



January 27, 2012

Aaron Mason
WI DNR - PARK MANAGER
1034 COUNTY ROAD A
Hudson, WI 54016

Subject: Dam Inspection Report for LITTLE FALLS DAM,
Field File No. 55.01, Key Sequence No. 54, St. Croix County.

Dear Aaron:

Enclosed is the Dam Safety Inspection Report based on the inspection of the LITTLE FALLS DAM on 10/17/2011. This report has recommendations to manage the dam along with time frames for items that are required to be completed.

DAM FAILURE ANALYSIS (DFA)

DATE

Submit a Dam Failure Analysis for approval if needed

March 31, 2014

I checked the data base and there hasn't been an approval of a DFA. There is some information on a study of the Willow River but it is unclear if it is a DFA. If you have an approval letter for a DFA then you do not need to do one, just send me a copy of the approval letter and I'll update the data base to show that this has been done.

In order to determine the extent of the dam failure floodplain (hydraulic shadow) for the dam, and determine the required hydraulic capacity for the hazard the dam creates, you must hire an engineer registered in the state of Wisconsin to perform a dam failure analysis. You may be able to get help from the Bureau of Facilities and Lands on either finding an engineer or having them prepare a DFA. They can contact Bill Sturtevant, WDNR Dam Safety Engineer in Madison if they have any questions.

In addition to establishing the hazard rating and the required hydraulic capacity for the dam, St Croix County will utilize this dam failure analysis to determine if additional downstream land use controls must be implemented. Maps, profiles and floodway data tables necessary for the adoption of land use controls (floodplain zoning) must be submitted with the dam failure analysis to the Department. The maps, profiles, and floodway data tables also need to be submitted to St Croix County for adoption to their flood plain zoning ordinance once the Department approves the DFA.

EMERGENCY ACTION PLAN**DATE**

Submit an EAP for approval if needed

September 30, 2014

Again, our data base shows that an EAP has not been approved. If one has then send me a copy of it and I'll update our data base. If not a dam failure analysis will provide the information necessary to develop a detailed Emergency Action Plan (EAP) and determine whether or not there is a need for a flood warning system. This detailed EAP identifies affected downstream properties based on the dam failure mapping and resources available for responding to an emergency situation. It is required so that during flooding or imminent failure of the dam, a series of well-planned steps can guide the owner, operator, and emergency workers through a process to minimize the potential for loss of life or property damage.

INSPECTION, OPERATION AND MAINTENANCE PLAN**DATE**

Submit an IOM for approval if needed

March 31, 2014

An Inspection, Operation and Maintenance plan (IOM) is required for all large dams in the State of Wisconsin. Again the data base indicates that one has not been approved. If you already have one please send a copy and we will update the data base.

If you do not have one you will need to find some one to prepare a plan for you that includes "checklists" used for daily, weekly, monthly, and yearly inspections, the plans and specifications for the dam, an operation schedule, a maintenance schedule for equipment, and the current names and telephone numbers of the operators. (Facilities and Lands may be able to write this plan for you.) The checklists should include all aspects of the structure and equipment, such as monitoring seepage of the abutment at the weir; measuring flow through and over the dam; proper gate operation to prevent water from flowing over the Tainter gates; lubrication; tree, brush and vegetation removal; and so on.

SIGNAGE**DATE**

Submit photos if needed

June 30, 2013

The dam may need a navigational standard portage or take out sign showing a safe route around the dam if people are navigating the river. The stream is classified as navigable so there may be a need for this. I don't believe people would navigate down to the park from the north because of the "falls" at the former dam site, but I assume people could come to the park and put in on the lake and then want to navigate down stream of the lake. Does that happen? If so then a portage route and signs is probably needed. I will leave it up to you determine if it is needed based on what you see as use at the park.

INSPECTION**DATE**

Submit an inspection report

December 31, 2013

The next inspection of the dam by an engineer is scheduled for 2013. The inspection should include an inspection of the face of the dam to check on the condition of the concrete. The weeping on the backside of the concrete may be a sign of a problem on the front of the dam. I would recommend that the inspection be after a complete draw down of the impoundment.

The concrete around the pinions of the Tainter gates should also be inspected. There are cracks at the pinions and some heaving of concrete in the walkway across the abutment of the Tainter gate and former powerhouse.

Also all of the Tainter gates should be operated under full pool as part of the next inspection to show that they are in working order. I also recommend that the generator be run to energize the motor control panel to make sure that everything works.

The right hand abutment looking downstream of the dam also needs to be inspected. The steep bank and flows over the dam spillway made it too dangerous to inspect during this inspection. The abutment should be checked for seepage and erosion.

Under cutting of the apron on the entire width of the dam should also be checked during the next inspection.

CAPITAL EXPENDITURE BUDGET

DATE

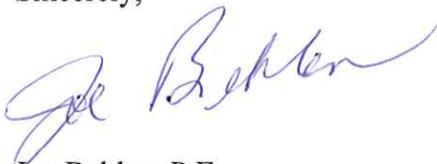
None

I highly recommend that you prepare a capital expenditure budget for the dam covering at least ten years. The dam has been repaired in recent times but the over all structure appears to be quite old and additional low cost repairs may not be possible as the concrete continues to deteriorate and reinforcing steel corrodes.

