

**WHITE PAPER NO. 4 –
DAMS IN WISCONSIN AND ON THE LOWER FOX RIVER**

Response to Comments by The Fox River Group

**COMMENTS OF THE FOX RIVER GROUP ON THE
WISCONSIN DEPARTMENT OF NATURAL RESOURCES'
DRAFT REMEDIAL INVESTIGATION, DRAFT FEASIBILITY STUDY
DRAFT BASELINE HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT
AND PROPOSED PLAN**

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ABSTRACT

In October 2001, the Wisconsin Department of Natural Resources (WDNR) and United States Environmental Protection Agency (EPA) released the *Proposed Remedial Action Plan, Lower Fox River and Green Bay* (Proposed Plan) (WDNR and EPA, 2001) for remediation on the Lower Fox River and Green Bay and other supporting documents for public input. Numerous comments were received from the public including comments concerning the dams that are located on the Lower Fox River. To assist in responding to these comments, the WDNR prepared the following review of the River dams.

This evaluation found that the dams on the Lower Fox River are subject to state and federal regulation, that most of the dams are regulated for energy production and are not primarily flood control structures, that there are no plans to remove any of the dams, and there is concern regarding the release of upstream contaminated sediment in the event of a dam removal or failure. Inspection and dam stability information on the dams owned and operated by the United States Army Corp of Engineers (USACE) reveals that the dams are regularly inspected, have post-inspection maintenance conducted, and have no significant stability concerns.

BACKGROUND

The first dam built in Wisconsin was built in 1809 to provide power for a sawmill on the Fox River at De Pere. Black River saw its first sawmill in 1819, and in 1831 one was built on the Wisconsin River. These early dams aided people in providing flowages for transporting goods, and for powering lumber and grain mills. The first state regulation of dams began with the Milldam Act, a part of the Wisconsin Territorial Laws of 1840, No. 48. The purpose of this act was to encourage the construction of mill-powering dams by permitting the flooding of the land of others without acquiring easements for millponds. These early dams provided for and encouraged settlement in Wisconsin.

In 1841, dams on navigable streams were required to obtain legislative permission, as a part of the Wisconsin Territorial Laws of 1841, No. 9. This helped encourage economic development, as well as protect the public interest in waterways. The Milldam Act was repealed in 1849 (Chapter 157), as the constitutionality of preventing compensation by flooded landowners was challenged at the Wisconsin Supreme Court. The impoundments created by dams were viewed as a public resource, and therefore it was argued that private land, such as the land being flooded by these dams, could not be taken from its landowners for public use without compensation being given to the landowner. In 1857, the Milldam Act was revived under Chapter 62, Laws of 1857, but was repealed and recreated in 1858. In a court case in 1860, it was stated by the court that the Milldam Act would be overruled if it were not for precedent and economic benefits, and therefore the Milldam Act was constitutional.

In 1863, it was declared that navigable waterways are public highways. In the following years, the “sawlog” test was developed to determine navigability. In 1909, the legislature decided they no longer had the time or expertise to issue permits for dams and that responsibility was given to state agencies.

For much of the early 1900s, the Railroad Commission and then the Public Service Commission (PSC) had jurisdiction over dams. Laws changed over the years to address issues such as the rights of upstream and downstream landowners, the debate over navigable and non-navigable rivers, and public safety rights. In 1967, the WDNR was created, and jurisdiction over dams was handed over from the PSC to the WDNR. In the early 1980s, the WDNR developed standards for design, construction, and reconstruction of large dams, and enacted Warning Sign and Portages for Dams rules for public safety. In 1991, procedures for implementation of a dam maintenance, repair, modification, or abandonment grant program were put into place.

The WDNR currently deals with permitting for new dam construction, repairs, reconstruction, ownership transfers, and abandonment. Many dams in the state have been in place since the late 1800s, and a great deal of time must be invested in inspecting aging dams and making sure they comply with public safety requirements and environmental regulations.

WISCONSIN DAMS

There are approximately 3,700 dams inventoried in the State of Wisconsin. An additional 700 dams have been built and washed out or removed since the late 19th century. The federal government has jurisdiction over large dams that produce hydroelectricity – approximately 5 percent of the dams in Wisconsin. The WDNR regulates most of the rest of the dams. Approximately 50 percent of the dams in Wisconsin are owned by private individuals, 19 percent by the State of Wisconsin, 16 percent by municipalities such as townships or county governments, and 15 percent by other ownership types.

