

PROJECT SUMMARY REPORT
FOR THE
LAKE BELLE VIEW RESTORATION PLANNING PROJECT

VILLAGE OF BELLEVILLE
DANE COUNTY
WISCONSIN

JANUARY 2009

PREPARED
FOR
THE VILLAGE OF BELLEVILLE LAKE COMMITTEE



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1 INTRODUCTION

1.1 BACKGROUND AND PURPOSE

The Village of Belleville, WI has been working on a plan to restore Lake Belle View for over thirty years. Planning has included several extensive engineering studies by private consultants and the U.S. Army Corps of Engineers (USACE) as well as many discussions with the Wisconsin Department of Natural Resources (WDNR) and Dane County. A special taxing referendum was passed that has generated approximately \$1 million for conducting activities associated with restoration of the Lake. However, due to a variety of circumstances associated with the complexity and cost of the project, the Village has not yet agreed upon or implemented a restoration plan for the Lake.

In September 2008, the Village hired a multidisciplinary team of consultants lead by Montgomery Associates to facilitate action on the restoration effort by reviewing previous studies and identifying restoration options and alternatives for the Village to consider. The Montgomery Associates team has been working with the Village Lake Committee since then in a series of working sessions that have identified and refined several lake restoration alternatives. This process is anticipated to conclude in January 2009 with recommendations for a phased lake restoration plan. This report provides a brief documentation of the investigations and analyses conducted for the Lake Committee, and the key elements of the recommended plan.

1.2 DATA SOURCES

Previous Studies

There have been many previous studies associated with restoration of Lake Belle View conducted over the past thirty years. The studies looked at a broad range of alternatives and provided significant watershed, ecological, engineering, and cost information.

The following is a summary of references reviewed in conducting this project.

Sugar River Reservoir Rehabilitation Engineering Study, R.A. Smith & Assoc., Inc., 1989

Lake Belle View Restoration Feasibility Study, MSA Professional Services, 1997

Lake Belle View Restoration Project – Lake Evaluation Studies Progress Report, MSA Professional Services, 1999

Wisconsin Department of Natural Resources River Management Protection Grant Application, MSA Professional Services, 2002

Definite Project Report with Integrated Environmental Assessment, Section 206 Lake Belle View Aquatic Restoration Project, US Army Corps of Engineers, 2004

Discussions with Prof. Ken Potter at the UW-Madison on the water resource management study report on Lake Belle View

Interviews

The project team performed confidential interviews with Lake Committee members as well as other members of the community selected by the Village as part of the first activities on the project. The list of people to be interviewed was determined by the Lake committee, with the intent of providing a broad cross-section of the interests involved, and including persons familiar with previous planning efforts. A



total of 14 people were interviewed. The interviews were conducted in September 2008, and provided a broad range of information including community perspective of previous studies and proposed alternatives, historical recollections of recreational use and park layout, and desired outcomes for a newly proposed lake restoration project. While the information obtained was wide ranging and included many perspectives, the interviewees expressed the following general sentiments:

1. Lake Belle View is a public asset and needs to be maintained as a lake;
2. Complete abandonment of the Lake by removal of the dam and restoration of free-flowing river conditions was not favored by 13 out of 14 of the interview respondents;
3. The restoration project should promote recreational uses such as human powered water sports and fishing through lake deepening;
4. The restoration project must be maintainable in the long-term;
5. The viewscape from the Park and Highway 69 should be maintained as a generally open water setting;
6. Measures should be taken to improve the overall water quality of the Lake; and
7. Restoration efforts should include mechanisms to improve the aesthetics and functionality of the "north channel".

Lake Committee Meetings

A total of four Lake Committee meetings were held to discuss options and progress, solicit Committee input, and receive questions and input from the general public present. Meetings were held at the Village Hall on the following dates:

- September 17th, 2008
- October 8th, 2008
- October 22nd, 2008
- December 17th, 2008

Lavalle Dam Removal Site Visit

Two Lake Committee members accompanied members of the project team to Lavallo, WI to view a project that removed a dam on the Baraboo River and created an offline pond. The site was chosen because it involved creation of an offline pond to minimize nutrient loading and maintain a millpond setting. The berm/dam used to separate the pond from the river was also used as greenspace/parkland. While the Lavallo project differs from the Lake Belle View project in that a dam removal is not proposed, the project does exhibit some of the aesthetic characteristics inherent with separation of the



Offline Pond at Lavallo, WI



river and lake portions of the system and provided a real world visual example.