I suggest you work with Facilities and Lands to come up with a budget for the dam so funds can be budgeted and available when needed. Information on what items will need to be budgeted for will be more clear after the next inspection.

Aaron, if you have any questions on this letter or the enclosed inspection report feel free to contact me.

Sincerely,



Joe Behlen, P.E.
Dam Safety Engineer

C: Bill Sturtevant- WDNR WT/3
Brent Binder – WDNR Facility and Lands – via e-mail

Dam Inspection Report

Little Falls Dam

Inspection Date: October 17, 2011

Present for Inspection: Aaron Mason, Park Superintendent
Joe Behlen, Dam Safety Engineer

Previous inspection: 6/24/2011

Owner: Wisconsin Department of Natural Resources
Willow River State Park

Contacts: Aaron Manson, Manager
1034 County Road A
Hudson, WI 54106



FILE REVIEW

Unfortunately I do not have files for this dam. The only information I have is from our data base.

II. Governing Authority

Statute

Wisconsin State Statute Chapter 31

Navigable stream

Classification

Large Dam by NR 333 definition

III. Dam Identification

Field File Number: 55.01
National Identification: W153
Dam Key Sequence Number 54

IV. Permits, Approvals, and Operating Orders

Permit: Unknown
Dam Plan Approval: Unknown
Public Interest Water Levels Set
Minimum None
Maximum None
Minimum flow 25% of forward flow

Orders Issued:

Date	Docket ID	Description
2/1968	3-WC-1968-0018	Owner Transfer
2/1944	2-WP-1944-0619	Owner Transfer

V: Water Body:

Classification: Willow River
Navigable
Coldwater Sport Fish
Trout Waters – Wisconsin Trout Streams 2002

VI. Dam Design Information

Normal Storage 1342 ac-ft
Structural Height 30 feet
Hydraulic Height 24 feet
Crest length 370
Spillway capacity 9600 CFS

VII. Upstream Structures:

2.5 miles upstream of dam
County Road A Bridge (No data available)

