 | $95,900 | $95,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,394,700 | $6,323,800 | $3,070,900 | $3,070,900 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $25,128,200 | $16,385,300 | $8,742,900 | $8,742,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.2.ST-4.7

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Analysis ST-4

(values in thousands of dollars)

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $92,190 | $92,190 | $92,190 | $92,190 |
| Outlet Operation and Maintenance | $11,734 | $11,734 | $11,734 | $11,734 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation(weighted average) [1] | $13,813 | $13,813 | $13,813 | $13,813 |
| Natural Resources Monitoring/Mitigation | $50,432 | $50,432 | $50,432 | $50,432 |
| **Total Costs: Present Value** | $168,169 | $168,169 | $168,169 | $168,169 |
| **Annualized Total Cost** | $11,232 | $11,232 | $11,232 | $11,232 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $2 | $2 | $2 | $2 |
| Features Adjacent to Devils Lake | $2,883 | $3,845 | $8,743 | $3,412 |
| Downstream Features (weighted average) [5] | -$3,295 | -$3,295 | -$3,295 | -$3,295 |
| **Total Annualized Benefit** | -$411 | $552 | $5,450 | $119 |
| | | | | |
| **NET BENEFIT** | -$11,642 | -$10,680 | -$5,782 | -$11,113 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | -0.04 | 0.05 | 0.49 | 0.01 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

[5] For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the costs and benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.42 | 0.55 | 1.26 | 0.49 |
| Traces With BCR>1 | | | | |
| Total Number Out of 10,000 Traces | 1441 | 2226 | 4695 | 1718 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*ST-5 Tables*
*(Stochastic - Pelican Lake 300 cfs Constrained Outlet)*

## Table TD.2.ST-5.1

## Economic Analysis of Devils Lake Alternatives

## Analysis ST-5
## Probability of Reaching Decision/Action Levels at Each Feature
## (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 251 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 251 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 59 / 43 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 83 / 76 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 64 / 51 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 51 / 36 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 41 / 26 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 34 / 21 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 29 / 16 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 25 / 13 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 20 / 11 | ■ | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1456 | 17 / 8 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 14 / 7 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 12 / 5 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 9 / 4 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 7 / 3 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 4 / 2 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 2 / 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 1 / 0.5 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.2.ST-5.2

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-5
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | A* | Relocation of Structures: Then Temporary Closure | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.2.ST-5.3

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-5

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Most Likely Action Strategies
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $334,000 | $333,300 | $700 | $0 | $0 | $0 | $700 |
| 2 | City of Devils Lake | $836,100 | $577,000 | $259,100 | $0 | $0 | $0 | $259,100 |
| 3 | Fort Totten | $11,200 | $8,700 | $2,500 | $0 | $0 | $0 | $2,500 |
| 4 | City of Minnewaukan | $112,200 | $82,800 | $29,400 | $0 | $0 | $0 | $29,400 |
| 5 | St. Michael | $20,200 | $16,000 | $4,200 | $0 | $0 | $0 | $4,200 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $239,400 | $28,800 | $4,700 | $4,300 | $400 | $29,200 |
| 7 | Grahams Island State Park | $128,500 | $92,200 | $36,300 | $11,600 | $11,400 | $200 | $36,500 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $882,400 | $57,900 | $1,148,200 | $935,700 | $212,500 | $270,400 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,200 | $800 | $120,000 | $102,200 | $17,800 | $18,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $934,400 | $708,200 | $226,200 | $0 | $0 | $0 | $226,200 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $169,600 | $124,500 | $0 | $0 | $0 | $124,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $223,300 | $119,000 | $104,300 | $0 | $0 | $0 | $104,300 |
| 13 | US Highway 2 | $585,100 | $316,600 | $268,500 | $0 | $0 | $0 | $268,500 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $33,700 | $27,600 | $0 | $0 | $0 | $27,600 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $94,800 | $78,700 | $0 | $0 | $0 | $78,700 |
| 16 | Highway 281 South of US Highway 2 | $2,413,200 | $1,817,900 | $595,300 | $0 | $0 | $0 | $595,300 |
| 17 | Highway 281 North of US Highway 2 | $308,600 | $190,500 | $118,100 | $0 | $0 | $0 | $118,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $411,600 | $151,800 | $259,800 | $0 | $0 | $0 | $259,800 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $37,900 | $39,800 | $0 | $0 | $0 | $39,800 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $58,800 | $48,000 | $0 | $0 | $0 | $48,000 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,970,300 | $1,817,000 | $153,300 | $0 | $0 | $0 | $153,300 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $114,600 | $43,400 | $0 | $0 | $0 | $43,400 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $118,100 | $31,700 | $0 | $0 | $0 | $31,700 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $10,521,400 | $7,982,500 | $2,538,900 | $1,284,500 | $1,053,600 | $230,900 | $2,769,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-5.4

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $333,300 | $700 | $0 | $0 | $0 | $700 |
| 2 | City of Devils Lake | $836,100 | $577,000 | $259,100 | $0 | $0 | $0 | $259,100 |
| 3 | Fort Totten | $11,200 | $8,700 | $2,500 | $0 | $0 | $0 | $2,500 |
| 4 | City of Minnewaukan | $112,200 | $82,800 | $29,400 | $0 | $0 | $0 | $29,400 |
| 5 | St. Michael | $20,200 | $16,000 | $4,200 | $0 | $0 | $0 | $4,200 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $239,400 | $28,800 | $4,700 | $4,300 | $400 | $29,200 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $93,800 | $66,500 | $27,300 | $27,300 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $882,400 | $57,900 | $1,148,200 | $935,700 | $212,500 | $270,400 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,200 | $800 | $120,000 | $102,200 | $17,800 | $18,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $180,600 | $57,000 | $57,000 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $169,600 | $124,500 | $0 | $0 | $0 | $124,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $22,000 | $20,900 | $20,900 |
| 13 | US Highway 2 | $347,400 | $200,800 | $146,600 | $182,300 | $78,700 | $103,600 | $250,200 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $33,700 | $27,600 | $0 | $0 | $0 | $27,600 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $94,800 | $78,700 | $0 | $0 | $0 | $78,700 |
| 16 | Highway 281 South of US Highway 2 | $239,600 | $239,500 | $100 | $1,797,000 | $1,312,000 | $485,000 | $485,100 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $89,100 | $74,500 | $74,500 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $62,600 | $57,000 | $57,000 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $21,900 | $29,200 | $29,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $58,800 | $48,000 | $0 | $0 | $0 | $48,000 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $654,400 | $42,300 | $42,300 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $114,600 | $43,400 | $0 | $0 | $0 | $43,400 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $118,100 | $31,700 | $0 | $0 | $0 | $31,700 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $4,059,200 | $3,175,200 | $884,000 | $4,657,500 | $3,530,000 | $1,127,500 | $2,011,500 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-5.5

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-5

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $349,800 | $349,700 | $100 | $0 | $0 | $0 | $100 |
| 2 | City of Devils Lake | $2,210,300 | $1,864,400 | $345,900 | $0 | $0 | $0 | $345,900 |
| 3 | Fort Totten | $59,600 | $59,600 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $143,300 | $109,300 | $34,000 | $0 | $0 | $0 | $34,000 |
| 5 | St. Michael | $116,300 | $116,300 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,578,300 | $1,577,900 | $400 | $4,700 | $4,300 | $400 | $800 |
| 7 | Grahams Island State Park | $1,126,300 | $1,126,100 | $200 | $11,600 | $11,400 | $200 | $400 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $1,148,200 | $935,700 | $212,500 | $212,500 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,200 | $800 | $120,000 | $102,200 | $17,800 | $18,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,468,500 | $2,082,200 | $386,300 | $0 | $0 | $0 | $386,300 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $717,200 | $459,800 | $257,400 | $0 | $0 | $0 | $257,400 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $438,100 | $253,300 | $184,800 | $0 | $0 | $0 | $184,800 |
| 13 | US Highway 2 | $1,047,700 | $605,800 | $441,900 | $0 | $0 | $0 | $441,900 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $97,900 | $56,600 | $41,300 | $0 | $0 | $0 | $41,300 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $292,700 | $169,200 | $123,500 | $0 | $0 | $0 | $123,500 |
| 16 | Highway 281 South of US Highway 2 | $1,484,000 | $1,483,600 | $400 | $1,569,300 | $1,569,000 | $300 | $700 |
| 17 | Highway 281 North of US Highway 2 | $132,700 | $92,100 | $40,600 | $265,900 | $185,700 | $80,200 | $120,800 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $694,500 | $269,100 | $425,400 | $0 | $0 | $0 | $425,400 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $37,900 | $39,800 | $0 | $0 | $0 | $39,800 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $170,500 | $98,600 | $71,900 | $0 | $0 | $0 | $71,900 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $404,400 | $323,200 | $81,200 | $0 | $0 | $0 | $81,200 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $24,193,300 | $21,717,400 | $2,475,900 | $3,119,700 | $2,808,300 | $311,400 | $2,787,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-5.6

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,300 | $332,800 | $500 | $500 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $5,607,400 | $4,529,400 | $1,078,000 | $1,078,000 |
| 3 | Fort Totten | $0 | $0 | $0 | $10,200 | $7,900 | $2,300 | $2,300 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $170,700 | $114,000 | $56,700 | $56,700 |
| 5 | St. Michael | $0 | $0 | $0 | $19,400 | $15,400 | $4,000 | $4,000 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $35,300 | $22,100 | $13,200 | $13,200 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $94,000 | $66,600 | $27,400 | $27,400 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $2,265,900 | $1,981,500 | $284,400 | $284,400 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $124,200 | $105,300 | $18,900 | $18,900 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $180,600 | $57,000 | $57,000 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $375,000 | $188,300 | $186,700 | $186,700 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $22,000 | $20,900 | $20,900 |
| 13 | US Highway 2 | $0 | $0 | $0 | $666,400 | $305,000 | $361,400 | $361,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $703,000 | $316,200 | $386,800 | $386,800 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $523,000 | $237,800 | $285,200 | $285,200 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,612,800 | $2,072,100 | $540,700 | $540,700 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $89,100 | $74,500 | $74,500 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $62,600 | $57,000 | $57,000 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $21,900 | $29,200 | $29,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $709,000 | $320,000 | $389,000 | $389,000 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $654,400 | $42,300 | $42,300 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $172,400 | $104,900 | $67,500 | $67,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,394,700 | $8,167,600 | $1,227,100 | $1,227,100 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $25,128,200 | $19,917,500 | $5,210,700 | $5,210,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.2.ST-5.7

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Analysis ST-5

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $84,180 | $84,180 | $84,180 | $84,180 |
| Outlet Operation and Maintenance | $9,475 | $9,475 | $9,475 | $9,475 |
| Hwy 19 Dam Construction | $381 | $381 | $381 | $381 |
| Hwy 19 Dam Operation and Maintenance | $68 | $68 | $68 | $68 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $116,736 | $116,736 | $116,736 | $116,736 |
| **Annualized Total Cost** | $7,797 | $7,797 | $7,797 | $7,797 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $1 | $1 | $1 | $1 |
| Features Adjacent to Devils Lake | $2,012 | $2,787 | $5,211 | $2,770 |
| Downstream Features (weighted average) [5] | $134 | $134 | $134 | $134 |
| **Total Annualized Benefit** | $2,146 | $2,922 | $5,346 | $2,905 |
| | | | | |
| **NET BENEFIT** | -$5,650 | -$4,874 | -$2,451 | -$4,892 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.28 | 0.37 | 0.69 | 0.37 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

[5]For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the annualized benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.32 | 0.44 | 0.83 | 0.44 |
| Traces With BCR>1 | | | | |
| Total Number Out of 10,000 Traces | 803 | 1606 | 3125 | 1412 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*ST-6 Tables*
*(Stochastic - Pelican Lake 480 cfs Unconstrained Outlet)*

## Table TD.2.ST-6.1

## Economic Analysis of Devils Lake Alternatives

### Analysis ST-6
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Cando | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19 / Devils Lake to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20 / Devils Lake to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 (Stump Lake) | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 59 / 35 (Stump Lake) | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 83 / 71 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 64 / 44 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 51 / 29 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 41 / 20 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 34 / 15 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 29 / 11 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 25 / 9 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 20 / 7 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 17 / 6 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 14 / 4 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 12 / 3 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 9 / 3 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 7 / 2 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 4 / 1 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 2 / 0.7 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 1 / 0.3 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.2.ST-6.2

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-6
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | A* | Relocation of Structures: Then Temporary Closure | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.2.ST-6.3

### Economic Analysis of Devils Lake Alternatives
### Analysis ST-6

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Most Likely Action Strategies
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $332,900 | $1,100 | $0 | $0 | $0 | $1,100 |
| 2 | City of Devils Lake | $836,100 | $463,400 | $372,700 | $0 | $0 | $0 | $372,700 |
| 3 | Fort Totten | $11,200 | $7,700 | $3,500 | $0 | $0 | $0 | $3,500 |
| 4 | City of Minnewaukan | $112,200 | $69,000 | $43,200 | $0 | $0 | $0 | $43,200 |
| 5 | St. Michael | $20,200 | $14,300 | $5,900 | $0 | $0 | $0 | $5,900 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $228,200 | $40,000 | $4,700 | $4,100 | $600 | $40,600 |
| 7 | Grahams Island State Park | $128,500 | $76,500 | $52,000 | $11,600 | $11,400 | $200 | $52,200 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $858,200 | $82,100 | $1,148,200 | $843,500 | $304,700 | $386,800 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $1,800 | $1,200 | $120,000 | $94,400 | $25,600 | $26,800 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $934,400 | $608,800 | $325,600 | $0 | $0 | $0 | $325,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $122,000 | $172,100 | $0 | $0 | $0 | $172,100 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $223,300 | $81,700 | $141,600 | $0 | $0 | $0 | $141,600 |
| 13 | US Highway 2 | $585,100 | $218,700 | $366,400 | $0 | $0 | $0 | $366,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $23,400 | $37,900 | $0 | $0 | $0 | $37,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $65,700 | $107,800 | $0 | $0 | $0 | $107,800 |
| 16 | Highway 281 South of US Highway 2 | $2,413,200 | $1,694,000 | $719,200 | $0 | $0 | $0 | $719,200 |
| 17 | Highway 281 North of US Highway 2 | $308,600 | $143,300 | $165,300 | $0 | $0 | $0 | $165,300 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $411,600 | $105,300 | $306,300 | $0 | $0 | $0 | $306,300 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $25,000 | $52,700 | $0 | $0 | $0 | $52,700 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $40,900 | $65,900 | $0 | $0 | $0 | $65,900 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,970,300 | $1,755,400 | $214,900 | $0 | $0 | $0 | $214,900 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $95,200 | $62,800 | $0 | $0 | $0 | $62,800 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $105,100 | $44,700 | $0 | $0 | $0 | $44,700 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $10,521,400 | $7,136,500 | $3,384,900 | $1,284,500 | $953,400 | $331,100 | $3,716,000 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-6.4

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $332,900 | $1,100 | $0 | $0 | $0 | $1,100 |
| 2 | City of Devils Lake | $836,100 | $463,400 | $372,700 | $0 | $0 | $0 | $372,700 |
| 3 | Fort Totten | $11,200 | $7,700 | $3,500 | $0 | $0 | $0 | $3,500 |
| 4 | City of Minnewaukan | $112,200 | $69,000 | $43,200 | $0 | $0 | $0 | $43,200 |
| 5 | St. Michael | $20,200 | $14,300 | $5,900 | $0 | $0 | $0 | $5,900 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $228,200 | $40,000 | $4,700 | $4,100 | $600 | $40,600 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $93,800 | $55,400 | $38,400 | $38,400 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $858,200 | $82,100 | $1,148,200 | $843,500 | $304,700 | $386,800 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $1,800 | $1,200 | $120,000 | $94,400 | $25,600 | $26,800 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $150,300 | $87,300 | $87,300 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $122,000 | $172,100 | $0 | $0 | $0 | $172,100 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $14,700 | $28,200 | $28,200 |
| 13 | US Highway 2 | $347,400 | $142,100 | $205,300 | $182,300 | $49,700 | $132,600 | $337,900 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $23,400 | $37,900 | $0 | $0 | $0 | $37,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $65,700 | $107,800 | $0 | $0 | $0 | $107,800 |
| 16 | Highway 281 South of US Highway 2 | $239,600 | $239,400 | $200 | $1,797,000 | $1,072,400 | $724,600 | $724,800 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $61,000 | $102,600 | $102,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $41,900 | $77,700 | $77,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $13,800 | $37,300 | $37,300 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $40,900 | $65,900 | $0 | $0 | $0 | $65,900 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $598,800 | $97,900 | $97,900 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $95,200 | $62,800 | $0 | $0 | $0 | $62,800 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $105,100 | $44,700 | $0 | $0 | $0 | $44,700 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $4,059,200 | $2,812,800 | $1,246,400 | $4,657,500 | $3,000,000 | $1,657,500 | $2,903,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-6.5

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-6

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $349,800 | $349,600 | $200 | $0 | $0 | $0 | $200 |
| 2 | City of Devils Lake | $2,210,300 | $1,683,700 | $526,600 | $0 | $0 | $0 | $526,600 |
| 3 | Fort Totten | $59,600 | $59,500 | $100 | $0 | $0 | $0 | $100 |
| 4 | City of Minnewaukan | $143,300 | $92,600 | $50,700 | $0 | $0 | $0 | $50,700 |
| 5 | St. Michael | $116,300 | $116,300 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,578,300 | $1,577,600 | $700 | $4,700 | $4,100 | $600 | $1,300 |
| 7 | Grahams Island State Park | $1,126,300 | $1,125,900 | $400 | $11,600 | $11,400 | $200 | $600 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $1,148,200 | $843,500 | $304,700 | $304,700 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $1,800 | $1,200 | $120,000 | $94,400 | $25,600 | $26,800 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,468,500 | $1,880,300 | $588,200 | $0 | $0 | $0 | $588,200 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $717,200 | $344,800 | $372,400 | $0 | $0 | $0 | $372,400 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $438,100 | $179,100 | $259,000 | $0 | $0 | $0 | $259,000 |
| 13 | US Highway 2 | $1,047,700 | $428,400 | $619,300 | $0 | $0 | $0 | $619,300 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $97,900 | $40,000 | $57,900 | $0 | $0 | $0 | $57,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $292,700 | $119,700 | $173,000 | $0 | $0 | $0 | $173,000 |
| 16 | Highway 281 South of US Highway 2 | $1,484,000 | $1,483,300 | $700 | $1,569,300 | $1,568,700 | $600 | $1,300 |
| 17 | Highway 281 North of US Highway 2 | $132,700 | $74,000 | $58,700 | $265,900 | $149,800 | $116,100 | $174,800 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $694,500 | $190,300 | $504,200 | $0 | $0 | $0 | $504,200 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $25,000 | $52,700 | $0 | $0 | $0 | $52,700 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $170,500 | $69,700 | $100,800 | $0 | $0 | $0 | $100,800 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $404,400 | $281,400 | $123,000 | $0 | $0 | $0 | $123,000 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $24,193,300 | $20,703,500 | $3,489,800 | $3,119,700 | $2,671,900 | $447,800 | $3,937,600 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-6.6

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,300 | $332,600 | $700 | $700 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $5,607,400 | $4,007,400 | $1,600,000 | $1,600,000 |
| 3 | Fort Totten | $0 | $0 | $0 | $10,200 | $7,000 | $3,200 | $3,200 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $170,700 | $89,600 | $81,100 | $81,100 |
| 5 | St. Michael | $0 | $0 | $0 | $19,400 | $13,900 | $5,500 | $5,500 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $35,300 | $16,400 | $18,900 | $18,900 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $94,000 | $55,400 | $38,600 | $38,600 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $2,265,900 | $1,859,100 | $406,800 | $406,800 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $124,200 | $97,000 | $27,200 | $27,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $150,300 | $87,300 | $87,300 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $375,000 | $123,000 | $252,000 | $252,000 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $14,700 | $28,200 | $28,200 |
| 13 | US Highway 2 | $0 | $0 | $0 | $666,400 | $192,200 | $474,200 | $474,200 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $703,000 | $197,200 | $505,800 | $505,800 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $523,000 | $149,100 | $373,900 | $373,900 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,612,800 | $1,767,800 | $845,000 | $845,000 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $61,000 | $102,600 | $102,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $41,900 | $77,700 | $77,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $13,800 | $37,300 | $37,300 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $709,000 | $199,800 | $509,200 | $509,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $598,800 | $97,900 | $97,900 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $172,400 | $76,500 | $95,900 | $95,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,394,700 | $6,327,800 | $3,066,900 | $3,066,900 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $25,128,200 | $16,392,300 | $8,735,900 | $8,735,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.2.ST-6.7

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Analysis ST-6

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $129,230 | $129,230 | $129,230 | $129,230 |
| Outlet Operation and Maintenance | $13,985 | $13,985 | $13,985 | $13,985 |
| Hwy 19 Dam Construction | $256 | $256 | $256 | $256 |
| Hwy 19 Dam Operation and Maintenance | $47 | $47 | $47 | $47 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation (weighted average) [1] | $12,518 | $12,518 | $12,518 | $12,518 |
| Natural Resources Monitoring/Mitigation | $50,432 | $50,432 | $50,432 | $50,432 |
| **Total Costs: Present Value** | $206,468 | $206,468 | $206,468 | $206,468 |
| **Annualized Total Cost** | $13,790 | $13,790 | $13,790 | $13,790 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $2 | $2 | $2 | $2 |
| Features Adjacent to Devils Lake | $2,904 | $3,938 | $8,736 | $3,716 |
| Downstream Features (weighted average) [5] | -$2,290 | -$2,290 | -$2,290 | -$2,290 |
| **Total Annualized Benefit** | $615 | $1,649 | $6,447 | $1,428 |
| | | | | |
| **NET BENEFIT** | -$13,174 | -$12,141 | -$7,342 | -$12,362 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.04 | 0.12 | 0.47 | 0.10 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

[5] For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the costs and benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.30 | 0.41 | 0.91 | 0.39 |
| Traces With BCR>1 | | | | |
| Total Number Out of 10,000 Traces | 724 | 1442 | 3628 | 1317 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*ST-7a Tables*
*(Stochastic - Combination 1 - Upper Basin Management and Maximum Infrastructure Protection)*

## Table TD.2.ST-7a.1

## Economic Analysis of Devils Lake Alternatives

### Analysis ST-7a
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rea. | 7 Graham's Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Alions US Hwy 2 | 12 BNRR / Churches Ferry to Canada | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Without Outlet % / With Outlet % | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 59 / 54 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 83 / 80 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 64 / 60 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 51 / 46 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 41 / 36 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 34 / 30 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 29 / 25 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 25 / 21 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 20 / 17 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 17 / 14 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 14 / 12 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 12 / 10 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 9 / 8 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 7 / 6 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 4 / 4 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 2 / 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 1 / 0.8 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.2.ST-7a.2

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-7a
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Maximum Infrastructure Protection Strategies WITHOUT PROJECT | | Based on Set of Maximum Infrastructure Protection Strategies WITH PROJECT | |
|---|---|---|---|---|---|
| | | Name | Description | Name | Description |
| 1 | Churchs Ferry | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.2.ST-7a.3

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-7a

## Annual Benefits of Project for Features Adjacent to Devils Lake Based on Set of Maximum Infrastructure Protection (MIP) Strategies (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,300 | $0 | $333,300 | $333,300 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $5,607,400 | $0 | $5,607,400 | $5,607,400 |
| 3 | Fort Totten | $0 | $0 | $0 | $10,200 | $0 | $10,200 | $10,200 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $170,700 | $0 | $170,700 | $170,700 |
| 5 | St. Michael | $0 | $0 | $0 | $19,400 | $0 | $19,400 | $19,400 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $35,300 | $4,600 | $30,700 | $30,700 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $94,000 | $11,600 | $82,400 | $82,400 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $2,265,900 | $1,073,600 | $1,192,300 | $1,192,300 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $124,200 | $114,200 | $10,000 | $10,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $0 | $237,600 | $237,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $375,000 | $0 | $375,000 | $375,000 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $0 | $42,900 | $42,900 |
| 13 | US Highway 2 | $0 | $0 | $0 | $666,400 | $0 | $666,400 | $666,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $703,000 | $0 | $703,000 | $703,000 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $523,000 | $0 | $523,000 | $523,000 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,612,800 | $0 | $2,612,800 | $2,612,800 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $0 | $163,600 | $163,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $0 | $119,600 | $119,600 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $0 | $51,100 | $51,100 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $709,000 | $0 | $709,000 | $709,000 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $0 | $696,700 | $696,700 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $172,400 | $0 | $172,400 | $172,400 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,394,700 | $0 | $9,394,700 | $9,394,700 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $25,128,200 | $1,204,000 | $23,924,200 | $23,924,200 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The maximum infrastructure protection strategies analyzed include temporary closure of roads and rail lines without the project.

· With the project feature were assumed to be incremental protected or relocated.

· The costs and damages for without the project assume the feature are not protected or are abandoned.

· The costs with the project assume incremental protection of all the feature and are included as a project cost in Table TD.2.ST-7a.4

· The damages with the project assume incremental protection of all the feature.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
## Table TD.2.ST-7a.4

### Cost and Benefit Summary with Maximum Infrastructure Protection
Analysis ST-7a

| (in thousands of dollars) | |
|---|---|
| **COSTS** | |
| Outlet Construction | $0 |
| Outlet Operation and Maintenance | $0 |
| Hwy 19 Dam Construction | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 |
| Maximum Infrastructure Protection (MIP) | $125,926 |
| MIP Operation and Maintenance | $1,905 |
| Expanded Infrastructure Measures (EIM) | $0 |
| EIM Operation and Maintenance | $0 |
| Upper Basin Management | $39,681 |
| Ion Exchange/Alternate Water Source Installation | $0 |
| Natural Resources Monitoring/Mitigation | $0 |
| **Total Costs: Present Value** | $167,512 |
| **Annualized Total Cost** | $11,188 |
| | |
| **ANNUALIZED BENEFITS** | |
| Annual Cost Savings and Damages Prevented: | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 |
| Features Adjacent to Devils Lake[2] | $23,924 |
| Downstream Features (weighted average)[1] | NA |
| **Total Annualized Benefit** | NA |
| | |
| **NET BENEFIT** | NA |
| | |
| **BENEFIT-COST RATIO (BCR)** | NA |

[1]For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the annualized benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories. If the weighted average is "NA", there was no data to compute the weighted average.

[2]The Annual Cost Savings and Damages Prevented values for the features adjacent to Devils Lake for the with-project condition are for the Most Likely Action strategies. The costs and damages for the without-project condition are no protection strategies.

Note: Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.
The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | |
|---|---|
| Benefit-Cost Ratio (BCR) | 2.14 |
| Traces With BCR>1 | |
| Total Number Out of 10,000 Traces | 9996 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.
The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

***ST-7b Tables***
***(Stochastic - Combination 1 - Upper Basin Management and Expanded Infrastructure Measures)***

## Table TD.2.ST-7b.1

## Economic Analysis of Devils Lake Alternatives

### Analysis ST-7b
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8.1 | 8.2 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Churcha Ferry | City of Devils Lake | Fort Totten | City of Minnewaukan | St. Michael | Gilbert C. Grafton State Mill. Res. | Graham Island State Park | Devils Lake Rural Areas | Stump Lake Rural Areas | RRV&W / Minnewaukan South | CPR / Devils Lake to Harlowe | BNRR / Alonzo US Hwy 2 | BNRR / Churchs Ferry to Canado | US Hwy 2 | Hwy 57 between Hwy 20 and BIA 1 | Hwy 57 between BIA 1 and Hwy 281 | Hwy 281 South of US Hwy 2 | Hwy 281 North of US Hwy 2 | Hwy 19 / Devils Lake Levee to Hwy 281 | Hwy 1 | Hwy 20 North of Devils Lake | Hwy 20 / Devils Lake Levee to Hwy 57 | Hwy 20 between Hwy 57 and Tokio | BIA 1 between Hwy 57 and BIA 6 | BIA 6 between Hwy 20 and Fort Totten |
| | Without Outlet % / With Outlet % | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 | Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 59 / 54 | Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 83 / 80 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 64 / 60 | | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 51 / 46 | | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 41 / 36 | | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 34 / 30 | | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 29 / 25 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 25 / 21 | | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 20 / 17 | | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 17 / 14 | | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 14 / 12 | | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 12 / 10 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 9 / 8 | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 7 / 6 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 4 / 4 | | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 2 / 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 1 / 0.8 | | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.2.ST-7b.2

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-7b
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | A* | Relocation of Structures: Then Temporary Closure | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(2)A | 2 Incremental Road Raise:Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

**Table TD.2.ST-7b.3**

**Economic Analysis of Devils Lake Alternatives**
**Analysis ST-7b**

**Annual Benefits of Project for Features Adjacent to Devils Lake**
**Based on Set of Most Likely Action Strategies**
**(listed by feature)**

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $333,700 | $300 | $0 | $0 | $0 | $300 |
| 2 | City of Devils Lake | $836,100 | $756,300 | $79,800 | $0 | $0 | $0 | $79,800 |
| 3 | Fort Totten | $11,200 | $10,400 | $800 | $0 | $0 | $0 | $800 |
| 4 | City of Minnewaukan | $112,200 | $101,700 | $10,500 | $0 | $0 | $0 | $10,500 |
| 5 | St. Michael | $20,200 | $0 | $20,200 | $0 | $0 | $0 | $20,200 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $260,000 | $8,200 | $4,700 | $4,600 | $100 | $8,300 |
| 7 | Grahams Island State Park | $128,500 | $116,600 | $11,900 | $11,600 | $11,600 | $0 | $11,900 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $614,000 | $326,300 | $1,148,200 | $1,073,600 | $74,600 | $400,900 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,700 | $300 | $120,000 | $114,200 | $5,800 | $6,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $934,400 | $856,700 | $77,700 | $0 | $0 | $0 | $77,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $255,900 | $38,200 | $0 | $0 | $0 | $38,200 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $223,300 | $190,100 | $33,200 | $0 | $0 | $0 | $33,200 |
| 13 | US Highway 2 | $585,100 | $499,400 | $85,700 | $0 | $0 | $0 | $85,700 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $52,500 | $8,800 | $0 | $0 | $0 | $8,800 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $148,400 | $25,100 | $0 | $0 | $0 | $25,100 |
| 16 | Highway 281 South of US Highway 2 | $2,413,200 | $2,309,600 | $103,600 | $0 | $0 | $0 | $103,600 |
| 17 | Highway 281 North of US Highway 2 | $308,600 | $271,900 | $36,700 | $0 | $0 | $0 | $36,700 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $411,600 | $351,900 | $59,700 | $0 | $0 | $0 | $59,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $65,100 | $12,600 | $0 | $0 | $0 | $12,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $91,500 | $15,300 | $0 | $0 | $0 | $15,300 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,970,300 | $39,700 | $1,930,600 | $0 | $0 | $0 | $1,930,600 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $143,200 | $14,800 | $0 | $0 | $0 | $14,800 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $0 | $149,800 | $0 | $0 | $0 | $149,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $10,521,400 | $7,471,300 | $3,050,100 | $1,284,500 | $1,204,000 | $80,500 | $3,130,600 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-7b.4

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-7b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $333,700 | $300 | $0 | $0 | $0 | $300 |
| 2 | City of Devils Lake | $836,100 | $756,300 | $79,800 | $0 | $0 | $0 | $79,800 |
| 3 | Fort Totten | $11,200 | $10,400 | $800 | $0 | $0 | $0 | $800 |
| 4 | City of Minnewaukan | $112,200 | $101,700 | $10,500 | $0 | $0 | $0 | $10,500 |
| 5 | St. Michael | $20,200 | $0 | $20,200 | $0 | $0 | $0 | $20,200 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $260,000 | $8,200 | $4,700 | $4,600 | $100 | $8,300 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $93,800 | $85,400 | $8,400 | $8,400 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $614,000 | $326,300 | $1,148,200 | $1,073,600 | $74,600 | $400,900 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,700 | $300 | $120,000 | $114,200 | $5,800 | $6,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $217,900 | $19,700 | $19,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $255,900 | $38,200 | $0 | $0 | $0 | $38,200 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $36,600 | $6,300 | $6,300 |
| 13 | US Highway 2 | $347,400 | $300,200 | $47,200 | $182,300 | $150,400 | $31,900 | $79,100 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $52,500 | $8,800 | $0 | $0 | $0 | $8,800 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $148,400 | $25,100 | $0 | $0 | $0 | $25,100 |
| 16 | Highway 281 South of US Highway 2 | $239,600 | $239,500 | $100 | $1,797,000 | $1,656,400 | $140,600 | $140,700 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $142,500 | $21,100 | $21,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $101,600 | $18,000 | $18,000 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $42,100 | $9,000 | $9,000 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $91,500 | $15,300 | $0 | $0 | $0 | $15,300 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $39,700 | -$39,700 | $696,700 | $0 | $696,700 | $657,000 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $128,300 | $29,700 | $0 | $8,800 | -$8,800 | $20,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $0 | $149,800 | $0 | $0 | $0 | $149,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $4,059,200 | $3,338,300 | $720,900 | $4,657,500 | $3,634,100 | $1,023,400 | $1,744,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-7b.5

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-7b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $349,800 | $349,800 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $2,210,300 | $2,081,700 | $128,600 | $0 | $0 | $0 | $128,600 |
| 3 | Fort Totten | $59,600 | $59,600 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $143,300 | $130,700 | $12,600 | $0 | $0 | $0 | $12,600 |
| 5 | St. Michael | $116,300 | $0 | $116,300 | $0 | $0 | $0 | $116,300 |
| 6 | Gilbert C. Grafton State Military Res. | $1,578,300 | $1,578,100 | $200 | $4,700 | $4,600 | $100 | $300 |
| 7 | Grahams Island State Park | $1,126,300 | $1,126,200 | $100 | $11,600 | $11,600 | $0 | $100 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,002,400 | $409,900 | $1,148,200 | $1,073,600 | $74,600 | $484,500 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,700 | $300 | $120,000 | $114,200 | $5,800 | $6,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,468,500 | $2,324,900 | $143,600 | $0 | $0 | $0 | $143,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $717,200 | $640,000 | $77,200 | $0 | $0 | $0 | $77,200 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $438,100 | $378,600 | $59,500 | $0 | $0 | $0 | $59,500 |
| 13 | US Highway 2 | $1,047,700 | $905,400 | $142,300 | $0 | $0 | $0 | $142,300 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $97,900 | $84,600 | $13,300 | $0 | $0 | $0 | $13,300 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $292,700 | $252,900 | $39,800 | $0 | $0 | $0 | $39,800 |
| 16 | Highway 281 South of US Highway 2 | $1,484,000 | $1,483,800 | $200 | $1,569,300 | $1,569,100 | $200 | $400 |
| 17 | Highway 281 North of US Highway 2 | $132,700 | $119,800 | $12,900 | $265,900 | $240,200 | $25,700 | $38,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $694,500 | $600,200 | $94,300 | $0 | $0 | $0 | $94,300 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $65,100 | $12,600 | $0 | $0 | $0 | $12,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $170,500 | $147,300 | $23,200 | $0 | $0 | $0 | $23,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $65,500 | $6,861,200 | $0 | $0 | $0 | $6,861,200 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $404,400 | $373,100 | $31,300 | $0 | $0 | $0 | $31,300 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $0 | $1,241,500 | $0 | $0 | $0 | $1,241,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $24,193,300 | $14,772,400 | $9,420,900 | $3,119,700 | $3,013,300 | $106,400 | $9,527,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-7b.6

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-7b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,300 | $333,100 | $200 | $200 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $5,607,400 | $5,232,600 | $374,800 | $374,800 |
| 3 | Fort Totten | $0 | $0 | $0 | $10,200 | $9,500 | $700 | $700 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $170,700 | $151,900 | $18,800 | $18,800 |
| 5 | St. Michael | $0 | $0 | $0 | $19,400 | $18,100 | $1,300 | $1,300 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $35,300 | $31,900 | $3,400 | $3,400 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $94,000 | $85,600 | $8,400 | $8,400 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $2,265,900 | $1,861,300 | $404,600 | $404,600 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $124,200 | $118,100 | $6,100 | $6,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $217,900 | $19,700 | $19,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $375,000 | $323,500 | $51,500 | $51,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $36,600 | $6,300 | $6,300 |
| 13 | US Highway 2 | $0 | $0 | $0 | $666,400 | $564,800 | $101,600 | $101,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $703,000 | $594,600 | $108,400 | $108,400 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $523,000 | $442,500 | $80,500 | $80,500 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,612,800 | $2,466,000 | $146,800 | $146,800 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $142,500 | $21,100 | $21,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $101,600 | $18,000 | $18,000 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $42,100 | $9,000 | $9,000 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $709,000 | $599,800 | $109,200 | $109,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $683,300 | $13,400 | $13,400 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $172,400 | $152,800 | $19,600 | $19,600 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,394,700 | $9,048,000 | $346,700 | $346,700 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $25,128,200 | $23,258,100 | $1,870,100 | $1,870,100 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.2.ST-7b.7

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Analysis ST-7b

(values in thousands of dollars)

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $0 | $0 | $0 | $0 |
| Outlet Operation and Maintenance | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $14,062 | $14,062 | $14,062 | $14,062 |
| EIM Operation and Maintenance | $1,905 | $1,905 | $1,905 | $1,905 |
| Upper Basin Management | $39,681 | $39,681 | $39,681 | $39,681 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $0 | $0 | $0 | $0 |
| **Total Costs: Present Value** | $55,648 | $55,648 | $55,648 | $55,648 |
| **Annualized Total Cost** | $3,717 | $3,717 | $3,717 | $3,717 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $1,744 | $9,527 | $1,870 | $3,131 |
| Downstream Features (weighted average) [5] | NA | NA | NA | NA |
| **Total Annualized Benefit** | $1,745 | $9,528 | $1,870 | $3,131 |
| | | | | |
| **NET BENEFIT** | -$1,972 | $5,811 | -$1,846 | -$586 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.47 | 2.56 | 0.50 | 0.84 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

[5] For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the annualized benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

If the weighted average is "NA", this type of scenario was not run for the the wet, moderate-wet, moderate-dry and dry conditions.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.47 | 2.56 | 0.50 | 0.84 |
| Traces With BCR>1 | | | | |
| Total Number Out of 10,000 Traces | 390 | 9982 | 1128 | 2091 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

***ST-8a Tables***
***(Stochastic - Combination 2 - West Bay 300 cfs Constrained Outlet, Upper Basin Management , and Maximum Infrastructure Protection)***

## Table TD.2.ST-8a.1

## Economic Analysis of Devils Lake Alternatives

### Analysis ST-8a
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churches Ferry to Cando | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/ Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/ Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1439 | 59 / 51 (Stump Lake) | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1447 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1448 | 83 / 79 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1449 | 64 / 57 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1450 | 51 / 41 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1451 | 41 / 32 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1452 | 34 / 25 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1453 | 29 / 20 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1454 | 25 / 16 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1455 | 20 / 13 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1456 | 17 / 10 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1457 | 14 / 8 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 12 / 6 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1459 | 9 / 5 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1460 | 7 / 3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1461 | 4 / 2 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1462 | 2 / 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 1 / 0.5 | | | | | | | | | | | | | | | | | | | | | | | | | |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.2.ST-8a.2

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-8a
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Maximum Infrastructure Protection Strategies WITHOUT PROJECT | | Based on Set of Maximum Infrastructure Protection Strategies WITH PROJECT | |
|---|---|---|---|---|---|
| | | Name | Description | Name | Description |
| 1 | Churchs Ferry | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.2.ST-8a.3

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-8a

## Annual Benefits of Project for Features Adjacent to Devils Lake Based on Set of Maximum Infrastructure Protection (MIP) Strategies (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,300 | $0 | $333,300 | $333,300 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $5,607,400 | $0 | $5,607,400 | $5,607,400 |
| 3 | Fort Totten | $0 | $0 | $0 | $10,200 | $0 | $10,200 | $10,200 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $170,700 | $0 | $170,700 | $170,700 |
| 5 | St. Michael | $0 | $0 | $0 | $19,400 | $0 | $19,400 | $19,400 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $35,300 | $4,400 | $30,900 | $30,900 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $94,000 | $11,500 | $82,500 | $82,500 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $2,265,900 | $981,700 | $1,284,200 | $1,284,200 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $124,200 | $108,500 | $15,700 | $15,700 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $0 | $237,600 | $237,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $375,000 | $0 | $375,000 | $375,000 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $0 | $42,900 | $42,900 |
| 13 | US Highway 2 | $0 | $0 | $0 | $666,400 | $0 | $666,400 | $666,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $703,000 | $0 | $703,000 | $703,000 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $523,000 | $0 | $523,000 | $523,000 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,612,800 | $0 | $2,612,800 | $2,612,800 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $0 | $163,600 | $163,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $0 | $119,600 | $119,600 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $0 | $51,100 | $51,100 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $709,000 | $0 | $709,000 | $709,000 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $0 | $696,700 | $696,700 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $172,400 | $0 | $172,400 | $172,400 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,394,700 | $0 | $9,394,700 | $9,394,700 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $0 | $0 | $0 | $25,128,200 | $1,106,100 | $24,022,100 | $24,022,100 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The maximum infrastructure protection strategies analyzed include temporary closure of roads and rail lines without the project.

