Appendix D

HYDROLOGY AND DRAINAGE

Division of Transportation
System Development
Southeast Regional Office
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Hooker Lake Drainage Meeting
MEETING MINUTES
DECEMBER 12, 2008

DATE: 12/18/08
Location: Town of Salem, Town Hall
FROM: Kurt Flierl, WisDOT SE Region, Project Manager

ATTENDEES:

WisDOT SE Region – Anita Pusch, Kurt Flierl, Dawn Marshall, Reem Shana

WDNR – Tanya Meyer, Michael Luba

Town of Salem – Brad Zautcke

Residents – Tim/Barb Vanderhoef, Michael Rombalski, William/Virginia Winter, Rob Pizzalu, Robert Harris, Frank/Carol Bell, Tom Hinze, John McEntegart, Tim Malecki, Jamie Rook, Richard Rukstales, Marion Schmidt, Greg Kruchko

Representatives from the WisDOT, and WDNR met with residents affected by higher than historic Hooker Lake levels. Tim Vanderhoef, a resident since 2005 that has been impacted by lake levels, shared background and pictures from 2006-2008 identifying flooding, runoff water, and debris carried by runoff water. Primary concern from residents was a perceived increase in the amount of water entering Hooker Lake, how much faster water is entering Hooker Lake, water levels remaining higher than historic for longer periods of time, and runoff affecting Hooker Lake water quality. Additional comments and concerns included: perceived increases in the volume of runoff for drainage areas east of STH 83 which were not impacted with STH 83 construction, and the inability to mow lake frontage due to higher than historic lake levels. Residents have correlated the 2006 STH 83 construction as one of the root causes of increases in Hooker Lake water levels – ie. "there must be some connection". Other potential contributing factors that were identified included reconstruction of a dam on private property in 2002, adjacent development around Montgomery Lake, development within the Hooker Lake watershed, and record precipitation/hydrologic events (eg. rain, snow melt, frozen ground).

WISDOT
WisDOT staff provided background and handouts on two storm sewer systems constructed in 2006, and shared a plan view of the entire 1330 acre Hooker Lake watershed and the approximate 115 acres of that watershed that pass through department constructed storm sewer system.

North Storm Sewer System
- Approx. 950ft. in length from 82nd Street to 81st Street
- Drains 85 acres
- Includes detention swale

The department constructed a detention swale on the west side of STH 83, just north of existing residential development, to control peak discharges from a 56 acre drainage area feeding into department storm sewer. Peak discharge for a 50 year rainfall event were reduced from 80 cfs (cubic feet per

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second) to 30 cfs. The detention swale was constructed to primarily reduce the size of storm sewers along STH 83. Secondary benefits include some storm water retention and treatment. The 56 acre area, combined with an adjacent 29 acre area, provide 90% of the storm water input into the department constructed north storm sewer system which discharges approximately 200 ft. east of STH 83 on 82nd Street. The size of the pipe discharging at 82nd Street (36-inch) has not changed. Contrary to discussion that the Town of Salem had no input into the design of the storm sewer, WisDOT staff shared that the Town of Salem reviewed the storm sewer design and also paid for 90% of the costs of the north storm sewer system based on contributing flows from outside of the highway right of way. WisDOT staff identified that the 85 acres that drain overland and eventually drain through the north storm sewer system had previously drained overland and then through culverts, ditches, and a partial storm sewer system. WisDOT identified that the time for water to travel overland and then through the detention swale, storm sewers, and eventually reach Hooker Lake, has minimally changed (minutes, not hours) - and in peak events the time has increased due to the detention that is taking place in the newly constructed swale. WisDOT tried to convey that by the time water from adjoining large tracts of land reached the previous system of culverts and storm sewer, that it was either a shallow concentrated flow, or open channel flow and that little, if any, infiltration was taking place during peak events. WisDOT staff did identify an increase in impervious area due to a slightly wider paved roadway where infiltration is not taking place across those now paved areas of roadway/sidewalk, which creates more runoff volume. The increase in impervious area for the areas feeding the north storm system is approximately 0.4 acres (18,000 SF) – of which 47% is due to Town of Salem requested sidewalk. The bottom 0.8 ft. of the detention swale detains approximately 3500 cubic feet of water for longer periods of time due to swale discharge being located 0.8 ft. above the bottom of the swale – offsetting the runoff volume created by an approximate 2.5" event.

South Storm Sewer System

- Approx. 1600 ft. in length (along STH 83) – South of 85th Street to 82nd Street
- Discharges east of STH 83 on 83rd Street
- Drains 29 acres

Although not described in full detail at the meeting, WisDOT constructed a storm sewer system that carries storm water from the STH 83 roadway from 400 ft. south of 85th Street up to 82nd Street. This storm system also carries stormwater runoff from an adjacent approximately 28 acres. It was relayed to residents that a partial storm sewer system from west 83rd Street up to 82nd Street was in place prior to construction, and that cross culverts – some buried over time – also carried storm water from the west side of STH 83 to the east side of STH 83 near 83rd place. The discharge of the previous storm system, a 2 ft. by 2 ft. box culvert, was located about 400 ft. south of 82nd Street between Gus's Garage and a carryout pizza restaurant and eventually combined with the discharge from 82nd Street(above) and entered a 36-inch concrete pipe located approx 250 ft east of STH 83 which crosses private property (Rook property) and enters Hooker Lake under water. The discharge for the south sewer system was moved to 83rd Street as part of 2006 roadway construction due to the inadequate size of the pipe crossing private property. The department shared that the average travel time for water to travel overland and then travel through the newly constructed storm system has increased, however that average increase is not creating a measurable increase in Hooker Lake water levels. Prior to construction, some stormwater detention was likely taking place at the confluence of the two storm sewer systems due to the inadequate sizing of the 36-inch pipe crossing private property – but again, this water would have created localized flooding west of the Rook property and subsided in a matter of hours – not days. WisDOT staff shared photos of the entrance to the 36-inch pipe in which runoff debris had blocked the entrance – creating the situation described. Similar to the north storm sewer system, the Town of Salem reviewed our construction plans and participated in the construction cost of the south system based on contributing flows from outside of the highway right of way.

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WDNR
WDNR staff provided background and information on a private dam on Hooker Lake. The dam is privately owned by Mr. Michael Bryzek and was reconstructed without a permit in 2002. Information obtained by WDNR staff appears to indicate that the dam spillway was reconstructed 0.7 ft. higher than previous and also 0.9 feet less in width. Inability to access the Bryzek Dam has precluded WDNR from obtaining and verifying as-built information. WDNR has been coordinating with Mr. Bryzek's attorney regarding survey of his dam, as well as the Hooker Lake Dam.

WDNR staff also shared information on floodplain mapping. Floodplain mapping of Hooker Lake was complete, relatively speaking, in recent years. Mr. Vanderhoef's house is located within the 100 year flood plain.

Town of Salem
Town staff indicated that a storm water district has recently been created which could undertake a study to evaluate the Hooker Lake watershed and actions that could mitigate flooding.

General Discussion
Residents discussed other potential causes that may have resulted in increased level of Hooker Lake. Discussion indicated that development and flooding of area around Montgomery Lake has contributed to Hooker Lake water levels.

Historic nature of precipitation events was also discussed. WDNR identified that Hooker Lake flooding this past June was not unique and that flooding took place at lakes across the southern half of the state. Flooding this past June resulted in closing of IH 94 in Jefferson County and also STH 50 in Kenosha County.