A dam with a structural height of over 6 feet and impounding 50 acre-feet or more, or having a structural height of 25 feet or more and impounding more than 15 acre-feet is classified as a large dam. There are approximately 1,200 large dams in Wisconsin. Dams are classified as *High Hazard* when their failure would put lives at risk. The “hazard” rating is not based on the physical attributes, quality, or strength of the dam itself, but rather the possibility of loss of life and property should the dam fail.

The Public Trust Doctrine emanates from Article IX, Section 1 of the Wisconsin Constitution. It states that all rivers, lakes, and navigable waterways are under the jurisdiction of the State of Wisconsin. Any structure which is built on a waterway impacts the public rights to that waterway, and needs to be monitored by the State of Wisconsin to assure safety, water quality, public access, and monitor its impact on Wisconsin wildlife.

Dam Safety Program

Chapter 31, created in 1917 under the Water Power Law, was developed to ensure that dams are safely built, operated, and maintained. NR 333 provides design and construction standards for large dams and NR 335 covers the administration of the Municipal Dam Repair and Removal Grant Program. WDNR is responsible for administration of these regulations. Chapter 31 covers:

- Dam permitting;
- Dam construction;
- Dam safety, operation, and maintenance;
- Alteration or repair of dams;
- Dam transfer and dam removal; and
- Water level and flow control.

In regards to dam safety inspections, Chapter 31.19 requires the department to inspect all of the large dams on navigable waterways once every 10 years. However, WDNR does not typically inspect dams that are regulated by a federal agency.

Dam Removal

Dams have been built and removed in Wisconsin for almost 200 years. In the early years, when a dam no longer provided a functional or economic purpose it was removed from the stream. Many of the dams in the state today have been in place for years. While many of these no longer provide their original function, they have become a part of the communities' identity. This can make decisions about whether to perform costly upgrades to dams or remove them very difficult.

The WDNR is required to review and approve all applications for dam abandonment and removal. Consideration of abandonment/removal has usually come about because of a failure incident or as the result of a WDNR inspection that found significant defects that requires major repairs to correct. Economic, social, and environmental factors all play a significant role in the decision to remove dams.

HISTORY AND POLICY

In recent decades, Wisconsin has seen a large number of its historic dams aging and falling into disrepair. In most cases, WDNR has remained neutral in the decision-making process, only seeking to correct safety deficiencies at dams. As dam removals have been accomplished over the last 20 years, significant improvements have been noted in water quality, habitat, and biodiversity at many of these sites. In light of this, in recent years, WDNR has advocated for the removal of certain dams for the purpose of stream and habitat restoration.

In all cases, WDNR's activities related to dam removal included assuring the project meets the statutory requirements of Chapter 31 and is completed in a manner that protects the public rights in navigable waters and public safety. In cases where we advocate dam removal, we have participated in public information meetings to explain the benefits of

dam removal to the surrounding ecosystem and assisting with funding to accomplish removal and restoration activities. In the future, these types of efforts will probably continue on a selective basis, driven by watershed plans that identify dams that are most detrimental to the ecosystem. These efforts cannot be accomplished without a willing owner or if there is a responsible party that is willing and able to take over ownership of the dam and properly operate and maintain the structure.

Almost 100 dams have been removed from Wisconsin streams since 1967. The dam inventory lists over 900 dams that have been built and removed since the 1800s. Removed dams have ranged in size from small dams on trout streams such as the Cartwright dam on Shell Creek, medium size dams such as the Ontario dam on the Kickapoo River, and fairly large dams on warm-water streams such as the North Avenue dam on the Milwaukee River.

REASONS FOR REMOVAL

The three major reasons for dam removals in Wisconsin are:

- Removal of an unsafe structure under Chapter 31.19 of our state statutes. Under Chapter 31.19 the WDNR is required to inspect “large” dams at least once every 10 years to ensure their safety.
- Chapter 31.187 charges the WDNR with removing “abandoned” dams when either no owner is found or the owner or owners are not able to fund repairs.
- In a few cases, WDNR has removed or proposed to remove dams that have a significant environmental impact. Many of those are on WDNR properties.