· With the project feature were assumed to be incremental protected or relocated.

· The costs and damages for without the project assume the feature are not protected or are abandoned.

· The costs with the project assume incremental protection of all the feature and are included as a project cost in Table TD.2.ST-8a.4

· The damages with the project assume incremental protection of all the feature.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
## Table TD.2.ST-8a.4

### Cost and Benefit Summary with Maximum Infrastructure Protection

Analysis ST-8a

| (in thousands of dollars) | |
|---|---|
| **COSTS** | |
| Outlet Construction | $58,540 |
| Outlet Operation and Maintenance | $6,001 |
| Hwy 19 Dam Construction | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 |
| Maximum Infrastructure Protection (MIP) | $110,175 |
| MIP Operation and Maintenance | $1,776 |
| Expanded Infrastructure Measures (EIM) | $0 |
| EIM Operation and Maintenance | $0 |
| Upper Basin Management | $39,681 |
| Ion Exchange/Alternate Water Source Installation | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 |
| **Total Costs: Present Value** | $238,805 |
| **Annualized Total Cost** | $15,950 |
| | |
| **ANNUALIZED BENEFITS** | |
| Annual Cost Savings and Damages Prevented: | |
| Annual Reduction in ESAP Costs (Upland Storage) | $1 |
| Features Adjacent to Devils Lake[2] | $24,022 |
| Downstream Features (weighted average)[1] | $166 |
| **Total Annualized Benefit** | $24,189 |
| | |
| **NET BENEFIT** | $8,239 |
| | |
| **BENEFIT-COST RATIO (BCR)** | 1.52 |

[1]For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the annualized benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

[2]The Annual Cost Savings and Damages Prevented values for the features adjacent to Devils Lake for the with-project condition are for the Most Likely Action strategies. The costs and damages for the without-project condition are no protection strategies.

Note: Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.
The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.
The BCR calculated in this table incorporates the costs and benefits associated with only one lake level trace; this is not a probabilistic analysis.

**WITHOUT DOWNSTREAM IMPACTS**

| | |
|---|---|
| Benefit-Cost Ratio (BCR) | 1.66 |
| Traces With BCR>1 | |
| Total Number Out of 10,000 Traces | 8664 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.
The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*ST-8b Tables*
*(Stochastic - Combination 2 - West Bay 300 cfs Constrained Outlet, Upper Basin Management , and Expanded Infrastructure Measures)*

## Table TD.2.ST-8b.1

## Economic Analysis of Devils Lake Alternatives

### Analysis ST-8b
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 south of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 59 / 51 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 83 / 79 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 64 / 57 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 51 / 41 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 41 / 32 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 34 / 25 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 29 / 20 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 25 / 16 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 20 / 13 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 17 / 10 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 14 / 8 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 12 / 6 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 9 / 5 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 7 / 3 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 4 / 2 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 2 / 1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 1 / 0.5 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.2.ST-8b.2

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-8b
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | A* | Relocation of Structures: Then Temporary Closure | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(2)A | 2 Incremental Road Raise:Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.2.ST-8b.3

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-8b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $334,000 | $333,400 | $600 | $0 | $0 | $0 | $600 |
| 2 | City of Devils Lake | $836,100 | $645,900 | $190,200 | $0 | $0 | $0 | $190,200 |
| 3 | Fort Totten | $11,200 | $9,400 | $1,800 | $0 | $0 | $0 | $1,800 |
| 4 | City of Minnewaukan | $112,200 | $91,400 | $20,800 | $0 | $0 | $0 | $20,800 |
| 5 | St. Michael | $20,200 | $0 | $20,200 | $0 | $0 | $0 | $20,200 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $245,700 | $22,500 | $4,700 | $4,400 | $300 | $22,800 |
| 7 | Grahams Island State Park | $128,500 | $101,200 | $27,300 | $11,600 | $11,500 | $100 | $27,400 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $590,900 | $349,400 | $1,148,200 | $981,700 | $166,500 | $515,900 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,500 | $500 | $120,000 | $108,500 | $11,500 | $12,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $934,400 | $762,300 | $172,100 | $0 | $0 | $0 | $172,100 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $192,400 | $101,700 | $0 | $0 | $0 | $101,700 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $223,300 | $133,000 | $90,300 | $0 | $0 | $0 | $90,300 |
| 13 | US Highway 2 | $585,100 | $355,700 | $229,400 | $0 | $0 | $0 | $229,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $38,100 | $23,200 | $0 | $0 | $0 | $23,200 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $106,700 | $66,800 | $0 | $0 | $0 | $66,800 |
| 16 | Highway 281 South of US Highway 2 | $2,413,200 | $2,162,400 | $250,800 | $0 | $0 | $0 | $250,800 |
| 17 | Highway 281 North of US Highway 2 | $308,600 | $218,000 | $90,600 | $0 | $0 | $0 | $90,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $411,600 | $253,100 | $158,500 | $0 | $0 | $0 | $158,500 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $40,900 | $36,800 | $0 | $0 | $0 | $36,800 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $66,400 | $40,400 | $0 | $0 | $0 | $40,400 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,970,300 | $28,800 | $1,941,500 | $0 | $0 | $0 | $1,941,500 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $125,500 | $32,500 | $0 | $0 | $0 | $32,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $0 | $149,800 | $0 | $0 | $0 | $149,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $10,521,400 | $6,503,700 | $4,017,700 | $1,284,500 | $1,106,100 | $178,400 | $4,196,100 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-8b.4

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-8b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $333,400 | $600 | $0 | $0 | $0 | $600 |
| 2 | City of Devils Lake | $836,100 | $645,900 | $190,200 | $0 | $0 | $0 | $190,200 |
| 3 | Fort Totten | $11,200 | $9,400 | $1,800 | $0 | $0 | $0 | $1,800 |
| 4 | City of Minnewaukan | $112,200 | $91,400 | $20,800 | $0 | $0 | $0 | $20,800 |
| 5 | St. Michael | $20,200 | $0 | $20,200 | $0 | $0 | $0 | $20,200 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $245,700 | $22,500 | $4,700 | $4,400 | $300 | $22,800 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $93,800 | $73,500 | $20,300 | $20,300 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $590,900 | $349,400 | $1,148,200 | $981,700 | $166,500 | $515,900 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,500 | $500 | $120,000 | $108,500 | $11,500 | $12,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $202,200 | $35,400 | $35,400 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $192,400 | $101,700 | $0 | $0 | $0 | $101,700 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $24,900 | $18,000 | $18,000 |
| 13 | US Highway 2 | $347,400 | $230,400 | $117,000 | $182,300 | $83,900 | $98,400 | $215,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $38,100 | $23,200 | $0 | $0 | $0 | $23,200 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $106,700 | $66,800 | $0 | $0 | $0 | $66,800 |
| 16 | Highway 281 South of US Highway 2 | $239,600 | $239,500 | $100 | $1,797,000 | $1,482,700 | $314,300 | $314,400 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $105,900 | $57,700 | $57,700 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $71,800 | $47,800 | $47,800 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $23,400 | $27,700 | $27,700 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $66,400 | $40,400 | $0 | $0 | $0 | $40,400 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $28,800 | -$28,800 | $696,700 | $0 | $696,700 | $667,900 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $116,100 | $41,900 | $0 | $4,900 | -$4,900 | $37,000 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $0 | $149,800 | $0 | $0 | $0 | $149,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $4,059,200 | $2,941,100 | $1,118,100 | $4,657,500 | $3,167,800 | $1,489,700 | $2,607,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-8b.5

### Economic Analysis of Devils Lake Alternatives
### Analysis ST-8b

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $349,800 | $349,800 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $2,210,300 | $1,982,900 | $227,400 | $0 | $0 | $0 | $227,400 |
| 3 | Fort Totten | $59,600 | $59,600 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $143,300 | $120,100 | $23,200 | $0 | $0 | $0 | $23,200 |
| 5 | St. Michael | $116,300 | $0 | $116,300 | $0 | $0 | $0 | $116,300 |
| 6 | Gilbert C. Grafton State Military Res. | $1,578,300 | $1,578,000 | $300 | $4,700 | $4,400 | $300 | $600 |
| 7 | Grahams Island State Park | $1,126,300 | $1,126,100 | $200 | $11,600 | $11,500 | $100 | $300 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,002,400 | $409,900 | $1,148,200 | $981,700 | $166,500 | $576,400 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $2,500 | $500 | $120,000 | $108,500 | $11,500 | $12,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,468,500 | $2,214,500 | $254,000 | $0 | $0 | $0 | $254,000 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $717,200 | $534,700 | $182,500 | $0 | $0 | $0 | $182,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $438,100 | $290,600 | $147,500 | $0 | $0 | $0 | $147,500 |
| 13 | US Highway 2 | $1,047,700 | $694,900 | $352,800 | $0 | $0 | $0 | $352,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $97,900 | $64,900 | $33,000 | $0 | $0 | $0 | $33,000 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $292,700 | $194,100 | $98,600 | $0 | $0 | $0 | $98,600 |
| 16 | Highway 281 South of US Highway 2 | $1,484,000 | $1,483,700 | $300 | $1,569,300 | $1,569,100 | $200 | $500 |
| 17 | Highway 281 North of US Highway 2 | $132,700 | $106,100 | $26,600 | $265,900 | $213,100 | $52,800 | $79,400 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $694,500 | $460,600 | $233,900 | $0 | $0 | $0 | $233,900 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $40,900 | $36,800 | $0 | $0 | $0 | $36,800 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $170,500 | $113,100 | $57,400 | $0 | $0 | $0 | $57,400 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $50,300 | $6,876,400 | $0 | $0 | $0 | $6,876,400 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $404,400 | $351,400 | $53,000 | $0 | $0 | $0 | $53,000 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $0 | $1,241,500 | $0 | $0 | $0 | $1,241,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $24,193,300 | $13,821,200 | $10,372,100 | $3,119,700 | $2,888,300 | $231,400 | $10,603,500 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.2.ST-8b.6

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-8b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,300 | $332,900 | $400 | $400 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $5,607,400 | $4,855,800 | $751,600 | $751,600 |
| 3 | Fort Totten | $0 | $0 | $0 | $10,200 | $8,500 | $1,700 | $1,700 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $170,700 | $127,400 | $43,300 | $43,300 |
| 5 | St. Michael | $0 | $0 | $0 | $19,400 | $16,200 | $3,200 | $3,200 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $35,300 | $24,100 | $11,200 | $11,200 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $94,000 | $73,700 | $20,300 | $20,300 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $2,265,900 | $1,739,700 | $526,200 | $526,200 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $124,200 | $112,100 | $12,100 | $12,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $202,200 | $35,400 | $35,400 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $375,000 | $221,200 | $153,800 | $153,800 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $24,900 | $18,000 | $18,000 |
| 13 | US Highway 2 | $0 | $0 | $0 | $666,400 | $342,200 | $324,200 | $324,200 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $703,000 | $354,700 | $348,300 | $348,300 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $523,000 | $267,200 | $255,800 | $255,800 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,612,800 | $2,286,900 | $325,900 | $325,900 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $105,900 | $57,700 | $57,700 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $71,800 | $47,800 | $47,800 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $23,400 | $27,700 | $27,700 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $709,000 | $359,200 | $349,800 | $349,800 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $673,400 | $23,300 | $23,300 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $172,400 | $124,200 | $48,200 | $48,200 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,394,700 | $8,646,200 | $748,500 | $748,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $25,128,200 | $20,993,800 | $4,134,400 | $4,134,400 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.2.ST-8b.7

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Analysis ST-8b

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $58,540 | $58,540 | $58,540 | $58,540 |
| Outlet Operation and Maintenance | $6,001 | $6,001 | $6,001 | $6,001 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $12,798 | $12,798 | $12,798 | $12,798 |
| EIM Operation and Maintenance | $1,776 | $1,776 | $1,776 | $1,776 |
| Upper Basin Management | $39,681 | $39,681 | $39,681 | $39,681 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $141,428 | $141,428 | $141,428 | $141,428 |
| **Annualized Total Cost** | $9,446 | $9,446 | $9,446 | $9,446 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $1 | $1 | $1 | $1 |
| Features Adjacent to Devils Lake | $2,608 | $10,604 | $4,134 | $4,196 |
| Downstream Features (weighted average) [5] | $166 | $166 | $166 | $166 |
| **Total Annualized Benefit** | $2,775 | $10,770 | $4,301 | $4,363 |
| | | | | |
| **NET BENEFIT** | -$6,671 | $1,325 | -$5,145 | -$5,083 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.29 | 1.14 | 0.46 | 0.46 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

[5] For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the annualized benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.33 | 1.34 | 0.52 | 0.53 |
| Traces With BCR>1 | | | | |
| Total Number Out of 10,000 Traces | 193 | 8438 | 1487 | 957 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

***ST-10 Tables***
***(Stochastic - East End 480 cfs Uncontrained Outlet)***

## Table TD.2.ST-10.1

## Economic Analysis of Devils Lake Alternatives

## Analysis ST-10
### Probability of Reaching Decision/Action Levels at Each Feature (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churches Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 59 / 35 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 83 / 71 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 64 / 44 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 51 / 29 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 41 / 20 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 34 / 15 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 29 / 11 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 25 / 9 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 20 / 7 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 17 / 6 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 14 / 4 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 12 / 3 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 9 / 3 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 7 / 2 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 4 / 1 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 2 / 0.8 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 1 / 0.3 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.2.ST-10.2

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-10
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | R(1)A* | Relocation of Structure at First and Second Action Levels:1 Road Raise: Then Temporary Closure During Floods | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.2.ST-10.3

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-10

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | Annual Strategy Costs * (averaged over 10,000 traces) With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $334,000 | $332,900 | $1,100 | $0 | $0 | $0 | $1,100 |
| 2 | City of Devils Lake | $836,100 | $463,500 | $372,600 | $0 | $0 | $0 | $372,600 |
| 3 | Fort Totten | $11,200 | $7,700 | $3,500 | $0 | $0 | $0 | $3,500 |
| 4 | City of Minnewaukan | $112,200 | $69,000 | $43,200 | $0 | $0 | $0 | $43,200 |
| 5 | St. Michael | $20,200 | $14,300 | $5,900 | $0 | $0 | $0 | $5,900 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $228,200 | $40,000 | $4,700 | $4,100 | $600 | $40,600 |
| 7 | Grahams Island State Park | $128,500 | $76,600 | $51,900 | $11,600 | $11,400 | $200 | $52,100 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $858,200 | $82,100 | $1,148,200 | $843,300 | $304,900 | $387,000 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $1,800 | $1,200 | $120,000 | $94,400 | $25,600 | $26,800 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $934,400 | $608,400 | $326,000 | $0 | $0 | $0 | $326,000 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $122,000 | $172,100 | $0 | $0 | $0 | $172,100 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $223,300 | $81,800 | $141,500 | $0 | $0 | $0 | $141,500 |
| 13 | US Highway 2 | $585,100 | $218,900 | $366,200 | $0 | $0 | $0 | $366,200 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $23,500 | $37,800 | $0 | $0 | $0 | $37,800 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $65,700 | $107,800 | $0 | $0 | $0 | $107,800 |
| 16 | Highway 281 South of US Highway 2 | $2,413,200 | $1,946,600 | $466,600 | $0 | $0 | $0 | $466,600 |
| 17 | Highway 281 North of US Highway 2 | $308,600 | $143,500 | $165,100 | $0 | $0 | $0 | $165,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $411,600 | $155,900 | $255,700 | $0 | $0 | $0 | $255,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $25,000 | $52,700 | $0 | $0 | $0 | $52,700 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $40,900 | $65,900 | $0 | $0 | $0 | $65,900 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,970,300 | $1,755,500 | $214,800 | $0 | $0 | $0 | $214,800 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $95,200 | $62,800 | $0 | $0 | $0 | $62,800 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $105,200 | $44,600 | $0 | $0 | $0 | $44,600 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $10,521,400 | $7,440,300 | $3,081,100 | $1,284,500 | $953,200 | $331,300 | $3,412,400 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.2.ST-10.4

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-10

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $334,000 | $332,900 | $1,100 | $0 | $0 | $0 | $1,100 |
| 2 | City of Devils Lake | $836,100 | $463,500 | $372,600 | $0 | $0 | $0 | $372,600 |
| 3 | Fort Totten | $11,200 | $7,700 | $3,500 | $0 | $0 | $0 | $3,500 |
| 4 | City of Minnewaukan | $112,200 | $69,000 | $43,200 | $0 | $0 | $0 | $43,200 |
| 5 | St. Michael | $20,200 | $14,300 | $5,900 | $0 | $0 | $0 | $5,900 |
| 6 | Gilbert C. Grafton State Military Res. | $268,200 | $228,200 | $40,000 | $4,700 | $4,100 | $600 | $40,600 |
| 7 | Grahams Island State Park | $3,500 | $60,200 | -$56,700 | $93,800 | $20,400 | $73,400 | $16,700 |
| 8.1 | Devils Lake Rural Areas | $940,300 | $858,200 | $82,100 | $1,148,200 | $843,300 | $304,900 | $387,000 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $1,800 | $1,200 | $120,000 | $94,400 | $25,600 | $26,800 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $150,200 | $87,400 | $87,400 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $294,100 | $122,000 | $172,100 | $0 | $0 | $0 | $172,100 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $14,700 | $28,200 | $28,200 |
| 13 | US Highway 2 | $347,400 | $142,300 | $205,100 | $182,300 | $49,800 | $132,500 | $337,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $61,300 | $23,500 | $37,800 | $0 | $0 | $0 | $37,800 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $173,500 | $65,700 | $107,800 | $0 | $0 | $0 | $107,800 |
| 16 | Highway 281 South of US Highway 2 | $239,600 | $239,400 | $200 | $1,797,000 | $1,071,800 | $725,200 | $725,400 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $61,000 | $102,600 | $102,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $41,900 | $77,700 | $77,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $13,800 | $37,300 | $37,300 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $106,800 | $40,900 | $65,900 | $0 | $0 | $0 | $65,900 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $598,600 | $98,100 | $98,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $158,000 | $95,200 | $62,800 | $0 | $0 | $0 | $62,800 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $149,800 | $105,200 | $44,600 | $0 | $0 | $0 | $44,600 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $4,059,200 | $2,870,000 | $1,189,200 | $4,657,500 | $2,964,000 | $1,693,500 | $2,882,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.2.ST-10.5

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-10

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $349,800 | $349,600 | $200 | $0 | $0 | $0 | $200 |
| 2 | City of Devils Lake | $2,210,300 | $1,682,300 | $528,000 | $0 | $0 | $0 | $528,000 |
| 3 | Fort Totten | $59,600 | $59,500 | $100 | $0 | $0 | $0 | $100 |
| 4 | City of Minnewaukan | $143,300 | $92,500 | $50,800 | $0 | $0 | $0 | $50,800 |
| 5 | St. Michael | $116,300 | $116,300 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,578,300 | $1,577,600 | $700 | $4,700 | $4,100 | $600 | $1,300 |
| 7 | Grahams Island State Park | $1,126,300 | $1,125,900 | $400 | $11,600 | $11,400 | $200 | $600 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $1,148,200 | $843,300 | $304,900 | $304,900 |
| 8.2 | Stump Lake Rural Areas | $3,000 | $1,800 | $1,200 | $120,000 | $94,400 | $25,600 | $26,800 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,468,500 | $1,878,800 | $589,700 | $0 | $0 | $0 | $589,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $717,200 | $345,100 | $372,100 | $0 | $0 | $0 | $372,100 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $438,100 | $179,400 | $258,700 | $0 | $0 | $0 | $258,700 |
| 13 | US Highway 2 | $1,047,700 | $428,900 | $618,800 | $0 | $0 | $0 | $618,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $97,900 | $40,100 | $57,800 | $0 | $0 | $0 | $57,800 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $292,700 | $119,800 | $172,900 | $0 | $0 | $0 | $172,900 |
| 16 | Highway 281 South of US Highway 2 | $1,484,000 | $1,483,300 | $700 | $1,569,300 | $1,568,700 | $600 | $1,300 |
| 17 | Highway 281 North of US Highway 2 | $132,700 | $74,100 | $58,600 | $265,900 | $150,100 | $115,800 | $174,400 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $694,500 | $284,400 | $410,100 | $0 | $0 | $0 | $410,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $77,700 | $25,000 | $52,700 | $0 | $0 | $0 | $52,700 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $170,500 | $69,800 | $100,700 | $0 | $0 | $0 | $100,700 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $404,400 | $281,500 | $122,900 | $0 | $0 | $0 | $122,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $24,193,300 | $20,796,200 | $3,397,100 | $3,119,700 | $2,672,000 | $447,700 | $3,844,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.2.ST-10.6

## Economic Analysis of Devils Lake Alternatives
## Analysis ST-10

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * (averaged over 10,000 traces) Without Project A | With Project B | Annual Costs Avoided with Project C = A - B | Remaining Annual Damages with Strategy in Place * (averaged over 10,000 traces) Without Project D | With Project E | Annual Damages Reduced by Project F = D - E | Annual Damage Reduction and Costs Avoided with Project G = C + F |
|---|---|---|---|---|---|---|---|---|
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,300 | $332,600 | $700 | $700 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $5,607,400 | $4,004,600 | $1,602,800 | $1,602,800 |
| 3 | Fort Totten | $0 | $0 | $0 | $10,200 | $7,000 | $3,200 | $3,200 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $170,700 | $89,600 | $81,100 | $81,100 |
| 5 | St. Michael | $0 | $0 | $0 | $19,400 | $13,900 | $5,500 | $5,500 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $35,300 | $16,400 | $18,900 | $18,900 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $94,000 | $55,400 | $38,600 | $38,600 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $2,265,900 | $1,859,000 | $406,900 | $406,900 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $124,200 | $97,000 | $27,200 | $27,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $237,600 | $150,200 | $87,400 | $87,400 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $375,000 | $123,100 | $251,900 | $251,900 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $42,900 | $14,700 | $28,200 | $28,200 |
| 13 | US Highway 2 | $0 | $0 | $0 | $666,400 | $192,600 | $473,800 | $473,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $703,000 | $197,500 | $505,500 | $505,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $523,000 | $149,300 | $373,700 | $373,700 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,612,800 | $1,766,600 | $846,200 | $846,200 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $163,600 | $61,000 | $102,600 | $102,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $119,600 | $41,900 | $77,700 | $77,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $51,100 | $13,800 | $37,300 | $37,300 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $709,000 | $200,200 | $508,800 | $508,800 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $696,700 | $598,600 | $98,100 | $98,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $172,400 | $76,500 | $95,900 | $95,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,394,700 | $6,323,800 | $3,070,900 | $3,070,900 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $25,128,200 | $16,385,300 | $8,742,900 | $8,742,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.2.ST-10.7

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Analysis ST-10

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $57,407 | $57,407 | $57,407 | $57,407 |
| Outlet Operation and Maintenance | $525 | $525 | $525 | $525 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | NA | NA | NA | NA |
| Natural Resources Monitoring/Mitigation | $50,432 | $50,432 | $50,432 | $50,432 |
| **Total Costs: Present Value** | $108,364 | $108,364 | $108,364 | $108,364 |
| **Annualized Total Cost** | $7,238 | $7,238 | $7,238 | $7,238 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $2 | $2 | $2 | $2 |
| Features Adjacent to Devils Lake | $2,883 | $3,845 | $8,743 | $3,412 |
| Downstream Features (weighted average) [5] | NA | NA | NA | NA |
| **Total Annualized Benefit** | NA | NA | NA | NA |
| | | | | |
| **NET BENEFIT** | NA | NA | NA | NA |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | NA | NA | NA | NA |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

[5] For the purposes of including the impact of downstream features on the overall BCR of the stochastic traces, this is a weighted average of the annualized benefits for the downstream features during wet (WF), moderate-wet (M1), moderate-dry (M2) and dry (DR) based on the percentage of the 10,000 traces that fall into these four categories.

If the weighted average is "NA", this type of scenario was not run for the the wet, moderate-wet, moderate-dry and dry conditions.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.75 | 0.99 | 2.26 | 0.88 |
| Traces With BCR>1 | | | | |
| Total Number Out of 10,000 Traces | 2737 | 3366 | 6780 | 2715 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

# TD.3.0 Wet Future Scenario

The following table lists the alternatives and sensitivity analyses for which tables are included in this section. Note that there are several tables that are included for each alternative or sensitivity analysis. The last digit of each table number (x) reflects a variable number for each of the tables.

| Table Number | Alternative Number | Description of Alternative |
|---|---|---|
| TD.3.WF-1.x | WF-1 | Upper Basin Management |
| TD.3.WF-2a.x | WF-2a | Maximum Infrastructure Protection |
| TD.3.WF-2b.x | WF-2b | Expanded Infrastructure Measures |
| TD.3.WF-3.x | WF-3 | West Bay 300 cfs Constrained Outlet |
| TD.3.WF-4.x | WF-4 | West Bay 480 cfs Unconstrained Outlet |
| TD.3.WF-5.x | WF-5 | Pelican Lake 300 cfs Constrained Outlet |
| TD.3.WF-6.x | WF-6 | Pelican Lake 480 cfs Unconstrained Outlet |
| TD.3.WF-7a.x | WF-7a | Combination 1 – Upper Basin Management and Maximum Infrastructure Protection |
| TD.3.WF-7b.x | WF-7b | Combination 1 – Upper Basin Management and Expanded Infrastructure Measures |
| TD.3.WF-8a.x | WF-8a | Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection |
| TD.3.WF-8b.x | WF-8b | Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures |
| | WF-9 | NOTE: WF-9 is the base condition – without project future condition |
| TD.3.WF-10.x | WF-10 | East End 480 cfs Unconstrained Outlet |
| TD.3.WF-11.x | WF-11 | Raise Natural Outlet |
| TD.3.WF-12.x | WF-12 | Outlet Erosion: West Bay 300 cfs Constrained Outlet |
| TD.3.WF-13.x | WF-13 | Outlet Erosion: West Bay 480 cfs Constrained Outlet |
| TD.3.WF-14a.x | WF-14a | Combination 2 with Outlet Erosion – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection |
| TD3.WF-14b.x | WF-14b | Combination 2 with Outlet Erosion – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures |

The following table lists the 11 individual tables that are included for the majority of the alternatives or sensitivity analyses: Upper Basin Management (WF-1), Expanded Infrastructure Measures (WF-2b, WF-7b, WF-8b, and WF-14b), various outlets (WF-3, WF-4, WF-5, WF-6, WF-10, WF-12, and WF-13), and embankment protection (WF-11).

| Last Digit of Each Table Number | Table Description |
|---|---|
| 1 | Probability of Reaching Decision/Action Levels at Each Feature |
| 2 | Sets of Feature Strategies |
| 3 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies |
| 4 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies |
| 5 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) |
| 6 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies |
| 7 | Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities |
| 8 | Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users |
| 9 | Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features |
| 10 | Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users |
| 11 | Cost and Benefit Summary: 4 Sets of Feature Strategies |

The following table lists the eight individual tables that are included for the Maximum Infrastructure Protection sensitivity analysis (WF-2a, WF-7a, WF-8a, and WF-14a).

| Last Digit of Each Table Number | Table Description |
|---|---|
| 1 | Probability of Reaching Decision/Action Levels at Each Feature |
| 2 | Sets of Feature Strategies |
| 3 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies |
| 4 | Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities |
| 5 | Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users |
| 6 | Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features |
| 7 | Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users |
| 8 | Cost and Benefit Summary with Maximum Infrastructure Protection |

*WF-1 Tables*
*(Wet Future - Upper Basin Management)*

## Table TD.3.WF-1.1

## Economic Analysis of Devils Lake Alternatives

### Scenario WF-1
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rea. | 7 Graham Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 100 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 100 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 100 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 100 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 100 / 100 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 100 / 100 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 100 / 100 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 100 / 100 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 100 / 100 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 100 / 100 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.3.WF-1.2

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-1
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | A* | Relocation of Structures: Then Temporary Closure | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.3.WF-1.3

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-1

## Annual Benefits of Project for Feature Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $344,200 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $3,523,700 | $3,523,700 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $40,500 | $38,300 | $2,200 | $0 | $0 | $0 | $2,200 |
| 4 | City of Minnewaukan | $397,100 | $361,900 | $35,200 | $0 | $0 | $0 | $35,200 |
| 5 | St. Michael | $76,300 | $75,800 | $500 | $0 | $0 | $0 | $500 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $531,400 | $34,100 | $9,200 | $8,700 | $500 | $34,600 |
| 7 | Grahams Island State Park | $505,700 | $476,300 | $29,400 | $13,300 | $13,200 | $100 | $29,500 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,658,000 | $65,400 | $3,846,600 | $3,626,000 | $220,600 | $286,000 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $267,200 | $5,100 | $5,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $3,638,500 | $3,441,600 | $196,900 | $0 | $0 | $0 | $196,900 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $2,076,100 | $172,800 | $0 | $0 | $0 | $172,800 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,003,700 | $1,808,400 | $195,300 | $0 | $0 | $0 | $195,300 |
| 13 | US Highway 2 | $4,933,600 | $4,476,200 | $457,400 | $0 | $0 | $0 | $457,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $438,100 | $41,500 | $0 | $0 | $0 | $41,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $1,280,400 | $126,000 | $0 | $0 | $0 | $126,000 |
| 16 | Highway 281 South of US Highway 2 | $6,015,600 | $5,820,300 | $195,300 | $0 | $0 | $0 | $195,300 |
| 17 | Highway 281 North of US Highway 2 | $1,442,000 | $1,343,400 | $98,600 | $0 | $0 | $0 | $98,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $3,336,600 | $3,037,800 | $298,800 | $0 | $0 | $0 | $298,800 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $829,500 | $109,100 | $0 | $0 | $0 | $109,100 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $762,900 | $72,400 | $0 | $0 | $0 | $72,400 |
| 22 | Highway 20 between Highway 57 and Tokio | $3,629,800 | $3,452,100 | $177,700 | $0 | $0 | $0 | $177,700 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $676,700 | $25,100 | $0 | $0 | $0 | $25,100 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $515,800 | $24,300 | $0 | $0 | $0 | $24,300 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $39,335,000 | $36,977,000 | $2,358,000 | $4,141,400 | $3,915,100 | $226,300 | $2,584,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-1.4

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-1

## Annual Benefits of Project for Feature Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $344,200 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $3,523,700 | $3,523,700 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $40,500 | $38,300 | $2,200 | $0 | $0 | $0 | $2,200 |
| 4 | City of Minnewaukan | $397,100 | $361,900 | $35,200 | $0 | $0 | $0 | $35,200 |
| 5 | St. Michael | $76,300 | $75,800 | $500 | $0 | $0 | $0 | $500 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $531,400 | $34,100 | $9,200 | $8,700 | $500 | $34,600 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $479,400 | $123,200 | $356,200 | $356,200 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,658,000 | $65,400 | $3,846,600 | $3,626,000 | $220,600 | $286,000 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $267,200 | $5,100 | $5,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $476,900 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $2,076,100 | $172,800 | $0 | $0 | $0 | $172,800 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $358,100 | $30,900 | $30,900 |
| 13 | US Highway 2 | $4,933,600 | $4,476,200 | $457,400 | $0 | $0 | $0 | $457,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $438,100 | $41,500 | $0 | $0 | $0 | $41,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $1,280,400 | $126,000 | $0 | $0 | $0 | $126,000 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $1,082,000 | $24,800 | $24,800 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $858,100 | $57,600 | $57,600 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $714,100 | $184,100 | $184,100 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $762,900 | $72,400 | $0 | $0 | $0 | $72,400 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $576,000 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $676,700 | $25,100 | $0 | $0 | $0 | $25,100 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $515,800 | $24,300 | $0 | $0 | $0 | $24,300 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $19,317,200 | $18,260,300 | $1,056,900 | $10,545,100 | $9,665,300 | $879,800 | $1,936,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-1.5

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-1

## Annual Benefits of Project for Feature Adjacent to Devils Lake
## Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $4,817,300 | $4,817,300 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $439,900 | $388,700 | $51,200 | $0 | $0 | $0 | $51,200 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $9,200 | $8,700 | $500 | $500 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $13,300 | $13,200 | $100 | $100 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $3,846,600 | $3,626,000 | $220,600 | $220,600 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $267,200 | $5,100 | $5,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $5,379,700 | $5,379,700 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $3,198,900 | $3,198,900 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,602,200 | $2,446,300 | $155,900 | $0 | $0 | $0 | $155,900 |
| 13 | US Highway 2 | $6,222,100 | $5,849,200 | $372,900 | $0 | $0 | $0 | $372,900 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $581,500 | $546,600 | $34,900 | $0 | $0 | $0 | $34,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,738,100 | $1,633,900 | $104,200 | $0 | $0 | $0 | $104,200 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $493,600 | $493,600 | $0 | $1,021,700 | $1,021,700 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $4,124,800 | $3,877,600 | $247,200 | $0 | $0 | $0 | $247,200 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $829,500 | $109,100 | $0 | $0 | $0 | $109,100 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $1,012,700 | $952,000 | $60,700 | $0 | $0 | $0 | $60,700 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $1,022,500 | $1,022,500 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $47,891,300 | $46,755,200 | $1,136,100 | $6,738,100 | $6,511,800 | $226,300 | $1,362,400 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-1.6