WisDOT staff inquired if Mr. Vanderhoef could identify that dates in which flooding events had taken place for a historical perspective. The dates currently identified include August and December of 2006, August of 2007, and April and June of 2008. Although not shared at the meeting, these dates correlate with recorded historic events in the Kenosha Area, including:

- Four of the top six historic crests of the Fox River near New Muenster
    1. 15.18 ft. on **6/15/2008**
    2. 14.98 ft. on **8/24/2007**
    3. 14.10 ft. on 2/21/1994
    4. 13.73 ft. on **5/24/2004**
    5. 12.68 ft. on 6/15/1999
    6. 12.14 ft. on **4/12/2008**

- Record of near record rainfall August 11, 2004

- Two of the top four historic crests of the Des Plaines River at Russel IL (State Line)
    1. 11.09 ft. on **5/23/2004**
    2. 10.75 ft. on 3/6/1976
    3. 10.75 ft. on 9/27/1986
    4. 10.51 ft. on **8/24/2007**

- State of Emergency in Kenosha County in August 2007 due to "worst flooding in more than 30 years"
- Flash Flooding as a result of August 24, 2006 storm following saturated conditions

- Flash Flooding in Kenosha area, September 12, 2006
- Blizzard of December 1, 2006 - in which 17 inches of snow were recorded at Kenosha U.S. Coast Guard station – followed by snow melt and rain the third week of December
- Flash Flooding of June 18, 2007, with 2.6 inches of rain reported in Bristol
- Heavy Rain from June 7-9th, 2008

ACTION ITEMS

- WisDOT staff will provide response to Mr. Vanderhoef in late January/early February that will summarize storm sewer design and any changes in volume of water reaching Hooker Lake, the time for water to get to Hooker Lake, and impacts on Hooker Lake water levels. *Since meeting with residents on December 12, the department will hire a consultant to do an independent review of the department designed roadway drainage and quantify changes in runoff affecting Hooker Lake water levels. Copy of that report will be provided to Mr. Vanderhoef, the Hooker Lake District, and the Town of Salem.*
- WisDOT staff will pursue as-built survey of Bryzek Dam using WisDOT survey crews and include information in response to Mr. Vanderhoef and Hooker Lake District.

APPENDIX N
TOWN OF SALEM DRAINAGE AND FLOODING COMPLAINT INVENTORY
December 2009

Map ID	Tax Key	Address	Owner Name	Complaint	Date	Inspection Date	ERU Fee	Field Observations	Town Issue	State or County Issue	Private Property Issue	Located in Regulatory Flood Plain Limits	Problem Affecting Multiple Homes (#)	Only Floods in Large Storm Events	Recommendations	Estimated Cost ($ in 2009)	Priority Ranking
1	65-4-120-073-0781	31017 82nd Street	William Schreier	Backyard flooding after farm developed	3/4/2009	07/09/09 9:00am	1	Large drainage area coming from the South; Across the street from the Fox River/floodplain; No one was home during inspection.	N	N	Y	N	N	Y	Does not appear to be an issue that the Town can solve beyond property acquisition.	$171,200*	Low
2	65-4-120-073-0155	8122 Shorewood Dr	Kenneth Morrison	Fix Fox River	3/13/2009	---	1	Located in a flood plain. Phone number has been disconnected, and based on the County's website, ownership has changed.	N	N	Y	Y	Y	Y	Located in a flood plain directly along the Fox River. Phone number has been disconnected, and based on the County's website, ownership has changed. Does not appear to be an issue the Town can solve beyond property acquisition.	$112,400*	Low
3	65-4-120-183-0516	31020 93rd Street (CTH F)	Marcia Lee	Neighbor modified flow run off	4/1/2009	07/09/09 1:00pm	2	Downstream property does not have a driveway culvert causing water to pond on her property; Neighbor also constructed a berm on his lot line which also causes ponding on her property.	N	Y	Y	N	N	N	Sent the property owner the contact information for the County Highway department to try and get a driveway culvert installed on neighboring property.	< $2,500	Low
4	67-4-120-312-0480	11807 306th Court	Charles Vance	Flooding	7/13/2009	7/17/2009 and 11/18/2009	1	No one was home during either inspection; Mike Murdock and his crew completed work to relieve a clogged ditch and SS inlet down the road from this property in mid-July. 3/4 of the property is within a floodplain.	N	N	Y	Y	N	Y	Could not find any contact information for this owner, but two seperate site visits were conducted. Not sure what exact complaint is but the garage is lower than the roadway elevation and land surrounding the house is in a floodplain. It was determined that this is not an issue that the Town can resolve at this time beyond property acquisition.	$276,500*	Low
5	66-4-120-294-1365	28628 115th Place	Sandra Burritt	Driveway floods when it rains because of road	4/14/2009	7/17/2009	1	Complained of driveway flooding. Located on top of a hill with a low area at the end of the driveway.	N	N	Y	N	N	Y	Appears to be a private property issue that could be solved by repaving the driveway to drain towards the road.	< $10,000	Low
6	66-4-120-291-0285	10420 286th Avenue	Amanda Schuett	Flooding, drainage pipe to small	7/14/2009	7/17/2009	1	Claims that the culvert beneath 286th Street is too small and causes entire property to flood.	Y	N	N	N	Y (3)	Y	Look into possible upgrades in size of this culvert or add additional culverts beneath road.	< $10,000	Medium
7	66-4-120-212-1410	9700 276th Avenue	David Gilbertsen	Broken field tiles to lake	5/20/2009	7/31/2009 9:30am	1	Broken drain tile that runs from a wetland behind his property across Camp Lake Road to an apartment complex property and discharges to Center Lake. They think the tile is broken somewhere near the lake and are looking for some legal advice on how to go about fixing and getting an agreement in place for maintenance.	N	N	Y	N	Y (2)	Y	Check with Town Attorney to see if there are any sample agreements they can use. Mr. Gilbertson and the neighbor are both willing to fix the issue themselves but would like some input on the legal obligations/agreements for future maintenance.	< $2,500	Low
8	66-4-120-212-0425	27601 95th Street	Thaddeus Mazuchowski	Water coming from every direction	7/14/2009	11/18/2009	1	House located at the bottom of a hill; adjacent to a floodplain; no formal ditches/conveyance systems in this neighborhood. Water ponds in the low area on his property near the road. Property owner has to pump water to the other side of his home to the channel behind him.	N	N	Y	Y	Y (3)	N	Homeowner could regrade the open areas of the lot to provide positive drainage toward the channel. Another possible solution would be to construct a ditch conveyance system to direct runoff away from this home during average, more frequent rain events.	< $10,000	Low
9	66-4-120-212-0125	27544 94th Street	Michelle Verran	Only one on street that floods	9/21/2009	10/2/2009 anytime	1	Runoff is ponding above the foundation walls on the west side of the house; Owners recently installed a drain tile/pea gravel in this area but no sealant or clay dyke was installed. Claims that the driveway culvert has woodchucks nesting inside.	N	N	Y	N	N	Y	Property owner wants to build a retaining wall above the foundation wall to avoid this issue. Advised them to extend the drain tile to the roadway ditch to give relief. Town televised the driveway culvert the week of October 12th and did not find any blockage in the culvert. Work to be completed by homeowner, but time may be needed to provide guidance.	< $2,500	Low
10	65-4-120-161-0300	27101 85th Street	James Hauri	Stagnant water on property	6/29/2009	11/18/2009	1	85th Street roadway culvert is directed towards his property and runoff from Silver Lake Park sits in a low area on his property because there are no formal ditches on the south side of the road.	Y	N	Y	N	N	N	A possible solution is to construct a berm/ditch at the discharge point of culvert to direct runoff to the wetland complex to the east, or reposition the culvert at an angle further east to promote runoff to drain toward this wetland and not this property.	< $10,000	Low
11	66-4-120-283-0700	27531 113th Street	Pamela Doyle	Flooding in neighborhood	3/2/2009	7/17/2009	1	Very flat neighborhood in a floodplain. Mike Murdock indicated that survey shots in the past proved that the elevations of Camp Lake, surrounding wetlands and most roadway ditches in this neighborhood were the same.	Y	N	N	Y	Y (14)	Y	Property acquisition appears to be the only feasible solution for this neighborhood. Same neighborhood as complaint #12. Cost includes purchase of all lots in the floodplain with homes built on them in this neighborhood.	$2,131,300* (Cost includes solution to complaint #12)	Medium
12	66-4-120-283-0580	27414 113th Street	John Van Den Berge	Flooding	7/13/2009	7/17/2009	1	Claims that the CTH C culvert upstream of his property was upsized about 10 years ago and causes additional flooding on his property. Mike Murdock has talked to the County and they claim that this culvert was collapsed for many years before they replaced it in kind. All of his property is within a floodplain.	Y	Y	N	Y	Y (14)	Y	Does not appear to be an issue that the Town can solve at this time beyond property acquisition. Same neighborhood as complaint #11. Cost includes purchase of all lots in the floodplain with homes built on them in this neighborhood.	$2,131,300* (Cost includes solution to complaint #11)	Medium
13	66-4-120-281-1466	10714 269th Avenue	Leah Wheeler	Flood Damage	7/14/2009	07/31/09 1:00pm	1	Property sustained substantial flood damage during the June storm, but never usually had any flooding issues in the home in past. Lake area behind house is in a flood plain and always has drainage issues.	N	N	Y	Y	N	Y	Does not appear to be an issue that the Town can solve at this time beyond property acquisition.	$359,800*	Low

* Property Acquisition values are based on the 2009 Assessed Value of the property(s).