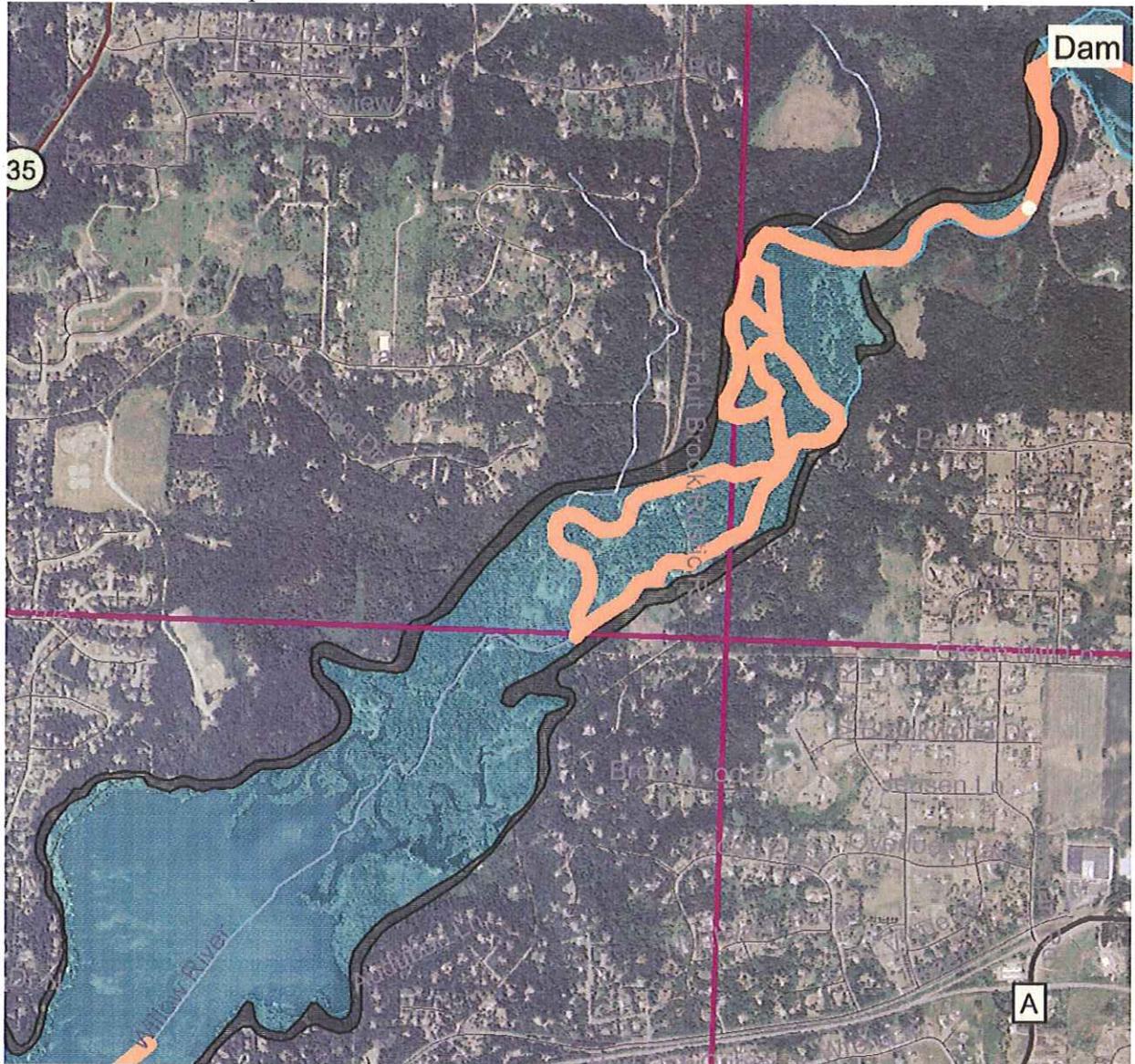
VIII. Upstream Dams

11 miles
New Richmond Dam FF 55.05 DKS N 188
Large Dam
Storage - 1500 ac-ft
Hydraulic head: 11
Spillway capacity 4600 CFS

VIII. Downstream Structures:

1.25 miles downstream of dam
Trout Brook/Rustic Road Bridge (No data available)

IX. Downstream Development:



The Flood Insurance Rate Map above does not indicate that there is development in the 100 year flood plain elevation down stream of the dam, but this would need to be confirmed.

The dam data base does not indicate that there has been a dam failure analysis (DFA). The flood shadow created by a dam failure can be larger (wider) than the flood plain created by a 100year storm event. The St Croix County Planning and Zoning Department is to enforce zoning to the DFA boundaries or the 100 year flood plain, which ever is greater.

The 2009 FIS indicates that a detailed study was completed on the Willow River from the dam down to the confluence with the St Croix River. It is unclear if this detailed study was the DFA or was for some other purpose.

X. Dam Hazard Rating:

Conditionally set as *high hazard* in the data base.

XI. Dam Emergency Action Plan:

None according to data base.

XII. Dam Inspection and Operation Manual:

None according to data base.

XIII. Dam Financial Assurance:

None needed - Municipality

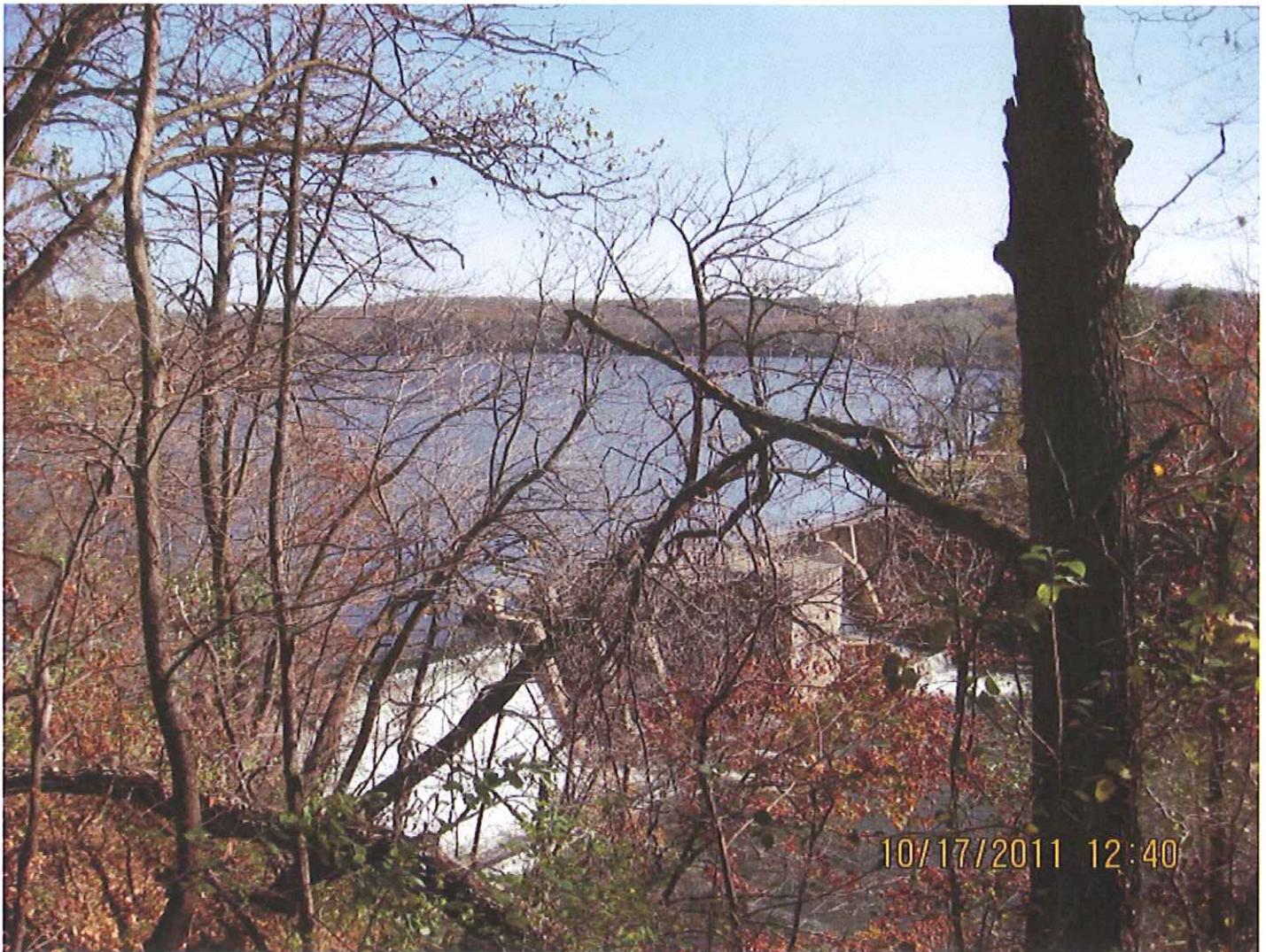
XIV. Past Inspection Follow Up Required:

None listed.

FIELD INSPECTION

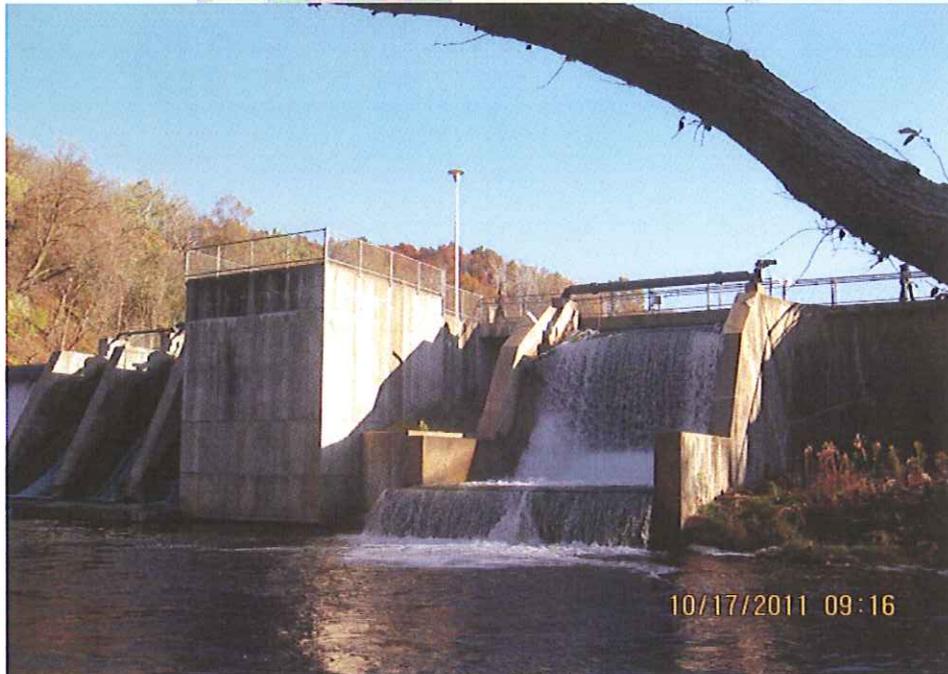
I. Dam Description

This is a concrete arch dam approximately 370 feet in length that is placed between sandstone bedrock.





The spillway pictured above is the primary spillway



One large Tainter gate and three smaller Tainter gates are used as auxiliary spillways. The larger Tainter gate above has flow over topping the gate.

II. Monuments – Benchmarks - Elevations

A. Bench marks – A bench mark was found south east of the dam. No survey was taken

- III. Signage:
- | | |
|------------------------|---------------|
| A. Warning sign: | Yes, in place |
| B. Portage Route Signs | None |

IV. Embankments

- A. Vegetation – There is some woody vegetation on the downstream embankment on the left hand side looking down stream. The vegetation makes it difficult to see if there is seepage taking place.



- V. Erosion – None found

VI. Spillways

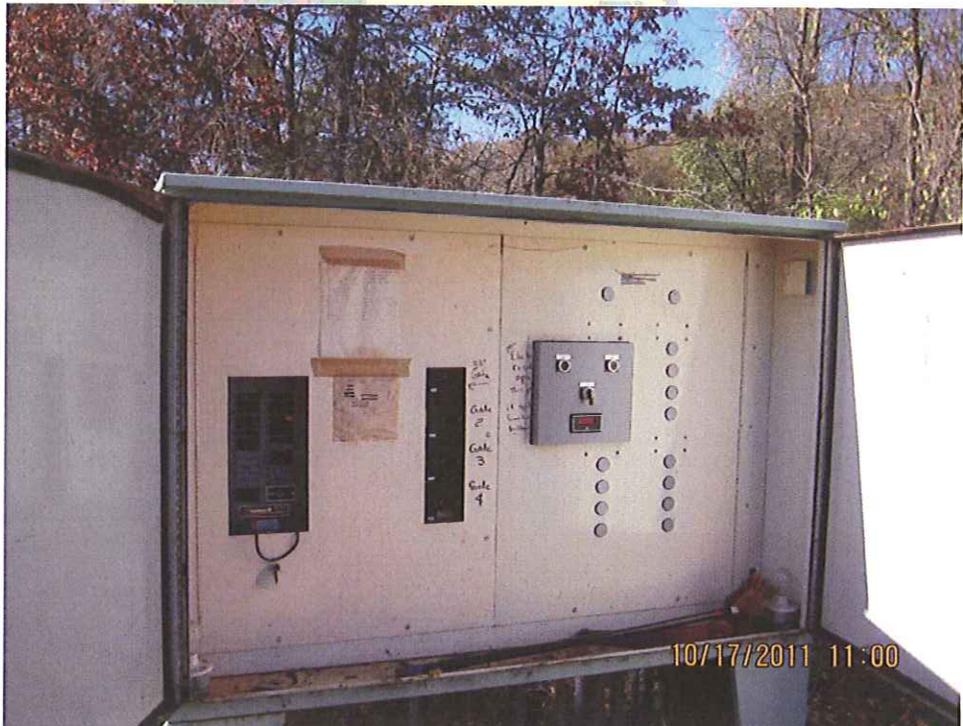
- A. Fix crest (See picture above.)