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-1

## Annual Benefits of Project
## Based on Set of No Flood Protection Strategies for Feature Adjacent to Devils Lake
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $339,000 | $339,000 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $15,259,300 | $15,259,300 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $36,900 | $34,900 | $2,000 | $2,000 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $831,500 | $799,200 | $32,300 | $32,300 |
| 5 | St. Michael | $0 | $0 | $0 | $70,400 | $70,000 | $400 | $400 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $12,000 | $11,600 | $400 | $400 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $480,600 | $124,300 | $356,300 | $356,300 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $5,939,900 | $5,638,200 | $301,700 | $301,700 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $283,900 | $278,700 | $5,200 | $5,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $476,900 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $2,997,900 | $2,977,500 | $20,400 | $20,400 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $358,100 | $30,900 | $30,900 |
| 13 | US Highway 2 | $0 | $0 | $0 | $7,109,600 | $6,568,400 | $541,200 | $541,200 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $7,638,900 | $7,063,000 | $575,900 | $575,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $5,580,100 | $5,160,500 | $419,600 | $419,600 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $5,214,000 | $5,214,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $1,082,000 | $24,800 | $24,800 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $858,100 | $57,600 | $57,600 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $714,100 | $184,100 | $184,100 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $7,655,300 | $7,079,700 | $575,600 | $575,600 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $576,000 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $838,700 | $877,400 | -$38,700 | -$38,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $13,073,000 | $13,073,000 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $77,723,600 | $74,633,900 | $3,089,700 | $3,089,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.3.WF-1.7**

### Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities
Scenario WF-1

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $196,100 |
| Fargo | $0 | $743,800 |
| Grand Forks | $30,700 | $1,445,900 |
| Grafton | $0 | $11,000 |
| Drayton | $900 | $56,800 |
| Pembina | $200 | $25,700 |
| Morris | $0 | $100,900 |
| Letellier | $0 | $113,900 |
| | | |
| TOTAL | $31,800 | $2,694,100 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $0 | $183,500 |
| Fargo | $0 | $698,300 |
| Grand Forks | $23,600 | $1,098,300 |
| Grafton | $0 | $9,700 |
| Drayton | $700 | $46,600 |
| Pembina | $100 | $21,600 |
| Morris | $0 | $94,300 |
| Letellier | $0 | $106,200 |
| | | |
| TOTAL | $24,400 | $2,258,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | $0 | $12,600 |
| Fargo | $0 | $45,500 |
| Grand Forks | $7,100 | $347,600 |
| Grafton | $0 | $1,300 |
| Drayton | $200 | $10,200 |
| Pembina | $100 | $4,100 |
| Morris | $0 | $6,600 |
| Letellier | $0 | $7,700 |
| | | |
| TOTAL | $7,400 | $435,600 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-1.8

### Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users
Scenario WF-1

### Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $41,000 |
| American Crystal Sugar | $1,400 |
| **TOTAL** | $42,400 |

### Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $31,200 |
| American Crystal Sugar | $900 |
| **TOTAL** | $32,100 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | $9,800 |
| American Crystal Sugar | $500 |
| **TOTAL** | $10,300 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-1.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario WF-1

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $514,600 |
| Agricultural- Other | $208,200 |
| Urban (Lisbon and Valley City) | $9,347,000 |
| Transportation | $2,355,800 |
| | |
| TOTAL | $12,425,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $508,700 |
| Agricultural- Other | $207,300 |
| Urban (Lisbon and Valley City) | $9,264,400 |
| Transportation | $2,349,600 |
| | |
| TOTAL | $12,330,000 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | $5,900 |
| Agricultural- Other | $900 |
| Urban (Lisbon and Valley City) | $82,600 |
| Transportation | $6,200 |
| | |
| TOTAL | $95,600 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-1.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario WF-1

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $478,500 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $420,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | $58,000 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.3.WF-1.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario WF-1

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $0 | $0 | $0 | $0 |
| Outlet Operation and Maintenance | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $39,681 | $39,681 | $39,681 | $39,681 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $0 | $0 | $0 | $0 |
| **Total Costs: Present Value** | $39,681 | $39,681 | $39,681 | $39,681 |
| **Annualized Total Cost** | $2,650 | $2,650 | $2,650 | $2,650 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $1,937 | $1,362 | $3,090 | $2,584 |
| Downstream Features | $607 | $607 | $607 | $607 |
| **Total Annualized Benefit** | $2,544 | $1,969 | $3,697 | $3,191 |
| | | | | |
| **NET BENEFIT** | -$107 | -$681 | $1,046 | $541 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.96 | 0.74 | 1.39 | 1.20 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.73 | 0.51 | 1.17 | 0.98 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 0 | 1 | 0 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

## *WF-2a Tables*
## *(Wet Future - Maximum Infrastructure Protection)*

## Table TD.3.WF-2a.1

## Economic Analysis of Devils Lake Alternatives

### Scenario WF-2a
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rea. | 7 Graham Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churches Ferry to Cando | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/ Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/ Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 100 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 100 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 100 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 100 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 100 / 100 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 100 / 100 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 100 / 100 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 100 / 100 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 100 / 100 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 100 / 100 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.3.WF-2a.2

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-2a
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Maximum Infrastructure Protection Strategies WITHOUT PROJECT | | Based on Set of Maximum Infrastructure Protection Strategies WITH PROJECT | |
|---|---|---|---|---|---|
| | | Name | Description | Name | Description |
| 1 | Churchs Ferry | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.3.WF-2a.3

### Economic Analysis of Devils Lake Alternatives
### Scenario WF-2a

### Annual Benefits of Project for Features Adjacent to Devils Lake Based on Set of Maximum Infrastructure Protection (MIP) Strategies (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $339,000 | $0 | $339,000 | $339,000 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $15,259,300 | $0 | $15,259,300 | $15,259,300 |
| 3 | Fort Totten | $0 | $0 | $0 | $36,900 | $0 | $36,900 | $36,900 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $831,500 | $0 | $831,500 | $831,500 |
| 5 | St. Michael | $0 | $0 | $0 | $70,400 | $0 | $70,400 | $70,400 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $12,000 | $9,200 | $2,800 | $2,800 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $480,600 | $13,300 | $467,300 | $467,300 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $5,939,900 | $3,838,100 | $2,101,800 | $2,101,800 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $283,900 | $272,300 | $11,600 | $11,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $0 | $476,900 | $476,900 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $2,997,900 | $0 | $2,997,900 | $2,997,900 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $0 | $389,000 | $389,000 |
| 13 | US Highway 2 | $0 | $0 | $0 | $7,109,600 | $0 | $7,109,600 | $7,109,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $7,638,900 | $0 | $7,638,900 | $7,638,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $5,580,100 | $0 | $5,580,100 | $5,580,100 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $5,214,000 | $0 | $5,214,000 | $5,214,000 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $0 | $1,106,800 | $1,106,800 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $0 | $915,700 | $915,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $0 | $898,200 | $898,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $7,655,300 | $0 | $7,655,300 | $7,655,300 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $0 | $576,000 | $576,000 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $838,700 | $0 | $838,700 | $838,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $13,073,000 | $0 | $13,073,000 | $13,073,000 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $77,723,600 | $4,132,900 | $73,590,700 | $73,590,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The maximum infrastructure protection strategies analyzed include temporary closure of roads and rail lines without the project.

· With the project feature were assumed to be incremental protected or relocated.

· The costs and damages for without the project assume the feature are not protected or are abandoned.

· The costs with the project assume incremental protection of all the feature and are included as a project cost in Table TD.3.WF-2a.4

· The damages with the project assume incremental protection of all the feature.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.3.WF-2a.4

### Cost and Benefit Summary with Maximum Infrastructure Protection
### Municipal Water Treatment Facilities
Scenario WF-2a

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $196,100 |
| Fargo | $0 | $743,800 |
| Grand Forks | $30,700 | $1,445,900 |
| Grafton | $0 | $11,000 |
| Drayton | $900 | $56,800 |
| Pembina | $200 | $25,700 |
| Morris | $0 | $100,900 |
| Letellier | $0 | $113,900 |
| | | |
| TOTAL | $31,800 | $2,694,100 |

### Damages: WITH PROJECT[1]

| | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| s for the features adjace<br>damages for the without | B(1) | B(2) |
| Valley City | $0 | $196,100 |
| Fargo | $0 | $743,800 |
| Grand Forks | $30,700 | $1,445,900 |
| Grafton | $0 | $11,000 |
| Drayton | $900 | $56,800 |
| Pembina | $200 | $25,700 |
| Morris | $0 | $100,900 |
| Letellier | $0 | $113,900 |
| | | |
| TOTAL | $31,800 | $2,694,100 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-2a.5

### Cost and Benefit Summary with Maximum Infrastructure Protection
### Industrial Water Users
Scenario WF-2a

### Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $41,000 |
| American Crystal Sugar | $1,400 |
| **TOTAL** | $42,400 |

### Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $41,000 |
| American Crystal Sugar | $1,400 |
| **TOTAL** | $42,400 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-2a.6

### Cost and Benefit Summary with Maximum Infrastructure Protection
### Flow-Related Features
Scenario WF-2a

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $514,600 |
| Agricultural- Other | $208,200 |
| Urban (Lisbon and Valley City) | $9,347,000 |
| Transportation | $2,355,800 |
| | |
| TOTAL | $12,425,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $514,600 |
| Agricultural- Other | $208,200 |
| Urban (Lisbon and Valley City) | $9,347,000 |
| | $2,355,800 |
| | |
| TOTAL | $12,425,600 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | $0 |
| Agricultural- Other | $0 |
| Urban (Lisbon and Valley City) | $0 |
| Transportation | $0 |
| | |
| TOTAL | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-2a.7

### Cost and Benefit Summary with Maximum Infrastructure Protection
### Irrigation Water Users

Scenario WF-2a

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $478,500 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $478,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-2a.8

### Cost and Benefit Summary with Maximum Infrastructure Protection

Scenario WF-2a

| (in thousands of dollars) | |
|---|---|
| **COSTS** | |
| Outlet Construction | $0 |
| Outlet Operation and Maintenance | $0 |
| Hwy 19 Dam Construction | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 |
| Maximum Infrastructure Protection (MIP) | $579,474 |
| MIP Operation and Maintenance | $6,033 |
| Expanded Infrastructure Measures (EIM) | $0 |
| EIM Operation and Maintenance | $0 |
| Upper Basin Management | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 |
| Natural Resources Monitoring/Mitigation | $0 |
| **Total Costs: Present Value** | $585,507 |
| **Annualized Total Cost** | $39,105 |
| | |
| **ANNUALIZED BENEFITS** | |
| Annual Cost Savings and Damages Prevented: | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 |
| Features Adjacent to Devils Lake* | $73,591 |
| Downstream Features | $0 |
| **Total Annualized Benefit** | $73,591 |
| | |
| **NET BENEFIT** | $34,485 |
| | |
| **BENEFIT-COST RATIO (BCR)** | 1.88 |

*The Annual Cost Savings and Damages Prevented values for the features adjacent to Devils Lake for the with-project condition are for the Most Likely Action strategies. The costs and damages for the without-project condition are no protection strategies.

Note: Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.
The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.
The BCR calculated in this table incorporates the costs and benefits associated with only one lake level trace; this is not a probabilistic analysis.

**WITHOUT DOWNSTREAM IMPACTS**

| | |
|---|---|
| Benefit-Cost Ratio (BCR) | 1.88 |
| Traces With BCR>1 | |
| Total Number Out of 1 Trace | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.
The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*WF-2b Tables*
*(Wet Future - Expanded Infrastructure Measures)*

## Table TD.3.WF-2b.1

## Economic Analysis of Devils Lake Alternatives

## Scenario WF-2b
## Probability of Reaching Decision/Action Levels at Each Feature
## (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mil. Res. | 7 Graham's Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Alons US Hwy 2 | 12 BNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19 / Devils Lake to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20 / Devils Lake to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 100 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 100 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 100 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 100 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 100 / 100 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 100 / 100 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 100 / 100 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 100 / 100 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 100 / 100 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 100 / 100 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.3.WF-2b.2

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-2b
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | A* | Relocation of Structures: Then Temporary Closure | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(2)A | 2 Incremental Road Raise:Then Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.3.WF-2b.3

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-2b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $344,200 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $3,523,700 | $3,523,700 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $40,500 | $40,500 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $397,100 | $397,100 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $76,300 | $0 | $76,300 | $0 | $0 | $0 | $76,300 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $565,500 | $0 | $9,200 | $9,200 | $0 | $0 |
| 7 | Grahams Island State Park | $505,700 | $505,700 | $0 | $13,300 | $13,300 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,308,500 | $414,900 | $3,846,600 | $3,838,100 | $8,500 | $423,400 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $272,300 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $3,638,500 | $3,638,500 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $2,248,900 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,003,700 | $2,003,700 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $4,933,600 | $4,933,600 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $479,600 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $1,406,400 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $6,015,600 | $6,015,600 | $0 | $0 | $0 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $1,442,000 | $1,442,000 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $3,336,600 | $3,336,600 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $938,600 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $835,300 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $3,629,800 | $368,500 | $3,261,300 | $0 | $0 | $0 | $3,261,300 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $701,800 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $0 | $540,100 | $0 | $0 | $0 | $540,100 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $39,335,000 | $35,042,400 | $4,292,600 | $4,141,400 | $4,132,900 | $8,500 | $4,301,100 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-2b.4

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-2b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $344,200 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $3,523,700 | $3,523,700 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $40,500 | $40,500 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $397,100 | $397,100 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $76,300 | $0 | $76,300 | $0 | $0 | $0 | $76,300 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $565,500 | $0 | $9,200 | $9,200 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $479,400 | $479,400 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,308,500 | $414,900 | $3,846,600 | $3,838,100 | $8,500 | $423,400 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $272,300 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $476,900 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $2,248,900 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $389,000 | $0 | $0 |
| 13 | US Highway 2 | $4,933,600 | $4,933,600 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $479,600 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $1,406,400 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $1,106,800 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $915,700 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $898,200 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $835,300 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $368,500 | -$368,500 | $576,000 | $0 | $576,000 | $207,500 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $471,700 | $230,100 | $0 | $218,300 | -$218,300 | $11,800 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $0 | $540,100 | $0 | $0 | $0 | $540,100 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $19,317,200 | $18,424,300 | $892,900 | $10,545,100 | $10,178,900 | $366,200 | $1,259,100 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-2b.5

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-2b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $4,817,300 | $4,817,300 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $439,900 | $439,900 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,700 | $0 | $116,700 | $0 | $0 | $0 | $116,700 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $9,200 | $9,200 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $13,300 | $13,300 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,002,400 | $409,900 | $3,846,600 | $3,838,100 | $8,500 | $418,400 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $272,300 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $5,379,700 | $5,379,700 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $3,198,900 | $3,198,900 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,602,200 | $2,602,200 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $6,222,100 | $6,222,100 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $581,500 | $581,500 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,738,100 | $1,738,100 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $493,600 | $493,600 | $0 | $1,021,700 | $1,021,700 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $4,124,800 | $4,124,800 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $938,600 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $1,012,700 | $1,012,700 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $450,300 | $6,476,400 | $0 | $0 | $0 | $6,476,400 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $1,022,500 | $1,022,500 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $0 | $1,241,500 | $0 | $0 | $0 | $1,241,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $47,891,300 | $39,646,800 | $8,244,500 | $6,738,100 | $6,729,600 | $8,500 | $8,253,000 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-2b.6

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-2b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $339,000 | $339,000 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $15,259,300 | $15,259,300 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $36,900 | $36,900 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $831,500 | $831,500 | $0 | $0 |
| 5 | St. Michael | $0 | $0 | $0 | $70,400 | $70,400 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $12,000 | $12,000 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $480,600 | $480,600 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $5,939,900 | $5,518,400 | $421,500 | $421,500 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $283,900 | $283,900 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $476,900 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $2,997,900 | $2,997,900 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $389,000 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $7,109,600 | $7,109,600 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $7,638,900 | $7,638,900 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $5,580,100 | $5,580,100 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $5,214,000 | $5,214,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $1,106,800 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $915,700 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $898,200 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $7,655,300 | $7,655,300 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $576,000 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $838,700 | $838,700 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $13,073,000 | $13,073,000 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $77,723,600 | $77,302,100 | $421,500 | $421,500 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.3.WF-2b.7**

**Annual Benefits of Project Downstream of Devils Lake:**
**Municipal Water Treatment Facilities**
Scenario WF-2b

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $196,100 |
| Fargo | $0 | $743,800 |
| Grand Forks | $30,700 | $1,445,900 |
| Grafton | $0 | $11,000 |
| Drayton | $900 | $56,800 |
| Pembina | $200 | $25,700 |
| Morris | $0 | $100,900 |
| Letellier | $0 | $113,900 |
| | | |
| TOTAL | $31,800 | $2,694,100 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $0 | $196,100 |
| Fargo | $0 | $743,800 |
| Grand Forks | $30,700 | $1,445,900 |
| Grafton | $0 | $11,000 |
| Drayton | $900 | $56,800 |
| Pembina | $200 | $25,700 |
| Morris | $0 | $100,900 |
| Letellier | $0 | $113,900 |
| | | |
| TOTAL | $31,800 | $2,694,100 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.3.WF-2b.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario WF-2b

## Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $41,000 |
| American Crystal Sugar | $1,400 |
| **TOTAL** | $42,400 |

## Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $41,000 |
| American Crystal Sugar | $1,400 |
| **TOTAL** | $42,400 |

## TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-2b.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario WF-2b

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $514,600 |
| Agricultural- Other | $208,200 |
| Urban (Lisbon and Valley City) | $9,347,000 |
| Transportation | $2,355,800 |
| | |
| **TOTAL** | $12,425,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $514,600 |
| Agricultural- Other | $208,200 |
| Urban (Lisbon and Valley City) | $9,347,000 |
| Transportation | $2,355,800 |
| | |
| **TOTAL** | $12,425,600 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | $0 |
| Agricultural- Other | $0 |
| Urban (Lisbon and Valley City) | $0 |
| Transportation | $0 |
| | |
| **TOTAL** | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-2b.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario WF-2b

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $478,500 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $478,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.3.WF-2b.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario WF-2b

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $0 | $0 | $0 | $0 |
| Outlet Operation and Maintenance | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $54,800 | $54,800 | $54,800 | $54,800 |
| EIM Operation and Maintenance | $6,033 | $6,033 | $6,033 | $6,033 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $0 | $0 | $0 | $0 |
| **Total Costs: Present Value** | $60,834 | $60,834 | $60,834 | $60,834 |
| **Annualized Total Cost** | $4,063 | $4,063 | $4,063 | $4,063 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $1,259 | $8,253 | $422 | $4,301 |
| Downstream Features | $0 | $0 | $0 | $0 |
| **Total Annualized Benefit** | $1,259 | $8,253 | $422 | $4,301 |
| | | | | |
| **NET BENEFIT** | -$2,804 | $4,190 | -$3,642 | $238 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.31 | 2.03 | 0.10 | 1.06 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.31 | 2.03 | 0.10 | 1.06 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 1 | 0 | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*WF-3 Tables*
*(Wet Future - West Bay 300 cfs Constrained Outlet)*

## Table TD.3.WF-3.1

## Economic Analysis of Devils Lake Alternatives

### Scenario WF-3
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rees. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Church Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 100 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 100 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 100 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 100 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 100 / 100 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 100 / 100 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 100 / 100 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 100 / 100 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 100 / 100 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 100 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.3.WF-3.2

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-3
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | R(1)A* | Relocation of Structure at First and Second Action Levels:1 Road Raise: Then Temporary Closure During Floods | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Floods | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | R(1) | Temporary Closure During Flooding | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.3.WF-3.3

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-3

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $342,400 | $1,800 | $0 | $0 | $0 | $1,800 |
| 2 | City of Devils Lake | $3,523,700 | $3,239,500 | $284,200 | $0 | $0 | $0 | $284,200 |
| 3 | Fort Totten | $40,500 | $34,500 | $6,000 | $0 | $0 | $0 | $6,000 |
| 4 | City of Minnewaukan | $397,100 | $381,000 | $16,100 | $0 | $0 | $0 | $16,100 |
| 5 | St. Michael | $76,300 | $65,700 | $10,600 | $0 | $0 | $0 | $10,600 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $489,900 | $75,600 | $9,200 | $8,300 | $900 | $76,500 |
| 7 | Grahams Island State Park | $505,700 | $431,500 | $74,200 | $13,300 | $13,000 | $300 | $74,500 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,323,400 | $400,000 | $3,846,600 | $2,571,200 | $1,275,400 | $1,675,400 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $242,300 | $30,000 | $30,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $3,638,500 | $2,352,100 | $1,286,400 | $0 | $0 | $0 | $1,286,400 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $763,400 | $1,485,500 | $0 | $0 | $0 | $1,485,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,003,700 | $592,300 | $1,411,400 | $0 | $0 | $0 | $1,411,400 |
| 13 | US Highway 2 | $4,933,600 | $1,823,300 | $3,110,300 | $0 | $0 | $0 | $3,110,300 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $223,300 | $256,300 | $0 | $0 | $0 | $256,300 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $589,700 | $816,700 | $0 | $0 | $0 | $816,700 |
| 16 | Highway 281 South of US Highway 2 | $6,015,600 | $4,222,700 | $1,792,900 | $0 | $0 | $0 | $1,792,900 |
| 17 | Highway 281 North of US Highway 2 | $1,442,000 | $1,179,400 | $262,600 | $0 | $0 | $0 | $262,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $3,336,600 | $1,397,200 | $1,939,400 | $0 | $0 | $0 | $1,939,400 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $0 | $938,600 | $0 | $0 | $0 | $938,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $388,900 | $446,400 | $0 | $0 | $0 | $446,400 |
| 22 | Highway 20 between Highway 57 and Tokio | $3,629,800 | $3,265,200 | $364,600 | $0 | $0 | $0 | $364,600 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $449,900 | $251,900 | $0 | $0 | $0 | $251,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $318,000 | $222,100 | $0 | $0 | $0 | $222,100 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $39,335,000 | $23,881,400 | $15,453,600 | $4,141,400 | $2,834,800 | $1,306,600 | $16,760,200 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-3.4

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-3

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $342,400 | $1,800 | $0 | $0 | $0 | $1,800 |
| 2 | City of Devils Lake | $3,523,700 | $3,239,500 | $284,200 | $0 | $0 | $0 | $284,200 |
| 3 | Fort Totten | $40,500 | $34,500 | $6,000 | $0 | $0 | $0 | $6,000 |
| 4 | City of Minnewaukan | $397,100 | $381,000 | $16,100 | $0 | $0 | $0 | $16,100 |
| 5 | St. Michael | $76,300 | $65,700 | $10,600 | $0 | $0 | $0 | $10,600 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $489,900 | $75,600 | $9,200 | $8,300 | $900 | $76,500 |
| 7 | Grahams Island State Park | $3,500 | $209,500 | -$206,000 | $479,400 | $75,400 | $404,000 | $198,000 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,323,400 | $400,000 | $3,846,600 | $2,571,200 | $1,275,400 | $1,675,400 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $242,300 | $30,000 | $30,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $595,900 | -$119,000 | -$119,000 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $763,400 | $1,485,500 | $0 | $0 | $0 | $1,485,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $287,700 | $101,300 | $101,300 |
| 13 | US Highway 2 | $4,933,600 | $1,823,300 | $3,110,300 | $0 | $0 | $0 | $3,110,300 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $223,300 | $256,300 | $0 | $0 | $0 | $256,300 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $589,700 | $816,700 | $0 | $0 | $0 | $816,700 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $594,600 | -$594,600 | $1,106,800 | $321,500 | $785,300 | $190,700 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $985,100 | -$69,400 | -$69,400 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $0 | $898,200 | $898,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $388,900 | $446,400 | $0 | $0 | $0 | $446,400 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $661,800 | -$85,800 | -$85,800 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $449,900 | $251,900 | $0 | $0 | $0 | $251,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $318,000 | $222,100 | $0 | $0 | $0 | $222,100 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $19,317,200 | $12,734,300 | $6,582,900 | $10,545,100 | $7,324,200 | $3,220,900 | $9,803,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-3.5

### Economic Analysis of Devils Lake Alternatives
### Scenario WF-3

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $4,817,300 | $4,817,300 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $439,900 | $439,900 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $9,200 | $8,300 | $900 | $900 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $13,300 | $13,000 | $300 | $300 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $3,846,600 | $2,571,200 | $1,275,400 | $1,275,400 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $242,300 | $30,000 | $30,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $5,379,700 | $5,379,700 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $3,198,900 | $3,198,900 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,602,200 | $2,299,700 | $302,500 | $0 | $0 | $0 | $302,500 |
| 13 | US Highway 2 | $6,222,100 | $5,498,700 | $723,400 | $0 | $0 | $0 | $723,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $581,500 | $513,900 | $67,600 | $0 | $0 | $0 | $67,600 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,738,100 | $1,536,000 | $202,100 | $0 | $0 | $0 | $202,100 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $493,600 | $493,600 | $0 | $1,021,700 | $1,021,700 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $4,124,800 | $3,645,100 | $479,700 | $0 | $0 | $0 | $479,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $0 | $938,600 | $0 | $0 | $0 | $938,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $1,012,700 | $894,900 | $117,800 | $0 | $0 | $0 | $117,800 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $1,022,500 | $1,022,500 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $47,891,300 | $45,059,600 | $2,831,700 | $6,738,100 | $5,431,500 | $1,306,600 | $4,138,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-3.6

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-3

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $339,000 | $338,100 | $900 | $900 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $15,259,300 | $14,391,600 | $867,700 | $867,700 |
| 3 | Fort Totten | $0 | $0 | $0 | $36,900 | $31,400 | $5,500 | $5,500 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $831,500 | $737,700 | $93,800 | $93,800 |
| 5 | St. Michael | $0 | $0 | $0 | $70,400 | $60,800 | $9,600 | $9,600 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $12,000 | $11,100 | $900 | $900 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $480,600 | $435,300 | $45,300 | $45,300 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $5,939,900 | $4,165,400 | $1,774,500 | $1,774,500 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $283,900 | $253,900 | $30,000 | $30,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $595,900 | -$119,000 | -$119,000 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $2,997,900 | $2,689,100 | $308,800 | $308,800 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $287,700 | $101,300 | $101,300 |
| 13 | US Highway 2 | $0 | $0 | $0 | $7,109,600 | $4,865,900 | $2,243,700 | $2,243,700 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $7,638,900 | $5,198,800 | $2,440,100 | $2,440,100 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $5,580,100 | $3,891,200 | $1,688,900 | $1,688,900 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $5,214,000 | $5,324,200 | -$110,200 | -$110,200 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $991,300 | $115,500 | $115,500 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $985,100 | -$69,400 | -$69,400 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $0 | $898,200 | $898,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $7,655,300 | $5,258,100 | $2,397,200 | $2,397,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $661,800 | -$85,800 | -$85,800 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $838,700 | $813,200 | $25,500 | $25,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $13,073,000 | $13,073,000 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $77,723,600 | $65,060,600 | $12,663,000 | $12,663,000 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.3.WF-3.7**

**Annual Benefits of Project Downstream of Devils Lake:**
**Municipal Water Treatment Facilities**
Scenario WF-3

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $196,100 |
| Fargo | $0 | $743,800 |
| Grand Forks | $30,700 | $1,445,900 |
| Grafton | $0 | $11,000 |
| Drayton | $900 | $56,800 |
| Pembina | $200 | $25,700 |
| Morris | $0 | $100,900 |
| Letellier | $0 | $113,900 |
| | | |
| TOTAL | $31,800 | $2,694,100 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $14,200 | $0 |
| Fargo | $6,800 | $0 |
| Grand Forks | $27,100 | $0 |
| Grafton | $1,400 | $0 |
| Drayton | $900 | $0 |
| Pembina | $200 | $0 |
| Morris | $1,100 | $0 |
| Letellier | $2,000 | $0 |
| | | |
| TOTAL | $53,700 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$14,200 | $196,100 |
| Fargo | -$6,800 | $743,800 |
| Grand Forks | $3,600 | $1,445,900 |
| Grafton | -$1,400 | $11,000 |
| Drayton | $0 | $56,800 |
| Pembina | $0 | $25,700 |
| Morris | -$1,100 | $100,900 |
| Letellier | -$2,000 | $113,900 |
| | | |
| TOTAL | -$21,900 | $2,694,100 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.3.WF-3.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario WF-3

## Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $41,000 |
| American Crystal Sugar | $1,400 |
| **TOTAL** | $42,400 |

## Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $37,300 |
| American Crystal Sugar | $1,600 |
| **TOTAL** | $38,900 |

## TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | $3,700 |
| American Crystal Sugar | -$200 |
| **TOTAL** | $3,500 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-3.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario WF-3

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $514,600 |
| Agricultural- Other | $208,200 |
| Urban (Lisbon and Valley City) | $9,347,000 |
| Transportation | $2,355,800 |
| | |
| **TOTAL** | $12,425,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $549,800 |
| Agricultural- Other | $207,800 |
| Urban (Lisbon and Valley City) | $9,469,800 |
| Transportation | $2,358,300 |
| | |
| **TOTAL** | $12,585,700 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$35,200 |
| Agricultural- Other | $400 |
| Urban (Lisbon and Valley City) | -$122,800 |
| Transportation | -$2,500 |
| | |
| **TOTAL** | -$160,100 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-3.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario WF-3

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $478,500 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $36,800 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | $441,700 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.3.WF-3.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario WF-3

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $58,540 | $58,540 | $58,540 | $58,540 |
| Outlet Operation and Maintenance | $14,293 | $14,293 | $14,293 | $14,293 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $95,465 | $95,465 | $95,465 | $95,465 |
| **Annualized Total Cost** | $6,376 | $6,376 | $6,376 | $6,376 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $9,804 | $4,138 | $12,663 | $16,760 |
| Downstream Features | $2,957 | $2,957 | $2,957 | $2,957 |
| **Total Annualized Benefit** | $12,761 | $7,096 | $15,620 | $19,718 |
| | | | | |
| **NET BENEFIT** | $6,385 | $720 | $9,244 | $13,341 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 2.00 | 1.11 | 2.45 | 3.09 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 2.02 | 0.85 | 2.60 | 3.45 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 1 | 0 | 1 | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*WF-4 Tables*
*(Wet Future - West Bay 480 cfs Unconstrained Outlet)*

## Table TD.3.WF-4.1

## Economic Analysis of Devils Lake Alternatives

## Scenario WF-4
## Probability of Reaching Decision/Action Levels at Each Feature
## (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churches Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mil. Res. | 7 Graham's Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churches Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19 / Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20 / Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 100 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 100 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 100 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 100 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 100 / 100 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 100 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 100 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 100 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 100 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 100 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.3.WF-4.2

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-4
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | Re | Relocate Road | R(5) | 5 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Floods | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.3.WF-4.3

### Economic Analysis of Devils Lake Alternatives
### Scenario WF-4

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Most Likely Action Strategies
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy In Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $333,700 | $10,500 | $0 | $0 | $0 | $10,500 |
| 2 | City of Devils Lake | $3,523,700 | $1,962,100 | $1,561,600 | $0 | $0 | $0 | $1,561,600 |
| 3 | Fort Totten | $40,500 | $21,000 | $19,500 | $0 | $0 | $0 | $19,500 |
| 4 | City of Minnewaukan | $397,100 | $302,600 | $94,500 | $0 | $0 | $0 | $94,500 |
| 5 | St. Michael | $76,300 | $13,800 | $62,500 | $0 | $0 | $0 | $62,500 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $310,300 | $255,200 | $9,200 | $6,000 | $3,200 | $258,400 |
| 7 | Grahams Island State Park | $505,700 | $209,500 | $296,200 | $13,300 | $12,100 | $1,200 | $297,400 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,009,800 | $713,600 | $3,846,600 | $1,581,600 | $2,265,000 | $2,978,600 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $210,700 | $61,600 | $61,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $3,638,500 | $1,451,800 | $2,186,700 | $0 | $0 | $0 | $2,186,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $495,300 | $1,753,600 | $0 | $0 | $0 | $1,753,600 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,003,700 | $0 | $2,003,700 | $0 | $0 | $0 | $2,003,700 |
| 13 | US Highway 2 | $4,933,600 | $0 | $4,933,600 | $0 | $0 | $0 | $4,933,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $0 | $479,600 | $0 | $0 | $0 | $479,600 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $0 | $1,406,400 | $0 | $0 | $0 | $1,406,400 |
| 16 | Highway 281 South of US Highway 2 | $6,015,600 | $2,452,100 | $3,563,500 | $0 | $0 | $0 | $3,563,500 |
| 17 | Highway 281 North of US Highway 2 | $1,442,000 | $594,600 | $847,400 | $0 | $0 | $0 | $847,400 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $3,336,600 | $0 | $3,336,600 | $0 | $0 | $0 | $3,336,600 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $0 | $938,600 | $0 | $0 | $0 | $938,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $0 | $835,300 | $0 | $0 | $0 | $835,300 |
| 22 | Highway 20 between Highway 57 and Tokio | $3,629,800 | $2,374,100 | $1,255,700 | $0 | $0 | $0 | $1,255,700 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $284,100 | $417,700 | $0 | $0 | $0 | $417,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $111,700 | $428,400 | $0 | $0 | $0 | $428,400 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $39,335,000 | $11,934,600 | $27,400,400 | $4,141,400 | $1,810,400 | $2,331,000 | $29,731,400 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-4.4

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-4

## Annual Benefits of Project for Features Adjacent to Devlis Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $333,700 | $10,500 | $0 | $0 | $0 | $10,500 |
| 2 | City of Devils Lake | $3,523,700 | $1,962,100 | $1,561,600 | $0 | $0 | $0 | $1,561,600 |
| 3 | Fort Totten | $40,500 | $21,000 | $19,500 | $0 | $0 | $0 | $19,500 |
| 4 | City of Minnewaukan | $397,100 | $223,700 | $173,400 | $0 | $0 | $0 | $173,400 |
| 5 | St. Michael | $76,300 | $13,800 | $62,500 | $0 | $0 | $0 | $62,500 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $310,300 | $255,200 | $9,200 | $6,000 | $3,200 | $258,400 |
| 7 | Grahams Island State Park | $3,500 | $209,500 | -$206,000 | $479,400 | $12,100 | $467,300 | $261,300 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,009,800 | $713,600 | $3,846,600 | $1,581,600 | $2,265,000 | $2,978,600 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $210,700 | $61,600 | $61,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $458,100 | $18,800 | $18,800 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $495,300 | $1,753,600 | $0 | $0 | $0 | $1,753,600 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $0 | $389,000 | $389,000 |
| 13 | US Highway 2 | $4,933,600 | $0 | $4,933,600 | $0 | $0 | $0 | $4,933,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $0 | $479,600 | $0 | $0 | $0 | $479,600 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $0 | $1,406,400 | $0 | $0 | $0 | $1,406,400 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $2,452,100 | -$962,900 | $1,575,000 | $0 | $1,575,000 | $612,100 |
| 17 | Highway 281 North of US Highway 2 | $0 | $594,600 | -$594,600 | $1,106,800 | $0 | $1,106,800 | $512,200 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $0 | $915,700 | $915,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $0 | $898,200 | $898,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $0 | $835,300 | $0 | $0 | $0 | $835,300 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $574,000 | $2,000 | $2,000 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $284,100 | $417,700 | $0 | $0 | $0 | $417,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $111,700 | $428,400 | $0 | $0 | $0 | $428,400 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $19,317,200 | $8,029,800 | $11,287,400 | $10,545,100 | $2,842,500 | $7,702,600 | $18,990,000 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-4.5