Lake Belle View Data

Multiple site visits were performed by members of the project team to observe the general layout and physical conditions, collect elevation and layout data for the existing dam and millrace, and observe drawdown conditions associated with removal of the pedestrian bridge downstream of the dam. The most up-to-date HEC-RAS hydraulic model was obtained from the WDNR to aid in preparing schematic layouts and performing rudimentary impact analyses. Additionally, aerial photographs were taken while the Lake was drawn down in September 2008 to assist in the lake restoration planning and visualization.

1.3 LAKE DESCRIPTION

Watershed Characteristics

The Sugar River watershed upstream of Lake Belle View is approximately 172 square miles. Landuse primarily consists of agricultural practices, although a portion of Madison, WI falls within the watershed and the area around Verona, WI has been rapidly urbanizing in recent years and will likely continue to do so. Additionally, the Madison Metropolitan Sewerage District discharges treated effluent to Badger Mill Creek, which combines with the Upper Sugar River south of Verona, WI. The Upper Sugar River is considered a cold water fishery, although the area above Lake Belle View is considered a transitional zone between a warm water and cold water fishery and the area downstream is managed as a warm water fishery. The Sugar River delivers approximately 59,800 pounds per year of phosphorous to Lake Belle View (estimate from the Wisconsin Lake Modeling Suite – WiLMS), which contributes to the poor water quality within the Lake. Additional detailed watershed information is available in the previous studies prepared for Lake Belle View.



Aerial View of Lake Belle View During September 2008 Drawdown

Existing Lake Conditions

Lake Belle View is created by an impoundment of the Sugar River by a large concrete dam and a much smaller dam located in the location of the former millrace. The concrete dam underwent significant repairs and enhancements within the last 15 years and includes gates as well as multiple concrete spillway sections. The millrace dam consists of an approximately three foot wide



Detached Benthic Algae in Lake Belle View

rectangular weir with wood stoplogs.

The Lake consists of approximately 94 acres of open water and 18 acres of forested islands. The Lake is primarily 1-2 feet in depth with the deepest areas occurring near where the river enters the lake, around Firemen's Park and immediately upstream of the dam (*Figure 1*). The current fishery is dominated by rough fish and little to no rooted vegetation is present. The Lake is hyper-eutrophic, has very little aquatic vegetation (emergent or rooted) and has large quantities of filamentous/benthic algae.

2 PRELIMINARY ALTERNATIVE DEVELOPMENT

2.1 WATER QUALITY CONSIDERATIONS

The water quality within the Lake is a direct reflection of the landuse within the watershed. Urban and agricultural uses lead to suspended solids and nutrient inputs. These inputs manifest themselves by filling of the Lake over time and promoting conditions favorable to benthic and planktonic algae. Benthic algae grows on the bottom of waterbodies and occasionally detaches, which cause odor and visual issues. Planktonic algae clouds the water, causes odor issues, and on occasion, can result in toxic conditions for humans and animals. In contrast, lakes that receive limited surface water inflow or have undeveloped and unfarmed watersheds typically exhibit much better water quality. The water quality of Lake Belle View will not appreciably improve without minimization of the nutrient and sediment inflows from the Sugar River.

Phosphorus concentrations in excess of 30 parts per billion (ppb) promote algae growth. The mean concentration in the Sugar River is approximately 410 ppb, which is over ten times the level required to promote algae growth. *Table 2-1* compares the phosphorus loading in Lake Belle View with other regional impoundments. Note that the other impoundments, while having a much lower loading ratio, also suffer from phosphorus driven water quality issues.