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December 2009

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14	66-4-120-281-1502	10615 269th Avenue	Brian Spiegelhoff	Flooding	6/19/2009	7/17/2009	1	Resident was very upset and did not provide much information other than his basement has been flooded and he had a sewer back-up the past two June rainfall events. Brad mentioned the possibility of him being on the sanitary sewer overflow complaint list.	N	N	Y	N	N	Y	Verify if owner is supposed to be on the sanitary sewer back-up list instead. Other possible solution is property acquisition.	$174,900*	Medium
15	66-4-120-281-0845	26831 105th Street	Charles Tess	Water has flooded home multiple times during heavy rains		7/17/2009	1	Property owner was hauling out flood damaged property when we walked by. He mentioned that his property floods during the major storm events.	N	N	Y	N	N	Y	Does not appear to be an issue that the Town can solve at this time beyond property acquisition.	$100,400*	Low
16	66-4-120-281-1155	26623 106th Street	Reported by Mike Murdock	Low area with constant drainage issues. Roadway cross culvert is directed towards house.	11/4/2009	11/4/2009 2:00pm		Kettle area just upstream of Shoreview Subdivision. A roadway cross culvert is directed towards this home. A Town owned Park is in this neighborhood, but appears to be a bit higher than the low area of the neighborhood.	Y	N	N	N	Y (13)	N	Determine if drainage from this low area can be directed toward the drainage canal through the Town owned Park property without increasing flooding to the Shoreview Subdivision downstream. Investigate if a water quality pond could be installed to help slow down flows and provide a water quality benefit.	< $300,000	High
17	66-4-120-214-0670	10326 268th Avenue	John Kraus	Lot retaining water	4/20/2009	7/17/2009	1	Property sits in a low spot between the 268th Ave and the railroad tracks. Property owner was not home, but saw that a sump pump was hooked up in the back yard with a dewatering hose in the backyard. Assumed that when backyard gets flooded, the dewatering hose directs water to the other side of the RR tracks. The drainage from Brad Kaminscky's neighborhood and a culvert beneath the RR tracks eventually drains to this area as well.	Y	N	N	N	Y (15)	N	Determine if drainage in the rear of the lot could be sent to the front of the house, under the roadway, to Camp Lake or if there is a more efficient drainage solution for this drainage area to get to Camp Lake without ponding by the RR tracks. Town owned Park is two lots to the east. Possible water quality pond could be designed if there is enough elevation drop.	< $250,000 (Cost includes solution for complaint #18)	High
18	66-4-120-214-0480	26501 103rd Place	Brad Kaminscky	Flooding	5/14/2009	7/31/2009 9:00am	1	Neighborhood flooding / ditches are undersized. The Town has tried to address the issue of excessive runoff from the field to the east by installing a berm in the ditch of 264th Street to split the flow between 103rd Place and 104th Street. In large storms the berm is ineffective. Driveway culverts along 103rd place are of varying sizes/conditions which may also contribute to these issues if they are undersized/clogged. Upstream of John Kraus drainage complaint.	Y	N	N	N	Y (15)	Y	Reassess the berm that was installed to see if a more permanent solution is possible. Evaluate culvert sizes and conditions along 103rd Place. Try to tie the solution to this problem with the drainage complaint from John Kraus.	< $250,000 (Cost includes solution for complaint #17)	High
19	66-4-120-214-1617	9924 270th Court	Patrick Mulvey	Flooding	7/13/2009	11/4/09 1:00pm	1	1 - Worried about the capacity of the private drain tile once the 27 or so lots to the south of the railroad get developed. Thinks the Town should take the responsibility to replace and upsize this tile. 2 - Very indirect drainage pattern on the north side of his block before it discharges into the neighboring wetland and eventually to the privately owned drain tile.	Y	N	N	N	Y (20)	N	1 - Property owners adjacent to this drain tile have collaboratively decided to pay a contractor to fix tile. Therefore nothing is recommended at this time. 2 - Reevaluate the existing drainage route to see if there is a more direct solution.	1 = $0 2 = < $10,000	1 = Low 2 = Medium
20	66-4-120-214-0770	27090 99th Street	Mary Kamin	Property Floods (house below road elevation)	9/1/2009	10/2/2009 9:30am	1	Basement flooding occurs regularly as house was built 1 foot below the adjacent roadway elevation. Property owner wants to put in a drain tile west of the house to get water to drain away from house but there is not a roadway ditch/conveyance system to tie into.	N	N	Y	N	N	N	Does not appear to be enough grade to bring the drain tile to the front of the house, the homeowner should look into bringing it behind house (near RR ditch) along with a small berm for overland flow. Also recommended that homeowner investigate the soils near his basement since the drainage area does not appear to be very large and water is somehow seeping in from the basement floor. Maybe there is a large sand seam that is bringing additional water toward the house? Homeowner to complete work, but some time may be needed to provide guidance.	< $2,500	Low
21	66-4-120-211-0281	26805 96th Place	Herbert Frank	Flooding	3/20/2009	07/31/09 1:30pm	1	Located in a flood plain. Resident is frustrated that he can't raise his house and we can't fix his problem.	Y	N	N	Y	Y (16)	N	Property acquisition appears to be the only feasible solution for this neighborhood. Cost includes purchase of all lots in the floodplain with homes built on them in this neighborhood.	$2,748,700*	Medium
22	65-4-120-164-0360	9025 269th Avenue	Cynthia Pastick	Backyard flooding because of new house	5/22/2009	7/17/2009	1	Talked to someone from this household while walking the site for complaint #24. Addressed the same concerns related to the Timber Lane Subdivision Flooding.	Y	N	N	Y	Y (12)	N	Address this issue as part of the Timber Lane Subdivision Conveyance System & Storage Project.	$659,500	High
23	65-4-120-164-0230	26711 89th Street	Ann Newcome	Flooding	6/30/2009	07/09/09 12:30pm	1	Looks like culverts beneath the driveway and 268th Ave along CTH AH are in very poor condition. Yard floods in almost all storm events.	N	Y	Y	N	N	N	Send the property owner the Kenosha County Highway Department contact information to begin the process of replacing this driveway culvert.	< $10,000	Low
24	65-4-120-161-0100	26400 89th Street	Ronald Schaetten	Field Flooding	4/28/2009	7/17/2009	4	Complaint related to the Timber Lane Subdivision Flooding Issues. Claims that a roadway culvert was removed near the newly constructed home that has caused ponding water in his agricultural fields. Completed a second field visit on 10/2/2009 to discuss the same issues.	Y	N	Y	N	N	Y	Address this issue as part of the Timber Lane Subdivision Conveyance System & Storage Project. On second site visit reiterated to the property owner that he could combine lots or move lot lines to try and maximize the amount of impervious area to one lot (maximum of 5 ERU's per parcel).	$659,500	High