### Economic Analysis of Devils Lake Alternatives
### Scenario WF-4

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $4,817,300 | $4,817,300 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $439,900 | $439,900 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $9,200 | $6,000 | $3,200 | $3,200 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $13,300 | $12,100 | $1,200 | $1,200 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $3,846,600 | $1,581,600 | $2,265,000 | $2,265,000 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $210,700 | $61,600 | $61,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $5,379,700 | $5,379,700 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $3,198,900 | $2,075,500 | $1,123,400 | $0 | $0 | $0 | $1,123,400 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,602,200 | $0 | $2,602,200 | $0 | $0 | $0 | $2,602,200 |
| 13 | US Highway 2 | $6,222,100 | $0 | $6,222,100 | $0 | $0 | $0 | $6,222,100 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $581,500 | $0 | $581,500 | $0 | $0 | $0 | $581,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,738,100 | $0 | $1,738,100 | $0 | $0 | $0 | $1,738,100 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $493,600 | $493,600 | $0 | $1,021,700 | $1,021,700 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $4,124,800 | $0 | $4,124,800 | $0 | $0 | $0 | $4,124,800 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $0 | $938,600 | $0 | $0 | $0 | $938,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $1,012,700 | $0 | $1,012,700 | $0 | $0 | $0 | $1,012,700 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $1,022,500 | $1,022,500 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $47,891,300 | $29,547,900 | $18,343,400 | $6,738,100 | $4,407,100 | $2,331,000 | $20,674,400 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-4.6

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-4

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $339,000 | $333,700 | $5,300 | $5,300 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $15,259,300 | $11,971,700 | $3,287,600 | $3,287,600 |
| 3 | Fort Totten | $0 | $0 | $0 | $36,900 | $19,100 | $17,800 | $17,800 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $831,500 | $277,200 | $554,300 | $554,300 |
| 5 | St. Michael | $0 | $0 | $0 | $70,400 | $13,400 | $57,000 | $57,000 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $12,000 | $8,800 | $3,200 | $3,200 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $480,600 | $400,000 | $80,600 | $80,600 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $5,939,900 | $2,783,000 | $3,156,900 | $3,156,900 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $283,900 | $222,300 | $61,600 | $61,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $458,100 | $18,800 | $18,800 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $2,997,900 | $1,206,400 | $1,791,500 | $1,791,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $0 | $389,000 | $389,000 |
| 13 | US Highway 2 | $0 | $0 | $0 | $7,109,600 | $0 | $7,109,600 | $7,109,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $7,638,900 | $0 | $7,638,900 | $7,638,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $5,580,100 | $0 | $5,580,100 | $5,580,100 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $5,214,000 | $4,532,900 | $681,100 | $681,100 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $828,700 | $278,100 | $278,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $0 | $915,700 | $915,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $0 | $898,200 | $898,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $7,655,300 | $0 | $7,655,300 | $7,655,300 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $574,000 | $2,000 | $2,000 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $838,700 | $681,300 | $157,400 | $157,400 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $13,073,000 | $11,639,500 | $1,433,500 | $1,433,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $77,723,600 | $35,950,100 | $41,773,500 | $41,773,500 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.3.WF-4.7

### Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities
Scenario WF-4

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $196,100 |
| Fargo | $0 | $743,800 |
| Grand Forks | $30,700 | $1,445,900 |
| Grafton | $0 | $11,000 |
| Drayton | $900 | $56,800 |
| Pembina | $200 | $25,700 |
| Morris | $0 | $100,900 |
| Letellier | $0 | $113,900 |
| | | |
| TOTAL | $31,800 | $2,694,100 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $0 | $26,300 |
| Fargo | $10,100 | $1,173,200 |
| Grand Forks | $45,500 | $2,155,200 |
| Grafton | $0 | $42,400 |
| Drayton | $1,600 | $73,800 |
| Pembina | $300 | $29,300 |
| Morris | $0 | $19,800 |
| Letellier | $0 | $21,300 |
| | | |
| TOTAL | $57,500 | $3,541,300 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | $0 | $169,800 |
| Fargo | -$10,100 | -$429,400 |
| Grand Forks | -$14,800 | -$709,300 |
| Grafton | $0 | -$31,400 |
| Drayton | -$700 | -$17,000 |
| Pembina | -$100 | -$3,600 |
| Morris | $0 | $81,100 |
| Letellier | $0 | $92,600 |
| | | |
| TOTAL | -$25,700 | -$847,200 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.3.WF-4.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario WF-4

## Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $41,000 |
| American Crystal Sugar | $1,400 |
| **TOTAL** | $42,400 |

## Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $65,800 |
| American Crystal Sugar | $3,500 |
| **TOTAL** | $69,300 |

## TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$24,800 |
| American Crystal Sugar | -$2,100 |
| **TOTAL** | -$26,900 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-4.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario WF-4

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $514,600 |
| Agricultural- Other | $208,200 |
| Urban (Lisbon and Valley City) | $9,347,000 |
| Transportation | $2,355,800 |
| | |
| TOTAL | $12,425,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $592,300 |
| Agricultural- Other | $209,700 |
| Urban (Lisbon and Valley City) | $9,546,000 |
| Transportation | $2,381,500 |
| | |
| TOTAL | $12,729,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$77,700 |
| Agricultural- Other | -$1,500 |
| Urban (Lisbon and Valley City) | -$199,000 |
| Transportation | -$25,700 |
| | |
| TOTAL | -$303,900 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-4.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario WF-4

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $478,500 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $178,900 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | $299,600 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.3.WF-4.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario WF-4

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $92,190 | $92,190 | $92,190 | $92,190 |
| Outlet Operation and Maintenance | $24,514 | $24,514 | $24,514 | $24,514 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $15,351 | $15,351 | $15,351 | $15,351 |
| Natural Resources Monitoring/Mitigation | $50,432 | $50,432 | $50,432 | $50,432 |
| **Total Costs: Present Value** | $182,487 | $182,487 | $182,487 | $182,487 |
| **Annualized Total Cost** | $12,188 | $12,188 | $12,188 | $12,188 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $1 | $1 | $1 | $1 |
| Features Adjacent to Devils Lake | $18,990 | $20,674 | $41,774 | $29,731 |
| Downstream Features | -$904 | -$904 | -$904 | -$904 |
| **Total Annualized Benefit** | $18,087 | $19,771 | $40,870 | $28,828 |
| | | | | |
| **NET BENEFIT** | $5,899 | $7,583 | $28,682 | $16,640 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 1.48 | 1.62 | 3.35 | 2.37 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 2.44 | 2.65 | 5.36 | 3.81 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 1 | 1 | 1 | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

***WF-5 Tables***
***(Wet Future - Pelican Lake 300 cfs Constrained Outlet)***

## Table TD.3.WF-5.1

## Economic Analysis of Devils Lake Alternatives

### Scenario WF-5
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Cando | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 100 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 100 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 100 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 100 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 100 / 100 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 100 / 100 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 100 / 100 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 100 / 100 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 100 / 100 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 100 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.3.WF-5.2

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-5
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | R(2)A* | Relocation of Structure at First and Second Action Levels:2 Road Raises: Then Temporary Closure During Floods | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.3.WF-5.3

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $342,000 | $2,200 | $0 | $0 | $0 | $2,200 |
| 2 | City of Devils Lake | $3,523,700 | $3,079,600 | $444,100 | $0 | $0 | $0 | $444,100 |
| 3 | Fort Totten | $40,500 | $34,500 | $6,000 | $0 | $0 | $0 | $6,000 |
| 4 | City of Minnewaukan | $397,100 | $376,400 | $20,700 | $0 | $0 | $0 | $20,700 |
| 5 | St. Michael | $76,300 | $62,600 | $13,700 | $0 | $0 | $0 | $13,700 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $481,000 | $84,500 | $9,200 | $8,100 | $1,100 | $85,600 |
| 7 | Grahams Island State Park | $505,700 | $413,700 | $92,000 | $13,300 | $13,000 | $300 | $92,300 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,308,100 | $415,300 | $3,846,600 | $2,517,700 | $1,328,900 | $1,744,200 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $238,600 | $33,700 | $33,700 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $3,638,500 | $2,247,400 | $1,391,100 | $0 | $0 | $0 | $1,391,100 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $717,600 | $1,531,300 | $0 | $0 | $0 | $1,531,300 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,003,700 | $523,400 | $1,480,300 | $0 | $0 | $0 | $1,480,300 |
| 13 | US Highway 2 | $4,933,600 | $1,611,400 | $3,322,200 | $0 | $0 | $0 | $3,322,200 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $197,400 | $282,200 | $0 | $0 | $0 | $282,200 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $521,200 | $885,200 | $0 | $0 | $0 | $885,200 |
| 16 | Highway 281 South of US Highway 2 | $6,015,600 | $3,564,900 | $2,450,700 | $0 | $0 | $0 | $2,450,700 |
| 17 | Highway 281 North of US Highway 2 | $1,442,000 | $1,179,400 | $262,600 | $0 | $0 | $0 | $262,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $3,336,600 | $841,300 | $2,495,300 | $0 | $0 | $0 | $2,495,300 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $0 | $938,600 | $0 | $0 | $0 | $938,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $343,700 | $491,600 | $0 | $0 | $0 | $491,600 |
| 22 | Highway 20 between Highway 57 and Tokio | $3,629,800 | $3,225,300 | $404,500 | $0 | $0 | $0 | $404,500 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $430,600 | $271,200 | $0 | $0 | $0 | $271,200 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $305,600 | $234,500 | $0 | $0 | $0 | $234,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $39,335,000 | $21,815,200 | $17,519,800 | $4,141,400 | $2,777,400 | $1,364,000 | $18,883,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-5.4

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $342,000 | $2,200 | $0 | $0 | $0 | $2,200 |
| 2 | City of Devils Lake | $3,523,700 | $3,079,600 | $444,100 | $0 | $0 | $0 | $444,100 |
| 3 | Fort Totten | $40,500 | $34,500 | $6,000 | $0 | $0 | $0 | $6,000 |
| 4 | City of Minnewaukan | $397,100 | $376,400 | $20,700 | $0 | $0 | $0 | $20,700 |
| 5 | St. Michael | $76,300 | $62,600 | $13,700 | $0 | $0 | $0 | $13,700 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $481,000 | $84,500 | $9,200 | $8,100 | $1,100 | $85,600 |
| 7 | Grahams Island State Park | $3,500 | $280,400 | -$276,900 | $479,400 | $58,600 | $420,800 | $143,900 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,308,100 | $415,300 | $3,846,600 | $2,517,700 | $1,328,900 | $1,744,200 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $238,600 | $33,700 | $33,700 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $581,700 | -$104,800 | -$104,800 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $717,600 | $1,531,300 | $0 | $0 | $0 | $1,531,300 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $210,900 | $178,100 | $178,100 |
| 13 | US Highway 2 | $4,933,600 | $1,611,400 | $3,322,200 | $0 | $0 | $0 | $3,322,200 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $197,400 | $282,200 | $0 | $0 | $0 | $282,200 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $521,200 | $885,200 | $0 | $0 | $0 | $885,200 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $957,200 | $149,600 | $149,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $557,000 | $358,700 | $358,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $0 | $898,200 | $898,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $343,700 | $491,600 | $0 | $0 | $0 | $491,600 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $666,600 | -$90,600 | -$90,600 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $430,600 | $271,200 | $0 | $0 | $0 | $271,200 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $305,600 | $234,500 | $0 | $0 | $0 | $234,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $19,317,200 | $11,589,400 | $7,727,800 | $10,545,100 | $7,371,400 | $3,173,700 | $10,901,500 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-5.5

### Economic Analysis of Devils Lake Alternatives
### Scenario WF-5

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $4,817,300 | $4,817,300 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $439,900 | $439,900 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $9,200 | $8,100 | $1,100 | $1,100 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $13,300 | $13,000 | $300 | $300 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $3,846,600 | $2,517,700 | $1,328,900 | $1,328,900 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $238,600 | $33,700 | $33,700 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $5,379,700 | $5,379,700 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $3,198,900 | $3,007,100 | $191,800 | $0 | $0 | $0 | $191,800 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,602,200 | $2,032,300 | $569,900 | $0 | $0 | $0 | $569,900 |
| 13 | US Highway 2 | $6,222,100 | $4,859,400 | $1,362,700 | $0 | $0 | $0 | $1,362,700 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $581,500 | $454,100 | $127,400 | $0 | $0 | $0 | $127,400 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,738,100 | $1,357,400 | $380,700 | $0 | $0 | $0 | $380,700 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $493,600 | $493,600 | $0 | $1,021,700 | $1,021,700 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $4,124,800 | $2,158,800 | $1,966,000 | $0 | $0 | $0 | $1,966,000 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $0 | $938,600 | $0 | $0 | $0 | $938,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $1,012,700 | $790,900 | $221,800 | $0 | $0 | $0 | $221,800 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $1,022,500 | $1,022,500 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $47,891,300 | $42,132,400 | $5,758,900 | $6,738,100 | $5,374,100 | $1,364,000 | $7,122,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-5.6

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $339,000 | $337,800 | $1,200 | $1,200 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $15,259,300 | $14,156,100 | $1,103,200 | $1,103,200 |
| 3 | Fort Totten | $0 | $0 | $0 | $36,900 | $31,400 | $5,500 | $5,500 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $831,500 | $710,000 | $121,500 | $121,500 |
| 5 | St. Michael | $0 | $0 | $0 | $70,400 | $57,900 | $12,500 | $12,500 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $12,000 | $11,000 | $1,000 | $1,000 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $480,600 | $435,200 | $45,400 | $45,400 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $5,939,900 | $4,092,900 | $1,847,000 | $1,847,000 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $283,900 | $250,200 | $33,700 | $33,700 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $581,700 | -$104,800 | -$104,800 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $2,997,900 | $2,370,500 | $627,400 | $627,400 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $210,900 | $178,100 | $178,100 |
| 13 | US Highway 2 | $0 | $0 | $0 | $7,109,600 | $3,977,200 | $3,132,400 | $3,132,400 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $7,638,900 | $4,226,300 | $3,412,600 | $3,412,600 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $5,580,100 | $3,105,200 | $2,474,900 | $2,474,900 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $5,214,000 | $5,301,800 | -$87,800 | -$87,800 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $957,200 | $149,600 | $149,600 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $557,000 | $358,700 | $358,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $0 | $898,200 | $898,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $7,655,300 | $4,243,100 | $3,412,200 | $3,412,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $666,600 | -$90,600 | -$90,600 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $838,700 | $805,300 | $33,400 | $33,400 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $13,073,000 | $13,073,000 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $77,723,600 | $60,158,300 | $17,565,300 | $17,565,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.3.WF-5.7**

**Annual Benefits of Project Downstream of Devils Lake:**
**Municipal Water Treatment Facilities**
Scenario WF-5

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $196,100 |
| Fargo | $0 | $743,800 |
| Grand Forks | $30,700 | $1,445,900 |
| Grafton | $0 | $11,000 |
| Drayton | $900 | $56,800 |
| Pembina | $200 | $25,700 |
| Morris | $0 | $100,900 |
| Letellier | $0 | $113,900 |
| | | |
| TOTAL | $31,800 | $2,694,100 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $7,500 | $0 |
| Fargo | $2,900 | $0 |
| Grand Forks | $15,300 | $0 |
| Grafton | $900 | $0 |
| Drayton | $600 | $0 |
| Pembina | $100 | $0 |
| Morris | $700 | $0 |
| Letellier | $1,100 | $0 |
| | | |
| TOTAL | $29,100 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$7,500 | $196,100 |
| Fargo | -$2,900 | $743,800 |
| Grand Forks | $15,400 | $1,445,900 |
| Grafton | -$900 | $11,000 |
| Drayton | $300 | $56,800 |
| Pembina | $100 | $25,700 |
| Morris | -$700 | $100,900 |
| Letellier | -$1,100 | $113,900 |
| | | |
| TOTAL | $2,700 | $2,694,100 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-5.8

### Annual Benefits of Project Downstream of Devils Lake:
### Industrial Water Users
Scenario WF-5

### Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $41,000 |
| American Crystal Sugar | $1,400 |
| **TOTAL** | $42,400 |

### Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $20,400 |
| American Crystal Sugar | $1,100 |
| **TOTAL** | $21,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | $20,600 |
| American Crystal Sugar | $300 |
| **TOTAL** | $20,900 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-5.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario WF-5

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $514,600 |
| Agricultural- Other | $208,200 |
| Urban (Lisbon and Valley City) | $9,347,000 |
| Transportation | $2,355,800 |
| | |
| TOTAL | $12,425,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $549,900 |
| Agricultural- Other | $207,700 |
| Urban (Lisbon and Valley City) | $9,463,400 |
| Transportation | $2,357,300 |
| | |
| TOTAL | $12,578,300 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$35,300 |
| Agricultural- Other | $500 |
| Urban (Lisbon and Valley City) | -$116,400 |
| Transportation | -$1,500 |
| | |
| TOTAL | -$152,700 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-5.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario WF-5

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $478,500 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $15,700 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | $462,800 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.3.WF-5.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario WF-5

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $84,180 | $84,180 | $84,180 | $84,180 |
| Outlet Operation and Maintenance | $17,136 | $17,136 | $17,136 | $17,136 |
| Hwy 19 Dam Construction | $638 | $638 | $638 | $638 |
| Hwy 19 Dam Operation and Maintenance | $396 | $396 | $396 | $396 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $124,982 | $124,982 | $124,982 | $124,982 |
| **Annualized Total Cost** | $8,347 | $8,347 | $8,347 | $8,347 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $10,902 | $7,123 | $17,565 | $18,884 |
| Downstream Features | $3,028 | $3,028 | $3,028 | $3,028 |
| **Total Annualized Benefit** | $13,929 | $10,151 | $20,593 | $21,912 |
| | | | | |
| **NET BENEFIT** | $5,582 | $1,803 | $12,246 | $13,564 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 1.67 | 1.22 | 2.47 | 2.62 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 1.59 | 1.04 | 2.57 | 2.76 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 1 | 0 | 1 | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*WF-6 Tables*
*(Wet Future - Pelican Lake 480 cfs Unconstrained Outlet)*

## Table TD.3.WF-6.1

## Economic Analysis of Devils Lake Alternatives

### Scenario WF-6
### Probability of Reaching Decision/Action Levels at Each Feature (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 100 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 100 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 100 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 100 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 100 / 100 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 100 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 100 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 100 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 100 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 100 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.3.WF-6.2

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-6
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Most Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | Re | Relocate Road | R(5) | 5 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | R(1) | 1 Road Raise | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.3.WF-6.3

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy In Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $333,700 | $10,500 | $0 | $0 | $0 | $10,500 |
| 2 | City of Devils Lake | $3,523,700 | $2,050,700 | $1,473,000 | $0 | $0 | $0 | $1,473,000 |
| 3 | Fort Totten | $40,500 | $21,000 | $19,500 | $0 | $0 | $0 | $19,500 |
| 4 | City of Minnewaukan | $397,100 | $302,600 | $94,500 | $0 | $0 | $0 | $94,500 |
| 5 | St. Michael | $76,300 | $13,800 | $62,500 | $0 | $0 | $0 | $62,500 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $310,300 | $255,200 | $9,200 | $6,000 | $3,200 | $258,400 |
| 7 | Grahams Island State Park | $505,700 | $209,500 | $296,200 | $13,300 | $12,100 | $1,200 | $297,400 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,009,800 | $713,600 | $3,846,600 | $1,581,600 | $2,265,000 | $2,978,600 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $210,700 | $61,600 | $61,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $3,638,500 | $1,451,800 | $2,186,700 | $0 | $0 | $0 | $2,186,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $526,900 | $1,722,000 | $0 | $0 | $0 | $1,722,000 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,003,700 | $0 | $2,003,700 | $0 | $0 | $0 | $2,003,700 |
| 13 | US Highway 2 | $4,933,600 | $0 | $4,933,600 | $0 | $0 | $0 | $4,933,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $0 | $479,600 | $0 | $0 | $0 | $479,600 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $0 | $1,406,400 | $0 | $0 | $0 | $1,406,400 |
| 16 | Highway 281 South of US Highway 2 | $6,015,600 | $2,121,300 | $3,894,300 | $0 | $0 | $0 | $3,894,300 |
| 17 | Highway 281 North of US Highway 2 | $1,442,000 | $594,600 | $847,400 | $0 | $0 | $0 | $847,400 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $3,336,600 | $0 | $3,336,600 | $0 | $0 | $0 | $3,336,600 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $0 | $938,600 | $0 | $0 | $0 | $938,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $0 | $835,300 | $0 | $0 | $0 | $835,300 |
| 22 | Highway 20 between Highway 57 and Tokio | $3,629,800 | $2,374,100 | $1,255,700 | $0 | $0 | $0 | $1,255,700 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $284,100 | $417,700 | $0 | $0 | $0 | $417,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $111,700 | $428,400 | $0 | $0 | $0 | $428,400 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $39,335,000 | $11,724,000 | $27,611,000 | $4,141,400 | $1,810,400 | $2,331,000 | $29,942,000 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-6.4

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $344,200 | $333,700 | $10,500 | $0 | $0 | $0 | $10,500 |
| 2 | City of Devils Lake | $3,523,700 | $2,050,700 | $1,473,000 | $0 | $0 | $0 | $1,473,000 |
| 3 | Fort Totten | $40,500 | $21,000 | $19,500 | $0 | $0 | $0 | $19,500 |
| 4 | City of Minnewaukan | $302,600 | $223,700 | $78,900 | $0 | $0 | $0 | $78,900 |
| 5 | St. Michael | $76,300 | $13,800 | $62,500 | $0 | $0 | $0 | $62,500 |
| 6 | Gilbert C. Grafton State Military Res. | $565,500 | $310,300 | $255,200 | $9,200 | $6,000 | $3,200 | $258,400 |
| 7 | Grahams Island State Park | $3,500 | $209,500 | -$206,000 | $479,400 | $12,100 | $467,300 | $261,300 |
| 8.1 | Devils Lake Rural Areas | $1,723,400 | $1,009,800 | $713,600 | $3,846,600 | $1,581,600 | $2,265,000 | $2,978,600 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $210,700 | $61,600 | $61,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $458,100 | $18,800 | $18,800 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,248,900 | $526,900 | $1,722,000 | $0 | $0 | $0 | $1,722,000 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $0 | $389,000 | $389,000 |
| 13 | US Highway 2 | $4,933,600 | $0 | $4,933,600 | $0 | $0 | $0 | $4,933,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $479,600 | $0 | $479,600 | $0 | $0 | $0 | $479,600 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,406,400 | $0 | $1,406,400 | $0 | $0 | $0 | $1,406,400 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $2,121,300 | -$632,100 | $1,575,000 | $0 | $1,575,000 | $942,900 |
| 17 | Highway 281 North of US Highway 2 | $0 | $594,600 | -$594,600 | $1,106,800 | $0 | $1,106,800 | $512,200 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $0 | $915,700 | $915,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $0 | $898,200 | $898,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $835,300 | $0 | $835,300 | $0 | $0 | $0 | $835,300 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $574,000 | $2,000 | $2,000 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $701,800 | $284,100 | $417,700 | $0 | $0 | $0 | $417,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $540,100 | $111,700 | $428,400 | $0 | $0 | $0 | $428,400 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $19,222,700 | $7,819,200 | $11,403,500 | $10,545,100 | $2,842,500 | $7,702,600 | $19,106,100 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-6.5

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-6

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $4,817,300 | $4,817,300 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $439,900 | $439,900 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $9,200 | $6,000 | $3,200 | $3,200 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $13,300 | $12,100 | $1,200 | $1,200 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $3,846,600 | $1,581,600 | $2,265,000 | $2,265,000 |
| 8.2 | Stump Lake Rural Areas | $8,100 | $8,100 | $0 | $272,300 | $210,700 | $61,600 | $61,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $5,379,700 | $5,379,700 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $3,198,900 | $2,207,800 | $991,100 | $0 | $0 | $0 | $991,100 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $2,602,200 | $0 | $2,602,200 | $0 | $0 | $0 | $2,602,200 |
| 13 | US Highway 2 | $6,222,100 | $0 | $6,222,100 | $0 | $0 | $0 | $6,222,100 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $581,500 | $0 | $581,500 | $0 | $0 | $0 | $581,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,738,100 | $0 | $1,738,100 | $0 | $0 | $0 | $1,738,100 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $493,600 | $493,600 | $0 | $1,021,700 | $1,021,700 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $4,124,800 | $0 | $4,124,800 | $0 | $0 | $0 | $4,124,800 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $938,600 | $0 | $938,600 | $0 | $0 | $0 | $938,600 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $1,012,700 | $0 | $1,012,700 | $0 | $0 | $0 | $1,012,700 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $1,022,500 | $1,022,500 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $47,891,300 | $29,680,200 | $18,211,100 | $6,738,100 | $4,407,100 | $2,331,000 | $20,542,100 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.3.WF-6.6

## Economic Analysis of Devils Lake Alternatives
## Scenario WF-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $339,000 | $333,700 | $5,300 | $5,300 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $15,259,300 | $12,067,900 | $3,191,400 | $3,191,400 |
| 3 | Fort Totten | $0 | $0 | $0 | $36,900 | $19,100 | $17,800 | $17,800 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $831,500 | $277,200 | $554,300 | $554,300 |
| 5 | St. Michael | $0 | $0 | $0 | $70,400 | $13,400 | $57,000 | $57,000 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $12,000 | $8,800 | $3,200 | $3,200 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $480,600 | $400,000 | $80,600 | $80,600 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $5,939,900 | $2,783,000 | $3,156,900 | $3,156,900 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $283,900 | $222,300 | $61,600 | $61,600 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $476,900 | $458,100 | $18,800 | $18,800 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $2,997,900 | $1,338,200 | $1,659,700 | $1,659,700 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $389,000 | $0 | $389,000 | $389,000 |
| 13 | US Highway 2 | $0 | $0 | $0 | $7,109,600 | $0 | $7,109,600 | $7,109,600 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $7,638,900 | $0 | $7,638,900 | $7,638,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $5,580,100 | $0 | $5,580,100 | $5,580,100 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $5,214,000 | $4,532,900 | $681,100 | $681,100 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $1,106,800 | $828,700 | $278,100 | $278,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $915,700 | $0 | $915,700 | $915,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $898,200 | $0 | $898,200 | $898,200 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $7,655,300 | $0 | $7,655,300 | $7,655,300 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $576,000 | $574,000 | $2,000 | $2,000 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $838,700 | $681,300 | $157,400 | $157,400 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $13,073,000 | $11,639,500 | $1,433,500 | $1,433,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $77,723,600 | $36,178,100 | $41,545,500 | $41,545,500 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.3.WF-6.7

### Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities
Scenario WF-6

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $196,100 |
| Fargo | $0 | $743,800 |
| Grand Forks | $30,700 | $1,445,900 |
| Grafton | $0 | $11,000 |
| Drayton | $900 | $56,800 |
| Pembina | $200 | $25,700 |
| Morris | $0 | $100,900 |
| Letellier | $0 | $113,900 |
| | | |
| TOTAL | $31,800 | $2,694,100 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $0 | $26,300 |
| Fargo | $6,200 | $695,400 |
| Grand Forks | $30,900 | $1,468,800 |
| Grafton | $0 | $42,400 |
| Drayton | $1,200 | $52,000 |
| Pembina | $200 | $20,500 |
| Morris | $1,400 | $177,900 |
| Letellier | $0 | $21,300 |
| | | |
| TOTAL | $39,900 | $2,504,600 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | $0 | $169,800 |
| Fargo | -$6,200 | $48,400 |
| Grand Forks | -$200 | -$22,900 |
| Grafton | $0 | -$31,400 |
| Drayton | -$300 | $4,800 |
| Pembina | $0 | $5,200 |
| Morris | -$1,400 | -$77,000 |
| Letellier | $0 | $92,600 |
| | | |
| TOTAL | -$8,100 | $189,500 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.3.WF-6.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario WF-6

**Damages: WITHOUT PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $41,000 |
| American Crystal Sugar | $1,400 |
| **TOTAL** | $42,400 |

**Damages: WITH PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $43,900 |
| American Crystal Sugar | $2,400 |
| **TOTAL** | $46,300 |

**TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$2,900 |
| American Crystal Sugar | -$1,000 |
| **TOTAL** | -$3,900 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-6.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario WF-6

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $514,600 |
| Agricultural- Other | $208,200 |
| Urban (Lisbon and Valley City) | $9,347,000 |
| Transportation | $2,355,800 |
| | |
| TOTAL | $12,425,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $591,300 |
| Agricultural- Other | $209,500 |
| Urban (Lisbon and Valley City) | $9,546,000 |
| Transportation | $2,378,200 |
| | |
| TOTAL | $12,725,000 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$76,700 |
| Agricultural- Other | -$1,300 |
| Urban (Lisbon and Valley City) | -$199,000 |
| Transportation | -$22,400 |
| | |
| TOTAL | -$299,400 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.3.WF-6.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario WF-6

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| **Total Irrigation Damage To Crops** | $478,500 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| **Total Irrigation Damage To Crops** | $100,900 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| **Total Irrigation Damage To Crops** | $377,600 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# TD.4.0 Moderate Future 1 Scenario: 1450 Peak Lake Level

The following table lists the sensitivity analyses for which tables are included in this section. Note that there are several tables that are included for each analysis. The last digit of each table number (x) reflects a variable number for each of the tables.

| Table Number | Alternative Number | Description of Alternative |
|---|---|---|
| TD.4.M1-1.x | M1-1 | West Bay 300 cfs Constrained Outlet |
| TD.4.M1-2.x | M1-2 | West Bay 480 cfs Unconstrained Outlet |
| TD.4.M1-3a.x | M1-3a | Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection |
| TD.4.M1-3b.x | M1-3b | Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures |
| | M1-4 | NOTE: M1-4 is the base condition – without project future condition |
| TD.4.M1-5.x | M1-5 | Pelican Lake 300 cfs Constrained Outlet |
| TD.4.M1-6.x | M1-6 | Pelican Lake 480 cfs Unconstrained Outlet |

The following table lists the 11 individual tables that are included for the majority of the sensitivity analyses: Expanded Infrastructure Measures (M1-3b) and various outlets (M1-1, M1-2, M1-5, and M1-6).

| Last Digit of Each Table Number | Table Description |
|---|---|
| 1 | Probability of Reaching Decision/Action Levels at Each Feature |
| 2 | Sets of Feature Strategies |
| 3 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies |
| 4 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies |
| 5 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) |
| 6 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies |
| 7 | Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities |
| 8 | Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users |
| 9 | Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features |
| 10 | Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users |

| Last Digit of Each Table Number | Table Description |
|---|---|
| 11 | Cost and Benefit Summary: 4 Sets of Feature Strategies |

The following table lists the eight individual tables that are included for the Maximum Infrastructure Protection sensitivity analysis (M1-3a).

| Last Digit of Each Table Number | Table Description |
|---|---|
| 1 | Probability of Reaching Decision/Action Levels at Each Feature |
| 2 | Sets of Feature Strategies |
| 3 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies |
| 4 | Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities |
| 5 | Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users |
| 6 | Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features |
| 7 | Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users |
| 8 | Cost and Benefit Summary with Maximum Infrastructure Protection |

*M1-1 Tables*
*(Moderate 1 Future - West Bay 300 cfs Constrained Outlet)*

## Table TD.4.M1-1.1

## Economic Analysis of Devils Lake Alternatives

### Scenario M1-1
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rese. | 7 Graham's Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRVAW / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Alone US Hwy 2 | 12 BNRR / Churchs Ferry to Cando | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/ Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/ Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 0 (Stump Lake) | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 100 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 0 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 0 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 0 / 0 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 0 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.4.M1-1.2

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-1
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | S(2) | 2 Incremental Structure Relocations | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.4.M1-1.3

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $272,100 | $272,100 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $153,100 | $0 | $153,100 | $0 | $0 | $0 | $153,100 |
| 5 | St. Michael | $11,900 | $10,000 | $1,900 | $0 | $0 | $0 | $1,900 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $107,900 | $3,500 | $104,400 | $11,600 | $11,000 | $600 | $105,000 |
| 8.1 | Devils Lake Rural Areas | $838,500 | $800,300 | $38,200 | $805,100 | $634,500 | $170,600 | $208,800 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $65,300 | $31,200 | $31,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $691,500 | $691,500 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,294,000 | $1,294,000 | $0 | $0 | $0 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,572,500 | $1,572,500 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $143,900 | $0 | $143,900 | $0 | $0 | $0 | $143,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $60,200 | $60,200 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $5,681,400 | $5,239,900 | $441,500 | $916,900 | $714,500 | $202,400 | $643,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin stroage when the lake is at or above 1440.

## Table TD.4.M1-1.4

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $272,100 | $272,100 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $113,300 | $0 | $113,300 | $0 | $0 | $0 | $113,300 |
| 5 | St. Michael | $11,900 | $10,000 | $1,900 | $0 | $0 | $0 | $1,900 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $67,900 | $11,000 | $56,900 | $56,900 |
| 8.1 | Devils Lake Rural Areas | $838,500 | $800,300 | $38,200 | $805,100 | $634,500 | $170,600 | $208,800 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $65,300 | $31,200 | $31,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $163,700 | $159,000 | $4,700 | $4,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $240,400 | $240,400 | $0 | $490,900 | $477,700 | $13,200 | $13,200 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $1,011,200 | $1,003,400 | $7,800 | $7,800 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $143,900 | $0 | $143,900 | $0 | $0 | $0 | $143,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $60,200 | $60,200 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $2,219,600 | $1,922,300 | $297,300 | $2,639,000 | $2,354,600 | $284,400 | $581,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin stroage when the lake is at or above 1440.

## Table TD.4.M1-1.5

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-1

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $2,294,400 | $2,294,400 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $222,700 | $0 | $222,700 | $0 | $0 | $0 | $222,700 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $11,600 | $11,000 | $600 | $600 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $805,100 | $634,500 | $170,600 | $170,600 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $65,300 | $31,200 | $31,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,562,600 | $2,562,600 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $518,100 | $0 | $518,100 | $0 | $0 | $0 | $518,100 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $20,909,100 | $20,168,300 | $740,800 | $2,491,900 | $2,289,500 | $202,400 | $943,200 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin stroage when the lake is at or above 1440.