Table 2-1 Comparison of Phosphorus Loading in Lake Belle View to Other Regional Impoundments

Impoundment Name	Volume (acre-feet)	Watershed Size (acres)	Phosphorus Loading (lb/yr) ¹	Yearly Phosphorous Loading Ration (lb/acre-foot)	Primary Water Quality Issues
Belle View	~210	109,000	59,822	285	Sediment, filamentous/benthic algae
Cox Hollow	1,037	3,894	3,582	3.5	Low level eutrophic, rooted plants, periodic planktonic algae
White Mound	1,144	4,474	2,172	1.9	Hyper-eutrophic, rooted plants, planktonic and filamentous algae
Twin Valley	1,718	3,863	2,265	1.3	Eutrophic, planktonic and filamentous algae
Blackhawk	3,260	9,560	5,012	1.5	Meso-eutrophic, rooted plants, filamentous algae, periodic planktonic algae

1 – Estimates from the Wisconsin Lake Modeling Suite

2.2 ALTERNATIVE DEVELOPMENT

The project team developed eight preliminary alternatives for the Lake Committee to consider for further refinement. The preliminary alternatives ranged from doing nothing to removal of the dam and included separated “river” and Lake sections as well as maintenance of the river/Lake connection. A full list and descriptions of the alternatives is included in *Appendix A*. The various alternatives were compared and contrasted in a number of categories specifically covering topics that were stressed in the individual interviews and during the initial meeting with the Lake Committee. A full list of alternatives, including alternatives that do not meet the project goals developed during the interview process, were

included in order to facilitate discussion by the Lake Committee and will be useful in permitting activities in the future

2.3 COMMITTEE SELECTIONS

The preliminary alternatives were presented to the Lake Committee on October 8th, 2008 (see presentation in *Appendix A*). The Committee instructed the project team to further develop Alternatives 4 and 6, which varied in the direction that the main flow of the river would be routed and the degree of Lake and river separation. More detailed plans were presented at the October 22nd, 2008 meeting at which time the Committee directed the project team to proceed with development of Alternative 6, including preparation of opinions of probable cost (see *Appendix A*).

3 PREFERRED ALTERNATIVE

3.1 DESCRIPTION

The preferred alternative, Alternative 6, consists of the following principle elements:

- Construction of a separation berm directing the main flow of the Sugar River over the dam and isolating the Lake from the high nutrient and high suspended solids flow for large storm events (25 – 100 yr, to be determined in design). The berm would roughly run from the northwestern most tip of Firemen’s Park and extend to a road right-of-way located in the Town of Montrose on the north side of the Lake. The separation berm would result in an approximately 40 acre surface area of Lake Belle View with an additional 30 acres of surface area on the river side of the berm.
- Drawdown of the Lake and possible rotenone treatment to remove a large portion of the rough fish (carp) population.
- Minor modifications to the millrace structure to act as the outlet control for the Lake.
- Dredging of the Lake to a maximum depth of 8 – 10 feet. The deepest areas would be located around the park to minimize the amount of rooted vegetation, although pockets of shallower areas could be included to promote fishing opportunities from shore.
- Placement of dredge material around the existing islands to enhance the islands and create additional habitat areas.
- Based on a screening level hydraulic analysis, the separation berm would cause an increase in the 100-year flood elevations on the Sugar River. In order to mitigate the increase, a minor modification to the dam sill would be required. The modification involves removing approximately nine inches from the highest portion of the sill.

This alternative has the following advantages:

- Separation of the Sugar River and the Lake significantly reduces the amount of sediment and nutrients transported by the Sugar River from entering the Lake, which will improve the overall water quality and increase the lifespan of any lake enhancement projects. Additionally, the separation allows for more targeted fish management options, such as carp control, and the establishment of a desirable, warm water fishery. Control of Lake water levels at the former millrace structure will allow for manipulation of water levels in the future as part of fish or habitat management, independent of flood or low flow conditions on the Sugar River. The benefits will also include an increase in the available habitats for various wetland, upland, and migratory animals, and a powerful educational opportunity for the Village and other interested parties in millpond management options.
- The Sugar River will flow in a pattern and velocity that will be much more similar to the current conditions upstream and downstream of the Lake. Additionally, separation of the river from the Lake will likely decrease the thermal impacts of the current millpond, provide increased riverine or near-riverine habitat, produce less sediment deposition, and if the fish ladder option is constructed, greater fish movement and migration potential.