DECISION-MAKING PROCESS

The normal process in which a removal might be considered would involve a dam that has been identified as deficient through a failure or an inspection. The dam owner would then be contacted if an owner can be identified, and notified of the problems and given a timeline to correct all deficiencies. An official order may be given, ordering the dam owner to either perform the needed repairs or remove the structure – repair or removal is their choice. If the dam owner is considering removal, or if it is not economically feasible for the dam owner to repair the dam (dam removal generally costs one-third of estimated reconstruction costs), the owner submits an application to abandon the permit of the dam and a plan for removal of the structure. At this point, a public information meeting is often held, in which the WDNR explains the situation and gains public input. If the owner chooses to pursue dam removal, an Environmental Assessment may then be prepared, followed by public notice, which provides the opportunity for a contested case hearing. Once these steps are complete, a permit to abandon the dam will be issued with conditions for removal.

ENVIRONMENTAL BENEFITS

With regard to resource management, the most significant benefits of dam removal include:

- Reconnection of important seasonal fish habitat;
- Normalized temperature regimes;
- Improved water clarity (in most cases);
- Improved dissolved oxygen concentrations;
- Normalized sediment and energy transport; and
- Improved biological diversity.

In general, carp prefer the warm waters of an impoundment, yet when a dam is removed the cool water species such as trout and bass, generally preferred by anglers, can move back into the river and repopulate.

Dams on the Lower Fox River

Table 1, Lower Fox River Dam, is a summary of the location and pertinent information on the dams for the Lower Fox River from Lake Winnebago to Green Bay. In that stretch of the River, there are 13 existing dams and one dam that was abandoned. Of the existing dams, all are classified as large. Nine of these dams have a high hazard potential while four have a significant hazard rating. A majority of these dams (11) are licensed by the Federal Energy Regulatory Commission, suggesting that the dams' primary purpose is energy related, not flood control. While all of the dams have some potential for the release of contaminated sediments from upstream sediment deposits, the database maintained by the WDNR's Dam Safety Program specifically lists the releases of contaminated sediments as a concern relative to dam failure scenarios or immediate need for drawdowns for six of these dams.

Joint dam ownership is quite common for the dams along the Fox River. Eight dams have at least partial ownership by the USACE. Sections of some of these dams are also under private ownership. Negotiations are continuing between the State of Wisconsin and the USACE relative to transfer to the state the "transportation locks" portion from the USACE. The USACE (and co-owners) will retain the ownership of the dams. At this time, the WDNR is not aware of any plans to remove any of these dams. Of the Lower Fox River dams, WDNR Dam Safety staff has indicated that the De Pere dam may be in need of repairs; however, they do not believe that there is a concern of a catastrophic failure.

Inspection and Stability of Dams Owned or Partially Owned by the USACE

Eight of the dams on the Lower Fox River from Lake Winnebago to the mouth of the Fox River at Green Bay are either fully or partially owned by the USACE. The WDNR reviewed past periodic inspection and the conclusions of stability analysis for each of these dams. The results of this review are found in Table 2, Lower Fox River – U.S. Army Corps of Engineers – Dam Stability and Inspection Information, of this summary. In general, the stability analysis indicated that the spillway and sluiceway sections of the

dams have adequate compression to resist overturning, and they have adequate bearing capacity to support the maximum base pressure. While inspections did reveal various potential problems, such as the need for concrete repairs, the overall conclusion of the reports were that dams were found to be in good condition overall and no structural deficiencies were found which would affect the operation of the dam. Many of the inspection reports recommended development of a plan to prioritize concrete the repairs for the dams on the Fox River over a subsequent 5-year period. The USACE has stated that maintenance recommended by the routine inspection is conducted.

REFERENCES

This information is from WDNR's Dam Safety, Floodplain, and Shoreland Program's website concerning dam safety. In addition, the website provide more information such as frequently asked questions about the dams in Wisconsin. This website can be viewed at <http://www.dnr.state.wi.us/org/water/wm/dsfm/dams/index.html>.

The sources of information for Table 2 included copies of the inspection reports and the conclusions of the stability analysis including:

- *Menasha Dam, Dam Stability Analysis, Fox River, Wisconsin.* United States Army Corps of Engineers, Detroit District, NCD. December 1987.
- *Menasha Dam, Fourth Periodic Inspection, Fox River, Wisconsin.* United States Army Corps of Engineers, Detroit District. August 23, 1994.
- *Appleton Lower Dam, Dam Stability Analysis, Fox River, Wisconsin, Final Report.* United States Army Corps of Engineers, Detroit District. January 1997.
- *Appleton Upper Dam, Dam Stability Analysis, Fox River, Wisconsin, Final Report.* United States Army Corps of Engineers, Detroit District. September 1985.
- *Appleton Dams, Fifth Periodic Inspection, Fox River, Wisconsin.* United States Army Corps of Engineers, Detroit District. June 7, 1995.
- *Cedars Dam, Dam Stability Analysis, Fox River, Wisconsin, Final Report.* United States Army Corps of Engineers, Detroit District. January 1997.
- *Cedars Dam, Fifth Periodic Inspection, Fox River, Wisconsin.* United States Army Corps of Engineers, Detroit District. June 6, 1995.
- *Rapide Croche Dam, Dam Stability Analysis, Fox River, Wisconsin, Final Report.* United States Army Corps of Engineers, Detroit District. May 1997.
- *Rapide Croche Dam, Fourth Periodic Inspection, Fox River, Wisconsin.* United States Army Corps of Engineers, Detroit District. August 24, 1994.