## Table TD.4.M1-1.6

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $4,983,800 | $4,983,800 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $3,900 | $3,900 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $140,500 | $0 | $140,500 | $140,500 |
| 5 | St. Michael | $0 | $0 | $0 | $11,800 | $10,000 | $1,800 | $1,800 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $6,500 | $6,500 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $67,900 | $11,000 | $56,900 | $56,900 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $1,795,400 | $1,578,300 | $217,100 | $217,100 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $65,300 | $31,200 | $31,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $163,700 | $159,000 | $4,700 | $4,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,569,700 | $2,077,500 | $492,200 | $492,200 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $1,011,200 | $1,003,400 | $7,800 | $7,800 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $71,700 | $0 | $71,700 | $71,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $10,775,100 | $10,775,100 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $22,031,400 | $21,007,500 | $1,023,900 | $1,023,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin stroage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.4.M1-1.7**

### Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities
Scenario M1-1

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $7,500 | $0 |
| Fargo | $3,400 | $0 |
| Grand Forks | $9,500 | $0 |
| Grafton | $400 | $0 |
| Drayton | $300 | $0 |
| Pembina | $0 | $0 |
| Morris | $300 | $0 |
| Letellier | $500 | $0 |
| | | |
| TOTAL | $21,900 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$7,500 | $0 |
| Fargo | -$3,400 | $0 |
| Grand Forks | -$9,500 | $0 |
| Grafton | -$400 | $0 |
| Drayton | -$300 | $0 |
| Pembina | $0 | $0 |
| Morris | -$300 | $0 |
| Letellier | -$500 | $0 |
| | | |
| TOTAL | -$21,900 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-1.8

### Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users
Scenario M1-1

### Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

### Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $12,100 |
| American Crystal Sugar | $300 |
| **TOTAL** | $12,400 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$12,100 |
| American Crystal Sugar | -$300 |
| **TOTAL** | -$12,400 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-1.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario M1-1

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $493,400 |
| Agricultural- Other | $178,900 |
| Urban (Lisbon and Valley City) | $12,096,900 |
| Transportation | $1,908,400 |
| | |
| TOTAL | $14,677,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $499,200 |
| Agricultural- Other | $179,000 |
| Urban (Lisbon and Valley City) | $12,099,000 |
| Transportation | $1,908,800 |
| | |
| TOTAL | $14,686,000 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$5,800 |
| Agricultural- Other | -$100 |
| Urban (Lisbon and Valley City) | -$2,100 |
| Transportation | -$400 |
| | |
| TOTAL | -$8,400 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-1.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario M1-1

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $1,900 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $35,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$33,600 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.4.M1-1.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario M1-1

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $58,540 | $58,540 | $58,540 | $58,540 |
| Outlet Operation and Maintenance | $6,247 | $6,247 | $6,247 | $6,247 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $87,419 | $87,419 | $87,419 | $87,419 |
| **Annualized Total Cost** | $5,839 | $5,839 | $5,839 | $5,839 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $582 | $943 | $1,024 | $644 |
| Downstream Features | -$76 | -$76 | -$76 | -$76 |
| **Total Annualized Benefit** | $506 | $867 | $948 | $568 |
| | | | | |
| **NET BENEFIT** | -$5,333 | -$4,972 | -$4,891 | -$5,271 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.09 | 0.15 | 0.16 | 0.10 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.
Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.
The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.13 | 0.22 | 0.24 | 0.15 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1Trace | 0 | 0 | 0 | 0 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.
The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*M1-2 Tables*
*(Moderate 1 Future - West Bay 480 cfs Unconstrained Outlet)*

## Table TD.4.M1-2.1

## Economic Analysis of Devils Lake Alternatives

### Scenario M1-2
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mil. Res. | 7 Graham's Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churches Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 (Stump Lake) | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 0 (Stump Lake) | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 0 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 0 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 0 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 0 / 0 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 0 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.4.M1-2.2

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-2
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | S(2) | 2 Incremental Structure Relocations | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | R* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.4.M1-2.3

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-2

## Annual Benefits of Project for Feature Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $272,100 | $0 | $272,100 | $0 | $0 | $0 | $272,100 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $153,100 | $0 | $153,100 | $0 | $0 | $0 | $153,100 |
| 5 | St. Michael | $11,900 | $10,000 | $1,900 | $0 | $0 | $0 | $1,900 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $107,900 | $3,500 | $104,400 | $11,600 | $11,000 | $600 | $105,000 |
| 8.1 | Devils Lake Rural Areas | $838,500 | $742,900 | $95,600 | $805,100 | $299,200 | $505,900 | $601,500 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $44,300 | $52,200 | $52,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $691,500 | $0 | $691,500 | $0 | $0 | $0 | $691,500 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,294,000 | $240,400 | $1,053,600 | $0 | $0 | $0 | $1,053,600 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,572,500 | $1,572,500 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $143,900 | $0 | $143,900 | $0 | $0 | $0 | $143,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $60,200 | $13,400 | $46,800 | $0 | $0 | $0 | $46,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $5,681,400 | $3,118,500 | $2,562,900 | $916,900 | $358,200 | $558,700 | $3,121,600 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· All Scenerios assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.4.M1-2.4

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-2

## Annual Benefits of Project for Feature Adjacent to Devlis Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $272,100 | $0 | $272,100 | $0 | $0 | $0 | $272,100 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $113,300 | $0 | $113,300 | $0 | $0 | $0 | $113,300 |
| 5 | St. Michael | $11,900 | $10,000 | $1,900 | $0 | $0 | $0 | $1,900 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $1,130,300 | -$1,126,800 | $67,900 | $11,000 | $56,900 | -$1,069,900 |
| 8.1 | Devils Lake Rural Areas | $838,500 | $742,900 | $95,600 | $805,100 | $299,200 | $505,900 | $601,500 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $44,300 | $52,200 | $52,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $163,700 | $0 | $163,700 | $163,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $240,400 | $240,400 | $0 | $490,900 | $0 | $490,900 | $490,900 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $1,011,200 | $495,600 | $515,600 | $515,600 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $143,900 | $0 | $143,900 | $0 | $0 | $0 | $143,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $60,200 | $13,400 | $46,800 | $0 | $0 | $0 | $46,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $2,219,600 | $2,672,800 | -$453,200 | $2,639,000 | $853,800 | $1,785,200 | $1,332,000 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· All Scenerios assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.4.M1-2.5

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-2

### Annual Benefits of Project for Feature Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $2,294,400 | $0 | $2,294,400 | $0 | $0 | $0 | $2,294,400 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $222,700 | $0 | $222,700 | $0 | $0 | $0 | $222,700 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $11,600 | $11,000 | $600 | $600 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $805,100 | $299,200 | $505,900 | $505,900 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $44,300 | $52,200 | $52,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,562,600 | $0 | $2,562,600 | $0 | $0 | $0 | $2,562,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $518,100 | $0 | $518,100 | $0 | $0 | $0 | $518,100 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $20,909,100 | $15,311,300 | $5,597,800 | $2,491,900 | $1,933,200 | $558,700 | $6,156,500 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· All Scenerios assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.4.M1-2.6

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-2

## Annual Benefits of Project for Feature Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $4,983,800 | $0 | $4,983,800 | $4,983,800 |
| 3 | Fort Totten | $0 | $0 | $0 | $3,900 | $3,900 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $140,500 | $0 | $140,500 | $140,500 |
| 5 | St. Michael | $0 | $0 | $0 | $11,800 | $10,000 | $1,800 | $1,800 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $6,500 | $6,500 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $67,900 | $11,000 | $56,900 | $56,900 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $1,795,400 | $1,172,500 | $622,900 | $622,900 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $44,300 | $52,200 | $52,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $163,700 | $0 | $163,700 | $163,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,569,700 | $1,481,800 | $1,087,900 | $1,087,900 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $1,011,200 | $495,600 | $515,600 | $515,600 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $71,700 | $0 | $71,700 | $71,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $10,775,100 | $5,849,900 | $4,925,200 | $4,925,200 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $22,031,400 | $9,409,200 | $12,622,200 | $12,622,200 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.4.M1-2.7

### Annual Benefits of Project Downstream of Devils Lake:
### Municipal Water Treatment Facilities
Scenario M1-2

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $0 | $26,300 |
| Fargo | $10,500 | $1,223,500 |
| Grand Forks | $40,100 | $1,875,200 |
| Grafton | $0 | $42,600 |
| Drayton | $1,200 | $58,000 |
| Pembina | $200 | $24,700 |
| Morris | $0 | $19,800 |
| Letellier | $0 | $21,300 |
| | | |
| TOTAL | $52,000 | $3,291,400 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | $0 | -$26,300 |
| Fargo | -$10,500 | -$1,223,500 |
| Grand Forks | -$40,100 | -$1,875,200 |
| Grafton | $0 | -$42,600 |
| Drayton | -$1,200 | -$58,000 |
| Pembina | -$200 | -$24,700 |
| Morris | $0 | -$19,800 |
| Letellier | $0 | -$21,300 |
| | | |
| TOTAL | -$52,000 | -$3,291,400 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.4.M1-2.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario M1-2

**Damages: WITHOUT PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

**Damages: WITH PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $53,700 |
| American Crystal Sugar | $2,300 |
| **TOTAL** | $56,000 |

**TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$53,700 |
| American Crystal Sugar | -$2,300 |
| **TOTAL** | -$56,000 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-2.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario M1-2

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $493,400 |
| Agricultural- Other | $178,900 |
| Urban (Lisbon and Valley City) | $12,096,900 |
| Transportation | $1,908,400 |
| | |
| TOTAL | $14,677,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $530,100 |
| Agricultural- Other | $181,500 |
| Urban (Lisbon and Valley City) | $12,124,700 |
| Transportation | $1,929,700 |
| | |
| TOTAL | $14,766,000 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$36,700 |
| Agricultural- Other | -$2,600 |
| Urban (Lisbon and Valley City) | -$27,800 |
| Transportation | -$21,300 |
| | |
| TOTAL | -$88,400 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-2.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario M1-2

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $1,900 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $365,200 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$363,300 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.4.M1-2.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario M1-2

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $92,190 | $92,190 | $92,190 | $92,190 |
| Outlet Operation and Maintenance | $11,177 | $11,177 | $11,177 | $11,177 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $16,239 | $16,239 | $16,239 | $16,239 |
| Natural Resources Monitoring/Mitigation | $50,432 | $50,432 | $50,432 | $50,432 |
| **Total Costs: Present Value** | $170,038 | $170,038 | $170,038 | $170,038 |
| **Annualized Total Cost** | $11,357 | $11,357 | $11,357 | $11,357 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $2 | $2 | $2 | $2 |
| Features Adjacent to Devils Lake | $1,332 | $8,157 | $12,622 | $3,122 |
| Downstream Features | -$3,851 | -$3,851 | -$3,851 | -$3,851 |
| **Total Annualized Benefit** | -$2,517 | $2,307 | $8,773 | -$728 |
| | | | | |
| **NET BENEFIT** | -$13,874 | -$9,050 | -$2,584 | -$12,085 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | -0.22 | 0.20 | 0.77 | -0.06 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.
Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.
The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.19 | 0.89 | 1.83 | 0.45 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 0 | 1 | 0 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.
The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*M1-3a Tables*
*(Moderate 1 Future - Combination 2 - West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection)*

## Table TD.4M1-3a.1

## Economic Analysis of Devils Lake Alternatives

### Scenario M1-3a
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mil. Res. | 7 Graham's Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlow | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churches Ferry to Canada | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19 / Devils Lake / Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20 / Devils Lake / Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 (Stump Lake) | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 0 (Stump Lake) | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 0 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 0 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 0 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 0 / 0 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 0 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.4.M1-3a.2

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-3a
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Maximum Infrastructure Protection Strategies WITHOUT PROJECT | | Based on Set of Maximum Infrastructure Protection Strategies WITHOUT PROJECT | |
|---|---|---|---|---|---|
| | | Name | Description | Name | Description |
| 1 | Churchs Ferry | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.4M1-3a.3

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-3a

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Infrastructure Protection (MIP) Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $0 | $333,700 | $333,700 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $4,983,800 | $0 | $4,983,800 | $4,983,800 |
| 3 | Fort Totten | $0 | $0 | $0 | $3,900 | $0 | $3,900 | $3,900 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $140,500 | $0 | $140,500 | $140,500 |
| 5 | St. Michael | $0 | $0 | $0 | $11,800 | $0 | $11,800 | $11,800 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $6,500 | $3,700 | $2,800 | $2,800 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $67,900 | $11,000 | $56,900 | $56,900 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $1,795,400 | $629,700 | $1,165,700 | $1,165,700 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $53,400 | $43,100 | $43,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $163,700 | $0 | $163,700 | $163,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,569,700 | $0 | $2,569,700 | $2,569,700 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $1,011,200 | $0 | $1,011,200 | $1,011,200 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $71,700 | $0 | $71,700 | $71,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $10,775,100 | $0 | $10,775,100 | $10,775,100 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $0 | $0 | $0 | $22,031,400 | $697,800 | $21,333,600 | $21,333,600 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The maximum infrastructure protection strategies analyzed include temporary closure of roads and rail lines without the project.

· With the project feature were assumed to be incremental protected or relocated.

· The costs and damages for without the project assume the feature are not protected or are abandoned.

· The costs with the project assume incremental protection of all the feature and are included as a project cost in Table TD.4M1-3a.4

· The damages with the project assume incremental protection of all the feature.

## Economic Analysis of Devils Lake Alternatives
### Table TD.4.M1-3a.4

### Annual Benefits of Project Downstream of Devils Lake:
### Municipal Water Treatment Facilities
Scenario M1-3a

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $7,400 | $0 |
| Fargo | $3,300 | $0 |
| Grand Forks | $9,300 | $0 |
| Grafton | $300 | $0 |
| Drayton | $300 | $0 |
| Pembina | $0 | $0 |
| Morris | $300 | $0 |
| Letellier | $500 | $0 |
| | | |
| TOTAL | $21,400 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$7,400 | $0 |
| Fargo | -$3,300 | $0 |
| Grand Forks | -$9,300 | $0 |
| Grafton | -$300 | $0 |
| Drayton | -$300 | $0 |
| Pembina | $0 | $0 |
| Morris | -$300 | $0 |
| Letellier | -$500 | $0 |
| | | |
| TOTAL | -$21,400 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-3a.5

### Annual Benefits of Project Downstream of Devils Lake:
### Industrial Water Users
Scenario M1-3a

### Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

### Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $11,800 |
| American Crystal Sugar | $300 |
| **TOTAL** | $12,100 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$11,800 |
| American Crystal Sugar | -$300 |
| **TOTAL** | -$12,100 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-3a.6

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario M1-3a

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $493,400 |
| Agricultural- Other | $178,900 |
| Urban (Lisbon and Valley City) | $12,096,900 |
| Transportation | $1,908,400 |
| | |
| TOTAL | $14,677,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $498,600 |
| Agricultural- Other | $179,000 |
| Urban (Lisbon and Valley City) | $12,098,800 |
| Transportation | $1,908,700 |
| | |
| TOTAL | $14,685,100 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$5,200 |
| Agricultural- Other | -$100 |
| Urban (Lisbon and Valley City) | -$1,900 |
| Transportation | -$300 |
| | |
| TOTAL | -$7,500 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-3a.7

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario M1-3a

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $1,900 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $35,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$33,600 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-3a.8

### Cost and Benefit Summary with Maximum Infrastructure Protection

Scenario M1-3a

| (in thousands of dollars) | |
|---|---|
| **COSTS** | |
| Outlet Construction | $58,540 |
| Outlet Operation and Maintenance | $6,060 |
| Hwy 19 Dam Construction | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 |
| Maximum Infrastructure Protection (MIP) | $35,090 |
| MIP Operation and Maintenance | $0 |
| Expanded Infrastructure Measures (EIM) | $0 |
| EIM Operation and Maintenance | $0 |
| Upper Basin Management | $39,681 |
| Ion Exchange/Alternate Water Source Installation | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 |
| **Total Costs: Present Value** | $162,003 |
| **Annualized Total Cost** | $10,820 |
| | |
| **ANNUALIZED BENEFITS** | |
| Annual Cost Savings and Damages Prevented: | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 |
| Features Adjacent to Devils Lake* | $21,334 |
| Downstream Features | -$75 |
| **Total Annualized Benefit** | $21,259 |
| | |
| **NET BENEFIT** | $10,439 |
| | |
| **BENEFIT-COST RATIO (BCR)** | 1.96 |

*The Annual Cost Savings and Damages Prevented values for the features adjacent to Devils Lake for the with-project condition are for the Most Likely Action strategies. The costs and damages for the without project condition are no protection strategies

Note: Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.
The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.
The BCR calculated in this table incorporates the costs and benefits associated with only one lake level trace; this is not a probabilistic analysis.

**WITHOUT DOWNSTREAM IMPACTS**

| | |
|---|---|
| Benefit-Cost Ratio (BCR) | 2.29 |
| Traces With BCR>1 | |
| Total Number Out of 1 Trace | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.
The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*M1-3b Tables*
*(Moderate 1 Future - Combination 2 - West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures)*

## Table TD.4M1-3b.1

## Economic Analysis of Devils Lake Alternatives

### Scenario M1-3b
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rese. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 261 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 261 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 (Stump Lake) | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 0 (Stump Lake) | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 0 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 0 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 0 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 0 / 0 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 0 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.4.M1-3b.2

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-3b
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | S(2) | 2 Incremental Structure Relocations | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 5 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.4M1-3b.3

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-3b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $272,100 | $0 | $272,100 | $0 | $0 | $0 | $272,100 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $153,100 | $0 | $153,100 | $0 | $0 | $0 | $153,100 |
| 5 | St. Michael | $11,900 | $0 | $11,900 | $0 | $0 | $0 | $11,900 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $107,900 | $3,500 | $104,400 | $11,600 | $11,000 | $600 | $105,000 |
| 8.1 | Devils Lake Rural Areas | $838,500 | $510,300 | $328,200 | $805,100 | $629,700 | $175,400 | $503,600 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $53,400 | $43,100 | $43,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $691,500 | $0 | $691,500 | $0 | $0 | $0 | $691,500 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,294,000 | $1,294,000 | $0 | $0 | $0 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,572,500 | $0 | $1,572,500 | $0 | $0 | $0 | $1,572,500 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $143,900 | $0 | $143,900 | $0 | $0 | $0 | $143,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $60,200 | $0 | $60,200 | $0 | $0 | $0 | $60,200 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $5,681,400 | $2,343,600 | $3,337,800 | $916,900 | $697,800 | $219,100 | $3,556,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely future strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 20,000 acre-feet of upper basin stroage when the lake is at or above 1440.

## Table TD.4M1-3b.4

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-3b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $272,100 | $0 | $272,100 | $0 | $0 | $0 | $272,100 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $113,300 | $0 | $113,300 | $0 | $0 | $0 | $113,300 |
| 5 | St. Michael | $11,900 | $0 | $11,900 | $0 | $0 | $0 | $11,900 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $67,900 | $11,000 | $56,900 | $56,900 |
| 8.1 | Devils Lake Rural Areas | $838,500 | $510,300 | $328,200 | $805,100 | $629,700 | $175,400 | $503,600 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $53,400 | $43,100 | $43,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $163,700 | $0 | $163,700 | $163,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $240,400 | $240,400 | $0 | $490,900 | $477,700 | $13,200 | $13,200 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $1,011,200 | $0 | $1,011,200 | $1,011,200 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $143,900 | $0 | $143,900 | $0 | $0 | $0 | $143,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $60,200 | $0 | $60,200 | $0 | $0 | $0 | $60,200 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $2,219,600 | $1,290,000 | $929,600 | $2,639,000 | $1,175,500 | $1,463,500 | $2,393,100 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 20,000 acre-feet of upper basin stroage when the lake is at or above 1440.

## Table TD.4M1-3b.5

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-3b

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $2,294,400 | $0 | $2,294,400 | $0 | $0 | $0 | $2,294,400 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $222,700 | $0 | $222,700 | $0 | $0 | $0 | $222,700 |
| 5 | St. Michael | $116,700 | $0 | $116,700 | $0 | $0 | $0 | $116,700 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $11,600 | $11,000 | $600 | $600 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,002,400 | $409,900 | $805,100 | $629,700 | $175,400 | $585,300 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $53,400 | $43,100 | $43,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,562,600 | $0 | $2,562,600 | $0 | $0 | $0 | $2,562,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $0 | $6,926,700 | $0 | $0 | $0 | $6,926,700 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $518,100 | $0 | $518,100 | $0 | $0 | $0 | $518,100 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $0 | $1,241,500 | $0 | $0 | $0 | $1,241,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $20,909,100 | $6,616,500 | $14,292,600 | $2,491,900 | $2,272,800 | $219,100 | $14,511,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 20,000 acre-feet of upper basin stroage when the lake is at or above 1440.

## Table TD.4M1-3b.6

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-3b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $4,983,800 | $0 | $4,983,800 | $4,983,800 |
| 3 | Fort Totten | $0 | $0 | $0 | $3,900 | $3,900 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $140,500 | $0 | $140,500 | $140,500 |
| 5 | St. Michael | $0 | $0 | $0 | $11,800 | $10,000 | $1,800 | $1,800 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $6,500 | $6,500 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $67,900 | $11,000 | $56,900 | $56,900 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $1,795,400 | $1,283,900 | $511,500 | $511,500 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $53,400 | $43,100 | $43,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $163,700 | $0 | $163,700 | $163,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,569,700 | $1,959,500 | $610,200 | $610,200 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $1,011,200 | $714,400 | $296,800 | $296,800 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $71,700 | $0 | $71,700 | $71,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $10,775,100 | $10,588,900 | $186,200 | $186,200 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $22,031,400 | $14,965,200 | $7,066,200 | $7,066,200 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 20,000 acre-feet of upper basin stroage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.4.M1-3b.7

### Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities
Scenario M1-3b

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $7,400 | $0 |
| Fargo | $3,300 | $0 |
| Grand Forks | $9,300 | $0 |
| Grafton | $300 | $0 |
| Drayton | $300 | $0 |
| Pembina | $0 | $0 |
| Morris | $300 | $0 |
| Letellier | $500 | $0 |
| | | |
| TOTAL | $21,400 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$7,400 | $0 |
| Fargo | -$3,300 | $0 |
| Grand Forks | -$9,300 | $0 |
| Grafton | -$300 | $0 |
| Drayton | -$300 | $0 |
| Pembina | $0 | $0 |
| Morris | -$300 | $0 |
| Letellier | -$500 | $0 |
| | | |
| TOTAL | -$21,400 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-3b.8

### Annual Benefits of Project Downstream of Devils Lake:
### Industrial Water Users
Scenario M1-3b

### Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

### Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $11,800 |
| American Crystal Sugar | $300 |
| **TOTAL** | $12,100 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$11,800 |
| American Crystal Sugar | -$300 |
| **TOTAL** | -$12,100 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-3b.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario M1-3b

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $493,400 |
| Agricultural- Other | $178,900 |
| Urban (Lisbon and Valley City) | $12,096,900 |
| Transportation | $1,908,400 |
| | |
| TOTAL | $14,677,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $498,600 |
| Agricultural- Other | $179,000 |
| Urban (Lisbon and Valley City) | $12,098,800 |
| Transportation | $1,908,700 |
| | |
| TOTAL | $14,685,100 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$5,200 |
| Agricultural- Other | -$100 |
| Urban (Lisbon and Valley City) | -$1,900 |
| Transportation | -$300 |
| | |
| TOTAL | -$7,500 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-3b.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario M1-3b

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $1,900 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $35,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$33,600 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.4.M1-3b.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario M1-3b

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $58,540 | $58,540 | $58,540 | $58,540 |
| Outlet Operation and Maintenance | $6,060 | $6,060 | $6,060 | $6,060 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $39,681 | $39,681 | $39,681 | $39,681 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $126,913 | $126,913 | $126,913 | $126,913 |
| **Annualized Total Cost** | $8,476 | $8,476 | $8,476 | $8,476 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $2,393 | $14,512 | $7,066 | $3,557 |
| Downstream Features | -$75 | -$75 | -$75 | -$75 |
| **Total Annualized Benefit** | $2,319 | $14,437 | $6,992 | $3,482 |
| | | | | |
| **NET BENEFIT** | -$6,158 | $5,961 | -$1,485 | -$4,994 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.27 | 1.70 | 0.82 | 0.41 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.34 | 2.08 | 1.01 | 0.51 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1Trace | 0 | 1 | 1 | 0 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*M1-5 Tables*
*(Moderate 1 Future - Pelican Lake 300 cfs Constrained Outlet)*

## Table TD.4.M1-5.1

## Economic Analysis of Devils Lake Alternatives

### Scenario M1-5
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rea. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19 / Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20 / Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 0 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 0 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 0 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 0 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 0 / 0 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 0 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.4.M1-5.2

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-5
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | S(2) | 2 Incremental Structure Relocations | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.4.M1-5.3

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $272,100 | $0 | $272,100 | $0 | $0 | $0 | $272,100 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $153,100 | $0 | $153,100 | $0 | $0 | $0 | $153,100 |
| 5 | St. Michael | $11,900 | $10,000 | $1,900 | $0 | $0 | $0 | $1,900 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $107,900 | $3,500 | $104,400 | $11,600 | $11,000 | $600 | $105,000 |
| 8.1 | Devils Lake Rural Areas | $838,500 | $742,900 | $95,600 | $805,100 | $299,200 | $505,900 | $601,500 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $44,300 | $52,200 | $52,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $691,500 | $0 | $691,500 | $0 | $0 | $0 | $691,500 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,294,000 | $240,400 | $1,053,600 | $0 | $0 | $0 | $1,053,600 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,572,500 | $1,572,500 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $143,900 | $0 | $143,900 | $0 | $0 | $0 | $143,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $60,200 | $13,400 | $46,800 | $0 | $0 | $0 | $46,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $5,681,400 | $3,118,500 | $2,562,900 | $916,900 | $358,200 | $558,700 | $3,121,600 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.4.M1-5.4

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $272,100 | $0 | $272,100 | $0 | $0 | $0 | $272,100 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $113,300 | $0 | $113,300 | $0 | $0 | $0 | $113,300 |
| 5 | St. Michael | $11,900 | $10,000 | $1,900 | $0 | $0 | $0 | $1,900 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $67,900 | $11,000 | $56,900 | $56,900 |
| 8.1 | Devils Lake Rural Areas | $838,500 | $742,900 | $95,600 | $805,100 | $299,200 | $505,900 | $601,500 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $44,300 | $52,200 | $52,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $163,700 | $0 | $163,700 | $163,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $240,400 | $240,400 | $0 | $490,900 | $0 | $490,900 | $490,900 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $1,011,200 | $711,200 | $300,000 | $300,000 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $143,900 | $0 | $143,900 | $0 | $0 | $0 | $143,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $60,200 | $13,400 | $46,800 | $0 | $0 | $0 | $46,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $2,219,600 | $1,546,000 | $673,600 | $2,639,000 | $1,069,400 | $1,569,600 | $2,243,200 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.4.M1-5.5

### Economic Analysis of Devils Lake Alternatives
### Scenario M1-5

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $2,294,400 | $0 | $2,294,400 | $0 | $0 | $0 | $2,294,400 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $222,700 | $0 | $222,700 | $0 | $0 | $0 | $222,700 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $11,600 | $11,000 | $600 | $600 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $805,100 | $299,200 | $505,900 | $505,900 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $44,300 | $52,200 | $52,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,562,600 | $0 | $2,562,600 | $0 | $0 | $0 | $2,562,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $518,100 | $0 | $518,100 | $0 | $0 | $0 | $518,100 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $20,909,100 | $15,311,300 | $5,597,800 | $2,491,900 | $1,933,200 | $558,700 | $6,156,500 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.4.M1-5.6

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $4,983,800 | $0 | $4,983,800 | $4,983,800 |
| 3 | Fort Totten | $0 | $0 | $0 | $3,900 | $3,900 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $140,500 | $0 | $140,500 | $140,500 |
| 5 | St. Michael | $0 | $0 | $0 | $11,800 | $10,000 | $1,800 | $1,800 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $6,500 | $6,500 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $67,900 | $11,000 | $56,900 | $56,900 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $1,795,400 | $1,172,500 | $622,900 | $622,900 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $44,300 | $52,200 | $52,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $163,700 | $0 | $163,700 | $163,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,569,700 | $1,834,000 | $735,700 | $735,700 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $1,011,200 | $711,200 | $300,000 | $300,000 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $71,700 | $0 | $71,700 | $71,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $10,775,100 | $9,347,200 | $1,427,900 | $1,427,900 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $0 | $0 | $0 | $22,031,400 | $13,474,300 | $8,557,100 | $8,557,100 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.4.M1-5.7**

### Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities
Scenario M1-5

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $9,500 | $0 |
| Fargo | $4,100 | $0 |
| Grand Forks | $14,400 | $0 |
| Grafton | $600 | $0 |
| Drayton | $500 | $0 |
| Pembina | $100 | $0 |
| Morris | $600 | $0 |
| Letellier | $900 | $0 |
| | | |
| TOTAL | $30,700 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$9,500 | $0 |
| Fargo | -$4,100 | $0 |
| Grand Forks | -$14,400 | $0 |
| Grafton | -$600 | $0 |
| Drayton | -$500 | $0 |
| Pembina | -$100 | $0 |
| Morris | -$600 | $0 |
| Letellier | -$900 | $0 |
| | | |
| TOTAL | -$30,700 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.4.M1-5.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario M1-5

**Damages: WITHOUT PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

**Damages: WITH PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $18,000 |
| American Crystal Sugar | $700 |
| **TOTAL** | $18,700 |

**TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$18,000 |
| American Crystal Sugar | -$700 |
| **TOTAL** | -$18,700 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-5.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario M1-5

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $493,400 |
| Agricultural- Other | $178,900 |
| Urban (Lisbon and Valley City) | $12,096,900 |
| Transportation | $1,908,400 |
| | |
| TOTAL | $14,677,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $516,400 |
| Agricultural- Other | $180,100 |
| Urban (Lisbon and Valley City) | $12,113,900 |
| Transportation | $1,914,400 |
| | |
| TOTAL | $14,724,800 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$23,000 |
| Agricultural- Other | -$1,200 |
| Urban (Lisbon and Valley City) | -$17,000 |
| Transportation | -$6,000 |
| | |
| TOTAL | -$47,200 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-5.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario M1-5

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $1,900 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $36,900 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$35,000 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.4.M1-5.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario M1-5

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $84,180 | $84,180 | $84,180 | $84,180 |
| Outlet Operation and Maintenance | $10,436 | $10,436 | $10,436 | $10,436 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $117,248 | $117,248 | $117,248 | $117,248 |
| **Annualized Total Cost** | $7,831 | $7,831 | $7,831 | $7,831 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $2,243 | $6,157 | $8,557 | $3,122 |
| Downstream Features | -$132 | -$132 | -$132 | -$132 |
| **Total Annualized Benefit** | $2,112 | $6,025 | $8,426 | $2,990 |
| | | | | |
| **NET BENEFIT** | -$5,719 | -$1,806 | $595 | -$4,841 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.27 | 0.77 | 1.08 | 0.38 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.
Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.
The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.36 | 0.97 | 1.35 | 0.49 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 0 | 1 | 0 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.
The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*M1-6 Tables*
*(Moderate 1 Future - Pelican Lake 480 cfs Unconstrained Outlet)*

## Table TD.4.M1-6.1

## Economic Analysis of Devils Lake Alternatives

### Scenario M1-6
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Cando | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/ Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/ Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 0 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 0 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 0 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 0 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 0 / 0 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 0 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.4.M1-6.2

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-6
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | S(2) | 2 Incremental Structure Relocations | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | A* | Relocation of Structures: Then Temporary Closure | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.4.M1-6.3

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $272,100 | $0 | $272,100 | $0 | $0 | $0 | $272,100 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $153,100 | $0 | $153,100 | $0 | $0 | $0 | $153,100 |
| 5 | St. Michael | $11,900 | $10,000 | $1,900 | $0 | $0 | $0 | $1,900 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $107,900 | $3,500 | $104,400 | $11,600 | $11,000 | $600 | $105,000 |
| 8.1 | Devils Lake Rural Areas | $838,500 | $742,900 | $95,600 | $805,100 | $299,200 | $505,900 | $601,500 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $44,300 | $52,200 | $52,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $691,500 | $0 | $691,500 | $0 | $0 | $0 | $691,500 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,294,000 | $240,400 | $1,053,600 | $0 | $0 | $0 | $1,053,600 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,572,500 | $1,572,500 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $143,900 | $0 | $143,900 | $0 | $0 | $0 | $143,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $60,200 | $13,400 | $46,800 | $0 | $0 | $0 | $46,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $5,681,400 | $3,118,500 | $2,562,900 | $916,900 | $358,200 | $558,700 | $3,121,600 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.4.M1-6.4

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $272,100 | $0 | $272,100 | $0 | $0 | $0 | $272,100 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $113,300 | $0 | $113,300 | $0 | $0 | $0 | $113,300 |
| 5 | St. Michael | $11,900 | $10,000 | $1,900 | $0 | $0 | $0 | $1,900 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $67,900 | $11,000 | $56,900 | $56,900 |
| 8.1 | Devils Lake Rural Areas | $838,500 | $742,900 | $95,600 | $805,100 | $299,200 | $505,900 | $601,500 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $44,300 | $52,200 | $52,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $163,700 | $0 | $163,700 | $163,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $240,400 | $240,400 | $0 | $490,900 | $0 | $490,900 | $490,900 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $1,011,200 | $495,600 | $515,600 | $515,600 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $143,900 | $0 | $143,900 | $0 | $0 | $0 | $143,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $60,200 | $13,400 | $46,800 | $0 | $0 | $0 | $46,800 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $2,219,600 | $1,546,000 | $673,600 | $2,639,000 | $853,800 | $1,785,200 | $2,458,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.4.M1-6.5

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-6

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $2,294,400 | $0 | $2,294,400 | $0 | $0 | $0 | $2,294,400 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $222,700 | $0 | $222,700 | $0 | $0 | $0 | $222,700 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $11,600 | $11,000 | $600 | $600 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $805,100 | $299,200 | $505,900 | $505,900 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $44,300 | $52,200 | $52,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $2,562,600 | $0 | $2,562,600 | $0 | $0 | $0 | $2,562,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $518,100 | $0 | $518,100 | $0 | $0 | $0 | $518,100 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $20,909,100 | $15,311,300 | $5,597,800 | $2,491,900 | $1,933,200 | $558,700 | $6,156,500 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.4.M1-6.6

## Economic Analysis of Devils Lake Alternatives
## Scenario M1-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $4,983,800 | $0 | $4,983,800 | $4,983,800 |
| 3 | Fort Totten | $0 | $0 | $0 | $3,900 | $3,900 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $140,500 | $0 | $140,500 | $140,500 |
| 5 | St. Michael | $0 | $0 | $0 | $11,800 | $10,000 | $1,800 | $1,800 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $6,500 | $6,500 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $67,900 | $11,000 | $56,900 | $56,900 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $1,795,400 | $1,172,500 | $622,900 | $622,900 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $96,500 | $44,300 | $52,200 | $52,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $163,700 | $0 | $163,700 | $163,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $2,569,700 | $1,481,800 | $1,087,900 | $1,087,900 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $1,011,200 | $495,600 | $515,600 | $515,600 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $71,700 | $0 | $71,700 | $71,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $10,775,100 | $5,849,900 | $4,925,200 | $4,925,200 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $0 | $0 | $0 | $22,031,400 | $9,409,200 | $12,622,200 | $12,622,200 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.4.M1-6.7**

### Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities
Scenario M1-6

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $0 | $26,300 |
| Fargo | $8,200 | $952,700 |
| Grand Forks | $30,700 | $1,444,200 |
| Grafton | $0 | $42,600 |
| Drayton | $900 | $45,700 |
| Pembina | $200 | $19,600 |
| Morris | $1,200 | $170,500 |
| Letellier | $0 | $21,300 |
| | | |
| TOTAL | $41,200 | $2,722,900 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | $0 | -$26,300 |
| Fargo | -$8,200 | -$952,700 |
| Grand Forks | -$30,700 | -$1,444,200 |
| Grafton | $0 | -$42,600 |
| Drayton | -$900 | -$45,700 |
| Pembina | -$200 | -$19,600 |
| Morris | -$1,200 | -$170,500 |
| Letellier | $0 | -$21,300 |
| | | |
| TOTAL | -$41,200 | -$2,722,900 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-6.8

### Annual Benefits of Project Downstream of Devils Lake:
### Industrial Water Users
Scenario M1-6

### Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

### Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $41,900 |
| American Crystal Sugar | $1,500 |
| **TOTAL** | $43,400 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$41,900 |
| American Crystal Sugar | -$1,500 |
| **TOTAL** | -$43,400 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-6.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario M1-6

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $493,400 |
| Agricultural- Other | $178,900 |
| Urban (Lisbon and Valley City) | $12,096,900 |
| Transportation | $1,908,400 |
| | |
| TOTAL | $14,677,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $533,900 |
| Agricultural- Other | $181,800 |
| Urban (Lisbon and Valley City) | $12,124,700 |
| Transportation | $1,935,700 |
| | |
| TOTAL | $14,776,100 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$40,500 |
| Agricultural- Other | -$2,900 |
| Urban (Lisbon and Valley City) | -$27,800 |
| Transportation | -$27,300 |
| | |
| TOTAL | -$98,500 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.4.M1-6.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario M1-6

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $1,900 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $398,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$396,600 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.4.M1-6.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario M1-6

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $129,230 | $129,230 | $129,230 | $129,230 |
| Outlet Operation and Maintenance | $13,770 | $13,770 | $13,770 | $13,770 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $13,049 | $13,049 | $13,049 | $13,049 |
| Natural Resources Monitoring/Mitigation | $50,432 | $50,432 | $50,432 | $50,432 |
| **Total Costs: Present Value** | $206,482 | $206,482 | $206,482 | $206,482 |
| **Annualized Total Cost** | $13,791 | $13,791 | $13,791 | $13,791 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $2 | $2 | $2 | $2 |
| Features Adjacent to Devils Lake | $2,459 | $6,157 | $12,622 | $3,122 |
| Downstream Features | -$3,303 | -$3,303 | -$3,303 | -$3,303 |
| **Total Annualized Benefit** | -$842 | $2,856 | $9,321 | -$179 |
| | | | | |
| **NET BENEFIT** | -$14,633 | -$10,935 | -$4,469 | -$13,970 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | -0.06 | 0.21 | 0.68 | -0.01 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.26 | 0.64 | 1.32 | 0.33 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 0 | 1 | 0 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

# TD.5.0 Moderate Future 2 Scenario: 1455 Peak Lake Level

The following table lists the sensitivity analyses for which tables are included in this section. Note that there are several tables that are included for each analysis. The last digit of each table number (x) reflects a variable number for each of the tables.

| Table Number | Alternative Number | Description of Alternative |
|---|---|---|
| TD.5.M2-1.x | M2-1 | West Bay 300 cfs Constrained Outlet |
| TD.5.M2-2.x | M2-2 | West Bay 480 cfs Unconstrained Outlet |
| TD.5.M2-3a.x | M2-3a | Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection |
| TD.5.M2-3b.x | M2-3b | Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures |
| | M2-4 | NOTE: M2-4 is the base condition – without project future condition |
| TD.5.M2-5.x | M2-5 | Pelican Lake 300 cfs Constrained Outlet |
| TD.5.M2-6.x | M2-6 | Pelican Lake 480 cfs Unconstrained Outlet |

The following table lists the 11 individual tables that are included for the majority of the analyses: Expanded Infrastructure Measures (M2-3b) and various outlets (M2-1, M2-2, M2-5, and M2-6).

| Last Digit of Each Table Number | Table Description |
|---|---|
| 1 | Probability of Reaching Decision/Action Levels at Each Feature |
| 2 | Sets of Feature Strategies |
| 3 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies |
| 4 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies |
| 5 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) |
| 6 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies |
| 7 | Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities |
| 8 | Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users |
| 9 | Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features |
| 10 | Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users |
| 11 | Cost and Benefit Summary: 4 Sets of Feature Strategies |

The following table lists the eight individual tables that are included for the Maximum Infrastructure Protection sensitivity analysis (M2-3a).