- The berm could be used as a pedestrian walkway for wildlife observation or as a bike path connection for neighborhoods north of the Lake to the Park and downtown Belleville.
- Use of dredge material for island enhancement and habitat creation will provide multiple wildlife benefits along with being the most cost effective means for dredge material reuse. This area has the potential to be used for a variety of recreational purposes such as nature trails and an outdoor learning site.
- Separation of Lake Belle View from the Sugar River allows for greater flexibility in the management of both waterbodies in both the near and long-term. For example, modifications to the dam or construction of a fish ladder or recreational "kayak chute" on the river could be pursued on a separate timeframe from the restoration of the Lake.

3.2 PHASING AND SCOPE OPTIONS

Three potential options were prepared to illustrate the extent of restoration possible for a given monetary expenditure. These options should be considered as brackets of a potential project or potential phases of a project. The primary difference between the three options is the amount and depth of dredging conducted.

Initial Phase Option A

Option A was developed as the lowest cost alternative that would satisfy the majority of the Committee criteria. It includes all of the principle elements and advantages described above, but limits dredging to areas immediately around the Park (*Figure 2*). Additionally it does not include in-lake vegetation establishment. The opinion of probable cost for Option A is approximately \$1.6 million. The breakdown of costs is included in *Appendix B*.

Initial Phase Option B

Option B was developed as an alternative that would satisfy the majority of the Committee criteria and was within the potential budget noted by individuals interviewed. It includes all of the principle elements of Option A and also includes increasing the amount and depth of dredging and specifically includes removal of downed trees and dredging of the "north channel" area (*Figure 3*). Additionally a small amount of in-lake vegetation/fishery habitat was included in the cost estimate. The opinion of probable cost for Option B is approximately \$2.5 million. The breakdown of costs is included in *Appendix B*.

Full Lake Buildout

A Full Lake Buildout option was developed to illustrate a potential vision for the end phase of the Lake Restoration project and provide the Lake Committee with an idea of potential costs (*Figure 4*). The Full Lake Buildout option includes all of the elements in Options A and B above and also includes additional dredging to increase the depth of the Lake and additional in-lake vegetation/fishery habitat creation. The opinion of probable cost for full Lake Buildout is approximately \$5.5 million. The breakdown of costs is included in *Appendix B*.

3.3 COST DEVELOPMENT

Costs were developed using discussions with local contractors, cost estimating references, and engineering experience. Additionally, in order to develop costs for the options described above, a number of assumptions were required and included the following:

- The Lake and river would be drawn down, much like it was in September 2008, and the separation berm would be constructed using conventional road base material.
- After construction of the separation berm, the Lake would be drawn down further using the millrace structure. The Lake would be maintained in a drawn down state for at least three to six months to aid in the removal of rough fish and dewater/consolidate dredge material.
- Dredging for Options A and B and a portion of the Full Lake Buildout option would be conducted using mechanical means during the winter. All of the dredge material would be placed in the Lake for island and habitat enhancement.
- Approximately half of the dredging for the Full Lake Buildout option would be conducted by hydraulic means. All hydraulically dredged material would need to be disposed of off-site. We have assumed that the Village will negotiate with the identified landowners and no land acquisition / land lease costs have been included in the cost estimate.
- Depending on the final route of the separation berm, private land may be impacted. We have not included land acquisition costs in the opinion of probable costs.

3.4 REGULATORY COORDINATION

Members of the project team met with WDNR representative to discuss the selected alternative in regards to permitting feasibility. In general, the representatives were receptive to the project and indicated it was a step forward from existing conditions. They also indicated that the project would be able to receive the necessary permits depending on the details developed during preliminary engineering. The representatives did caution that restoration of the waterbody shouldn't be confined to the Lake; efforts should be made to discuss promoting fish passage around the dam and possibly incorporating these features into an additional phase of the complete project.

4 ITEMS FOR FUTURE CONSIDERATION

If a project is pursued by the Village, a number of items require consideration by the Lake Committee and the Village as a whole. These items include major decisions such as the initial extent of construction to design and community development items such as open space planning and pedestrian connection details.