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25	65-4-120-153-0261	25720 93rd Street	Terry Skweres	Flooding from neighbors	3/5/2009	07/09/09 9:30am	1	1 - New Home east of this property has caused flooding of the adjacent Town owned property (french drain system) and this water encroaches onto their driveway/garage. 2 - Overall drainage issues on this street; it appears that there are multiple damaged or undersized culverts causing drainage issues; property owner has multiple ideas on how to fix neighborhood drainage.	Y	N	N	N	Y (17)	N	1 - Maintenance of the Town-owned french drain system should be looked into; 2 - Town televised the existing storm sewer on south side of road to confirm connections but ran into a blockage early on; Further surveying should be completed to determine alternate drainage solutions for this neighborhood.	1 = < $10,000 2 = < $100,000	High
26	65-4-120-154-0311	25501 89th Street	Gloria Albor	Flooding	7/13/2009	7/17/2009	1	Reiterated the repeated flooding issues his property has experienced every spring; Related to the Albor high water relief project.	Y	N	N	N	Y (2 + road)	N	Address this issue as part of the Albor High Water Relief Conveyance System Project.	$111,875	High
27	65-4-120-154-0320	25425 89th Street	John McLeran	Flooding	7/13/2009	7/17/2009	1	Reiterated the repeated flooding issues his property has experienced every spring; Related to the Albor high water relief project.	Y	N	N	N	Y (2 + road)	N	Address this issue as part of the Albor High Water Relief Conveyance System Project	$111,875	High
28	65-4-120-154-0130	24847 89th Street	James Beinecke	Flooding	5/8/2009	7/17/2009	1	No one was home during inspection, but later talked to him on the phone. Expressed that poor drainage from the 83/AH intersection floods the downstream properties on AH.	Y	Y	N	N	Y (5)	Y	Investigate whether the low area west of the intersection is a wetland to determine if it is possible to regrade this area to help drainage. Since this drainage is connected with CTH AH, coordinate solution with the County.	< $100,000	Medium
29	65-4-120-142-0271	8731 Antioch Road	Walter Langner	Flooding & Freezing in Entrance of Apartment Building	3/31/2009	07/09/09 11:00am	4	1 - Roof Drain problems; 2 - Drainage from STH 83 runs down driveway onto property (freezes in winter); 3 - Claims to have more runoff coming from the east since the Salem Streams Subdivision was developed.	N	N	Y	N	N	N	Review plans for Salem Streams Subdivision to ensure drainage was installed as approved. Other issues appear to be strictly private property issues.	< $2,500	Low
30	65-4-120-104-0595	24915 82nd Street	Lawrence & Mary Cukla	Heavy Flooding, property damage from STH 83	8/24/2009	10/2/2009 10:30am	1	Gravel is being washed down the channel that goes across the low section of their property ever since STH 83 was redone.	Y	Y	N	N	N	Y	Rip rap or large stone is recommended to be installed down the steep slope from 82nd Street to the channel (State responsibility?) to slow the velocity of the flows and minimize erosion.	< $10,000	Low
31	65-4-120-113-0870	24200 84th Street	Lorraine Paul	Meadow of Mills Pond needs dredging; STH 83 causing additional runoff to property	6/19/2009	11/18/2009		Lorraine not available to meet, but met with neighbor Frank Bell. Concerned about the available depth left in the wet detention pond; property owner claims that many areas of the pond has less than 3 foot depth.	N	N	N	Y	Y	Y	Review the maintenance agreement for this development to see if we can find language that requires the "owner" (developer at this point), to dredge pond as it gets filled with sediment.	< $10,000	Low
32	65-4-120-031-0211	25401 60th Street	William Holter	Farm field flooding her lot (Never in past)	7/2/2009	07/31/09 10:00am	1	Rear of property had standing water after the last two June storms from flooding on the neighboring ag field.	N	N	Y	N	N	Y	Private property issue; does not appear to be an issue that the Town can solve at this time.	---	---
33		near 26407 122nd Street	Reported by Mike Murdock	Frequent roadway flooding in this area	11/18/2009	11/18/2009		Appears to be a broken drain tile in this kettle area that causes water to pond and in larger rainfall events cause flooding on 122nd Street.	Y	N	Y	N	N	Y	Possible solution is to construct a high water relief conveyance system for this kettled area in the roadway right-of-way that allows water to drain to the east into the larger wetland complex.	< $100,000	Medium
34	67-4-120-344-0567	25020 Runyard Way E	Walter Losianowycz	Flooding	5/5/2009	07/09/09 10:00am	1	Stagnant water issues in the rear of his lot. Neighbor claims a storm sewer system was supposed to be installed for this area as part of the development.	Y	N	Y	N	N	Y	Check plans for Subdivision to confirm his claims. Send information on rain gardens to homeowner.	< $2,500	Low
35	67-4-120-344-0539	12720 249th Avenue	John Ciesla	Flooding	7/13/2009	11/4/2009 11:30am	1	Claims that neighboring property (67-4-120-353-0303 - extremely large parcel) previously hauled in tons of dirt and caused a dam in the existing drainage patterns which causes water to backflow onto the road in front of their house. They previously contacted the County, but they apparently went to the wrong side of the property.	Y	Y	N	N	Y (3)	Y	Follow up with the County to see what they found when they visited this site previously.	< $10,000	Low
36	67-4-120-344-0546	12755 249th Avenue	Jeff Malueg	Neighbor pumping water/Icing problems	3/2/2009	11/4/09 11:00am	1	Neighboring property's sump pump is directed along the property line and his lawn is constantly wet because of the clayey soils. Especially a problem in the winter with sheets of ice over his driveway. Nieghbor has dug a pit at the outfall point and filled with gravel to try to get water to seep into the ground better. Has improved since this work was done but still very soggy after rainfall events. Water does not appear to make it over the curb.	N	N	Y	N	Y (2)	N	This appears to be a private property issue between two neighbors. A curb cut could be installed at this location in the Town right-of-way to help the water get onto the road quicker, but will not solve the amount of water being pumped from his sump pump and eventually running across the driveway approach.	< $10,000	Low
37	66-4-120-264-0301	11534 Antioch Rd	Anna Kenjar	Flooding because of new development	7/13/2009	11/18/2009 11:30am	1	Complaining that groundwater is getting into her basement due to excessive ponding at the field inlet adjacent to her home. Claiming that the Heritage Estates development is causing excessive runoff or the field inlet is sized too small.	N	N	Y	N	N	Y	Recommended that the homeowner investigate options to protect the foundation of the home or install a french drain around the home to direct subsurface water away from the basement foundation. Work to be completed by homeowner, but some time may be needed to provide guidance.	< $2,500	Low
38		23908 116th Place	STH 83 culvert from Heritage Estates to Hickory Hollows Subdivision.	STH 83 culvert was upsized when roadway was reconstructed and it's causing erosion on property.		07/09/09 11:30am	1	Rip rap downstream of STH 83 Culvert has been blown out; causing downstream erosion problems for field inlet within this subdivision. Christine Gustafson has also complained about this in the past.	Y	Y	N	N	N	Y	On 11/04/2009 it appeared that additional rip rap had been placed at this outlet. Mike Murdock confirmed that this work was completed by the Town. Continue to keep an eye on this culvert and fix/maintain the rip rap as needed.	< $10,000	Low

* Property Acquisition values are based on the 2009 Assessed Value of the property(s).

