LAKE BELLE VIEW / SUGAR RIVER RESTORATION PROJECT SUMMARY
JULY 2011

PROJECT SETTING

Lake Belle View is a shallow millpond located approximately 20 miles southwest of Madison on the Sugar River in the Village of Belleville, Dane County, Wisconsin. Two rivers, the Sugar River and the West Branch Sugar River, converge several miles upstream, feeding into Lake Belle View. The watershed above Lake Belle View is approximately 172 square miles. The Sugar River, classified as an Exceptional Resource Water (ERW), has a watershed that is highly agricultural and experiencing rapid urban growth. The project area is 133 acres and includes Lake Belle View, the Sugar River, and floodplain forest /other wetland communities.

DESCRIPTION OF PROJECT

The Lake Belle View / Sugar River Restoration project has enhanced ecological conditions in the lake and the river in a long-term sustainable manner, while also satisfying the strong desire to maintain Lake Belle View as a centerpiece of the community's cultural, aesthetic and recreational assets. This is been a long process involving many meetings over multiple decades.

This project is unique in its approach to the lake and river separation by maintaining both bodies of water while allowing the river to run continuously past the lake. This comprehensive project can serve as a national model for other millponds and rivers in Wisconsin, and the United States. The project will provide an alternative to an "all or nothing" scenario. Primary water renewal flow to the lake will be groundwater inflow, estimated to be approximately 1,100 acre-ft/yr. Additional future project activities may include further deepening of a portion of the lake and construction of fish passage features to meet longer-term objectives.

Specific goals of the project include:

- Improve lake and river water quality
- Improve habitat for fish, birds and other wildlife; in particular to expand the floodplain forest wetlands
- Decrease sedimentation and water quality impacts from the Sugar River
- Enhance recreational opportunities
- Increase lake depth and improve river functions
- Enable a stable long-term River and Lake management program
- Enhance aesthetics, and specifically preserve the lake, islands and basic viewscape
- Preserve the aesthetics and functions of the Village Community Park

The principal construction elements of the Lake Belle Ville / Sugar Restoration project include:

1. An earthen berm separating Lake Belle View from the Sugar River, extending from the Community Park to the north end of the lake, has been constructed. This 3200-foot berm now isolates the lake from the high nutrient and high suspended solids loads in the Sugar River for all but the largest flood events. The Sugar River flows around the west side of the

lake, and discharges over the existing dam. Berm and landscaping construction is complete. This project is now being monitored for proper vegetation restoration. Water clarity has been greatly improved as noted on the before and after photos included at the end of this report. Note the high sediment load within the Sugar River and the visibility of the bottom in the newly restored portion of Lake Belle View.

To prevent any floodplain increases the berm is designed to overtop at specially constructed overflow sections to allow events that are greater than the 25-year flood to pass into the lake. The general construction of the berm allows for portage and passage of small personal watercraft between the lake and river system.

2. Modifications to the millrace structure, now complete, within Community Park allow regulation of the water level for the Lake separately from the control of the Sugar River provided by the dam. Operation of the structure will allow water level manipulation to mimic floodplain hydroperiods and to manage the lake fishery and wildlife functions.

3. Regrading and restoration of existing lake-bottom sediment under drawdown conditions is complete. This has created the opportunity for new wetland and floodplain forest habitat as well as significantly improving the littoral zone and enhancing existing wetland and floodplain forest habitat. Additionally, variability in lake depth has been created in order to significantly increase lake habitat variability for fishery and recreation improvement.

4. Restoration of a warm water fishery through fish stocking and transfer of native species from the Sugar River to Lake Belle View to increase diversity is in progress. Four transfers, assisted by DNR staff, have been completed and additional stocking of commercially available species will be conducted this fall (*See attached report).* Qualitative observations indicate significant reproduction of forage species (fathead minnows) as well as the absence of common carp.

5. The main wetland habitat areas have been built. The soil is still too wet in many areas for access to the site to finish grading so the areas have been temporarily stabilized. The contractor will complete the grading by October 15 after which seeding dormant seeding of native vegetation will take place. Emergent zone areas have already been seeded and qualitative observations indicate a healthy population of volunteer native species including arrowhead and rice cut grass. Additionally, the Village recently awarded a contract to perform vegetation maintenance and establishment for the next four years. This work includes control of invasive species in the existing island, new habitat areas and emergent zones; maintenance of native vegetation; seeding of additional forbs and sedges to increase plant diversity; and seeding and planting of trees for long-term establishment of forested areas including floodplain forest..

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DESCRIPTION OF PROBLEMS ADDRESSED BY COMPREHENSIVE PROJECT

Surface runoff from agricultural and urban areas in the Sugar River watershed has carried large loads of sediment and nutrients into Lake Belle View, leading to substantial water quality issues. It is estimated that at least 4 feet of river-borne sediment has accumulated in the lake since 1926; resulting in a mean depth of 2 feet and a maximum depth of less than 6 feet in the 92-acre lake. The lake has the distinctive water quality and fishery problems associated with aging impoundments including sedimentation, turbidity, lack of aquatic plant diversity, excessive nutrients and algal blooms. Excessive nutrient enrichment fuels benthic algae that floats to the surface and reduces water clarity. Associated oxygen level reduction has significantly reduced water quality in the lake and negatively affected the entire riverine ecosystem. Surface runoff from agricultural and urban areas draining into the lake and river has magnified water quality issues. The Wisconsin Tropic State Index (WTSI) indicates that values for Lake Belle View are 68 for Secchi depth, chlorophyll a and total phosphorus. The public beach on Lake Belle View was closed after WDNR monitoring detected high fecal coliform bacteria levels throughout the 1970s. The quality of the river system is further reduced by the extensive warming of the water by the shallow turbid lake resulting in a warming of the Sugar River and thermal pollution downstream of the dam.