4.1 PROJECT EXTENT AND PHASING

The Village needs to decide on the ultimate endpoint for the project and potential interim phasing options. Three potential options have been described within this report which brackets a potential restoration project. Additionally, since having the Lake drawn down for an extended period of time would facilitate mechanical dredging and potentially reduce overall costs, the Village needs to consider the timing of construction projects, fishery rehabilitation, and the potential impacts of having the Lake drawn down.

4.2 RECREATIONAL USE ADDITIONS

The separation berm and island/habitat enhancement offer a multitude of recreational possibilities. The Village should consider the potential for pedestrian connectivity from the areas north of the Lake to the Park and ultimately to downtown Belleville. Additionally, the Village should consider whether they want to promote pedestrian access to the island enhancement/habitat areas through the creation of nature trails or if they would prefer to discourage such access. These items should be in agreement with the Village's Master Plan or be considered as part of a new open space/downtown planning effort.

Since the separation berm would eliminate upstream connectivity via boat navigation, multiple portage locations could be included at the Park or along the berm itself. Additionally, access could be promoted to both the river and the Lake via multiple small watercraft launches.

4.3 RIVER MANAGEMENT SUPPLEMENTAL TO LAKE PROJECT

In discussions with the WDNR, fish passage and management/restoration of the Sugar River were stressed as being very important. Additionally, the WDNR expressed that funds may be available to assist in construction of a fish passage feature. The Village should consider the potential for a fish ladder. The fish ladder could potentially be designed to include other recreational benefits, such as a kayak run similar to the Wausau Whitewater Park.

4.4 REGULATORY COORDINATION

Close coordination with the various regulatory entities involved in permitting the Lake Restoration Project should be initiated as soon as possible to shorten the permitting timeline and provide avenues for design feedback. Dredging of, or filling on, the Lake bottom will require several permits from multiple regulatory agencies. A brief summary of the potential regulatory entities along with the various permit programs is summarized below.

USACE

- Section 404 Clean Water Act permitting
- Section 10 Navigable Waters Act permitting

WDNR

- Navigable Waters (Dredging, Placement of Fill, Structures)
 - a. Authorized by Ch. 30 of the State Statutes
 - b. Regulated under Wisconsin Administrative Code Chapters NR 300 – 329 and NR 340 – 353
- Dam Ownership
 - a. Authorized by Ch. 31 of the State Statutes
 - b. Regulated under Wisconsin Administrative Code Chapters NR 300 – 335
- Floodplain
 - a. Locally implemented but must meet the requirements listed in Wisconsin Administrative Code Chapter NR 116
- Wetland Fill
 - a. Section 401 Water Quality Certification (related to USACE Section 404 Permitting)
- Erosion Control
 - a. Regulated under Wisconsin Administrative Code Chapters NR 216 and NR 151
- Codified Authorizations
 - a. Lake Belle View has a codified authorization in the State Statutes under Ch. 30.2026 allowing placement of fill on the bed of the Lake for a number of uses including enhancement of aesthetics and recreation and separating the river from the Lake.
 - b. The authorization still requires WDNR “approval”

Dane County/Local

- Floodplain
 - a. Zoning approval, as mandated by WDNR
- Shoreland Zoning and Erosion Control

4.5 NON-GOVERNMENTAL ORGANIZATION COORDINATION

Non-Governmental Organizations (NGOs), such as Wings over Wisconsin or Ducks Unlimited, should be engaged to provide design assistance and feedback and potentially help identify additional funding sources. Additionally, non-regulatory agencies such as the Natural Resource Conservation Service may be able to provide design assistance to offset project costs.

4.6 IDENTIFYING OTHER FUNDING SOURCES

In addition to discussions with NGOs, the Village should begin identifying potential private and local, state, and federal funding opportunities. Several applicable grant programs exist, such as DNR’s River and Lake Protection Grant Program, and these programs typically have application deadlines. Additionally, the Village should coordinate with state and federal representatives to determine potential funding possibilities available under economic stimulus programs.

FIGURES

APPENDIX A
PRELIMINARY ALTERNATIVE MATRIX
LAKE COMMITTEE PRESENTATIONS

APPENDIX B
OPINIONS OF PROBABLE COSTS

APPENDIX C
OCTOBER 1ST, 2008 AERIAL PHOTOGRAPHS