| Last Digit of Each Table Number | Table Description |
|---|---|
| 1 | Probability of Reaching Decision/Action Levels at Each Feature |
| 2 | Sets of Feature Strategies |
| 3 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies |
| 4 | Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities |
| 5 | Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users |
| 6 | Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features |
| 7 | Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users |
| 8 | Cost and Benefit Summary with Maximum Infrastructure Protection |

*M2-1 Tables*
*(Moderate 2 Future - West Bay 300 cfs Constrained Outlet)*

## Table TD.5.M2-1.1

## Economic Analysis of Devils Lake Alternatives

### Scenario M2-1
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | | | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Cando | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/ Devils Lake to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/ Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Without Outlet % / With Outlet % | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 | Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 100 | | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 100 | | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 100 | | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 100 / 100 | | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 100 / 100 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 100 / 0 | | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.5.M2-1.2

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-1
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Micheel | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | A* | Relocation of Structures: Then Temporary Closure | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Toldo | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.5.M2-1.3

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $1,836,800 | $1,836,800 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $15,100 | $14,400 | $700 | $0 | $0 | $0 | $700 |
| 4 | City of Minnewaukan | $251,300 | $251,300 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $13,100 | $13,100 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $291,300 | $291,300 | $0 | $5,600 | $5,600 | $0 | $0 |
| 7 | Grahams Island State Park | $241,300 | $174,700 | $66,600 | $12,200 | $12,000 | $200 | $66,800 |
| 8.1 | Devils Lake Rural Areas | $1,097,200 | $1,033,200 | $64,000 | $1,791,100 | $1,543,200 | $247,900 | $311,900 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $6,300 | $400 | $205,700 | $175,200 | $30,500 | $30,900 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $1,881,800 | $1,133,800 | $748,000 | $0 | $0 | $0 | $748,000 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $495,300 | $495,300 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $492,000 | $0 | $492,000 | $0 | $0 | $0 | $492,000 |
| 13 | US Highway 2 | $1,514,800 | $0 | $1,514,800 | $0 | $0 | $0 | $1,514,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $185,500 | $0 | $185,500 | $0 | $0 | $0 | $185,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $489,900 | $0 | $489,900 | $0 | $0 | $0 | $489,900 |
| 16 | Highway 281 South of US Highway 2 | $3,752,000 | $3,674,100 | $77,900 | $0 | $0 | $0 | $77,900 |
| 17 | Highway 281 North of US Highway 2 | $385,800 | $362,700 | $23,100 | $0 | $0 | $0 | $23,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $1,160,700 | $0 | $1,160,700 | $0 | $0 | $0 | $1,160,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $323,100 | $0 | $323,100 | $0 | $0 | $0 | $323,100 |
| 22 | Highway 20 between Highway 57 and Tokio | $2,238,500 | $2,238,500 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $365,500 | $236,000 | $129,500 | $0 | $0 | $0 | $129,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $263,100 | $254,100 | $9,000 | $0 | $0 | $0 | $9,000 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $17,634,500 | $12,349,300 | $5,285,200 | $2,014,600 | $1,736,000 | $278,600 | $5,563,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.5.M2-1.4

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $1,836,800 | $1,836,800 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $15,100 | $14,400 | $700 | $0 | $0 | $0 | $700 |
| 4 | City of Minnewaukan | $185,800 | $185,800 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $13,100 | $13,100 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $291,300 | $291,300 | $0 | $5,600 | $5,600 | $0 | $0 |
| 7 | Grahams Island State Park | $241,300 | $3,500 | $237,800 | $12,200 | $123,200 | -$111,000 | $126,800 |
| 8.1 | Devils Lake Rural Areas | $1,097,200 | $1,033,200 | $64,000 | $1,791,100 | $1,543,200 | $247,900 | $311,900 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $6,300 | $400 | $205,700 | $175,200 | $30,500 | $30,900 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $407,600 | $532,300 | -$124,700 | -$124,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $495,300 | $495,300 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $96,000 | $0 | $96,000 | $96,000 |
| 13 | US Highway 2 | $1,514,800 | $0 | $1,514,800 | $0 | $0 | $0 | $1,514,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $185,500 | $0 | $185,500 | $0 | $0 | $0 | $185,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $489,900 | $0 | $489,900 | $0 | $0 | $0 | $489,900 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $345,700 | $196,400 | $149,300 | $149,300 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $407,100 | $0 | $407,100 | $407,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $323,100 | $0 | $323,100 | $0 | $0 | $0 | $323,100 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $577,500 | $563,400 | $14,100 | $14,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $365,500 | $236,000 | $129,500 | $0 | $0 | $0 | $129,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $263,100 | $254,100 | $9,000 | $0 | $0 | $0 | $9,000 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $9,147,400 | $6,192,700 | $2,954,700 | $5,423,500 | $4,714,300 | $709,200 | $3,663,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.5.M2-1.5

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $3,762,100 | $3,762,100 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $365,400 | $365,400 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $5,600 | $5,600 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $12,200 | $12,000 | $200 | $200 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $1,791,100 | $1,543,200 | $247,900 | $247,900 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $6,300 | $400 | $205,700 | $175,200 | $30,500 | $30,900 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $4,201,500 | $4,201,500 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,075,500 | $2,075,500 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $1,910,500 | $0 | $1,910,500 | $0 | $0 | $0 | $1,910,500 |
| 13 | US Highway 2 | $4,568,100 | $0 | $4,568,100 | $0 | $0 | $0 | $4,568,100 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $426,900 | $0 | $426,900 | $0 | $0 | $0 | $426,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,276,100 | $0 | $1,276,100 | $0 | $0 | $0 | $1,276,100 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $320,300 | $301,100 | $19,200 | $640,700 | $598,600 | $42,100 | $61,300 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $3,028,300 | $0 | $3,028,300 | $0 | $0 | $0 | $3,028,300 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $743,500 | $0 | $743,500 | $0 | $0 | $0 | $743,500 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $849,500 | $849,500 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $38,845,700 | $26,872,700 | $11,973,000 | $4,230,300 | $3,909,600 | $320,700 | $12,293,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.5.M2-1.6

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $9,680,300 | $9,680,300 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $13,800 | $13,200 | $600 | $600 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $230,400 | $230,400 | $0 | $0 |
| 5 | St. Michael | $0 | $0 | $0 | $12,800 | $12,800 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $8,400 | $8,400 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $279,200 | $123,200 | $156,000 | $156,000 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $3,103,800 | $2,776,700 | $327,100 | $327,100 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $215,300 | $184,200 | $31,100 | $31,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $407,600 | $532,300 | -$124,700 | -$124,700 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $704,000 | $617,100 | $86,900 | $86,900 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $96,000 | $0 | $96,000 | $96,000 |
| 13 | US Highway 2 | $0 | $0 | $0 | $1,613,000 | $0 | $1,613,000 | $1,613,000 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $1,777,900 | $0 | $1,777,900 | $1,777,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $1,343,800 | $0 | $1,343,800 | $1,343,800 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $4,667,700 | $4,221,600 | $446,100 | $446,100 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $345,700 | $196,400 | $149,300 | $149,300 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $407,100 | $0 | $407,100 | $407,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $1,807,200 | $0 | $1,807,200 | $1,807,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $577,500 | $563,400 | $14,100 | $14,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $458,200 | $440,700 | $17,500 | $17,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $11,919,000 | $11,554,800 | $364,200 | $364,200 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $40,002,400 | $31,489,200 | $8,513,200 | $8,513,200 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.5.M2-1.7**

### Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities
Scenario M2-1

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $8,300 | $0 |
| Fargo | $3,600 | $0 |
| Grand Forks | $10,400 | $0 |
| Grafton | $500 | $0 |
| Drayton | $300 | $0 |
| Pembina | $100 | $0 |
| Morris | $400 | $0 |
| Letellier | $700 | $0 |
| | | |
| TOTAL | $24,300 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$8,300 | $0 |
| Fargo | -$3,600 | $0 |
| Grand Forks | -$10,400 | $0 |
| Grafton | -$500 | $0 |
| Drayton | -$300 | $0 |
| Pembina | -$100 | $0 |
| Morris | -$400 | $0 |
| Letellier | -$700 | $0 |
| | | |
| TOTAL | -$24,300 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.5.M2-1.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario M2-1

**Damages: WITHOUT PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

**Damages: WITH PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $13,200 |
| American Crystal Sugar | $300 |
| **TOTAL** | $13,500 |

**TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$13,200 |
| American Crystal Sugar | -$300 |
| **TOTAL** | -$13,500 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-1.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario M2-1

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $418,900 |
| Agricultural- Other | $146,400 |
| Urban (Lisbon and Valley City) | $7,287,500 |
| Transportation | $1,801,800 |
| | |
| TOTAL | $9,654,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $430,300 |
| Agricultural- Other | $147,100 |
| Urban (Lisbon and Valley City) | $7,292,800 |
| Transportation | $1,804,100 |
| | |
| TOTAL | $9,674,300 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$11,400 |
| Agricultural- Other | -$700 |
| Urban (Lisbon and Valley City) | -$5,300 |
| Transportation | -$2,300 |
| | |
| TOTAL | -$19,700 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-1.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario M2-1

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $1,000 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $17,900 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$16,900 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.5.M2-1.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario M2-1

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $58,540 | $58,540 | $58,540 | $58,540 |
| Outlet Operation and Maintenance | $7,710 | $7,710 | $7,710 | $7,710 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $88,882 | $88,882 | $88,882 | $88,882 |
| **Annualized Total Cost** | $5,936 | $5,936 | $5,936 | $5,936 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $3,664 | $12,294 | $8,513 | $5,564 |
| Downstream Features | -$74 | -$74 | -$74 | -$74 |
| **Total Annualized Benefit** | $3,590 | $12,219 | $8,439 | $5,489 |
| | | | | |
| **NET BENEFIT** | -$2,347 | $6,283 | $2,503 | -$447 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.60 | 2.06 | 1.42 | 0.92 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.83 | 2.78 | 1.92 | 1.26 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 1 | 1 | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*M2-2 Tables*
*(Moderate 2 Future - West Bay 480 cfs Unconstrained Outlet)*

## Table TD.5.M2-2.1

## Economic Analysis of Devils Lake Alternatives

### Scenario M2-2
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rec. | 7 Graham's Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlow | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Canada | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19 / Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20 / Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 5 | 24 BIA 5 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 0 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 0 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 0 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 100 / 0 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 100 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.5.M2-2.2

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-2
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | S(2) | 2 Incremental Structure Relocations | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | Re | Relocate Road | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.5.M2-2.3

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-2

## Annual Benefits of Project for Feature Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $1,836,800 | $0 | $1,836,800 | $0 | $0 | $0 | $1,836,800 |
| 3 | Fort Totten | $15,100 | $4,300 | $10,800 | $0 | $0 | $0 | $10,800 |
| 4 | City of Minnewaukan | $251,300 | $0 | $251,300 | $0 | $0 | $0 | $251,300 |
| 5 | St. Michael | $13,100 | $10,000 | $3,100 | $0 | $0 | $0 | $3,100 |
| 6 | Gilbert C. Grafton State Military Res. | $291,300 | $197,800 | $93,500 | $5,600 | $3,700 | $1,900 | $95,400 |
| 7 | Grahams Island State Park | $241,300 | $3,500 | $237,800 | $12,200 | $11,000 | $1,200 | $239,000 |
| 8.1 | Devils Lake Rural Areas | $1,097,200 | $836,900 | $260,300 | $1,791,100 | $848,800 | $942,300 | $1,202,600 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $0 | $6,700 | $205,700 | $99,200 | $106,500 | $113,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $1,881,800 | $0 | $1,881,800 | $0 | $0 | $0 | $1,881,800 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $495,300 | $0 | $495,300 | $0 | $0 | $0 | $495,300 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $492,000 | $0 | $492,000 | $0 | $0 | $0 | $492,000 |
| 13 | US Highway 2 | $1,514,800 | $0 | $1,514,800 | $0 | $0 | $0 | $1,514,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $185,500 | $0 | $185,500 | $0 | $0 | $0 | $185,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $489,900 | $0 | $489,900 | $0 | $0 | $0 | $489,900 |
| 16 | Highway 281 South of US Highway 2 | $3,752,000 | $2,452,100 | $1,299,900 | $0 | $0 | $0 | $1,299,900 |
| 17 | Highway 281 North of US Highway 2 | $385,800 | $0 | $385,800 | $0 | $0 | $0 | $385,800 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $1,160,700 | $0 | $1,160,700 | $0 | $0 | $0 | $1,160,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $323,100 | $0 | $323,100 | $0 | $0 | $0 | $323,100 |
| 22 | Highway 20 between Highway 57 and Tokio | $2,238,500 | $1,572,500 | $666,000 | $0 | $0 | $0 | $666,000 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $365,500 | $0 | $365,500 | $0 | $0 | $0 | $365,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $263,100 | $111,700 | $151,400 | $0 | $0 | $0 | $151,400 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $17,634,500 | $5,522,500 | $12,112,000 | $2,014,600 | $962,700 | $1,051,900 | $13,163,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.5.M2-2.4

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-2

## Annual Benefits of Project for Feature Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $1,836,800 | $0 | $1,836,800 | $0 | $0 | $0 | $1,836,800 |
| 3 | Fort Totten | $15,100 | $4,300 | $10,800 | $0 | $0 | $0 | $10,800 |
| 4 | City of Minnewaukan | $185,800 | $0 | $185,800 | $0 | $0 | $0 | $185,800 |
| 5 | St. Michael | $13,100 | $10,000 | $3,100 | $0 | $0 | $0 | $3,100 |
| 6 | Gilbert C. Grafton State Military Res. | $291,300 | $197,800 | $93,500 | $5,600 | $3,700 | $1,900 | $95,400 |
| 7 | Grahams Island State Park | $241,300 | $3,500 | $237,800 | $12,200 | $11,000 | $1,200 | $239,000 |
| 8.1 | Devils Lake Rural Areas | $1,097,200 | $836,900 | $260,300 | $1,791,100 | $848,800 | $942,300 | $1,202,600 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $0 | $6,700 | $205,700 | $99,200 | $106,500 | $113,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $407,600 | $0 | $407,600 | $407,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $495,300 | $0 | $495,300 | $0 | $0 | $0 | $495,300 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $96,000 | $0 | $96,000 | $96,000 |
| 13 | US Highway 2 | $1,514,800 | $0 | $1,514,800 | $0 | $0 | $0 | $1,514,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $185,500 | $0 | $185,500 | $0 | $0 | $0 | $185,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $489,900 | $0 | $489,900 | $0 | $0 | $0 | $489,900 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $240,400 | $1,248,800 | $1,575,000 | $1,522,700 | $52,300 | $1,301,100 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $345,700 | $0 | $345,700 | $345,700 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $407,100 | $0 | $407,100 | $407,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $323,100 | $0 | $323,100 | $0 | $0 | $0 | $323,100 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $577,500 | $748,600 | -$171,100 | -$171,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $365,500 | $0 | $365,500 | $0 | $0 | $0 | $365,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $263,100 | $111,700 | $151,400 | $0 | $0 | $0 | $151,400 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $9,147,400 | $1,738,300 | $7,409,100 | $5,423,500 | $3,234,000 | $2,189,500 | $9,598,600 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.5.M2-2.5

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-2

### Annual Benefits of Project for Feature Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $3,762,100 | $0 | $3,762,100 | $0 | $0 | $0 | $3,762,100 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $365,400 | $0 | $365,400 | $0 | $0 | $0 | $365,400 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $5,600 | $3,700 | $1,900 | $1,900 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $12,200 | $11,000 | $1,200 | $1,200 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $1,791,100 | $848,800 | $942,300 | $942,300 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $0 | $6,700 | $205,700 | $99,200 | $106,500 | $113,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $4,201,500 | $0 | $4,201,500 | $0 | $0 | $0 | $4,201,500 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,075,500 | $0 | $2,075,500 | $0 | $0 | $0 | $2,075,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $1,910,500 | $0 | $1,910,500 | $0 | $0 | $0 | $1,910,500 |
| 13 | US Highway 2 | $4,568,100 | $0 | $4,568,100 | $0 | $0 | $0 | $4,568,100 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $426,900 | $0 | $426,900 | $0 | $0 | $0 | $426,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,276,100 | $0 | $1,276,100 | $0 | $0 | $0 | $1,276,100 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $320,300 | $0 | $320,300 | $640,700 | $0 | $640,700 | $961,000 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $3,028,300 | $0 | $3,028,300 | $0 | $0 | $0 | $3,028,300 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $743,500 | $0 | $743,500 | $0 | $0 | $0 | $743,500 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $849,500 | $0 | $849,500 | $0 | $0 | $0 | $849,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $38,845,700 | $15,311,300 | $23,534,400 | $4,230,300 | $2,537,700 | $1,692,600 | $25,227,000 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Table TD.5.M2-2.6

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-2

## Annual Benefits of Project for Feature Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $9,680,300 | $0 | $9,680,300 | $9,680,300 |
| 3 | Fort Totten | $0 | $0 | $0 | $13,800 | $3,900 | $9,900 | $9,900 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $230,400 | $0 | $230,400 | $230,400 |
| 5 | St. Michael | $0 | $0 | $0 | $12,800 | $10,000 | $2,800 | $2,800 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $8,400 | $6,500 | $1,900 | $1,900 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $279,200 | $11,000 | $268,200 | $268,200 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $3,103,800 | $1,837,800 | $1,266,000 | $1,266,000 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $215,300 | $99,200 | $116,100 | $116,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $407,600 | $0 | $407,600 | $407,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $704,000 | $0 | $704,000 | $704,000 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $96,000 | $0 | $96,000 | $96,000 |
| 13 | US Highway 2 | $0 | $0 | $0 | $1,613,000 | $0 | $1,613,000 | $1,613,000 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $1,777,900 | $0 | $1,777,900 | $1,777,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $1,343,800 | $0 | $1,343,800 | $1,343,800 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $4,667,700 | $2,936,900 | $1,730,800 | $1,730,800 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $345,700 | $0 | $345,700 | $345,700 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $407,100 | $0 | $407,100 | $407,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $1,807,200 | $0 | $1,807,200 | $1,807,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $577,500 | $748,600 | -$171,100 | -$171,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $458,200 | $0 | $458,200 | $458,200 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $11,919,000 | $8,907,000 | $3,012,000 | $3,012,000 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $0 | $0 | $0 | $40,002,400 | $14,894,600 | $25,107,800 | $25,107,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.5.M2-2.7**

### Annual Benefits of Project Downstream of Devils Lake:
### Municipal Water Treatment Facilities
Scenario M2-2

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $0 | $26,300 |
| Fargo | $10,500 | $1,226,400 |
| Grand Forks | $48,300 | $2,310,100 |
| Grafton | $0 | $43,100 |
| Drayton | $1,600 | $76,700 |
| Pembina | $300 | $31,200 |
| Morris | $0 | $19,800 |
| Letellier | $0 | $21,300 |
| | | |
| TOTAL | $60,700 | $3,754,900 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | $0 | -$26,300 |
| Fargo | -$10,500 | -$1,226,400 |
| Grand Forks | -$48,300 | -$2,310,100 |
| Grafton | $0 | -$43,100 |
| Drayton | -$1,600 | -$76,700 |
| Pembina | -$300 | -$31,200 |
| Morris | $0 | -$19,800 |
| Letellier | $0 | -$21,300 |
| | | |
| TOTAL | -$60,700 | -$3,754,900 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.5.M2-2.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario M2-2

## Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

## Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $69,900 |
| American Crystal Sugar | $3,400 |
| **TOTAL** | $73,300 |

## TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$69,900 |
| American Crystal Sugar | -$3,400 |
| **TOTAL** | -$73,300 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-2.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario M2-2

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $418,900 |
| Agricultural- Other | $146,400 |
| Urban (Lisbon and Valley City) | $7,287,500 |
| Transportation | $1,801,800 |
| | |
| TOTAL | $9,654,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $468,300 |
| Agricultural- Other | $147,800 |
| Urban (Lisbon and Valley City) | $7,310,100 |
| Transportation | $1,805,600 |
| | |
| TOTAL | $9,731,800 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$49,400 |
| Agricultural- Other | -$1,400 |
| Urban (Lisbon and Valley City) | -$22,600 |
| Transportation | -$3,800 |
| | |
| TOTAL | -$77,200 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-2.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario M2-2

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $1,000 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $291,300 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$290,300 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.5.M2-2.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario M2-2

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $92,190 | $92,190 | $92,190 | $92,190 |
| Outlet Operation and Maintenance | $16,940 | $16,940 | $16,940 | $16,940 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $15,924 | $15,924 | $15,924 | $15,924 |
| Natural Resources Monitoring/Mitigation | $50,432 | $50,432 | $50,432 | $50,432 |
| **Total Costs: Present Value** | $175,486 | $175,486 | $175,486 | $175,486 |
| **Annualized Total Cost** | $11,721 | $11,721 | $11,721 | $11,721 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $3 | $3 | $3 | $3 |
| Features Adjacent to Devils Lake | $9,599 | $25,227 | $25,108 | $13,164 |
| Downstream Features | -$4,256 | -$4,256 | -$4,256 | -$4,256 |
| **Total Annualized Benefit** | $5,345 | $20,973 | $20,854 | $8,910 |
| | | | | |
| **NET BENEFIT** | -$6,375 | $9,253 | $9,134 | -$2,810 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.46 | 1.79 | 1.78 | 0.76 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.
Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.
The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 1.32 | 3.46 | 3.45 | 1.81 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 1 | 1 | 1 | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.
The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*M2-3a Tables*
*(Moderate 2 Future - Combination 2 - West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection)*

## Table TD.5.M2-3a.1

## Economic Analysis of Devils Lake Alternatives

### Scenario M2-3a
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Alions US Hwy 2 | 12 BNRR / Churchs Ferry to Cando | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 100 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 100 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 100 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 100 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 100 / 100 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 100 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.5.M2-3a.2

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-3a
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Maximum Infrastructure Protection Strategies WITHOUT PROJECT | | Based on Set of Maximum Infrastructure Protection Strategies WITHOUT PROJECT | |
|---|---|---|---|---|---|
| | | Name | Description | Name | Description |
| 1 | Churchs Ferry | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.5.M2-3a.3

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-3a

## Annual Benefits of Project for Features Adjacent to Devils Lake Based on Set of Maximum Infrastructure Protection (MIP) Strategies (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $0 | $333,700 | $333,700 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $9,680,300 | $0 | $9,680,300 | $9,680,300 |
| 3 | Fort Totten | $0 | $0 | $0 | $13,800 | $0 | $13,800 | $13,800 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $230,400 | $0 | $230,400 | $230,400 |
| 5 | St. Michael | $0 | $0 | $0 | $12,800 | $0 | $12,800 | $12,800 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $8,400 | $5,600 | $2,800 | $2,800 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $279,200 | $12,000 | $267,200 | $267,200 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $3,103,800 | $1,225,900 | $1,877,900 | $1,877,900 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $215,300 | $174,000 | $41,300 | $41,300 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $407,600 | $0 | $407,600 | $407,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $704,000 | $0 | $704,000 | $704,000 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $96,000 | $0 | $96,000 | $96,000 |
| 13 | US Highway 2 | $0 | $0 | $0 | $1,613,000 | $0 | $1,613,000 | $1,613,000 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $1,777,900 | $0 | $1,777,900 | $1,777,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $1,343,800 | $0 | $1,343,800 | $1,343,800 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $4,667,700 | $0 | $4,667,700 | $4,667,700 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $345,700 | $0 | $345,700 | $345,700 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $407,100 | $0 | $407,100 | $407,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $1,807,200 | $0 | $1,807,200 | $1,807,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $577,500 | $0 | $577,500 | $577,500 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $458,200 | $0 | $458,200 | $458,200 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $11,919,000 | $0 | $11,919,000 | $11,919,000 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $40,002,400 | $1,417,500 | $38,584,900 | $38,584,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The maximum infrastructure protection strategies analyzed include temporary closure of roads and rail lines without the project.

· With the project feature were assumed to be incremental protected or relocated.

· The costs and damages for without the project assume the feature are not protected or are abandoned.

· The costs with the project assume incremental protection of all the feature and are included as a project cost in Table TD.5.M2-3a.4

· The damages with the project assume incremental protection of all the feature.

· The with- and without-project analyses assume 800 acre-feet of upper basin stroage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.5.M2-3a.4**

### Annual Benefits of Project Downstream of Devils Lake:
### Municipal Water Treatment Facilities
Scenario M2-3a

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $7,700 | $0 |
| Fargo | $3,300 | $0 |
| Grand Forks | $9,500 | $0 |
| Grafton | $500 | $0 |
| Drayton | $300 | $0 |
| Pembina | $0 | $0 |
| Morris | $400 | $0 |
| Letellier | $600 | $0 |
| | | |
| TOTAL | $22,300 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$7,700 | $0 |
| Fargo | -$3,300 | $0 |
| Grand Forks | -$9,500 | $0 |
| Grafton | -$500 | $0 |
| Drayton | -$300 | $0 |
| Pembina | $0 | $0 |
| Morris | -$400 | $0 |
| Letellier | -$600 | $0 |
| | | |
| TOTAL | -$22,300 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.5.M2-3a.5**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario M2-3a

## Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

## Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $11,800 |
| American Crystal Sugar | $200 |
| **TOTAL** | $12,000 |

## TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$11,800 |
| American Crystal Sugar | -$200 |
| **TOTAL** | -$12,000 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-3a.6

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario M2-3a

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $418,900 |
| Agricultural- Other | $146,400 |
| Urban (Lisbon and Valley City) | $7,287,500 |
| Transportation | $1,801,800 |
| | |
| TOTAL | $9,654,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $429,300 |
| Agricultural- Other | $147,000 |
| Urban (Lisbon and Valley City) | $7,292,200 |
| Transportation | $1,803,900 |
| | |
| TOTAL | $9,672,400 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$10,400 |
| Agricultural- Other | -$600 |
| Urban (Lisbon and Valley City) | -$4,700 |
| Transportation | -$2,100 |
| | |
| TOTAL | -$17,800 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-3a.7

## Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario M2-3a

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $1,000 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $17,800 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$16,800 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-3a.8

### Cost and Benefit Summary with Maximum Infrastructure Protection

Scenario M2-3a

| (in thousands of dollars) | |
|---|---|
| **COSTS** | |
| Outlet Construction | $58,540 |
| Outlet Operation and Maintenance | $7,229 |
| Hwy 19 Dam Construction | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 |
| Maximum Infrastructure Protection (MIP) | $143,660 |
| MIP Operation and Maintenance | $3,236 |
| Expanded Infrastructure Measures (EIM) | $0 |
| EIM Operation and Maintenance | $0 |
| Upper Basin Management | $39,681 |
| Ion Exchange/Alternate Water Source Installation | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 |
| **Total Costs: Present Value** | $274,978 |
| **Annualized Total Cost** | $18,365 |
| | |
| **ANNUALIZED BENEFITS** | |
| Annual Cost Savings and Damages Prevented: | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 |
| Features Adjacent to Devils Lake* | $38,585 |
| Downstream Features | -$69 |
| **Total Annualized Benefit** | $38,516 |
| | |
| **NET BENEFIT** | $20,151 |
| | |
| **BENEFIT-COST RATIO (BCR)** | 2.10 |

*The Annual Cost Savings and Damages Prevented values for the features adjacent to Devils Lake for the with-project condition are for the Most Likely Action strategies. The costs and damages for the without-project condition are no protection strategies.

Note: Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.
The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.
The BCR calculated in this table incorporates the costs and benefits associated with only one lake level trace; this is not a probabilistic analysis.

**WITHOUT DOWNSTREAM IMPACTS**

| | |
|---|---|
| Benefit-Cost Ratio (BCR) | 2.29 |
| Traces With BCR>1 | |
| Total Number Out of 1 Trace | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.
The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*M2-3b Tables*
*(Moderate 2 Future - Combination 2 - West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures)*

## Table TD.5.M2-3b.1

## Economic Analysis of Devils Lake Alternatives

### Scenario M2-3b
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rese. | 7 Grahams Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlow | 11 BNRR / Along US Hwy 2 | 12 SNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 100 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 100 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 100 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 100 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 100 / 100 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 100 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.5.M2-3b.2

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-3b
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | A* | Relocation of Structures: Then Temporary Closure | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | Re | Relocate Road | R(5) | 5 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.5.M2-3b.3

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-3b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $1,836,800 | $1,836,800 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $15,100 | $14,400 | $700 | $0 | $0 | $0 | $700 |
| 4 | City of Minnewaukan | $251,300 | $162,900 | $88,400 | $0 | $0 | $0 | $88,400 |
| 5 | St. Michael | $13,100 | $0 | $13,100 | $0 | $0 | $0 | $13,100 |
| 6 | Gilbert C. Grafton State Military Res. | $291,300 | $291,300 | $0 | $5,600 | $5,600 | $0 | $0 |
| 7 | Grahams Island State Park | $241,300 | $174,700 | $66,600 | $12,200 | $12,000 | $200 | $66,800 |
| 8.1 | Devils Lake Rural Areas | $1,097,200 | $619,800 | $477,400 | $1,791,100 | $1,225,900 | $565,200 | $1,042,600 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $6,300 | $400 | $205,700 | $174,000 | $31,700 | $32,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $1,881,800 | $1,133,800 | $748,000 | $0 | $0 | $0 | $748,000 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $495,300 | $495,300 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $492,000 | $0 | $492,000 | $0 | $0 | $0 | $492,000 |
| 13 | US Highway 2 | $1,514,800 | $0 | $1,514,800 | $0 | $0 | $0 | $1,514,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $185,500 | $0 | $185,500 | $0 | $0 | $0 | $185,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $489,900 | $0 | $489,900 | $0 | $0 | $0 | $489,900 |
| 16 | Highway 281 South of US Highway 2 | $3,752,000 | $2,452,100 | $1,299,900 | $0 | $0 | $0 | $1,299,900 |
| 17 | Highway 281 North of US Highway 2 | $385,800 | $362,700 | $23,100 | $0 | $0 | $0 | $23,100 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $1,160,700 | $0 | $1,160,700 | $0 | $0 | $0 | $1,160,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $323,100 | $0 | $323,100 | $0 | $0 | $0 | $323,100 |
| 22 | Highway 20 between Highway 57 and Tokio | $2,238,500 | $0 | $2,238,500 | $0 | $0 | $0 | $2,238,500 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $365,500 | $236,000 | $129,500 | $0 | $0 | $0 | $129,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $263,100 | $0 | $263,100 | $0 | $0 | $0 | $263,100 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $17,634,500 | $8,119,800 | $9,514,700 | $2,014,600 | $1,417,500 | $597,100 | $10,111,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin stroage when the lake is at or above 1440.

## Table TD.5.M2-3b.4

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-3b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $1,836,800 | $1,836,800 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $15,100 | $14,400 | $700 | $0 | $0 | $0 | $700 |
| 4 | City of Minnewaukan | $251,300 | $162,900 | $88,400 | $0 | $0 | $0 | $88,400 |
| 5 | St. Michael | $13,100 | $0 | $13,100 | $0 | $0 | $0 | $13,100 |
| 6 | Gilbert C. Grafton State Military Res. | $291,300 | $291,300 | $0 | $5,600 | $5,600 | $0 | $0 |
| 7 | Grahams Island State Park | $241,300 | $3,500 | $237,800 | $12,200 | $123,200 | -$111,000 | $126,800 |
| 8.1 | Devils Lake Rural Areas | $1,097,200 | $619,800 | $477,400 | $1,791,100 | $1,225,900 | $565,200 | $1,042,600 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $6,300 | $400 | $205,700 | $174,000 | $31,700 | $32,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $407,600 | $675,800 | -$268,200 | -$268,200 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $495,300 | $495,300 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $96,000 | $0 | $96,000 | $96,000 |
| 13 | US Highway 2 | $1,514,800 | $0 | $1,514,800 | $0 | $0 | $0 | $1,514,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $185,500 | $0 | $185,500 | $0 | $0 | $0 | $185,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $489,900 | $0 | $489,900 | $0 | $0 | $0 | $489,900 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $2,452,100 | -$962,900 | $1,575,000 | $0 | $1,575,000 | $612,100 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $345,700 | $196,400 | $149,300 | $149,300 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $407,100 | $0 | $407,100 | $407,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $323,100 | $0 | $323,100 | $0 | $0 | $0 | $323,100 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $577,500 | $0 | $577,500 | $577,500 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $365,500 | $236,000 | $129,500 | $0 | $0 | $0 | $129,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $263,100 | $0 | $263,100 | $0 | $0 | $0 | $263,100 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $9,212,900 | $6,452,100 | $2,760,800 | $5,423,500 | $2,400,900 | $3,022,600 | $5,783,400 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin stroage when the lake is at or above 1440.

## Table TD.5.M2-3b.5

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-3b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $3,762,100 | $3,762,100 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $365,400 | $237,000 | $128,400 | $0 | $0 | $0 | $128,400 |
| 5 | St. Michael | $116,700 | $0 | $116,700 | $0 | $0 | $0 | $116,700 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $5,600 | $5,600 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $12,200 | $12,000 | $200 | $200 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,002,400 | $409,900 | $1,791,100 | $1,225,900 | $565,200 | $975,100 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $6,300 | $400 | $205,700 | $174,000 | $31,700 | $32,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $4,201,500 | $4,201,500 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,075,500 | $2,075,500 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $1,910,500 | $0 | $1,910,500 | $0 | $0 | $0 | $1,910,500 |
| 13 | US Highway 2 | $4,568,100 | $0 | $4,568,100 | $0 | $0 | $0 | $4,568,100 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $426,900 | $0 | $426,900 | $0 | $0 | $0 | $426,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,276,100 | $0 | $1,276,100 | $0 | $0 | $0 | $1,276,100 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $320,300 | $301,100 | $19,200 | $640,700 | $598,600 | $42,100 | $61,300 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $3,028,300 | $0 | $3,028,300 | $0 | $0 | $0 | $3,028,300 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $743,500 | $0 | $743,500 | $0 | $0 | $0 | $743,500 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $0 | $6,926,700 | $0 | $0 | $0 | $6,926,700 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $849,500 | $849,500 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $0 | $1,241,500 | $0 | $0 | $0 | $1,241,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $38,845,700 | $18,049,500 | $20,796,200 | $4,230,300 | $3,591,100 | $639,200 | $21,435,400 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin stroage when the lake is at or above 1440.