The fix crest spillway appears to have been reconstructed in recent years. The condition of the spillway appeared to be adequate but a thorough inspection could not be done because the impoundment was at full pool and the spillway was flowing.

- B. Tainter gates (See picture above.)

The four Tainter gates have been repaired or modified in recent times, in the last 20 years or so, and appeared to be free of corrosion. Flow was going over the top of the larger Tainter gate at the time of the inspection so the trunnion arms, trunnion pins and bearings, vertical ribs, and arm bracing could not be inspected..

The Tainter gates are operated by motor driven cable winders. The motor controls are enclosed in motor control panel on the left hand side of the dam. The control panel has the option of being energized by a portable generator.

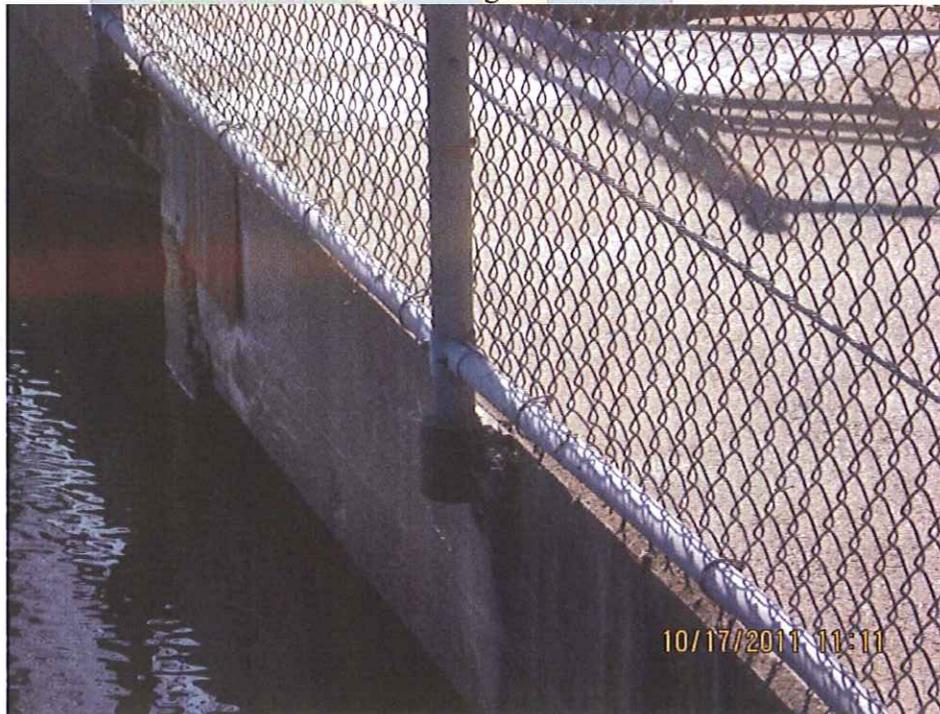


There is some corrosion in the panel. This can happen if the panel heater fails. The heater helps to remove the moisture.