APPENDIX N
TOWN OF SALEM DRAINAGE AND FLOODING COMPLAINT INVENTORY
December 2009

Map ID	Tax Key	Address	Owner Name	Complaint	Date	Inspection Date	ERU Fee	Field Observations	Town Issue	State or County Issue	Private Property Issue	Located in Regulatory Flood Plain Limits	Problem Affecting Multiple Homes (#)	Only Floods in Large Storm Events	Recommendations	Estimated Cost ($ in 2009)	Priority Ranking
39	67-4-120-354-1397	23502 125th Street	Theresa Jennings	Her and neighbors flood	9/16/2009	10/2/2009 8:30am	1	Catch basin and storm sewer installed in low area to handle drainage from 124th St, 124th Pl and 125th St. Appears to be a capacity issue.	Y	N	N	N	Y (25)	N	Look into size/capacity of existing storm sewer/drain tile and possibility of adding conveyance systems to 124th Street and 124th Place to avoid bringing all drainage to 125th Street.	< $300,000	High
40		122nd Street east of 224th Ave	reported by Mike Murdock	Constant drainage issues	8/28/2009	10/2/2009		According to Jason/Mike an existing drain tile runs along 122nd Street that discharges down 220th Avenue to Lake Shangrila. Town has installed a few french drain systems in the past in this area to alleviate drainage concerns.	Y	N	N	N	Y (13)	N	Investigate the possibility of running a storm sewer system down 122nd street that would discharge to a Town owned easement before draining to Lake Shangrila. Would likely be a deep sewer, but appears that it could work.	$205,175	High
41	67-4-120-361-2220	22033 117th Street	Scott & Gary Robb	His vacant lot next to house floods	4/29/2009	07/31/09 2:00pm	1	Erosion of shoulder of road occuring at the T-intersection with 221st Ave. Culvert beneath 117th Street and driveway culverts from the west join into a catch basin and discharge through a storm pipe to the lake. Looked like the pipe draining to the lake may be undersized.	Y	N	N	N	N	Y	Regrade and stabilize the eroded shoulder at the intersection. Investigate the sizes and capacity of the storm sewer system.	< $10,000	Low
42	66-4-120-243-0202	22725 98th Street	Dennis Sheen	Neighboring farm installed tile 06/2009	7/15/2009	07/31/09 12:00pm	1	Neighbor's drain tile being redirected to culvert under road onto his property and he is worried this will flood his crops further. The Town has installed an 18" drain tile system with catch basins west of his property on 98th 5-10 years ago.	N	N	N	N	N	N	Follow up with the Town attorney to see if there is any legal course of action or rights for the property owner in this situation.	< $2,500	Low
43	65-4-120-131-0705	8630 223rd Avenue	John Foglio	Flooding	7/13/2009	07/31/09 10:30am	1	Repeat flooding issues. It appears that the culvert in front of the home that crosses 223rd Ave to the wetland is pitched the wrong way / flat? Also the downstream culvert crossing Salem Road is smaller than the upstream culverts at 223rd and 86th Place. The Town put in two sock drains in their ditch/driveway culvert last summer to help aleviate this issue, but it seemed to make it worse.	Y	N	N	N	N	N	Investigate the culvert elevations/sizes. It appears that some rework would help aleviate the flooding issues for this property and the road.	< $100,000	High
44	65-4-120-132-0215	22505 85th Place	Deana Day	Backyard & Neighbors Flood	4/29/2009	07/31/09 11:00am	1	Back yard is constantly wet as well as surrounding neighbors. Neighborhood appears to be internally drained with no outlets. After looking at a map, identified this rear yard area as mapped wetland.	N	N	Y	N	Y (5)	N	Since this is a wetland there is not much the Town can do. Could look into a high water relief mechanism, but won't solve the "wetness" issue since this is a wetland.	---	---
															APPROXIMATE TOTAL	**$8,451,750**	

Source: Town of Salem, Wisconsin

* Property Acquisition values are based on the 2009 Assessed Value of the property(s).

KAPUR & ASSOCIATES, INC.
CONSULTING ENGINEERS

7711 N. Port Washington Road
Milwaukee, WI 53217
Ph: (414) 351-6668
Fax: (414) 351-4117

Memo

Date: May 2, 2009

To: Anita Pusch – WisDOT SER

Kurt Flierl – WisDOT SER

Cc:

From: Elizabeth S. Klemann, P.E.

RE: STH 83 (1332-00-70) Hydrology Evaluation

The Wisconsin Department of Transportation (WisDOT) reconstructed STH 83 in the Village of Salem in Kenosha County in 2006. There have been comments from the public to the WisDOT questioning whether the reconstruction of STH 83 to the west of Hooker Lake has contributed to recent flooding events on Hooker Lake. WisDOT asked Kapur & Associates, Inc. to do an independent review of the hydrology of the Hooker Lake watershed that crosses STH 83 in the portion that now has storm sewer, as requested by the Village of Salem. This memo summarizes that evaluation.

The hydrologic evaluation was conducted in HEC-HMS (the hydrology modeling software created by the U.S. Army Corps of Engineers) using TR-55 (UDSA, 1986) methodologies. TR-55 is a method for evaluating small watersheds that uses curve numbers (CN) to evaluate runoff. A CN is the percentage of rainfall that is converted to runoff. Higher CN values mean an area generates more runoff. Parking lots have a curve number of 99 (99% of rainfall becomes runoff) and wooded areas can have a curve number as low as 35 (35% of rainfall becomes runoff) depending on the soils.

DRAINAGE SUB-BASINS

Drainage basins were determined utilizing 2-foot contour mapping. 5 drainage basins are associated with the STH 83 storm sewer, although one basin has closed contours and does not contribute runoff in rainfalls up to the 2% probability event (50-year storm). See Figure 1.

- 85th Street (Blue)

  This drainage area is 8.38 acres east of 85th Street that drains to the south. In the existing condition it crosses STH 83 near 85th Street and eventually drains to Hooker Lake. The entire sub-basin is developed, primarily as residential.

In the post-construction model, 650 feet of STH 83 to the south were added to the sub-basin because the storm sewer extends to the south. The runoff from this sub-basin joins with the runoff from 83rd Street basin before being discharged east of STH 83 along 83rd Street.

- 83rd Street (Orange)

This approximately 22.7-acre sub-basin between 83rd Street and 82nd Street on the west side of STH 83 extends approximately 1400 feet to the west. The pre-construction runoff crossed STH 83 east of 83rd Street in a cross-culvert and flowed into Hooker Lake. The land use in this sub-basin includes residential, forest, and agricultural fields.

After construction, the runoff from this area was carried in storm sewer to the south to 83rd Street and joins the runoff from the 85th Street sub-basin before flowing in storm sewer pipe to the east where it discharges near Hooker Lake.

- Central (Green)

This sub-basin is approximately 22.1 acres on the west side of STH 83 between roughly 82nd Street and 81st Street. The majority of the sub-basin is agricultural fields, but there is a residential area adjacent to STH 83 and some forested areas. The pipe connecting this sub-basin to the discharge near Hooker Lake was lengthened, but the longest flow path within the basin was not altered.

- North (Red)

The 20.7-acre sub-basin adjacent to STH 83 is agricultural fields. In the pre-construction condition, the sub-basin drains toward STH 83 and then flows along the west side of STH 83 through the ditch in the Central sub-basin where the flows from both Central and North cross the road in a cross-culvert.

A detention pond was constructed with the roadway project and the runoff from the north sub-basin flows into this pond prior to being discharged into the storm sewer which then flows to the south before merging with the flows from the central sub-basin.

- North (non-contributing)

There is an approximately 35.2-acre sub-basin to the west of the north basin that has a depressed area that intercepts runoff. Runoff does not leave this sub-basin in rainfall events of 2-percent probability (50-year average occurrence interval). Some runoff does leave this sub-basin in the 1-percent probability event (100-year average occurrence interval). The runoff flows across the north basin following the same flow path as the north sub-basin,

After several days of rain, the area was ponded as shown in this picture taken on April 28, 2009

HYDROLOGIC EVALUATION METHODOLOGY

Both pre-construction and post-construction conditions were modeled using HEC-HMS. Drainage basins included all tributary areas to the west of STH 83 and to the ultimate location of the back of the walk (considered residential in the pre-construction condition) on the east side of STH 83.

The connectivity of the storm sewer was included, but because the storm sewer is a rapid conduit with minimal time lag is it not included explicitly in the model. The water is assumed to pass through the storm sewer instantaneously.

The area of interest was Hooker Lake and any impacts to the amount of runoff on the 102-acre lake.