- *Little Chute Dam, Stability Analysis, Fox River, Wisconsin, Final Report.* United States Army Corps of Engineers, Detroit District. April 1997.
- *Little Chute Dam, Fifth Periodic Inspection, Fox River, Wisconsin.* United States Army Corps of Engineers, Detroit District. May 22, 1996.
- *Little Kaukauna Dam, Stability Analysis, Fox River, Wisconsin, Final Report.* United States Army Corps of Engineers, Detroit District. November 1996.
- *Little Kaukauna Dam, Fifth Periodic Inspection, Fox River, Wisconsin.* United States Army Corps of Engineers, Detroit District. May 26, 1996.
- *Kaukauna Dam, Stability Analysis, Fox River, Wisconsin, Final Report.* United States Army Corps of Engineers, Detroit District. May 1997.
- *Kaukauna Dam, Fifth Periodic Inspection, Fox River, Wisconsin.* United States Army Corps of Engineers, Detroit District. May 21, 1996.
- *De Pere Dam, Stability Analysis, Fox River, Wisconsin, Final Report.* United States Army Corps of Engineers, Detroit District. April 1997.
- *De Pere Dam, Fifth Periodic Inspection, Fox River, Wisconsin.* United States Army Corps of Engineers, Detroit District. June 8, 1995.

WDNR and EPA, 2001. *Proposed Remedial Action Plan, Lower Fox River and Green Bay.* Wisconsin Department of Natural Resources, Madison, Wisconsin and Green Bay, Wisconsin and United States Environmental Protection Agency, Region 5, Chicago, Illinois. October.

TABLE 1 LOWER FOX RIVER DAM

Dam Seq. No.	Dam Official Name/ Popular Name	Field File No.	FERC License No.	Dam Size ¹	Owner Name	Hydraulic Height (feet)	Structure Height (feet)	Impound. Surface Area (acres)	Max. Impound. Storage (acre/ft)	Hazard Potential ²
601	Neenah	70.03		Large	Neenah & Menasha Power Co.	9.0	15.0	137,708.0	1,100,000.0	High
757	Menasha	70.02	2352	Large	USACE	9.0	16.0	280.0	1,300,000.0	High
789	Upper Appleton/ Vulcan	44.03	2895	Large	USACE & others	14.0	22.0	1,306.0	14,300.0	High
166	Middle Appleton	44.02	2807	Large	Fox Valley Corp.	10.0	18.0	35.0	200.0	High
788	Lower Appleton	44.01		Large	USACE	9.0	15.0	50.0	520.0	High
790	Kimberly/Cedars	44.07	10674	Large	USACE	12.0	16.0	270.0	2,300.0	High
722	Little Chute	44.11	2588	Large	USACE & others	14.0	18.0	80.0	660.0	Significant
720	Combined Locks	44.04	2715	Large	City of Kaukauna	20.0	30.0	130.0	1,040.0	Significant
81	Kaukauna/Upper Kaukauna	44.06	1510	Large	DAEN NCC, City of Kaukauna	25.0	27.0	120.0	800.0	High
4222	Middle Kaukauna	44.09			Outagamie Paper Co.	12.0				Abandoned
721	Lower Kaukauna/City Plant & Badger	44.08	2677	Large	City of Kaukauna	9.0	16.0	40.0	200.0	High
791	Rapide Croche	44.10	2677	Large	USACE	10.0	14.0	530.0	7,000.0	High
805	Little Kaukauna/Little Rapids	5.02	11596	Large	USACE & others	7.0	16.0	344.0	4,240.0	
804	De Pere	5.01	4914	Large	USACE & others	8.0	17.0	994.0	8,240.0	

Notes:

¹ Dam Size. A dam with a structural height of over 6 feet and impounding 50 acre-feet or more, or having a structural height of 25 feet or more and impounding more than 15 acre-feet is classified as a large dam.