C. Concrete Condition



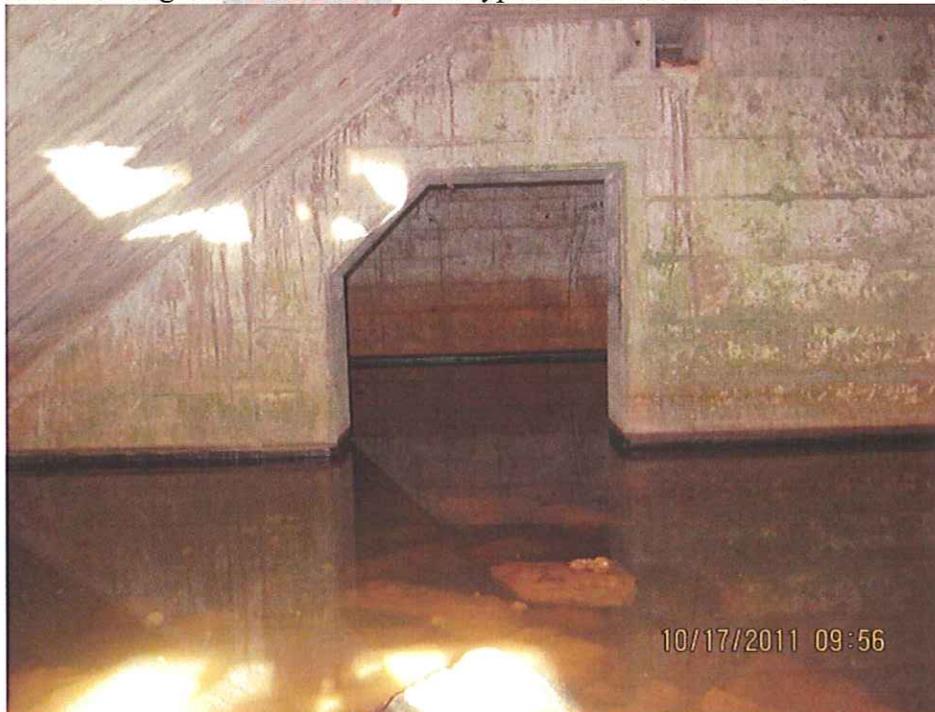
There are cracks from the cable winder down to the trunnion pin and beyond. This is next to the former power house area. Note that there is no way to access the trunnion pin and bearing for lubrication. The same situation exists for all four gates.



Concrete patching on the walkway, the lighter colored material, and shifting of the concrete at the crack near the water line.



This is one of the concrete arches of the dam. The concrete has small cracks and cracks with leaks that are leaving effervescence. This is typical of all of the arches.



This is the concrete below the left Tainter gate looking north to the former power house wall. The concrete appeared sound with no noticeable cracks or leaking.

- D. Abutments – The abutments on the left side were visible and in good shape. The abutments on the right side of the dam could not be accessed. The hillside on the right hand side of the dam was too steep to descend without a rope harness.

- E. Drains – There is a small weir for measuring flow coming from under and the concrete arches/abutments/sandstone. It looks to be a 30 degree V notch weir. There is no staff gauge associated with weir.

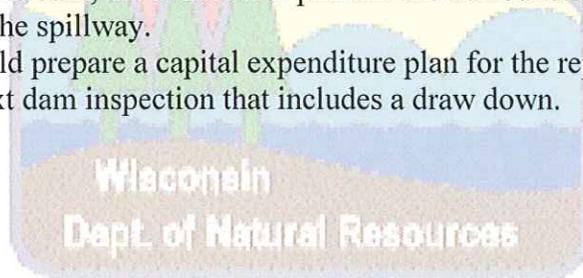


Findings of Fact

1. The dam is under the jurisdiction of Wisconsin State Statute Chapter 31.
2. The dam is classified as a large dam according to NR 333
3. An Emergency Action Plan as required by Wisconsin Administrative Code NR333 is needed according to the DNR Dam Data base.
4. An Inspection and Operations Manual as required by Wisconsin Administrative Code NR333 is needed according to the DNR Dam Data base.
5. The dam has a hazard rating estimated to be **high hazard** according to the DNR Dam Data base.
6. There is no method of measuring flow at the dam.
7. There is some woody vegetation growing on the downstream portion of the dam embankment.
8. Greasing/lubricating of the Tainter gates is difficult because of access.
9. The face of the dam and the Tainter gates could not be inspected.
10. There is cracking of the concrete at the pinions of the Tainter gates.
11. There is cracking and weeping from the cracks of the arched concrete.
12. There is seepage through the sandstone abutting the dam.
13. There are no portage signs or a portage route designated for the dam.

Conclusions and Recommendations

1. The dam needs to comply with the requirements of Wisconsin State Statute 31.
2. The dam needs to meet the requirements of NR 333 for large dams on navigable streams.
3. The dam owner needs to submit:
 - a. An Inspection, Operation and Maintenance (IOM) Plan.
 - b. An Emergency Action Plan (EAP).
 - c. A Dam Failure Analysis (DFA)
 - d. Inundations maps and flood elevations to St Croix County Planning and Zoning for updating their Floodplain Zoning Ordinance once the DFA is approved by the Department.
4. The dam needs to have a method of measuring flow to ensure it is passing 25% of base low flow as required in NR 333 and Wisconsin State Statute Chapter 31. This could be accomplished by having a staff gauge to measure head and preparing a head vs. discharge table.
5. The woody vegetation needs to be removed from the dam if it has not already been done.
6. The IOM plan should include a frequency and method of measuring flow from the "V" notch weir used to measure seepage and a system to document and trend flows.
7. The IOM should include a frequency for operating (exercising) the gates.
8. The IOM plan should include a method of gate operation that minimizes flow over the top of the Tainter gates.
9. The EAP and IOM should include the location of the portable generator, how it gets to the dam, and how it is connected and operated to energize the motor control panel.
10. The next inspection of the dam should include a draw down to expose the Tainter gate components, the face of the concrete dam, the concrete at pinions and surrounding the Tainter gates, and the concrete making up the spillway.
11. The dam owner should prepare a capital expenditure plan for the replacement and or repairs of the concrete after the next dam inspection that includes a draw down.