The following changes were made to the post-construction conditions:

- The 85th St sub-basin was enlarged for the additional roadway to the south that was connected to the storm sewer
- The 85th St sub-basin no longer drains to Hooker Lake via overland flow and instead merges with the 83rd sub-basin before both drain to Hooker Lake.
- The detention basin west of STH 83 was added in the North sub-basin
- The area of the roadway in all sub-basins was increased from 40' wide to 60' wide to account for addition of impervious surface in paved shoulder and sidewalk
- The North sub-basin no longer flows in a ditch to the Central sub-basin. The model was modified to change the connection to a pipe, which allows the water to move more quickly.
- The length of the channel that carries the south outfall, which carries the runoff from the 85th Street and 83rd Street sub-basins to Hooker Lake, was reduced to reflect the relocation of the outfall.

RAINFALL

Rainfall Depths used Bulletin 71 of USGS (Huff, 1992), which is a peer-reviewed estimate of rainfall in Illinois and Wisconsin that is widely accepted for use in modeling activities, such as this one.

Probability	Recurrence Interval (average frequency)	24-hour storm rainfall
4-percent	25-year	4.66
2-percent	50-year	5.38
1-percent	100-year	6.24

Rainfalls events are categorized by the probability of them being exceeded. A 4-percent probability storm is a rainfall event that will be smaller than only 4 percent of storms (i.e., greater than 96 percent of storms). In 100 years, the 4-percent probability event is expected to be seen only 4 times, which would be an average of every 25 years. However, the intervals can be much shorter. It is only over a long period of time these distribution patterns average out.

CONSERVATIVE ASSUMPTIONS

Several of the assumptions made in the model are conservative and will yield a change in runoff volumes that may be high.

- Rainfall depths used (Bulletin 71) are higher than other depths also published by the Southeast Wisconsin Regional Planning Commission. Higher rainfall amounts result in higher runoff amounts.

- No outlet was modeled on Hooker Lake for two reasons: a lack of information about the outfall and the modeled drainage area is not the complete Hooker Lake watershed. Including an outlet on Hooker Lake might offset some of the water added to the lake.

- In the pre-construction condition, the ditches adjacent to the roadway were assumed to be grass, but they were often paved. Pre-construction runoff may be slightly underestimated. In the post-construction condition, the terrace area (grass between the curb and sidewalk) was included in the impervious roadway area. Post-construction runoff may be slightly overestimated. Therefore, the change in runoff between the pre-construction and post-construction conditions may be slightly overestimated.

CONCLUSIONS

Figure 1 shows the drainage sub-basins and the discharge locations.

	Pre-construction – 1-percent Probability		Post-construction 1-percent Probability	
Discharge Location	Contributing Sub-basins	Peak Flow (cfs)	Contributing Sub-basins	Peak Flow (cfs)
84th Street	85th Street	33	None	0
83rd Street	None	0	85th Street and 83rd Street	124
Adjacent to BUILDING	Central	81	None	0
82nd Street	North (and North non-contributing)	171	Central and North (and North non-contributing)	117

The total peak flow discharge is reduced in the post-construction condition due to the addition of the storm water detention pond. Water is stored in the pond and discharged at a slower rate, which reduces the peak flow rate from the North and North non-contributing sub-basins.

The total amount of runoff was increased slightly due to the addition of paved shoulders and side walks, which are impervious areas.

The increase in the total amount of runoff would result in a very small increase (0.01 feet) over the entire surface of Hooker Lake. Please note, however, that this increase assumes there is no outlet from Hooker Lake, which is not the case. The actual amount of increase would be lower due to water exiting the lake. [See Table 1 for additional detail]

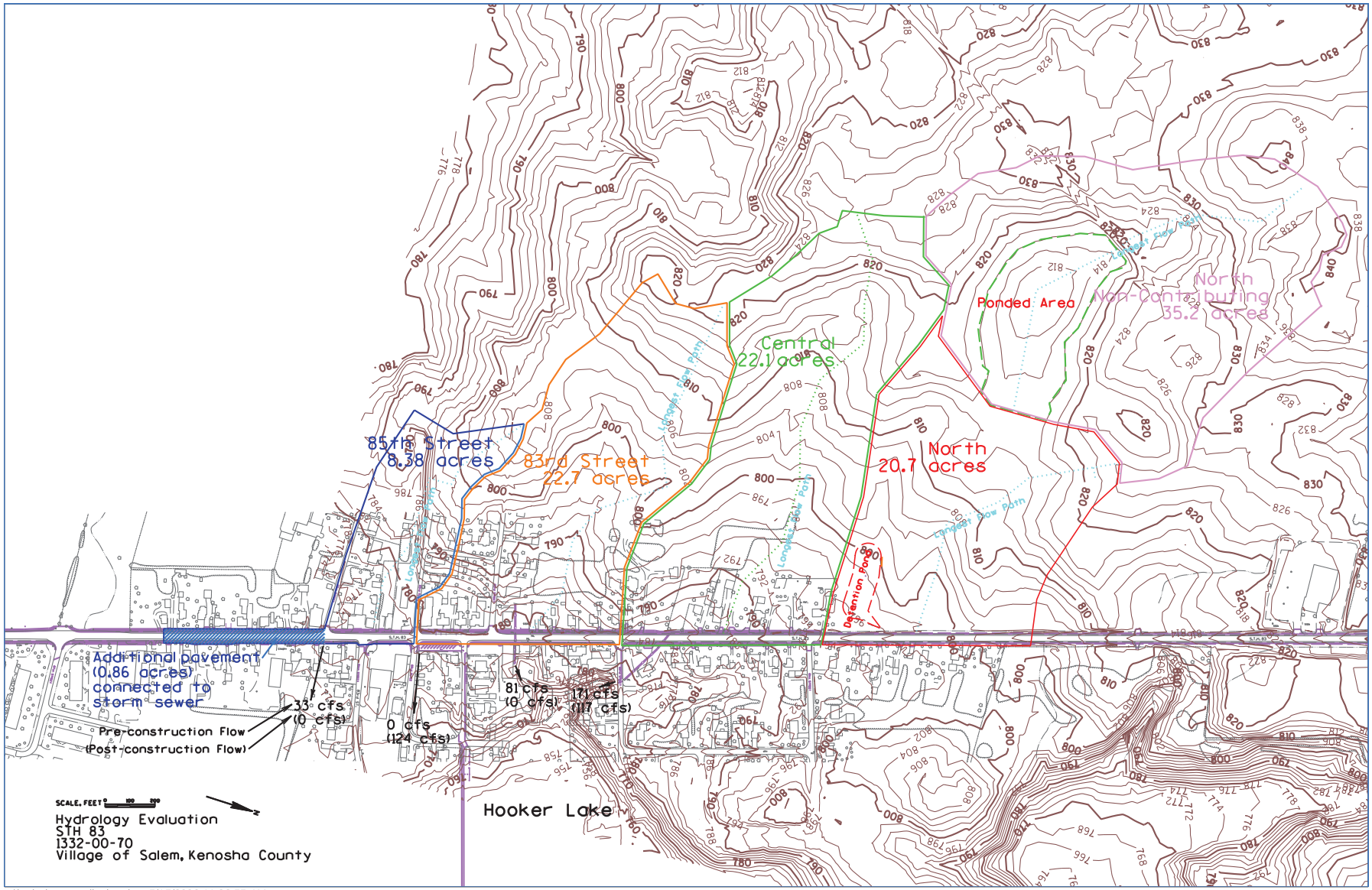
Any increases in water level seen on Hooker Lake are not due to changes associated with the reconstruction of STH 83.

TABLE 1 – Summary of results of modeling of STH 83 runoff.