## Table TD.5.M2-3b.6

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-3b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $9,680,300 | $9,680,300 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $13,800 | $13,200 | $600 | $600 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $230,400 | $149,500 | $80,900 | $80,900 |
| 5 | St. Michael | $0 | $0 | $0 | $12,800 | $11,800 | $1,000 | $1,000 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $8,400 | $8,400 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $279,200 | $123,200 | $156,000 | $156,000 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $3,103,800 | $2,021,200 | $1,082,600 | $1,082,600 |
| 8.2 | Stump Lake Rural Areas for Features Ad | $0 | $0 | $0 | $215,300 | $183,000 | $32,300 | $32,300 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $407,600 | $675,800 | -$268,200 | -$268,200 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $704,000 | $524,600 | $179,400 | $179,400 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $96,000 | $0 | $96,000 | $96,000 |
| 13 | US Highway 2 | $0 | $0 | $0 | $1,613,000 | $0 | $1,613,000 | $1,613,000 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $1,777,900 | $0 | $1,777,900 | $1,777,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $1,343,800 | $0 | $1,343,800 | $1,343,800 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $4,667,700 | $4,115,600 | $552,100 | $552,100 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $345,700 | $196,400 | $149,300 | $149,300 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $407,100 | $0 | $407,100 | $407,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $1,807,200 | $0 | $1,807,200 | $1,807,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $577,500 | $560,800 | $16,700 | $16,700 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $458,200 | $318,500 | $139,700 | $139,700 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $11,919,000 | $11,269,400 | $649,600 | $649,600 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $0 | $0 | $0 | $40,002,400 | $30,185,400 | $9,817,000 | $9,817,000 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin stroage when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.5.M2-3b.7**

### Annual Benefits of Project Downstream of Devils Lake:
### Municipal Water Treatment Facilities
Scenario M2-3b

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $7,700 | $0 |
| Fargo | $3,300 | $0 |
| Grand Forks | $9,500 | $0 |
| Grafton | $500 | $0 |
| Drayton | $300 | $0 |
| Pembina | $0 | $0 |
| Morris | $400 | $0 |
| Letellier | $600 | $0 |
| | | |
| TOTAL | $22,300 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$7,700 | $0 |
| Fargo | -$3,300 | $0 |
| Grand Forks | -$9,500 | $0 |
| Grafton | -$500 | $0 |
| Drayton | -$300 | $0 |
| Pembina | $0 | $0 |
| Morris | -$400 | $0 |
| Letellier | -$600 | $0 |
| | | |
| TOTAL | -$22,300 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.5.M2-3b.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario M2-3b

**Damages: WITHOUT PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

**Damages: WITH PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $11,800 |
| American Crystal Sugar | $200 |
| **TOTAL** | $12,000 |

**TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$11,800 |
| American Crystal Sugar | -$200 |
| **TOTAL** | -$12,000 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-3b.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario M2-3b

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $418,900 |
| Agricultural- Other | $146,400 |
| Urban (Lisbon and Valley City) | $7,287,500 |
| Transportation | $1,801,800 |
| | |
| TOTAL | $9,654,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $429,300 |
| Agricultural- Other | $147,000 |
| Urban (Lisbon and Valley City) | $7,292,200 |
| Transportation | $1,803,900 |
| | |
| TOTAL | $9,672,400 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$10,400 |
| Agricultural- Other | -$600 |
| Urban (Lisbon and Valley City) | -$4,700 |
| Transportation | -$2,100 |
| | |
| TOTAL | -$17,800 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-3b.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario M2-3b

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $1,000 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $17,800 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$16,800 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.5.M2-3b.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario M2-3b

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $58,540 | $58,540 | $58,540 | $58,540 |
| Outlet Operation and Maintenance | $7,229 | $7,229 | $7,229 | $7,229 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $22,086 | $22,086 | $22,086 | $22,086 |
| EIM Operation and Maintenance | $3,236 | $3,236 | $3,236 | $3,236 |
| Upper Basin Management | $39,681 | $39,681 | $39,681 | $39,681 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $153,404 | $153,404 | $153,404 | $153,404 |
| **Annualized Total Cost** | $10,246 | $10,246 | $10,246 | $10,246 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $5,783 | $21,435 | $9,817 | $10,112 |
| Downstream Features | -$69 | -$69 | -$69 | -$69 |
| **Total Annualized Benefit** | $5,715 | $21,367 | $9,748 | $10,043 |
| | | | | |
| **NET BENEFIT** | -$4,531 | $11,121 | -$497 | -$202 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.56 | 2.09 | 0.95 | 0.98 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.66 | 2.45 | 1.12 | 1.16 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 1 | 1 | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*M2-5 Tables*
*(Moderate 2 Future - Pelican Lake 300 cfs Constrained Outlet)*

## Table TD.5.M2-5.1

## Economic Analysis of Devils Lake Alternatives

### Scenario M2-5
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham's Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Church's Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 100 / 100 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 100 / 100 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 100 / 100 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 100 / 0 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 100 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 100 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.5.M2-5.2

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-5
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | A* | Relocation of Structures: Then Temporary Closure | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | Re | Relocate Road | R(5) | 5 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.5.M2-5.3

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $1,836,800 | $446,400 | $1,390,400 | $0 | $0 | $0 | $1,390,400 |
| 3 | Fort Totten | $15,100 | $4,300 | $10,800 | $0 | $0 | $0 | $10,800 |
| 4 | City of Minnewaukan | $251,300 | $162,900 | $88,400 | $0 | $0 | $0 | $88,400 |
| 5 | St. Michael | $13,100 | $12,000 | $1,100 | $0 | $0 | $0 | $1,100 |
| 6 | Gilbert C. Grafton State Military Res. | $291,300 | $197,800 | $93,500 | $5,600 | $3,700 | $1,900 | $95,400 |
| 7 | Grahams Island State Park | $241,300 | $114,500 | $126,800 | $12,200 | $11,600 | $600 | $127,400 |
| 8.1 | Devils Lake Rural Areas | $1,097,200 | $877,600 | $219,600 | $1,791,100 | $1,030,400 | $760,700 | $980,300 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $4,700 | $2,000 | $205,700 | $162,200 | $43,500 | $45,500 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $1,881,800 | $1,133,800 | $748,000 | $0 | $0 | $0 | $748,000 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $495,300 | $0 | $495,300 | $0 | $0 | $0 | $495,300 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $492,000 | $0 | $492,000 | $0 | $0 | $0 | $492,000 |
| 13 | US Highway 2 | $1,514,800 | $0 | $1,514,800 | $0 | $0 | $0 | $1,514,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $185,500 | $0 | $185,500 | $0 | $0 | $0 | $185,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $489,900 | $0 | $489,900 | $0 | $0 | $0 | $489,900 |
| 16 | Highway 281 South of US Highway 2 | $3,752,000 | $2,121,300 | $1,630,700 | $0 | $0 | $0 | $1,630,700 |
| 17 | Highway 281 North of US Highway 2 | $385,800 | $0 | $385,800 | $0 | $0 | $0 | $385,800 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $1,160,700 | $0 | $1,160,700 | $0 | $0 | $0 | $1,160,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $323,100 | $0 | $323,100 | $0 | $0 | $0 | $323,100 |
| 22 | Highway 20 between Highway 57 and Tokio | $2,238,500 | $1,572,500 | $666,000 | $0 | $0 | $0 | $666,000 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $365,500 | $153,100 | $212,400 | $0 | $0 | $0 | $212,400 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $263,100 | $111,700 | $151,400 | $0 | $0 | $0 | $151,400 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $17,634,500 | $7,246,300 | $10,388,200 | $2,014,600 | $1,207,900 | $806,700 | $11,194,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.5.M2-5.4

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $1,836,800 | $446,400 | $1,390,400 | $0 | $0 | $0 | $1,390,400 |
| 3 | Fort Totten | $15,100 | $4,300 | $10,800 | $0 | $0 | $0 | $10,800 |
| 4 | City of Minnewaukan | $185,800 | $120,600 | $65,200 | $0 | $0 | $0 | $65,200 |
| 5 | St. Michael | $13,100 | $12,000 | $1,100 | $0 | $0 | $0 | $1,100 |
| 6 | Gilbert C. Grafton State Military Res. | $291,300 | $197,800 | $93,500 | $5,600 | $3,700 | $1,900 | $95,400 |
| 7 | Grahams Island State Park | $241,300 | $3,500 | $237,800 | $12,200 | $83,800 | -$71,600 | $166,200 |
| 8.1 | Devils Lake Rural Areas | $1,097,200 | $877,600 | $219,600 | $1,791,100 | $1,030,400 | $760,700 | $980,300 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $4,700 | $2,000 | $205,700 | $162,200 | $43,500 | $45,500 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $407,600 | $447,400 | -$39,800 | -$39,800 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $495,300 | $0 | $495,300 | $0 | $0 | $0 | $495,300 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $96,000 | $0 | $96,000 | $96,000 |
| 13 | US Highway 2 | $1,514,800 | $0 | $1,514,800 | $0 | $0 | $0 | $1,514,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $185,500 | $0 | $185,500 | $0 | $0 | $0 | $185,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $489,900 | $0 | $489,900 | $0 | $0 | $0 | $489,900 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $2,121,300 | -$632,100 | $1,575,000 | $0 | $1,575,000 | $942,900 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $345,700 | $0 | $345,700 | $345,700 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $407,100 | $0 | $407,100 | $407,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $323,100 | $0 | $323,100 | $0 | $0 | $0 | $323,100 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $577,500 | $555,100 | $22,400 | $22,400 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $365,500 | $153,100 | $212,400 | $0 | $0 | $0 | $212,400 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $263,100 | $111,700 | $151,400 | $0 | $0 | $0 | $151,400 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $9,147,400 | $4,386,700 | $4,760,700 | $5,423,500 | $2,282,600 | $3,140,900 | $7,901,600 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.5.M2-5.5

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-5

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $3,762,100 | $3,762,100 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $365,400 | $237,000 | $128,400 | $0 | $0 | $0 | $128,400 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $5,600 | $3,700 | $1,900 | $1,900 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $12,200 | $11,600 | $600 | $600 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $1,791,100 | $1,030,400 | $760,700 | $760,700 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $4,700 | $2,000 | $205,700 | $162,200 | $43,500 | $45,500 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $4,201,500 | $4,201,500 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,075,500 | $0 | $2,075,500 | $0 | $0 | $0 | $2,075,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $1,910,500 | $0 | $1,910,500 | $0 | $0 | $0 | $1,910,500 |
| 13 | US Highway 2 | $4,568,100 | $0 | $4,568,100 | $0 | $0 | $0 | $4,568,100 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $426,900 | $0 | $426,900 | $0 | $0 | $0 | $426,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,276,100 | $0 | $1,276,100 | $0 | $0 | $0 | $1,276,100 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $320,300 | $0 | $320,300 | $640,700 | $0 | $640,700 | $961,000 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $3,028,300 | $0 | $3,028,300 | $0 | $0 | $0 | $3,028,300 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $743,500 | $0 | $743,500 | $0 | $0 | $0 | $743,500 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $849,500 | $551,200 | $298,300 | $0 | $0 | $0 | $298,300 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $38,845,700 | $24,067,800 | $14,777,900 | $4,230,300 | $2,782,900 | $1,447,400 | $16,225,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.5.M2-5.6

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $9,680,300 | $8,171,000 | $1,509,300 | $1,509,300 |
| 3 | Fort Totten | $0 | $0 | $0 | $13,800 | $3,900 | $9,900 | $9,900 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $230,400 | $149,500 | $80,900 | $80,900 |
| 5 | St. Michael | $0 | $0 | $0 | $12,800 | $11,800 | $1,000 | $1,000 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $8,400 | $6,500 | $1,900 | $1,900 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $279,200 | $83,800 | $195,400 | $195,400 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $3,103,800 | $2,068,800 | $1,035,000 | $1,035,000 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $215,300 | $168,800 | $46,500 | $46,500 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $407,600 | $447,400 | -$39,800 | -$39,800 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $704,000 | $0 | $704,000 | $704,000 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $96,000 | $0 | $96,000 | $96,000 |
| 13 | US Highway 2 | $0 | $0 | $0 | $1,613,000 | $0 | $1,613,000 | $1,613,000 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $1,777,900 | $0 | $1,777,900 | $1,777,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $1,343,800 | $0 | $1,343,800 | $1,343,800 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $4,667,700 | $3,761,000 | $906,700 | $906,700 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $345,700 | $0 | $345,700 | $345,700 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $407,100 | $0 | $407,100 | $407,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $1,807,200 | $0 | $1,807,200 | $1,807,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $577,500 | $555,100 | $22,400 | $22,400 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $458,200 | $100,300 | $357,900 | $357,900 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $11,919,000 | $9,955,900 | $1,963,100 | $1,963,100 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $40,002,400 | $25,817,500 | $14,184,900 | $14,184,900 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.5.M2-5.7

### Annual Benefits of Project Downstream of Devils Lake:
### Municipal Water Treatment Facilities
Scenario M2-5

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $9,700 | $0 |
| Fargo | $3,600 | $0 |
| Grand Forks | $15,800 | $0 |
| Grafton | $1,000 | $0 |
| Drayton | $500 | $0 |
| Pembina | $100 | $0 |
| Morris | $700 | $0 |
| Letellier | $1,400 | $0 |
| | | |
| TOTAL | $32,800 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$9,700 | $0 |
| Fargo | -$3,600 | $0 |
| Grand Forks | -$15,800 | $0 |
| Grafton | -$1,000 | $0 |
| Drayton | -$500 | $0 |
| Pembina | -$100 | $0 |
| Morris | -$700 | $0 |
| Letellier | -$1,400 | $0 |
| | | |
| TOTAL | -$32,800 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.5.M2-5.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario M2-5

**Damages: WITHOUT PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

**Damages: WITH PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $22,300 |
| American Crystal Sugar | $900 |
| **TOTAL** | $23,200 |

**TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$22,300 |
| American Crystal Sugar | -$900 |
| **TOTAL** | -$23,200 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-5.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario M2-5

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $418,900 |
| Agricultural- Other | $146,400 |
| Urban (Lisbon and Valley City) | $7,287,500 |
| Transportation | $1,801,800 |
| | |
| TOTAL | $9,654,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $442,700 |
| Agricultural- Other | $147,400 |
| Urban (Lisbon and Valley City) | $7,300,900 |
| Transportation | $1,804,600 |
| | |
| TOTAL | $9,695,600 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$23,800 |
| Agricultural- Other | -$1,000 |
| Urban (Lisbon and Valley City) | -$13,400 |
| Transportation | -$2,800 |
| | |
| TOTAL | -$41,000 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-5.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario M2-5

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $1,000 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $18,800 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$17,800 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.5.M2-5.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario M2-5

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $84,180 | $84,180 | $84,180 | $84,180 |
| Outlet Operation and Maintenance | $13,045 | $13,045 | $13,045 | $13,045 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $119,857 | $119,857 | $119,857 | $119,857 |
| **Annualized Total Cost** | $8,005 | $8,005 | $8,005 | $8,005 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $1 | $1 | $1 | $1 |
| Features Adjacent to Devils Lake | $7,902 | $16,225 | $14,185 | $11,195 |
| Downstream Features | -$115 | -$115 | -$115 | -$115 |
| **Total Annualized Benefit** | $7,787 | $16,111 | $14,071 | $11,081 |
| | | | | |
| **NET BENEFIT** | -$218 | $8,106 | $6,066 | $3,076 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.97 | 2.01 | 1.76 | 1.38 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 1.22 | 2.50 | 2.18 | 1.72 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 1 | 1 | 1 | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*M2-6 Tables*
*(Moderate 2 Future - Pelican Lake 480 cfs Unconstrained Outlet)*

## Table TD.5.M2-6.1

## Economic Analysis of Devils Lake Alternatives

## Scenario M2-6
## Probability of Reaching Decision/Action Levels at Each Feature
## (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churcha Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mil. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BN RR / Along US Hwy 2 | 12 BN RR / Churcha Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1439 | 100 / 0 (Stump Lake) | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1447 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1449 | 100 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1450 | 100 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1451 | 100 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1452 | 100 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1453 | 100 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1454 | 100 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1455 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1457 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1459 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1460 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.5.M2-6.2

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-6
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | S(2) | 2 Incremental Structure Relocations | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | Re | Relocate Road | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.5.M2-6.3

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $1,836,800 | $0 | $1,836,800 | $0 | $0 | $0 | $1,836,800 |
| 3 | Fort Totten | $15,100 | $4,300 | $10,800 | $0 | $0 | $0 | $10,800 |
| 4 | City of Minnewaukan | $251,300 | $0 | $251,300 | $0 | $0 | $0 | $251,300 |
| 5 | St. Michael | $13,100 | $10,000 | $3,100 | $0 | $0 | $0 | $3,100 |
| 6 | Gilbert C. Grafton State Military Res. | $291,300 | $197,800 | $93,500 | $5,600 | $3,700 | $1,900 | $95,400 |
| 7 | Grahams Island State Park | $241,300 | $3,500 | $237,800 | $12,200 | $11,000 | $1,200 | $239,000 |
| 8.1 | Devils Lake Rural Areas | $1,097,200 | $836,900 | $260,300 | $1,791,100 | $848,800 | $942,300 | $1,202,600 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $0 | $6,700 | $205,700 | $99,200 | $106,500 | $113,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $1,881,800 | $0 | $1,881,800 | $0 | $0 | $0 | $1,881,800 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $495,300 | $0 | $495,300 | $0 | $0 | $0 | $495,300 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $492,000 | $0 | $492,000 | $0 | $0 | $0 | $492,000 |
| 13 | US Highway 2 | $1,514,800 | $0 | $1,514,800 | $0 | $0 | $0 | $1,514,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $185,500 | $0 | $185,500 | $0 | $0 | $0 | $185,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $489,900 | $0 | $489,900 | $0 | $0 | $0 | $489,900 |
| 16 | Highway 281 South of US Highway 2 | $3,752,000 | $2,121,300 | $1,630,700 | $0 | $0 | $0 | $1,630,700 |
| 17 | Highway 281 North of US Highway 2 | $385,800 | $0 | $385,800 | $0 | $0 | $0 | $385,800 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $1,160,700 | $0 | $1,160,700 | $0 | $0 | $0 | $1,160,700 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $323,100 | $0 | $323,100 | $0 | $0 | $0 | $323,100 |
| 22 | Highway 20 between Highway 57 and Tokio | $2,238,500 | $1,572,500 | $666,000 | $0 | $0 | $0 | $666,000 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $365,500 | $0 | $365,500 | $0 | $0 | $0 | $365,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $263,100 | $111,700 | $151,400 | $0 | $0 | $0 | $151,400 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $17,634,500 | $5,191,700 | $12,442,800 | $2,014,600 | $962,700 | $1,051,900 | $13,494,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.5.M2-6.4

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $1,836,800 | $0 | $1,836,800 | $0 | $0 | $0 | $1,836,800 |
| 3 | Fort Totten | $15,100 | $4,300 | $10,800 | $0 | $0 | $0 | $10,800 |
| 4 | City of Minnewaukan | $185,800 | $0 | $185,800 | $0 | $0 | $0 | $185,800 |
| 5 | St. Michael | $13,100 | $10,000 | $3,100 | $0 | $0 | $0 | $3,100 |
| 6 | Gilbert C. Grafton State Military Res. | $291,300 | $197,800 | $93,500 | $5,600 | $3,700 | $1,900 | $95,400 |
| 7 | Grahams Island State Park | $241,300 | $3,500 | $237,800 | $12,200 | $11,000 | $1,200 | $239,000 |
| 8.1 | Devils Lake Rural Areas | $1,097,200 | $836,900 | $260,300 | $1,791,100 | $848,800 | $942,300 | $1,202,600 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $0 | $6,700 | $205,700 | $99,200 | $106,500 | $113,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $407,600 | $0 | $407,600 | $407,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $495,300 | $0 | $495,300 | $0 | $0 | $0 | $495,300 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $96,000 | $0 | $96,000 | $96,000 |
| 13 | US Highway 2 | $1,514,800 | $0 | $1,514,800 | $0 | $0 | $0 | $1,514,800 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $185,500 | $0 | $185,500 | $0 | $0 | $0 | $185,500 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $489,900 | $0 | $489,900 | $0 | $0 | $0 | $489,900 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $240,400 | $1,248,800 | $1,575,000 | $1,522,700 | $52,300 | $1,301,100 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $345,700 | $0 | $345,700 | $345,700 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $407,100 | $0 | $407,100 | $407,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $323,100 | $0 | $323,100 | $0 | $0 | $0 | $323,100 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $577,500 | $748,600 | -$171,100 | -$171,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $365,500 | $0 | $365,500 | $0 | $0 | $0 | $365,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $263,100 | $111,700 | $151,400 | $0 | $0 | $0 | $151,400 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $9,147,400 | $1,738,300 | $7,409,100 | $5,423,500 | $3,234,000 | $2,189,500 | $9,598,600 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.5.M2-6.5

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $3,762,100 | $0 | $3,762,100 | $0 | $0 | $0 | $3,762,100 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $365,400 | $0 | $365,400 | $0 | $0 | $0 | $365,400 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $5,600 | $3,700 | $1,900 | $1,900 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $12,200 | $11,000 | $1,200 | $1,200 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $1,791,100 | $848,800 | $942,300 | $942,300 |
| 8.2 | Stump Lake Rural Areas | $6,700 | $0 | $6,700 | $205,700 | $99,200 | $106,500 | $113,200 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $4,201,500 | $0 | $4,201,500 | $0 | $0 | $0 | $4,201,500 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $2,075,500 | $0 | $2,075,500 | $0 | $0 | $0 | $2,075,500 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $1,910,500 | $0 | $1,910,500 | $0 | $0 | $0 | $1,910,500 |
| 13 | US Highway 2 | $4,568,100 | $0 | $4,568,100 | $0 | $0 | $0 | $4,568,100 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $426,900 | $0 | $426,900 | $0 | $0 | $0 | $426,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $1,276,100 | $0 | $1,276,100 | $0 | $0 | $0 | $1,276,100 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $320,300 | $0 | $320,300 | $640,700 | $0 | $640,700 | $961,000 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $3,028,300 | $0 | $3,028,300 | $0 | $0 | $0 | $3,028,300 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $743,500 | $0 | $743,500 | $0 | $0 | $0 | $743,500 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $849,500 | $0 | $849,500 | $0 | $0 | $0 | $849,500 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $38,845,700 | $15,311,300 | $23,534,400 | $4,230,300 | $2,537,700 | $1,692,600 | $25,227,000 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.5.M2-6.6

## Economic Analysis of Devils Lake Alternatives
## Scenario M2-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $9,680,300 | $0 | $9,680,300 | $9,680,300 |
| 3 | Fort Totten | $0 | $0 | $0 | $13,800 | $3,900 | $9,900 | $9,900 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $230,400 | $0 | $230,400 | $230,400 |
| 5 | St. Michael | $0 | $0 | $0 | $12,800 | $10,000 | $2,800 | $2,800 |
| 6 | Gilbert C. Grafton State Milltary Res. | $0 | $0 | $0 | $8,400 | $6,500 | $1,900 | $1,900 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $279,200 | $11,000 | $268,200 | $268,200 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $3,103,800 | $1,837,800 | $1,266,000 | $1,266,000 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $215,300 | $99,200 | $116,100 | $116,100 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $407,600 | $0 | $407,600 | $407,600 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $704,000 | $0 | $704,000 | $704,000 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $96,000 | $0 | $96,000 | $96,000 |
| 13 | US Highway 2 | $0 | $0 | $0 | $1,613,000 | $0 | $1,613,000 | $1,613,000 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $1,777,900 | $0 | $1,777,900 | $1,777,900 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $1,343,800 | $0 | $1,343,800 | $1,343,800 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $4,667,700 | $2,936,900 | $1,730,800 | $1,730,800 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $345,700 | $0 | $345,700 | $345,700 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $407,100 | $0 | $407,100 | $407,100 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $1,807,200 | $0 | $1,807,200 | $1,807,200 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $577,500 | $748,600 | -$171,100 | -$171,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $458,200 | $0 | $458,200 | $458,200 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $11,919,000 | $8,907,000 | $3,012,000 | $3,012,000 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $0 | $0 | $0 | $40,002,400 | $14,894,600 | $25,107,800 | $25,107,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.5.M2-6.7**

### Annual Benefits of Project Downstream of Devils Lake:
### Municipal Water Treatment Facilities
Scenario M2-6

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $0 | $26,300 |
| Fargo | $7,300 | $837,900 |
| Grand Forks | $34,400 | $1,665,200 |
| Grafton | $0 | $43,100 |
| Drayton | $1,200 | $58,400 |
| Pembina | $200 | $23,400 |
| Morris | $0 | $19,800 |
| Letellier | $0 | $21,300 |
| | | |
| TOTAL | $43,100 | $2,695,400 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | $0 | -$26,300 |
| Fargo | -$7,300 | -$837,900 |
| Grand Forks | -$34,400 | -$1,665,200 |
| Grafton | $0 | -$43,100 |
| Drayton | -$1,200 | -$58,400 |
| Pembina | -$200 | -$23,400 |
| Morris | $0 | -$19,800 |
| Letellier | $0 | -$21,300 |
| | | |
| TOTAL | -$43,100 | -$2,695,400 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.5.M2-6.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario M2-6

## Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

## Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $51,400 |
| American Crystal Sugar | $2,200 |
| **TOTAL** | $53,600 |

## TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$51,400 |
| American Crystal Sugar | -$2,200 |
| **TOTAL** | -$53,600 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-6.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario M2-6

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $418,900 |
| Agricultural- Other | $146,400 |
| Urban (Lisbon and Valley City) | $7,287,500 |
| Transportation | $1,801,800 |
| | |
| TOTAL | $9,654,600 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $468,300 |
| Agricultural- Other | $147,800 |
| Urban (Lisbon and Valley City) | $7,310,100 |
| Transportation | $1,805,600 |
| | |
| TOTAL | $9,731,800 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$49,400 |
| Agricultural- Other | -$1,400 |
| Urban (Lisbon and Valley City) | -$22,600 |
| Transportation | -$3,800 |
| | |
| TOTAL | -$77,200 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.5.M2-6.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario M2-6

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $1,000 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $124,800 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$123,800 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.5.M2-6.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario M2-6

(values in thousands of dollars)

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $129,230 | $129,230 | $129,230 | $129,230 |
| Outlet Operation and Maintenance | $19,187 | $19,187 | $19,187 | $19,187 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $16,020 | $16,020 | $16,020 | $16,020 |
| Natural Resources Monitoring/Mitigation | $50,432 | $50,432 | $50,432 | $50,432 |
| **Total Costs: Present Value** | $214,869 | $214,869 | $214,869 | $214,869 |
| **Annualized Total Cost** | $14,351 | $14,351 | $14,351 | $14,351 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $3 | $3 | $3 | $3 |
| Features Adjacent to Devils Lake | $9,599 | $25,227 | $25,108 | $13,495 |
| Downstream Features | -$2,993 | -$2,993 | -$2,993 | -$2,993 |
| **Total Annualized Benefit** | $6,608 | $22,237 | $22,118 | $10,504 |
| | | | | |
| **NET BENEFIT** | -$7,743 | $7,886 | $7,767 | -$3,846 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.46 | 1.55 | 1.54 | 0.73 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.97 | 2.55 | 2.53 | 1.36 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 1 | 1 | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

# TD.6.0 Dry Future Scenario

The following table lists the sensitivity analyses for which tables are included in this section. Note that there are several tables that are included for each analysis. The last digit of each table number (x) reflects a variable number for each of the tables.

| Table Number | Alternative Number | Description of Alternative |
|---|---|---|
| TD.6.DR-1.x | DR-1 | West Bay 300 cfs Constrained Outlet |
| TD.6.DR-2.x | DR-2 | West Bay 480 cfs Unconstrained Outlet |
| TD.6.DR-3a.x | DR-3a | Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection |
| TD.6.DR-3b.x | DR-3b | Combination 2 – West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures |
| | DR-4 | NOTE: DR-4 is the base condition – without project future condition |
| TD.6.DR-5.x | DR-5 | Pelican Lake 300 cfs Constrained Outlet |
| TD.6.DR-6.x | DR-6 | Pelican Lake 480 cfs Unconstrained Outlet |

The following table lists the 11 individual tables that are included for the majority of the analyses: Expanded Infrastructure Measures (DR-3b) and various outlets (DR-1, DR-2, DR-5, and DR-6).

| Last Digit of Each Table Number | Table Description |
|---|---|
| 1 | Probability of Reaching Decision/Action Levels at Each Feature |
| 2 | Sets of Feature Strategies |
| 3 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Most Likely Action Strategies |
| 4 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Cost-Effective Strategies |
| 5 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) |
| 6 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of No Flood Protection Strategies |
| 7 | Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities |
| 8 | Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users |
| 9 | Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features |
| 10 | Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users |
| 11 | Cost and Benefit Summary: 4 Sets of Feature Strategies |

The following table lists the eight individual tables that are included for the Maximum Infrastructure Protection sensitivity analysis (DR-3a).

| Last Digit of Each Table Number | Table Description |
|---|---|
| 1 | Probability of Reaching Decision/Action Levels at Each Feature |
| 2 | Sets of Feature Strategies |
| 3 | Annual Benefits of Project for Features Adjacent to Devils Lake: Based on Set of Maximum Infrastructure Protection Strategies |
| 4 | Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities |
| 5 | Annual Benefits of Project Downstream of Devils Lake: Industrial Water Users |
| 6 | Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features |
| 7 | Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users |
| 8 | Cost and Benefit Summary with Maximum Infrastructure Protection |

*DR-1 Tables*
*(Dry Future - West Bay 300 cfs Constrained Outlet)*

## Table TD.6.DR-1.1

## Economic Analysis of Devils Lake Alternatives

### Scenario DR-1
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mil. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRVAW / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Alions US Hwy 2 | 12 BNRR / Churchs Ferry to Canada | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 (Stump Lake) | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 0 / 0 (Stump Lake) | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 0 / 0 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 0 / 0 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 0 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 0 / 0 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 0 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.6.DR-1.2

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-1
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | R(3) | 3 Incremental Railroad Raises | R(3) | 3 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Toldo | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.6.DR-1.3

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $10,000 | $10,000 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $856,100 | $856,100 | $0 | $960,800 | $960,800 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $2,452,100 | $2,452,100 | $0 | $0 | $0 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,572,500 | $1,572,500 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $111,700 | $111,700 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $5,541,700 | $5,541,700 | $0 | $1,048,000 | $1,048,000 | $0 | $0 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-1.4

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $10,000 | $10,000 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $856,100 | $856,100 | $0 | $960,800 | $960,800 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $240,400 | $240,400 | $0 | $1,250,600 | $1,250,600 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $502,100 | $502,100 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $111,700 | $111,700 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $1,757,500 | $1,757,500 | $0 | $2,800,700 | $2,800,700 | $0 | $0 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-1.5

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-1

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $960,800 | $960,800 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | **TOTAL** | $15,311,300 | $15,311,300 | $0 | $2,623,000 | $2,623,000 | $0 | $0 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-1.6

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-1

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $3,900 | $3,900 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $0 | $0 | $0 | $10,000 | $10,000 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $6,500 | $6,500 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $1,973,300 | $1,973,300 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $1,578,000 | $1,578,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $502,100 | $502,100 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,717,500 | $9,717,500 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $14,208,500 | $14,208,500 | $0 | $0 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.6.DR-1.7**

### Annual Benefits of Project Downstream of Devils Lake:
### Municipal Water Treatment Facilities
Scenario DR-1

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $4,400 | $0 |
| Fargo | $1,900 | $0 |
| Grand Forks | $5,000 | $0 |
| Grafton | $200 | $0 |
| Drayton | $200 | $0 |
| Pembina | $0 | $0 |
| Morris | $300 | $0 |
| Letellier | $300 | $0 |
| | | |
| TOTAL | $12,300 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$4,400 | $0 |
| Fargo | -$1,900 | $0 |
| Grand Forks | -$5,000 | $0 |
| Grafton | -$200 | $0 |
| Drayton | -$200 | $0 |
| Pembina | $0 | $0 |
| Morris | -$300 | $0 |
| Letellier | -$300 | $0 |
| | | |
| TOTAL | -$12,300 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.6.DR-1.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario DR-1

## Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

## Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $7,300 |
| American Crystal Sugar | $100 |
| **TOTAL** | $7,400 |

## TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$7,300 |
| American Crystal Sugar | -$100 |
| **TOTAL** | -$7,400 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-1.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario DR-1

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $375,500 |
| Agricultural- Other | $134,800 |
| Urban (Lisbon and Valley City) | $6,292,100 |
| Transportation | $1,626,100 |
| | |
| TOTAL | $8,428,500 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $383,900 |
| Agricultural- Other | $135,500 |
| Urban (Lisbon and Valley City) | $6,456,900 |
| Transportation | $1,628,400 |
| | |
| TOTAL | $8,604,700 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$8,400 |
| Agricultural- Other | -$700 |
| Urban (Lisbon and Valley City) | -$164,800 |
| Transportation | -$2,300 |
| | |
| TOTAL | -$176,200 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-1.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario DR-1

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $6,400 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $22,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$16,100 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.6.DR-1.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario DR-1

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $58,540 | $58,540 | $58,540 | $58,540 |
| Outlet Operation and Maintenance | $5,612 | $5,612 | $5,612 | $5,612 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $86,784 | $86,784 | $86,784 | $86,784 |
| **Annualized Total Cost** | $5,796 | $5,796 | $5,796 | $5,796 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $0 | $0 | $0 | $0 |
| Downstream Features | -$212 | -$212 | -$212 | -$212 |
| **Total Annualized Benefit** | -$212 | -$212 | -$212 | -$212 |
| | | | | |
| **NET BENEFIT** | -$6,008 | -$6,008 | -$6,008 | -$6,008 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | -0.04 | -0.04 | -0.04 | -0.04 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.00 | 0.00 | 0.00 | 0.00 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 0 | 0 | 0 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*DR-2 Tables*
*(Dry Future - West Bay 480 cfs Unconstrained Outlet)*

## Table TD.6.DR-2.1

## Economic Analysis of Devils Lake Alternatives

### Scenario DR-2
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton S1a1e Mil. Rea. | 7 Graham's Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Alcong US Hwy 2 | 12 BNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 0 / 0 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 0 / 0 | | ■ | | | ■ | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 0 / 0 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 0 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 0 / 0 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 0 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.6.DR-2.2

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-2
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | R(3) | 3 Incremental Railroad Raises | R(3) | 3 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.6.DR-2.3

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-2

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $10,000 | $10,000 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $856,100 | $856,100 | $0 | $960,800 | $960,800 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $2,452,100 | $2,452,100 | $0 | $0 | $0 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,572,500 | $1,572,500 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $111,700 | $111,700 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $5,541,700 | $5,541,700 | $0 | $1,048,000 | $1,048,000 | $0 | $0 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-2.4

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-2

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $10,000 | $10,000 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $856,100 | $856,100 | $0 | $960,800 | $960,800 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $240,400 | $240,400 | $0 | $1,250,600 | $1,250,600 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $502,100 | $502,100 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $111,700 | $111,700 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $1,757,500 | $1,757,500 | $0 | $2,800,700 | $2,800,700 | $0 | $0 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-2.5

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-2

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $960,800 | $960,800 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $15,311,300 | $15,311,300 | $0 | $2,623,000 | $2,623,000 | $0 | $0 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-2.6

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-2

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $3,900 | $3,900 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $0 | $0 | $0 | $10,000 | $10,000 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $6,500 | $6,500 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $1,973,300 | $1,973,300 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $1,578,000 | $1,578,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $502,100 | $502,100 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,717,500 | $4,811,200 | $4,906,300 | $4,906,300 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $0 | $0 | $0 | $14,208,500 | $9,302,200 | $4,906,300 | $4,906,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.6.DR-2.7**

### Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities
Scenario DR-2

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $0 | $26,300 |
| Fargo | $6,000 | $731,000 |
| Grand Forks | $22,300 | $1,089,200 |
| Grafton | $0 | $42,100 |
| Drayton | $800 | $42,500 |
| Pembina | $100 | $17,900 |
| Morris | $1,100 | $151,700 |
| Letellier | $1,900 | $194,800 |
| | | |
| TOTAL | $32,200 | $2,295,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment: Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply: Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | $0 | -$26,300 |
| Fargo | -$6,000 | -$731,000 |
| Grand Forks | -$22,300 | -$1,089,200 |
| Grafton | $0 | -$42,100 |
| Drayton | -$800 | -$42,500 |
| Pembina | -$100 | -$17,900 |
| Morris | -$1,100 | -$151,700 |
| Letellier | -$1,900 | -$194,800 |
| | | |
| TOTAL | -$32,200 | -$2,295,500 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-2.8

### Annual Benefits of Project Downstream of Devils Lake:
### Industrial Water Users
Scenario DR-2

### Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| TOTAL | $0 |

### Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $35,900 |
| American Crystal Sugar | $1,900 |
| TOTAL | $37,800 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$35,900 |
| American Crystal Sugar | -$1,900 |
| TOTAL | -$37,800 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-2.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario DR-2

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $375,500 |
| Agricultural- Other | $134,800 |
| Urban (Lisbon and Valley City) | $6,292,100 |
| Transportation | $1,626,100 |
| | |
| TOTAL | $8,428,500 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $391,000 |
| Agricultural- Other | $137,100 |
| Urban (Lisbon and Valley City) | $6,506,000 |
| Transportation | $1,635,200 |
| | |
| TOTAL | $8,669,300 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$15,500 |
| Agricultural- Other | -$2,300 |
| Urban (Lisbon and Valley City) | -$213,900 |
| Transportation | -$9,100 |
| | |
| TOTAL | -$240,800 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-2.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario DR-2

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $6,400 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $191,600 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$185,200 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.6.DR-2.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario DR-2

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $92,190 | $92,190 | $92,190 | $92,190 |
| Outlet Operation and Maintenance | $9,512 | $9,512 | $9,512 | $9,512 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $9,882 | $9,882 | $9,882 | $9,882 |
| Natural Resources Monitoring/Mitigation | $50,432 | $50,432 | $50,432 | $50,432 |
| **Total Costs: Present Value** | $162,016 | $162,016 | $162,016 | $162,016 |
| **Annualized Total Cost** | $10,821 | $10,821 | $10,821 | $10,821 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $0 | $0 | $4,906 | $0 |
| Downstream Features | -$2,792 | -$2,792 | -$2,792 | -$2,792 |
| **Total Annualized Benefit** | -$2,791 | -$2,791 | $2,115 | -$2,791 |
| | | | | |
| **NET BENEFIT** | -$13,612 | -$13,612 | -$8,706 | -$13,612 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | -0.26 | -0.26 | 0.20 | -0.26 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.00 | 0.00 | 0.72 | 0.00 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 0 | 0 | 0 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*DR-3a Tables*
*(Dry Future - Combination 2 - West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Maximum Infrastructure Protection)*

## Table TD.6.DR-3a.1

## Economic Analysis of Devils Lake Alternatives

## Scenario DR-3a
## Probability of Reaching Decision/Action Levels at Each Feature
## (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mil. Rea. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Alions US Hwy 2 | 12 BNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/ Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/ Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1439 | 0 / 0 | Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1447 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1449 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1450 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1451 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1452 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1453 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1454 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1455 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1457 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1459 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1460 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.6.DR-3a.2

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-3a
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Maximum Infrastructure Protection Strategies WITHOUT PROJECT | | Based on Set of Maximum Infrastructure Protection Strategies WITHOUT PROJECT | |
|---|---|---|---|---|---|
| | | Name | Description | Name | Description |
| 1 | Churchs Ferry | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.6.DR-3a.3

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-3a

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Infrastructure Protection (MIP) Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $0 | $333,700 | $333,700 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $3,900 | $0 | $3,900 | $3,900 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $0 | $0 | $0 | $10,000 | $0 | $10,000 | $10,000 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $6,500 | $3,700 | $2,800 | $2,800 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $1,973,300 | $294,600 | $1,678,700 | $1,678,700 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $65,500 | $7,000 | $7,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $1,578,000 | $0 | $1,578,000 | $1,578,000 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $502,100 | $0 | $502,100 | $502,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,717,500 | $0 | $9,717,500 | $9,717,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $14,208,500 | $374,800 | $13,833,700 | $13,833,700 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The maximum infrastructure protection strategies analyzed include temporary closure of roads and rail lines without the project.