Respectfully submitted


Joseph R. Behlen, P.E.
WDNR West Central Region
Dam Safety Engineer

Detailed Information for Dam: LITTLE FALLS

Dam Key Seq No: **54** Field File No: **55.01** Status: Size: **LARGE**
 Popular Name: **UPPER POWER DAM** Former Name: NID ID: **WI53**

Comment

AS OF 3/1995 REPAIR WORK HAS BEEN DONE BUT FILES DO NOT CLEARLY INDICATE APPROVALS ETC.. PLANS TO INSTALL A WARNING SYSTEM ARE UNDERWAY (TEF, 3/19/96).

Location Information

County: **St. Croix**
 Latitude: **45.01688680** Longitude: **-92.70642730**
 Permitted TRS: Located TRS:
 QQQ:NE,QQ:SW,Q:NE,Sec:08,T:29N,R:19W QQ:SW,Q:NE,Sec:8,T:29N,R:19W

Contact Information

Owner

Organization: **WI DNR - PARK MANAGER**
 Name: **Darrel Richer**
 Address: **1034 COUNTY ROAD A**
Hudson , WI 54016
 Phone: **(715) 386-5931**

Alternate Contact

Organization: **Aaron Mason**
 Name: **Aaron Mason**
 Address:
 Phone: **(715) 386-8946**

MARCH 19, 2009

Waterbody Information

Drainage Basin(sq mi): **171**

Stream

Local Name: **WILLOW**
 Row and Official Name:
 Navigable?
 When was navigability determined?

DA 194 10% 6415 2% 7/28 6921 1% 6995 2% 8014

Impoundment

Local Name: **LITTLE FALLS LAKE**
 Row and Official Name: **0**
 Size(acre): **172** Maximum Depth(ft): **18**

Navigability Comment:

Regulatory/Inspection

NR 333 Years **EAP: IOM: HYD: STAB: ZONE:**
 Auth Approval Desc: **GEN LAWS** Hazard Rating: **H** Estimated Hazard Rating: **H** Regulatory Agency: **WIDNR**
 FERC No: Exempt Issue Date: FERC Inspection Year: License Expiration Year:

Construction Characteristics

Normal Storage(acre-ft): **1342** Max Storage(acre-ft): **1700** Structural Height(ft): **30** Hydraulic Height(ft): **24**
 Crest Length(ft): **370** Spillway - Type: **Controlled**
 Discharge Through Principal spillway(cfs): **9600** Width/diameter of principal spillway (ft): **139**
 Total Discharge through all spillways(cfs): **9600** Total width/diameter of all spillways(ft):
 Core Type: Position: Foundation:
 Purpose(s): **RECREATION** Structure Type(s): **GRAVITY**

TRUNNION ARMS TRUNNION pin & bearing VERTICAL RIBS ARM BRACING

MULTI-ARCH EARTH

Water Levels

	Normal		Winter	
	MSL	Datum	MSL	Datum
Min				

Detailed Information for Dam: LITTLE FALLS

Normal		100.50		
Max				

Construction History

Designer	Construction Firm	Year Completed
HOLLAND,ACKERMAN,HOLLAND		1920

Outlet Gates

Valid Types are
 U-Uncontrolled, T=Tainter(Radial), L=Vertical Lift, S=Slide(Sluice Gate), N=Needle, V=Valve, O=Other
 Controlled, R=Rolled, B=Bascule, D=Drum, F=Flap, X=None

Type of Gate	Number of this Type
Uncontrolled	1
Tainter(radial)	3
Slide(Sluice gate)	1

Inspection History

Inspection Date	Report Date	Next Scheduled Date	Engineer	Inspection Type
06/24/2009	09/01/2010	2019	LEPAK	Inspection conducted under Chapter 31.19(2)decennial
04/25/1979	03/15/1966	2000		
09/21/1970			OTHER	General dam inspection, usually prior to 1986
			S	
09/01/1967			OTHER	General dam inspection, usually prior to 1986
			S	
08/06/1965	08/16/1965		OTHER	Inspection for the purpose of setting or checking water levels
			S	
08/06/1965			OTHER	General dam inspection, usually prior to 1986
			S	
08/15/1961	08/22/1961		OTHER	Inspection for the purpose of setting or checking water levels
			S	
08/15/1961			OTHER	General dam inspection, usually prior to 1986
			S	
08/22/1950			OTHER	General dam inspection, usually prior to 1986
			S	
08/22/1950	08/22/1950		OTHER	Inspection for the purpose of setting or checking water levels
			S	
06/24/1947			OTHER	General dam inspection, usually prior to 1986
			S	
06/24/1947	07/14/1947		OTHER	Inspection for the purpose of setting or checking water levels
			S	
10/19/1934			OTHER	General dam inspection, usually prior to 1986
			S	
04/18/1934	04/30/1934		OTHER	General dam inspection, usually prior to 1986
			S	
07/27/1933			OTHER	General dam inspection, usually prior to 1986
			S	