Hooker Lake	100-year Interval			50-year Interval			25-year Interval		
[Area=102 acres]	Pre-Const'n	Post-Const'n	Difference	Pre-Const'n	Post-Const'n	Difference	Pre-Const'n	Post-Const'n	Difference
Peak Flow (cfs)	282.3	232.1	**-50.2**	229.9	191.4	**-38.5**	186.7	156.9	**-29.7**
Total Volume of Runoff (ac-ft)	31.38	32.73	1.35	23.85	25.03	1.18	18.42	19.45	1.03
Depth of Total Runoff over Hooker Lake FT	0.31	0.32	0.013	0.23	0.25	0.012	0.18	0.19	0.010
IN	3.7	3.9	0.16	2.8	2.9	0.14	2.2	2.3	0.12

New Detention Pond*	100-year Interval			50-year Interval			25-year Interval		
	Pre-Const'n	Post-Const'n	Difference	Pre-Const'n	Post-Const'n	Difference	Pre-Const'n	Post-Const'n	Difference
Peak Flow (cfs)	86.8	28.5	**-58.2**	71.0	25.3	**-45.7**	57.9	22.2	**-35.7**
Total Volume of Runoff (ac-ft)	10.8	10.8	0.1	7.1	7.2	0.1	4.9	4.9	0.1

*The new detention pond is located at the outlet of the North sub-basin. This table compares the pre-construction and post-construction runoff from the North and North Non-contributing sub-basins.



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CHAPTER 4 - REVISED
STORM WATER QUANTITY ANALYSIS

INTRODUCTION

This chapter describes the approach used to determine flows and runoff volumes. The method and computer program are described, and the parameters used in the computations are discussed. Results from the analyses are presented.

The hydrologic analysis determined peak flows and runoff volumes for all the subbasins throughout the Town of Salem. Existing land use conditions in the watershed were analyzed using the year 2000 land use files for the Town developed by the Southeastern Wisconsin Regional Planning Commission (SEWRPC). The proposed 2020 land uses for the Town have been developed through the overall Town Neighborhoods planning process completed in 2007. The land use data provides information on the degree of imperviousness in the subbasin. Peak discharge flow rates and runoff volumes for the 2-, 10-, 25-, and 100-year recurrence interval storm events for the 24-hour storm duration have been developed for all the subbasins in the Town under existing and proposed land uses.

The Town of Salem Storm Water Ordinance includes two standards for stormwater management relating to water quantity. The Fox River runs along the western Town boundary, and the majority of the Town is located in the Fox River watershed. For the lands within the Fox River watershed, the standards require controls such that the post-construction peak storm water discharge rates shall not exceed the pre-construction peak discharge rates for the 2-year, 10-year, and 100-year, 24-hour design storms.

The eastern portion of the Town is within the Des Plaines River Watershed. For lands within the Des Plaines River Watershed, standards require controls to meet the post-construction 2-year storm peak discharge rate of 0.04 cubic feet per second per acre of new development and the 100-year peak discharge rate of 0.30 cubic feet per second per acre of new development. These release rates should be considered as maximums.

HYDROLOGIC METHODS

The rainfall/runoff relationships for all subbasins and major outfalls were developed using the hydrologic computer program PondPack, Urban Hydrology and Detention Pond Modeling Software, Version 10.1. PondPack is widely used for hydrologic analysis of urban and rural watersheds. The primary function of the PondPack model is to develop surface runoff hydrographs for each subbasin. The PondPack models evaluated each subbasin in the Town. Flow hydrographs for storm events with recurrence intervals of 2-, 10-, 25-, and 100-years were computed.

The Villages of Paddock Lake and Silver Lake are within the Salem Township boundary, but are separate municipalities and not part of the Town of Salem. Some of the subbasins are partially within the Town and one of the villages. If the portion of subbasin within the Town was less than 20 acres, the subbasin runoff was not evaluated. For partial subbasins that were evaluated, the subbasin included only the area within the Town.

Hydrologic Parameters

The data parameters required for the hydrologic analysis include precipitation, subbasin area, runoff curve numbers based on soil type and land use, and the timing associated with surface runoff reaching the stream system. The hydrologic parameters necessary for the analysis are described below.

Precipitation

The hydrologic analysis evaluated the 50%, 10%, 4%, and 1% annual chance probability of occurrence events, or the 2-, 10-, 25- and 100-year recurrence interval events, respectively. The peak discharges and runoff volumes were developed for a 24-hour storm using the SCS Type II rainfall distribution and 24-hour rainfall depths of 2.57, 3.62, 4.41, and 5.88 inches, respectively, obtained from the SEWRPC Technical Report #40, Rainfall Frequency in the Southeastern Wisconsin Region, April 2000.

Subbasin Area

The Town of Salem is divided into two major watersheds, the Fox River and the Des Plaines River. These two watersheds were divided into 14 sub-watersheds, and then further divided into 91 subbasins based on the topography, location of the tributary streams, location of major outfalls, and visual observations during field reconnaissance. The sub-watershed boundaries are shown in Figure 4-1, while the subbasin boundaries are illustrated in Figure 4-2. The subbasins ranged from 20 acres to 1,543 acres in size.

Soil Type

The hydrologic soil groups (HSG) in the Town of Salem were determined using the Natural Resources Conservation Service Soil Survey of Kenosha and Racine Counties, Wisconsin, 2003, and are shown on Figure 3-3. Soils are classified into four HSGs (A, B, C, and D) according to their minimum infiltration rate. The soils range from Group A, which has high permeability in well-drained soils, which produces less runoff, to Group D which has low permeability and more anticipated runoff. The predominant soils in the Town of Salem are Group C, which are primarily clay and have low infiltration rates, poor drainage, and high runoff potential. The HSG is used in determining the runoff curve number.