² Hazard. Dams are classified as High Hazard when their failure would put lives at risk. The “hazard” rating is not based on the physical attributes, quality, or strength of the dam itself, but rather the possibility of loss of life and property should the dam fail.

TABLE 2 LOWER FOX RIVER – U.S. ARMY CORPS OF ENGINEERS – DAM STABILITY AND INSPECTION INFORMATION

Name	Stability		Inspection	
	Date	Comments from analysis	Date	Comments from analysis
Menasha Dam	December 1987	Spillway meets current structural stability requirements. Sluiceway areas of scour need immediate repair; areas of little or no scour meet stability criteria.	August 1994	Menasha dam is in good condition overall and no structural deficiencies were found which would affect the operation of the dam. In 1989, 1,200 tons of armor stone were placed to fill scour holes.
Appleton Lower Dam	January 1997	Spillway and sluiceway sections have adequate compression to resist overturning and the have adequate bearing capacity to support the maximum base pressure.	June 1995	Appleton lower dam was found to be in satisfactory condition, but can be expected to degrade with time. No significant structural deficiencies were found that would affect safety or operation of the dam.
Appleton Upper Dam	September 1985	The analysis indicated that the Appleton upper dam monoliths meet current stability criteria, including sliding, overturning and bearing capacity requirements.	June 1995	Appleton upper dam was found to be in satisfactory condition, but can be expected to degrade with time. No significant structural deficiencies were found that would affect safety or operation of the dam.
Cedars Dam	January 1997	Spillway and sluiceway sections have adequate compression to resist overturning and the have adequate bearing capacity to support the maximum base pressure.	June 1995	The Cedars dam was found to be in satisfactory condition. No significant structural deficiencies were found that would affect safety or operation of the dam.
Little Chute	April 1997	Spillway and sluiceway sections have adequate compression to resist overturning and the have adequate bearing capacity to support the maximum base pressure.	May 1996	The Little Chute dam was found to be in acceptable condition. The areas of main concern are along the earthen structures that connect the concrete dam to high ground. The project can be expected to perform safely if the recommendations made in the inspection report are implemented.
Rapide Croche	May 1997	Spillway and sluiceway sections have adequate compression to resist overturning and the have adequate bearing capacity to support the maximum base pressure.	August 1994	The Rapide Croche dam was found to be in acceptable condition. The concrete of the piers is in various stages of deterioration, and can be expected to continue to degrade. The project can be expected to perform safely, but with maintenance and importance of detailed inspections will increase with age.

TABLE 2 LOWER FOX RIVER – U.S. ARMY CORPS OF ENGINEERS – DAM STABILITY AND INSPECTION INFORMATION

Name	Stability		Inspection	
	Date	Comments from analysis	Date	Comments from analysis
Little Kaukauna	November 1996	The lateral deflection of the pile cap (spillway or sluiceway section) exceeds 0.5 inch in all cases except the flood discharge condition for both the spillway and sluiceway sections. Ice loads will cause large lateral deflections, often exceeding the generally allowable value of 0.5 inch for this type of structure. The axial compressive forces in the piles are more than the allowable values for almost all the piles for usual and unusual conditions, and for most of the piles for these conditions. No piles were found in tension.	May 1996	The Little Kaukauna dam was found to be in satisfactory condition. No significant structural deficiencies were found which would affect the safety or operation of the dam. The project can be expected to continue to perform safely, provided normal maintenance and monitoring operations are followed and the recommendations of the inspection report are carried out.
Kaukauna	May 1997	Spillway and sluiceway sections have adequate compression to resist overturning and the have adequate bearing capacity to support the maximum base pressure.	May 1996	The Kaukauna dam was found to be in satisfactory condition. No significant structural deficiencies were found which would affect the safety or operation of the dam. The project can be expected to continue to perform safely, but the maintenance and the importance of detailed inspections will increase with time.
De Pere	April 1997	Spillway and sluiceway sections have adequate compression to resist overturning and the have adequate bearing capacity to support the maximum base pressure.	June 1995	The De Pere dam was found to be in satisfactory condition. No significant structural deficiencies were found which would affect the safety or operation of the dam. The project can be expected to continue to perform safely, but the maintenance and the importance of detailed inspections will increase with time.

Note:

¹ Sources of Information – Copies of the Inspection Reports and the conclusions of the Stability Analysis can be found at the WDNR RR Program files for the Fox River at the Gef II office building in Madison, Wisconsin.