Detailed Information for Dam: LITTLE FALLS

08/18/1932	08/18/1932	OTHER S	Inspection for the purpose of setting or checking water levels
04/10/1924		OTHER S	Informal inspection to check on status or progress on work directives
07/30/1921	12/09/1921	OTHER S	Inspection for the purpose of setting or checking water levels
06/29/1916	07/05/1916	OTHER S	Inspection for the purpose of setting or checking water levels
05/07/1914		OTHER S	General dam inspection, usually prior to 1986

Followups

Type of Followup	Due Date	Extension Date	Complete Date	Followup Comment
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Approvals

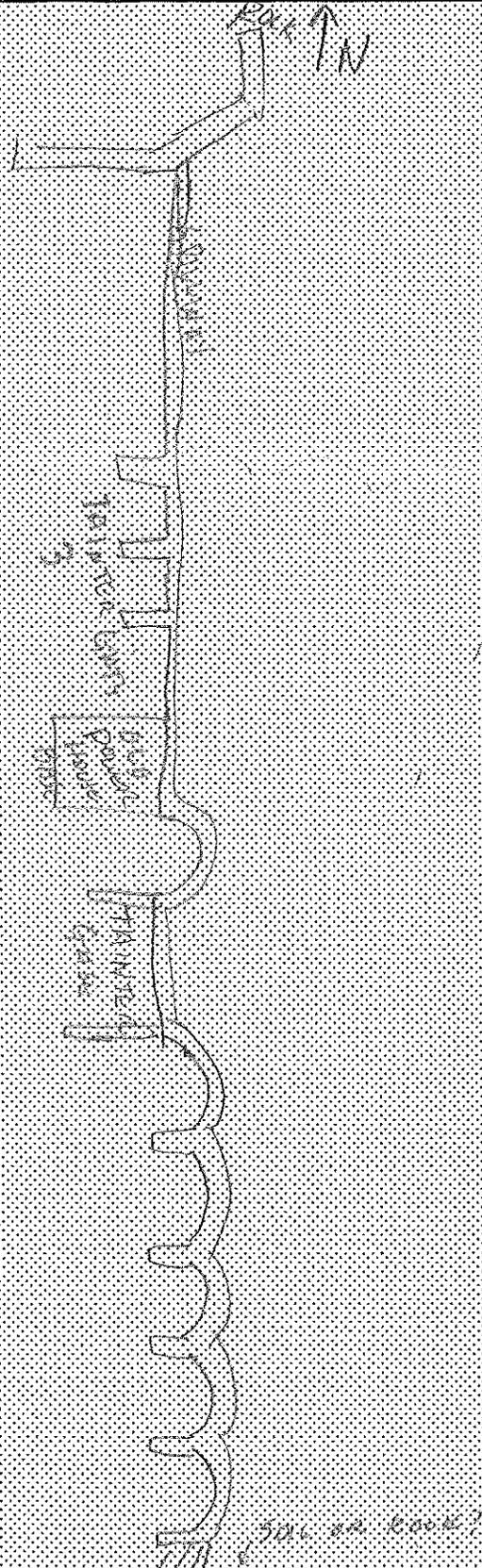
Month/Year	Docket ID	Description	Engineer
09 / 1979	3-WC-79-816	APPROVAL FOR TEMPORARY DRAWDOWN, 31.02	OTHERS
02 / 1968	3-WR-1968-0018	TRANSFER; STAT 31.185B	OTHERS
02 / 1944	2-WP-1944-0619	TRANSFER; STAT 31.185B	OTHERS

Orders

Issued Date	Complied Date	Docket ID	Order Description
06/23/1981		3-WC-81-830	Warning Signs

SPILLWAY--PRINCIPAL - FIXED CREST					Action		
Item	N	P	Notes/ Observations		M	I	R
I Fixed Crest			No problem	Not applicable			Could not inspect
A. Dimensions Top Width:							
B. Materials							
C. Shape (sharp-crested, broad-crested, ogee, chute, gated, overflow, morning glory, dropbox, labyrinth)							
D. Debris Prevention (racks, booms, etc.):			SELF CLEANSING				
E. Concrete Condition *			CAN'T SEE				
F. Flashboards (none, number): Type (Metal, wood): Dimensions: Operability:							
G. Abutments Condition: * Seepage/wetness:			GOOD ON LEFT SIDE WEIR - LOW FLOW	CAN NOT SEE ON RIGHT			
H. Drains Type: Weep holes, Relief drains, Other: Flow Rate:			No problem	Not applicable			Could not inspect
I. Other							
N= Noted; P= Photo; M= Monitor I= Investigate; R= Repair F.F.= Field File; RT = Right; LT = Left U/S = Upstream; D/S = Downstream					Action Suggestion 1. Requires immediate action 2. Plan to do soon 3. Do when convenient Controlled = Gated Uncontrolled = Overflow		
Additional Comments:							
* Type of Concrete Problems: Spalling, cracks, exposed rebar, misalignment, joints, bug holes, efflorescence, popouts, honeycombing, scaling, craze/map cracks, isolated crack, disintegration, other							
Dam Inspection Checklist							
Dam Name:		F.F.#:		Date:		16 of 7	

SKETCH



Dam Inspection Checklist

Dam Name:

F.F.#:

Date:

Page 7 of 7