· With the project, features were assumed to be incremental protected or relocated.

· The costs and damages for without the project assume the feature are not protected or are abandoned.

· The costs with the project assume incremental protection of all the feature and are included as a project cost in Table TD.6.DR-3a.4

· The damages with the project assume incremental protection of all the feature.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the like is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.6.DR-3a.4**

### Annual Benefits of Project Downstream of Devils Lake:
### Municipal Water Treatment Facilities
Scenario DR-3a

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $4,300 | $0 |
| Fargo | $1,800 | $0 |
| Grand Forks | $4,800 | $0 |
| Grafton | $200 | $0 |
| Drayton | $100 | $0 |
| Pembina | $0 | $0 |
| Morris | $200 | $0 |
| Letellier | $300 | $0 |
| | | |
| TOTAL | $11,700 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$4,300 | $0 |
| Fargo | -$1,800 | $0 |
| Grand Forks | -$4,800 | $0 |
| Grafton | -$200 | $0 |
| Drayton | -$100 | $0 |
| Pembina | $0 | $0 |
| Morris | -$200 | $0 |
| Letellier | -$300 | $0 |
| | | |
| TOTAL | -$11,700 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-3a.5

### Annual Benefits of Project Downstream of Devils Lake:
### Industrial Water Users
Scenario DR-3a

### Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| TOTAL | $0 |

### Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $7,000 |
| American Crystal Sugar | $100 |
| TOTAL | $7,100 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$7,000 |
| American Crystal Sugar | -$100 |
| TOTAL | -$7,100 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-3a.6

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario DR-3a

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $375,500 |
| Agricultural- Other | $134,800 |
| Urban (Lisbon and Valley City) | $6,292,100 |
| Transportation | $1,626,100 |
| | |
| TOTAL | $8,428,500 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $383,600 |
| Agricultural- Other | $135,500 |
| Urban (Lisbon and Valley City) | $6,455,800 |
| Transportation | $1,628,300 |
| | |
| TOTAL | $8,603,200 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$8,100 |
| Agricultural- Other | -$700 |
| Urban (Lisbon and Valley City) | -$163,700 |
| Transportation | -$2,200 |
| | |
| TOTAL | -$174,700 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-3a.7

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario DR-3a

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $6,400 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $22,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$16,100 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-3a.8

### Cost and Benefit Summary with Maximum Infrastructure Protection
Scenario DR-3a

| (in thousands of dollars) | |
|---|---|
| **COSTS** | |
| Outlet Construction | $58,540 |
| Outlet Operation and Maintenance | $5,437 |
| Hwy 19 Dam Construction | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 |
| Maximum Infrastructure Protection (MIP) | $51,818 |
| MIP Operation and Maintenance | $0 |
| Expanded Infrastructure Measures (EIM) | $0 |
| EIM Operation and Maintenance | $0 |
| Upper Basin Management | $39,681 |
| Ion Exchange/Alternate Water Source Installation | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 |
| **Total Costs: Present Value** | $178,108 |
| **Annualized Total Cost** | $11,896 |
| | |
| **ANNUALIZED BENEFITS** | |
| Annual Cost Savings and Damages Prevented: | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 |
| Features Adjacent to Devils Lake* | $13,834 |
| Downstream Features | -$210 |
| **Total Annualized Benefit** | $13,625 |
| | |
| **NET BENEFIT** | $1,729 |
| | |
| **BENEFIT-COST RATIO (BCR)** | 1.15 |

*The Annual Cost Savings and Damages Prevented values for the features adjacent to Devils Lake for the with-project condition are for the Most Likely Action strategies. The costs and damages for the without-project condition are no protection strategies.

Note: Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.
The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.
The BCR calculated in this table incorporates the costs and benefits associated with only one lake level trace; this is not a probabilistic analysis.

**WITHOUT DOWNSTREAM IMPACTS**

| | |
|---|---|
| Benefit-Cost Ratio (BCR) | 1.33 |
| Traces With BCR>1 | |
| Total Number Out of 1 Trace | 1 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.
The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

***DR-3b Tables***
***(Dry Future - Combination 2 - West Bay 300 cfs Constrained Outlet, Upper Basin Management, and Expanded Infrastructure Measures)***

## Table TD.6.DR-3b.1

## Economic Analysis of Devils Lake Alternatives

### Scenario DR-3b
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Church Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rees. | 7 Graham Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Aiens US Hwy 2 | 12 BNRR / Churches Ferry to Cando | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19 / Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20 / Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1439 | 0 / 0 | Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1447 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1449 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1450 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1451 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1452 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1453 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1454 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1455 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1457 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1459 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1460 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.6.DR-3b.2

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-3b
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | R(3) | 3 Incremental Railroad Raises | R(3) | 3 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.6.DR-3b.3

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-3b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $10,000 | $0 | $10,000 | $0 | $0 | $0 | $10,000 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $856,100 | $469,500 | $386,600 | $960,800 | $294,600 | $666,200 | $1,052,800 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $65,500 | $7,000 | $7,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $2,452,100 | $2,452,100 | $0 | $0 | $0 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,572,500 | $0 | $1,572,500 | $0 | $0 | $0 | $1,572,500 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $111,700 | $0 | $111,700 | $0 | $0 | $0 | $111,700 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $5,541,700 | $3,460,900 | $2,080,800 | $1,048,000 | $374,800 | $673,200 | $2,754,000 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-3b.4

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-3b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $10,000 | $0 | $10,000 | $0 | $0 | $0 | $10,000 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $856,100 | $469,500 | $386,600 | $960,800 | $294,600 | $666,200 | $1,052,800 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $65,500 | $7,000 | $7,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $240,400 | $240,400 | $0 | $1,250,600 | $1,002,900 | $247,700 | $247,700 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $502,100 | $0 | $502,100 | $502,100 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $111,700 | $0 | $111,700 | $0 | $0 | $0 | $111,700 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $1,757,500 | $1,249,200 | $508,300 | $2,800,700 | $1,377,700 | $1,423,000 | $1,931,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-3b.5

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-3b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,700 | $0 | $116,700 | $0 | $0 | $0 | $116,700 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,002,400 | $409,900 | $960,800 | $294,600 | $666,200 | $1,076,100 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $65,500 | $7,000 | $7,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $0 | $6,926,700 | $0 | $0 | $0 | $6,926,700 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $0 | $1,241,500 | $0 | $0 | $0 | $1,241,500 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $15,311,300 | $6,616,500 | $8,694,800 | $2,623,000 | $1,949,800 | $673,200 | $9,368,000 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-3b.6

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-3b

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $3,900 | $3,900 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $0 | $0 | $0 | $10,000 | $10,000 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $6,500 | $6,500 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $1,973,300 | $896,800 | $1,076,500 | $1,076,500 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $65,500 | $7,000 | $7,000 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $1,578,000 | $1,578,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $502,100 | $495,600 | $6,500 | $6,500 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,717,500 | $9,463,900 | $253,600 | $253,600 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $14,208,500 | $12,864,900 | $1,343,600 | $1,343,600 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
### Table TD.6.DR-3b.7

### Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities
Scenario DR-3b

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $4,300 | $0 |
| Fargo | $1,800 | $0 |
| Grand Forks | $4,800 | $0 |
| Grafton | $200 | $0 |
| Drayton | $100 | $0 |
| Pembina | $0 | $0 |
| Morris | $200 | $0 |
| Letellier | $300 | $0 |
| | | |
| TOTAL | $11,700 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$4,300 | $0 |
| Fargo | -$1,800 | $0 |
| Grand Forks | -$4,800 | $0 |
| Grafton | -$200 | $0 |
| Drayton | -$100 | $0 |
| Pembina | $0 | $0 |
| Morris | -$200 | $0 |
| Letellier | -$300 | $0 |
| | | |
| TOTAL | -$11,700 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-3b.8

### Annual Benefits of Project Downstream of Devils Lake:
### Industrial Water Users
Scenario DR-3b

### Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

### Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $7,000 |
| American Crystal Sugar | $100 |
| **TOTAL** | $7,100 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$7,000 |
| American Crystal Sugar | -$100 |
| **TOTAL** | -$7,100 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-3b.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario DR-3b

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $375,500 |
| Agricultural- Other | $134,800 |
| Urban (Lisbon and Valley City) | $6,292,100 |
| Transportation | $1,626,100 |
| | |
| TOTAL | $8,428,500 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $383,600 |
| Agricultural- Other | $135,500 |
| Urban (Lisbon and Valley City) | $6,455,800 |
| Transportation | $1,628,300 |
| | |
| TOTAL | $8,603,200 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$8,100 |
| Agricultural- Other | -$700 |
| Urban (Lisbon and Valley City) | -$163,700 |
| Transportation | -$2,200 |
| | |
| TOTAL | -$174,700 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-3b.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario DR-3b

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $6,400 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $22,500 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$16,100 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.6.DR-3b.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario DR-3b

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $58,540 | $58,540 | $58,540 | $58,540 |
| Outlet Operation and Maintenance | $5,437 | $5,437 | $5,437 | $5,437 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $39,681 | $39,681 | $39,681 | $39,681 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $126,290 | $126,290 | $126,290 | $126,290 |
| **Annualized Total Cost** | $8,435 | $8,435 | $8,435 | $8,435 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $0 | $0 | $0 | $0 |
| Features Adjacent to Devils Lake | $1,931 | $9,368 | $1,344 | $2,754 |
| Downstream Features | -$210 | -$210 | -$210 | -$210 |
| **Total Annualized Benefit** | $1,722 | $9,159 | $1,134 | $2,545 |
| | | | | |
| **NET BENEFIT** | -$6,713 | $724 | -$7,300 | -$5,890 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | 0.20 | 1.09 | 0.13 | 0.30 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.
Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.
The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.28 | 1.35 | 0.19 | 0.40 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 1 | 0 | 0 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.
The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

*DR-5 Tables*
*(Dry Future - Pelican Lake 300 cfs Constrained Outlet)*

## Table TD.6.DR-5.1

## Economic Analysis of Devils Lake Alternatives

### Scenario DR-5
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churches Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Res. | 7 Graham Island State Park | 8.1 Devils Lake Rural Area | 8.2 Stump Lake Rural Area | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Alions US Hwy 2 | 12 BNRR / Churches Ferry to Cando | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 0 / 0 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 0 / 0 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 0 / 0 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 0 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 0 / 0 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 0 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.6.DR-5.2

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-5
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | R(3) | 3 Incremental Railroad Raises | R(3) | 3 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.6.DR-5.3

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $10,000 | $10,000 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $856,100 | $856,100 | $0 | $960,800 | $960,800 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $2,452,100 | $2,121,300 | $330,800 | $0 | $0 | $0 | $330,800 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,572,500 | $1,572,500 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $111,700 | $111,700 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $5,541,700 | $5,210,900 | $330,800 | $1,048,000 | $1,048,000 | $0 | $330,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-5.4

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $10,000 | $10,000 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $856,100 | $856,100 | $0 | $960,800 | $960,800 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $240,400 | $240,400 | $0 | $1,250,600 | $1,250,600 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $502,100 | $502,100 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $111,700 | $111,700 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $1,757,500 | $1,757,500 | $0 | $2,800,700 | $2,800,700 | $0 | $0 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-5.5

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-5

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $960,800 | $960,800 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $15,311,300 | $15,311,300 | $0 | $2,623,000 | $2,623,000 | $0 | $0 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-5.6

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-5

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $3,900 | $3,900 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $0 | $0 | $0 | $10,000 | $10,000 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $6,500 | $6,500 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $1,973,300 | $1,973,300 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $1,578,000 | $1,578,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $502,100 | $502,100 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,717,500 | $5,844,200 | $3,873,300 | $3,873,300 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $14,208,500 | $10,335,200 | $3,873,300 | $3,873,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.6.DR-5.7**

### Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities
Scenario DR-5

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $5,900 | $0 |
| Fargo | $2,400 | $0 |
| Grand Forks | $7,300 | $0 |
| Grafton | $400 | $0 |
| Drayton | $300 | $0 |
| Pembina | $0 | $0 |
| Morris | $400 | $0 |
| Letellier | $600 | $0 |
| | | |
| TOTAL | $17,300 | $0 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | -$5,900 | $0 |
| Fargo | -$2,400 | $0 |
| Grand Forks | -$7,300 | $0 |
| Grafton | -$400 | $0 |
| Drayton | -$300 | $0 |
| Pembina | $0 | $0 |
| Morris | -$400 | $0 |
| Letellier | -$600 | $0 |
| | | |
| TOTAL | -$17,300 | $0 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-5.8

### Annual Benefits of Project Downstream of Devils Lake:
### Industrial Water Users
Scenario DR-5

### Damages: WITHOUT PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

### Damages: WITH PROJECT[1]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $10,100 |
| American Crystal Sugar | $500 |
| **TOTAL** | $10,600 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$10,100 |
| American Crystal Sugar | -$500 |
| **TOTAL** | -$10,600 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

# Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-5.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario DR-5

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $375,500 |
| Agricultural- Other | $134,800 |
| Urban (Lisbon and Valley City) | $6,292,100 |
| Transportation | $1,626,100 |
| | |
| TOTAL | $8,428,500 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $393,900 |
| Agricultural- Other | $135,700 |
| Urban (Lisbon and Valley City) | $6,467,800 |
| Transportation | $1,629,300 |
| | |
| TOTAL | $8,626,700 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$18,400 |
| Agricultural- Other | -$900 |
| Urban (Lisbon and Valley City) | -$175,700 |
| Transportation | -$3,200 |
| | |
| TOTAL | -$198,200 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-5.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario DR-5

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $6,400 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $20,300 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$13,900 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.6.DR-5.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario DR-5

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $84,180 | $84,180 | $84,180 | $84,180 |
| Outlet Operation and Maintenance | $9,196 | $9,196 | $9,196 | $9,196 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $0 | $0 | $0 | $0 |
| Natural Resources Monitoring/Mitigation | $22,632 | $22,632 | $22,632 | $22,632 |
| **Total Costs: Present Value** | $116,008 | $116,008 | $116,008 | $116,008 |
| **Annualized Total Cost** | $7,748 | $7,748 | $7,748 | $7,748 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $1 | $1 | $1 | $1 |
| Features Adjacent to Devils Lake | $0 | $0 | $3,873 | $331 |
| Downstream Features | -$240 | -$240 | -$240 | -$240 |
| **Total Annualized Benefit** | -$239 | -$239 | $3,634 | $91 |
| | | | | |
| **NET BENEFIT** | -$7,987 | -$7,987 | -$4,114 | -$7,657 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | -0.03 | -0.03 | 0.47 | 0.01 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.00 | 0.00 | 0.62 | 0.05 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 0 | 0 | 0 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.

***DR-6 Tables***
***(Dry Future - Pelican Lake 480 cfs Unconstrained Outlet)***

## Table TD.6.DR-6.1

## Economic Analysis of Devils Lake Alternatives

### Scenario DR-6
### Probability of Reaching Decision/Action Levels at Each Feature
### (without and with the project)

| Elevation | Without Outlet % / With Outlet % | 1 Churchs Ferry | 2 City of Devils Lake | 3 Fort Totten | 4 City of Minnewaukan | 5 St. Michael | 6 Gilbert C. Grafton State Mill. Rea. | 7 Graham's Island State Park | 8.1 Devils Lake Rural Areas | 8.2 Stump Lake Rural Areas | 9 RRV&W / Minnewaukan South | 10 CPR / Devils Lake to Harlowe | 11 BNRR / Along US Hwy 2 | 12 BNRR / Churchs Ferry to Canado | 13 US Hwy 2 | 14 Hwy 57 between Hwy 20 and BIA 1 | 15 Hwy 57 between BIA 1 and Hwy 281 | 16 Hwy 281 South of US Hwy 2 | 17 Hwy 281 North of US Hwy 2 | 18 Hwy 19/Devils Lake Levee to Hwy 281 | 19 Hwy 1 | 20 Hwy 20 North of Devils Lake | 21 Hwy 20/Devils Lake Levee to Hwy 57 | 22 Hwy 20 between Hwy 57 and Tokio | 23 BIA 1 between Hwy 57 and BIA 6 | 24 BIA 6 between Hwy 20 and Fort Totten |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | shading indicates decision/action level | | | | | | | | | | | | | | | | | | | | | | | | |
| 1409 | 100 / 100 Stump Lake | | | | | | | | | ■ | | | | | | | | | | | ■ | | | | | |
| 1439 | 0 / 0 Stump Lake | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1443 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| 1444 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1445 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1446 | 100 / 100 | | | | | | | | | | | | | | | | | | | | | | | ■ | | |
| 1447 | 100 / 100 | ■ | | ■ | | ■ | ■ | ■ | ■ | | | | | | | | | ■ | | | | | | | | |
| 1448 | 100 / 100 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1449 | 0 / 0 | | ■ | | | | | ■ | | | | ■ | | | | | | | | | | | | | ■ | |
| 1450 | 0 / 0 | | | | | ■ | | | ■ | | | | | | | | | | | | | | | | | |
| 1451 | 0 / 0 | | | ■ | ■ | | ■ | | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1452 | 0 / 0 | | ■ | | | | | | | | | | ■ | | | | | | | | | | | | | |
| 1453 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1454 | 0 / 0 | | | | | | | ■ | ■ | | | ■ | | ■ | ■ | ■ | ■ | | | ■ | | | ■ | | ■ | |
| 1455 | 0 / 0 | ■ | | | | ■ | | | | | | | | | | | | | | | | | | | | |
| 1456 | 0 / 0 | | | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | ■ | | | | | ■ | | |
| 1457 | 0 / 0 | | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1458 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | ■ |
| 1459 | 0 / 0 | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | ■ | |
| 1460 | 0 / 0 | | | | | | | | ■ | | | | | | | | | | | | | | | | | |
| 1461 | 0 / 0 | | | | | | ■ | ■ | | | | | | | | | | | ■ | | | | | ■ | | |
| 1462 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1463 | 0 / 0 | | | | | | | | | | | | | | | | | | | | | | | | | ■ |

Note: Elevations for decision/action levels are shown at 1-foot increments, rounded down to the nearest foot.

## Table TD.6.DR-6.2

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-6
## Sets of Feature Strategies

| Feature Number | Feature Description | Based on Set of Cost-Effective Strategies WITHOUT PROJECT | | Based on Set of Cost-Effective Strategies WITH PROJECT | | Based on Maximum Protection Strategies (at the First Decision/Action Level) | | Based on Set of No Flood Protection Strategies | | Based on Set of Most-Likely Action Strategies | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Name | Description | Name | Description | Name | Description | Name | Description | Name | Description |
| 1 | Churchs Ferry | S(2) | 2 Incremental Structure Relocations | S(2) | 2 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(2) | 2 Incremental Structure Relocations |
| 2 | City of Devils Lake | L(3) | 3 Incremental Levee Raises | L(3) | 3 Incremental Levee Raises | L | Raise Top of Levee to Elevation 1470 | No Protection | No Protection or Relocation | L(3) | 3 Incremental Levee Raises |
| 3 | Fort Totten | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 4 | City of Minnewaukan | L(2) | 2 Incremental Levee Raises | L(2) | 2 Incremental Levee Raises | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | L(2) | 2 Incremental Levee Raises |
| 5 | St. Michael | S(3) | 3 Incremental Structure Relocations | S(3) | 3 Incremental Structure Relocations | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(3) | 3 Incremental Structure Relocations |
| 6 | Gilbert C. Grafton State Military Reservation | R(4) | 4 Incremental Road and Levee Raises | R(4) | 4 Incremental Road and Levee Raises | R | Raise Access Road and Levee to Elevation1468 | No Protection | No Protection or Relocation | R(4) | 4 Incremental Road and Levee Raises |
| 7 | Grahams Island State Park | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels:4 Road Raises | R* | Relocate Structures and Raise Access Road to Elevation 1468 | No Protection | No Protection or Relocation | R(4)* | Relocation of Structure at First, Second, and Fifth Action Levels: 4 Road Raises |
| 8.1 | Devils Lake Rural Areas | S(11) | Structure Relocation | S(11) | Structure Relocation | S | Relocate All Structures Below Elevation 1464 | No Protection | No Protection or Relocation | S(11) | Structure Relocation |
| 8.2 | Stump Lake Rural Areas | S(1) | Structure Relocation | S(1) | Structure Relocation | S(1) | Relocate Structures from Elevation 1440 to 1445 | No Protection | No Protection or Relocation | S(1) | Structure Relocation |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | | N/A | | N/A | | N/A | | N/A | | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | R(3) | 3 Incremental Railroad Raises | R(3) | 3 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Railroad Raises |
| 11 | Burlington Northern Railroad: Along US Highway 2 | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | R(2) | 2 Incremental Railroad Raises | R(2) | 2 Incremental Railroad Raises | R | Raise Rail Line to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Railroad Raises |
| 13 | US Highway 2 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 14 | Highway 57 between Highway 20 and BIA 1 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 15 | Highway 57 between BIA 1 and Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 16 | Highway 281 South of US Highway 2 | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | R(1)A | 1 Incremental Road Raise: Then Temporary Closure During Flooding | Re | Relocate Road | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |
| 17 | Highway 281 North of US Highway 2 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | Re | Relocate Road | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 19 | Highway 1 | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road | Re | Relocate Road |
| 20 | Highway 20 North of City of Devils Lake | R(1) | 1 Incremental Road Raises | R(1) | 1 Incremental Road Raises | R(1) | 1 Road Raise | A | Temporary Closure During Flooding | R(1) | 1 Incremental Road Raises |
| 21 | Highway 20 between City of Devils Lake Levee and Highway 57 | R(2) | 2 Incremental Road Raises | R(2) | 2 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(2) | 2 Incremental Road Raises |
| 22 | Highway 20 between Highway 57 and Tokio | A | Temporary Closure During Flooding | A | Temporary Closure During Flooding | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(4) | 4 Incremental Road Raises |
| 23 | BIA 1 between Highway 57 and BIA 6 | R(3) | 3 Incremental Road Raises | R(3) | 3 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(3) | 3 Incremental Road Raises |
| 24 | BIA 6 between Highway 20 and Fort Totten | R(5) | 5 Incremental Road Raises | R(5) | 5 Incremental Road Raises | R | Raise Road to Elevation 1468 | A | Temporary Closure During Flooding | R(5) | 5 Incremental Road Raises |

## Table TD.6.DR-6.3

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Most Likely Action Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $10,000 | $10,000 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $856,100 | $856,100 | $0 | $960,800 | $960,800 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $2,452,100 | $2,121,300 | $330,800 | $0 | $0 | $0 | $330,800 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $1,572,500 | $1,572,500 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $111,700 | $111,700 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| TOTAL | | $5,541,700 | $5,210,900 | $330,800 | $1,048,000 | $1,048,000 | $0 | $330,800 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The most likely action strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-6.4

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of Cost-Effective Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project A | With Project B | C = A - B | Without Project D | With Project E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $333,700 | $333,700 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $4,300 | $4,300 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $10,000 | $10,000 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $197,800 | $197,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $3,500 | $3,500 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $856,100 | $856,100 | $0 | $960,800 | $960,800 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $240,400 | $240,400 | $0 | $1,250,600 | $1,250,600 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $502,100 | $502,100 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $111,700 | $111,700 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $1,757,500 | $1,757,500 | $0 | $2,800,700 | $2,800,700 | $0 | $0 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · The cost-effective strategies analyzed include temporary closure of some roads and rail lines.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-6.5

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-6

### Annual Benefits of Project for Features Adjacent to Devils Lake
### Based on Set of Maximum Protection Strategies (at the First Decision/Action Level)
### (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $351,000 | $351,000 | $0 | $0 | $0 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $59,800 | $59,800 | $0 | $0 | $0 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $116,700 | $116,700 | $0 | $0 | $0 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $1,583,800 | $1,583,800 | $0 | $3,700 | $3,700 | $0 | $0 |
| 7 | Grahams Island State Park | $1,130,300 | $1,130,300 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $2,412,300 | $2,412,300 | $0 | $960,800 | $960,800 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $1,489,200 | $1,489,200 | $0 | $1,575,000 | $1,575,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $6,926,700 | $6,926,700 | $0 | $0 | $0 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $1,241,500 | $1,241,500 | $0 | $0 | $0 | $0 | $0 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $15,311,300 | $15,311,300 | $0 | $2,623,000 | $2,623,000 | $0 | $0 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · In the maximum protection strategies, damages occur only in rural areas (Features 6, 7, 8.1, and 8.2) to land that is not protected and on roads that have been rerouted.

· The least costly maximum protection strategy was included for this scenerio.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Table TD.6.DR-6.6

## Economic Analysis of Devils Lake Alternatives
## Scenario DR-6

## Annual Benefits of Project for Features Adjacent to Devils Lake
## Based on Set of No Flood Protection Strategies
## (listed by feature)

| Feature Number | Feature Description | Annual Strategy Costs * | | Annual Costs Avoided with Project | Remaining Annual Damages with Strategy in Place * | | Annual Damages Reduced by Project | Annual Damage Reduction and Costs Avoided with Project |
|---|---|---|---|---|---|---|---|---|
| | | Without Project | With Project | | Without Project | With Project | | |
| | | A | B | C = A - B | D | E | F = D - E | G = C + F |
| 1 | Churchs Ferry | $0 | $0 | $0 | $333,700 | $333,700 | $0 | $0 |
| 2 | City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 3 | Fort Totten | $0 | $0 | $0 | $3,900 | $3,900 | $0 | $0 |
| 4 | City of Minnewaukan | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 5 | St. Michael | $0 | $0 | $0 | $10,000 | $10,000 | $0 | $0 |
| 6 | Gilbert C. Grafton State Military Res. | $0 | $0 | $0 | $6,500 | $6,500 | $0 | $0 |
| 7 | Grahams Island State Park | $0 | $0 | $0 | $11,000 | $11,000 | $0 | $0 |
| 8.1 | Devils Lake Rural Areas | $0 | $0 | $0 | $1,973,300 | $1,973,300 | $0 | $0 |
| 8.2 | Stump Lake Rural Areas | $0 | $0 | $0 | $72,500 | $72,500 | $0 | $0 |
| 9 | Red River Valley and Western Railroad: Minnewaukan South | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 10 | Canadian Pacific Railroad: City of Devils Lake to Harlowe | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 11 | Burlington Northern Railroad: Along US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 12 | Burlington Northern Railroad: Churchs Ferry to Cando | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 13 | US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 14 | Highway 57 between Highway 20 and BIA 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 15 | Highway 57 between BIA 1 and Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 16 | Highway 281 South of US Highway 2 | $0 | $0 | $0 | $1,578,000 | $1,578,000 | $0 | $0 |
| 17 | Highway 281 North of US Highway 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 18 | Highway 19 from the City of Devils Lake Levee to Highway 281 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 19 | Highway 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 20 | Highway 20 North of the City of Devils Lake | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 21 | Highway 20 from the City of Devils Lake Levee and Highway 57 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 22 | Highway 20 between Highway 57 and Tokio | $0 | $0 | $0 | $502,100 | $502,100 | $0 | $0 |
| 23 | BIA 1 between Highway 57 and BIA 6 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 24 | BIA 6 between Highway 20 and Fort Totten | $0 | $0 | $0 | $9,717,500 | $4,811,200 | $4,906,300 | $4,906,300 |
| 25 | Optional City 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 26 | Optional City 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 27 | Optional Road 1 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 28 | Optional Road 2 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | TOTAL | $0 | $0 | $0 | $14,208,500 | $9,302,200 | $4,906,300 | $4,906,300 |

* Average annual costs and damages based on present worth value over 50 years at an interest rate of 6.375%.

Note: · Damages to roads and rail lines were assumed to be the cost of restoration after the lake level recedes.

· The with- and without-project analyses assume 800 acre-feet of upper basin storage (ESAP) when the lake is at or above 1440.

## Economic Analysis of Devils Lake Alternatives
**Table TD.6.DR-6.7**

### Annual Benefits of Project Downstream of Devils Lake: Municipal Water Treatment Facilities
Scenario DR-6

### Damages: WITHOUT PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | A(1) | A(2) |
| Valley City | $0 | $0 |
| Fargo | $0 | $0 |
| Grand Forks | $0 | $0 |
| Grafton | $0 | $0 |
| Drayton | $0 | $0 |
| Pembina | $0 | $0 |
| Morris | $0 | $0 |
| Letellier | $0 | $0 |
| | | |
| TOTAL | $0 | $0 |

### Damages: WITH PROJECT[1]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | B(1) | B(2) |
| Valley City | $0 | $26,300 |
| Fargo | $3,100 | $373,700 |
| Grand Forks | $12,300 | $621,000 |
| Grafton | $0 | $42,100 |
| Drayton | $500 | $26,600 |
| Pembina | $100 | $11,200 |
| Morris | $700 | $86,200 |
| Letellier | $1,100 | $111,500 |
| | | |
| TOTAL | $17,800 | $1,298,600 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[3]

| Municipal Water Treatment Facility | Softening Treatment<br>Annualized Value for Treatment to Without-Outlet Concentrations of Total Hardness[2] (2001 Dollars, Annualized over 50 Years) | Additional Treatment or Alternate Water Supply<br>Annualized Value for Additional Treatment or for Alternate Drinking Water Supply (2001 Dollars, Annualized over 50 Years) |
|---|---|---|
| | C(1) = A(1) - B(1) | C(2) = A(2) - B(2) |
| Valley City | $0 | -$26,300 |
| Fargo | -$3,100 | -$373,700 |
| Grand Forks | -$12,300 | -$621,000 |
| Grafton | $0 | -$42,100 |
| Drayton | -$500 | -$26,600 |
| Pembina | -$100 | -$11,200 |
| Morris | -$700 | -$86,200 |
| Letellier | -$1,100 | -$111,500 |
| | | |
| TOTAL | -$17,800 | -$1,298,600 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]If these values are zero, and the Additional Treatment Costs are non-zero, an alternate supply of water is being used. In this case, the softening costs of this alternate water supply are counted in the Additional Treatment Costs column.

[3]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

**Economic Analysis of Devils Lake Alternatives**
**Table TD.6.DR-6.8**

**Annual Benefits of Project Downstream of Devils Lake:**
**Industrial Water Users**
Scenario DR-6

**Damages: WITHOUT PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | A |
| Manitoba Hydro | $0 |
| American Crystal Sugar | $0 |
| **TOTAL** | $0 |

**Damages: WITH PROJECT[1]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | B |
| Manitoba Hydro | $19,900 |
| American Crystal Sugar | $1,100 |
| **TOTAL** | $21,000 |

**TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]**

| | Water Treatment |
|---|---|
| Industrial Water Users | Annualized Value for Water Treatment (2001 Dollars, Annualized over 50 Years) |
| | C = A - B |
| Manitoba Hydro | -$19,900 |
| American Crystal Sugar | -$1,100 |
| **TOTAL** | -$21,000 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.6.DR-6.9

### Annual Benefits of Project Downstream of Devils Lake: Flow-Related Features
Scenario DR-6

### Damages: WITHOUT PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | A |
| Agricultural- Crop Damage | $375,500 |
| Agricultural- Other | $134,800 |
| Urban (Lisbon and Valley City) | $6,292,100 |
| Transportation | $1,626,100 |
| | |
| TOTAL | $8,428,500 |

### Damages: WITH PROJECT[1]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | B |
| Agricultural- Crop Damage | $390,500 |
| Agricultural- Other | $137,100 |
| Urban (Lisbon and Valley City) | $6,506,000 |
| Transportation | $1,635,200 |
| | |
| TOTAL | $8,668,800 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| Feature | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | C = A - B |
| Agricultural- Crop Damage | -$15,000 |
| Agricultural- Other | -$2,300 |
| Urban (Lisbon and Valley City) | -$213,900 |
| Transportation | -$9,100 |
| | |
| TOTAL | -$240,300 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
## Table TD.6.DR-6.10

### Annual Benefits of Project Downstream of Devils Lake: Irrigation Water Users

Scenario DR-6

### Damages: WITHOUT PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **A** |
| **Total Irrigation Damage To Crops** | $6,400 |

### Damages: WITH PROJECT[1]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **B** |
| **Total Irrigation Damage To Crops** | $55,000 |

### TOTAL BENEFITS (DAMAGES PREVENTED BY PROJECT)[2]

| | Annualized Value of Damages (2001 Dollars, Annualized over 50 Years) |
|---|---|
| | **C = A - B** |
| **Total Irrigation Damage To Crops** | -$48,600 |

[1]Damage values presented in the "With Project" and "Without Project" tables are only an estimate of possible damages. The usefulness of these values, in and of themselves, is questionable. The difference between the "With" and "Without" damages are of more significance for the purposes of this study.

[2]A negative total benefit indicates that the project generated more damages than it prevented.

Note: All dollar values are present worth values annualized over a 50-year period at an interest rate of 6.375% and rounded to the nearest $100.
These results are from a single trace of 50-year flow data with and without the project.

## Economic Analysis of Devils Lake Alternatives
### Table TD.6.DR-6.11

### Cost and Benefit Summary: 4 Sets of Feature Strategies
Scenario DR-6

**(values in thousands of dollars)**

| | Sets of Feature Strategies | | | |
|---|---|---|---|---|
| | Based on Set of Cost-Effective Strategies [1] | Based on Set of Maximum Protection Strategies (at the First Decision/Action Level) [2] | Based on Set of No Flood Protection Strategies [3] | Based on Set of Most Likely Action Strategies [1,4] |
| **COSTS** | | | | |
| Outlet Construction | $129,230 | $129,230 | $129,230 | $129,230 |
| Outlet Operation and Maintenance | $11,788 | $11,788 | $11,788 | $11,788 |
| Hwy 19 Dam Construction | $0 | $0 | $0 | $0 |
| Hwy 19 Dam Operation and Maintenance | $0 | $0 | $0 | $0 |
| Expanded Infrastructure Measures (EIM) | $0 | $0 | $0 | $0 |
| EIM Operation and Maintenance | $0 | $0 | $0 | $0 |
| Upper Basin Management | $0 | $0 | $0 | $0 |
| Ion Exchange/Alternate Water Source Installation | $9,480 | $9,480 | $9,480 | $9,480 |
| Natural Resources Monitoring/Mitigation | $50,432 | $50,432 | $50,432 | $50,432 |
| **Total Costs: Present Value** | $200,930 | $200,930 | $200,930 | $200,930 |
| **Annualized Total Cost** | $13,420 | $13,420 | $13,420 | $13,420 |
| | | | | |
| **ANNUALIZED BENEFITS** | | | | |
| Annual Cost Savings and Damages Prevented: | | | | |
| Annual Reduction in ESAP Costs (Upland Storage) | $1 | $1 | $1 | $1 |
| Features Adjacent to Devils Lake | $0 | $0 | $4,906 | $331 |
| Downstream Features | -$1,626 | -$1,626 | -$1,626 | -$1,626 |
| **Total Annualized Benefit** | -$1,626 | -$1,626 | $3,281 | -$1,295 |
| | | | | |
| **NET BENEFIT** | -$15,046 | -$15,046 | -$10,139 | -$14,715 |
| | | | | |
| **BENEFIT-COST RATIO (BCR)** | -0.12 | -0.12 | 0.24 | -0.10 |

[1] The cost-effective and most likely action strategies analyzed include temporary closure of some roads and rail lines.

[2] The maximum protection at the first action level is based on the least costly strategy that provides maximum protection at the first decision/action level.

[3] These strategies assume that No flood protection measures are constructed. Restoration of roads and rail lines was included as a damage after the lake level recedes.

[4] These strategies assume that current pattern of flood protection measures will continue.

Note: These strategies pertain only to the features adjacent to Devils Lake.

Net Benefit is calculated by subtracting the annualized total costs from the annualized total benefits.

The Benefit-Cost Ratio is calculated by dividing the total annualized benefit by the total annualized cost.

**WITHOUT DOWNSTREAM IMPACTS**

| | | | | |
|---|---|---|---|---|
| Benefit-Cost Ratio (BCR) | 0.00 | 0.00 | 0.52 | 0.04 |
| Traces With BCR>1 | | | | |
| Total Number Out of 1 Trace | 0 | 0 | 0 | 0 |

Note: The BCR and Traces With BCR>1 shown in this table do not include values from the downstream features.

The values shown only reflect the impact of the selected features around Devils Lake on the economics of the project.