The lake acts as a virtual fish hatchery for the carp population and has been described as a "carp factory". The slow and steady infiltration of sediment over many years has increased the amount of shallow water; contributing to a habitat that only supports rough fish and environmentally tolerant invertebrates. The prolific common carp population that is recruited within the existing millpond has largely eliminated emergent, floating leaf and submergent aquatic plants. The Water Resource Management (WRM) Workshop through the University of Wisconsin - Madison conducted several surveys of the lake including vegetation and invertebrates. The results of those surveys show that species diversity is low in the lake itself, but downstream of the dam a more diverse macro invertebrate population exists. An aquatic plant survey contracted by the Village in 2009 noted the presence of only two rooted species, curly-leaf pondweed (exotic) at 15.9% of the sites and sago pondweed at only 2.9% of the sites. Marshall and Stewart, 1993, sampled the upstream fishery and found 28 species. The spawning areas for more desirable game fish species have been destroyed. Carp populations are not only a result of, but also contribute to, the water quality problems in the lake through re-suspension of bottom sediments when scavenging

Lake Belle View currently contains eroding floodplain forest habitat. The most extensive occurrences of floodplain forest are found along rivers of southern Wisconsin, but the community also occurs at scattered locations in the north. Northern occurrences of this type tend to be less extensive, are often discontinuous, and are relatively species-poor compared to those in the south. At present, Wisconsin has lost 47% of its original ten million acres of wetlands. Many of the remaining 5.3 million acres are in the northern third of the state (Wisconsin DNR 1990). In some southern Wisconsin counties, the amount of wetland loss is well over 75%. Wisconsin's losses are reflective of the national status of wetlands; it is estimated that one-half of the nation's original 221 million acres of wetlands have been lost (Feierabend 1992). A large amount of remaining acreage in Wisconsin exists in a partly altered state, such as with old drainage ditches still functional enough to

change the hydrology of the wetland. Much of this remaining wetland acreage was at one time disturbed, either by drainage (followed by restoration) or by being cleared, repeatedly burned, grazed, or periodically plowed (Curtis 1959). Disturbance and other factors have opened many wetlands to invasion by non-native invasive species that can reduce the ecological value of wetlands.

PROJECT COST

Construction contract alone is $2.3 million, compromised mainly of past tax levies, DNR and Dane County funding contributions, and a $1.495 million borrowing.

PROJECT RESULTS

- Water Quality Improvement - Significant qualitative improvement in the water quality of the restored portion of the lake has been observed (Photos 2 & 4). Photo2 clearly indicates significant improvement in water clarity when comparing the Sugar River on the west side of the separation berm to the restored portion of Lake Belle View on the east side of the separation berm. Quantitative measurements of water quality improvement will be collected starting this fall and will be ongoing for at least the next five years per permit requirements.

- Ecological Enhancement – The improvement of the ecological environment of the lake will be an ongoing effort. However, observations of volunteer native emergent species such as arrowhead and rice cut grass as well as observations of submergent species such as long-leaf pondweed are evidence that the ecological environment has improved. The lake was partially refilled this year and the majority of the inflow was made up of groundwater with a smaller fraction being surface water runoff from the reduced watershed. Between April 30 and May 22, there was very little precipitation, yet the lake stage increased by about 1.5 feet, an average of ~ 0.9 inches per day. Water continues to flow out of the outlet for the lake, indicating a net inflow of groundwater.

FUTURE MANAGEMENT OF LAKE

The Village of Belleville will continue to manage their erosion and sediment control ordinances to minimize future lake loadings. Long-term management will include maintenance activities such as mowing and muskrat control to ensure integrity of the berm. Filamentous algae removal was completed by Dane County in July 2011, which resulted in a net export of phosphorous from the system. Following initial establishment of wetland trees, such as river birch, swamp white, oak, silver maples, etc. grass control will be completed as needed to ensure tree survival. Longer-term management of water levels will be conducted to mimic, as close as possible, natural conditions for floodplain forests.

In cooperation with the WI DNR, carp was eliminated from the lake system during initial construction followed by restocking of desirable fish species. Long-term control of carp

populations, if necessary, will be conducted to maintain a desirable aquatic plant and fish community in the lake. The Village has committed to work closely with the DNR to adaptively manage carp populations, including identifying methods and levels of removal effort.

TIMETABLE

Task	Status
Village Board Approval of Preferred Alternative / Permitting Process and Preliminary Engineering	Complete
Permitting Process (USACE and DNR Chapter 30)and Preliminary Engineering	Received
Contract Awarded	Complete June 2010
Berm Construction & Earthwork	Complete
Wetlands Restoration – Delay caused by wet spring	Fall 2011 - ongoing
Lake Refilling to Begin (1-ft Low)	April 2011
Project Completed / Lake Refilling Complete	August 2012

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Photo 1: Lake Belle View Prior to Construction (2010 Drawdown)

Photo 2: Lake Belle View After Construction of Separation Berm, Lake Deepening, and Habitat Earthwork (June 2011)

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Photo 3: Separation Berm and Walking Path (June 2011)

Photo 4: North Channel Portion of Lake Belle View Water Depths ~4 feet - Note the Water Clarity (June 2011)