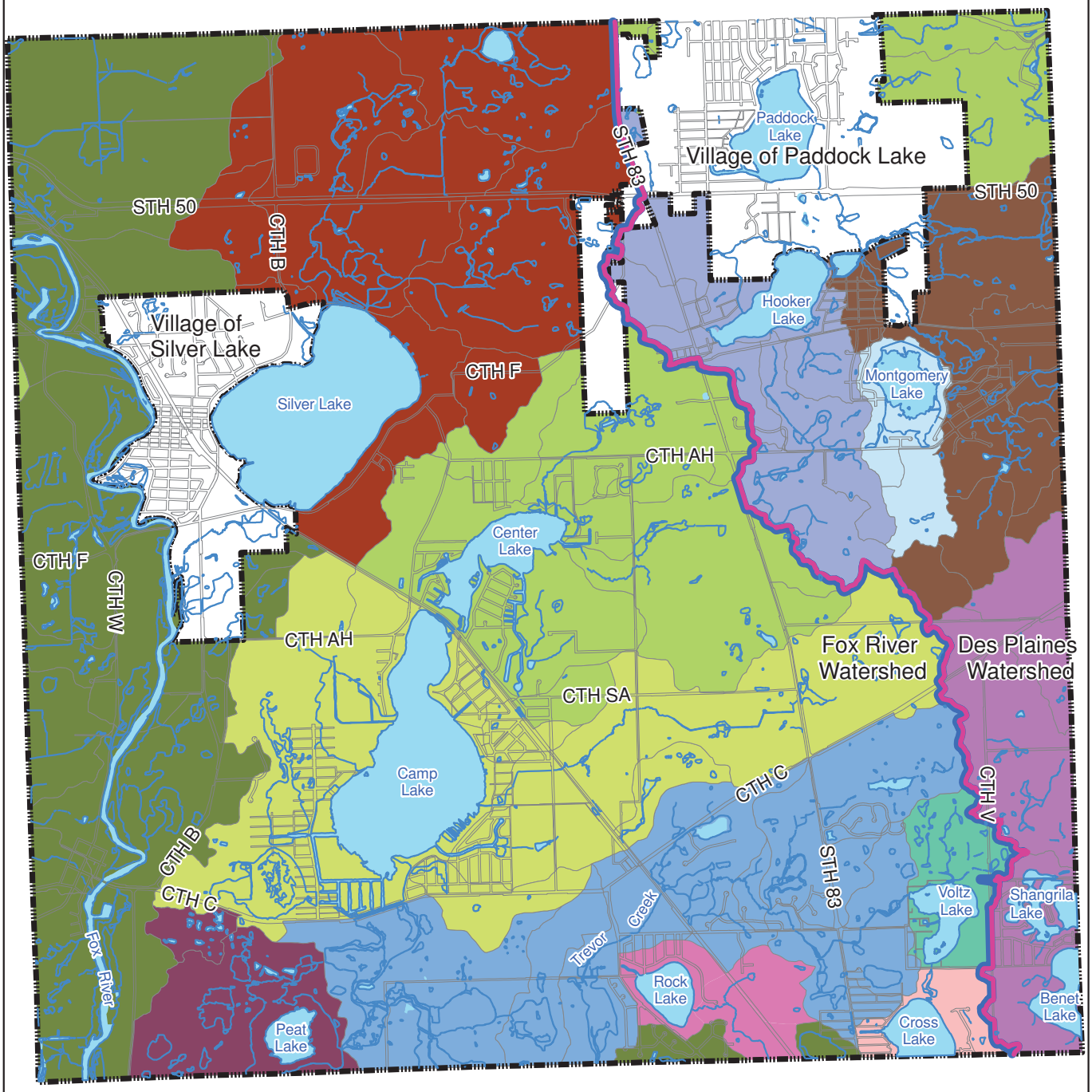
Runoff Curve Number

An area-weighted average curve number was computed for each subbasin based on land use and corresponding HSG determined using Geographic Information System (GIS). Existing year 2000 digital land use mapping was prepared by SEWRPC. Proposed 2020 land cover was determined from the proposed land use maps generated during the Neighborhood Planning process. The year 2000 land use was used for the two areas assumed to be annexed in the future and not included in the Neighborhood Planning process (shown on Figure 3-2). The runoff curve numbers assigned to each SEWRPC land cover classification are provided in Appendix B. The Neighborhood Planning process developed a different set of land use types and the curve numbers for those land covers are also provided in Appendix C.

Time of Concentration

The Time of Concentration (T_C) is defined as the time it takes for the surface water runoff to travel from the hydraulically most distant point of the subbasin to the discharge location. The T_C was calculated based on a combination of sheet flow, shallow concentrated flow, and open channel flow. The existing condition travel paths were determined from the available topographic mapping. The same times of concentration were used for the future 2020 condition. Generally, the T_C would be expected to be shorter for future conditions due to more impervious area and storm sewers, but insufficient data is available to estimate the future T_C.

These parameters were developed for existing 2000 and proposed 2020 land use conditions in each subbasin. Appendix D summarizes the subbasin parameter values used in the hydrologic analysis.



DRAFT

FIGURE 4-1
TOWN OF SALEM
SUBWATERSHED BOUNDARIES EXHIBIT

Legend

- MunicipalBoundary
- Major Watershed Division
- Subwatersheds
- Fox River (FR)
- Silver Lake (SL)
- Camp Lake (CP)
- Center Lake (CR)
- Peat Lake (PL)
- Brighton Creek (BC)
- Trevor Creek (TC)
- Dutch Gap Canal (DGC)
- Rock Lake (RL)
- Cross Lake (CS)
- Voltz Lake (VL)
- Salem Branch (SB)
- Montgomery Lake (ML)
- Hooker Lake (HL)

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September 2009

R.A. Smith National
Beyond Surveying and Engineering

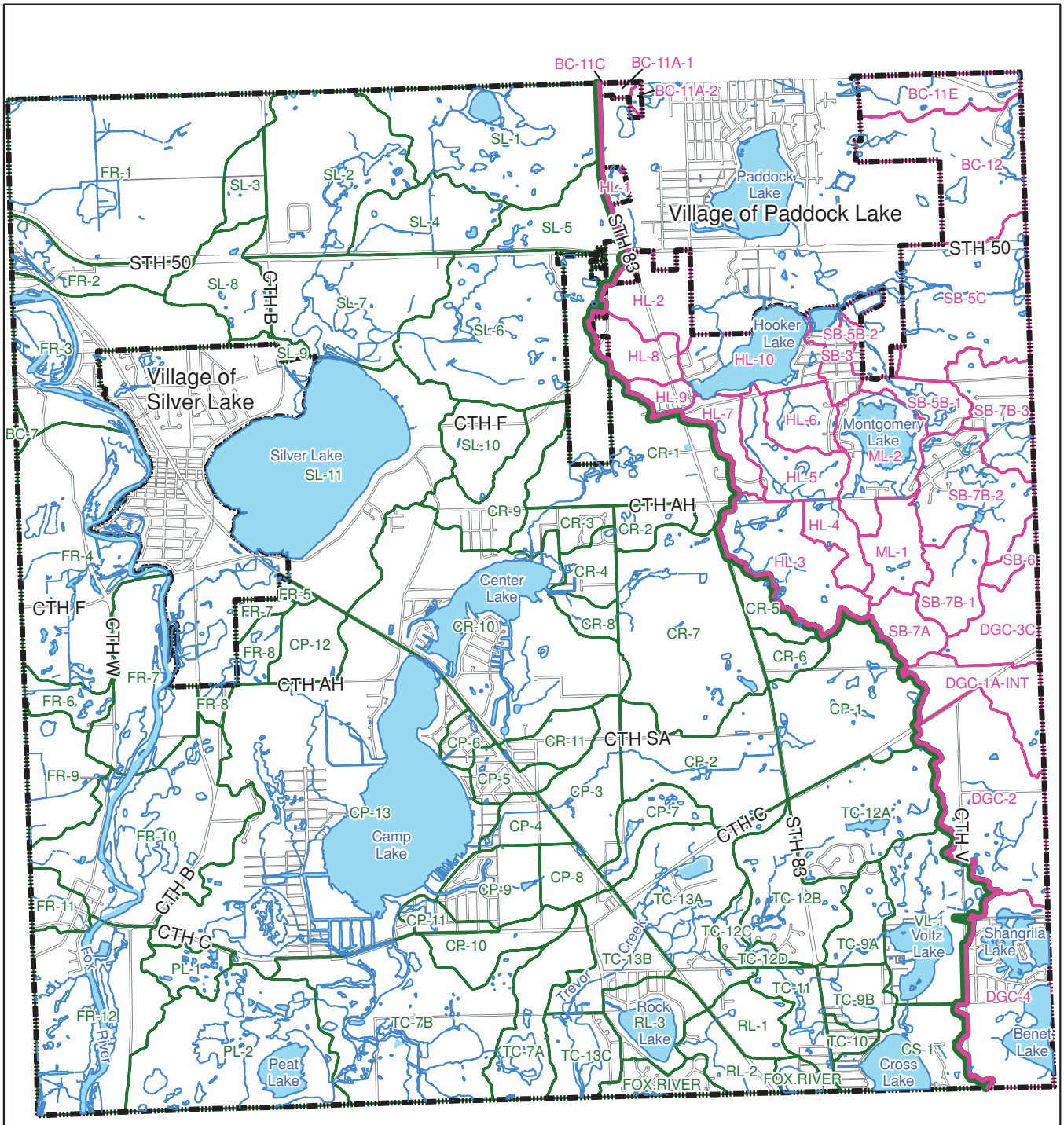

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FIGURE 4-2
TOWN OF SALEM
SUBBASIN BOUNDARIES EXHIBIT

Legend
- MunicipalBoundary
- Major Watershed Division
- Des Plaines Watershed
- Fox River Watershed
- SL-1 Subbasin ID

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September 2009

R.A. Smith National
Beyond Surveying and Engineering

Lakes in Town of Salem

Lakes of various sizes are scattered throughout the Town of Salem. A number of them have dam outlets, as identified by the Wisconsin Department of Natural Resources (WDNR). Some of the lakes provide substantial storage during storm events. Survey and analysis of the lake outlet structures was not part of this study, so the lake storage was not included in the hydrologic analysis. Some of the lakes have been evaluated in other studies. The lakes are shown on Figure 4-3 and available information on the lakes is provided in Table 4-1.

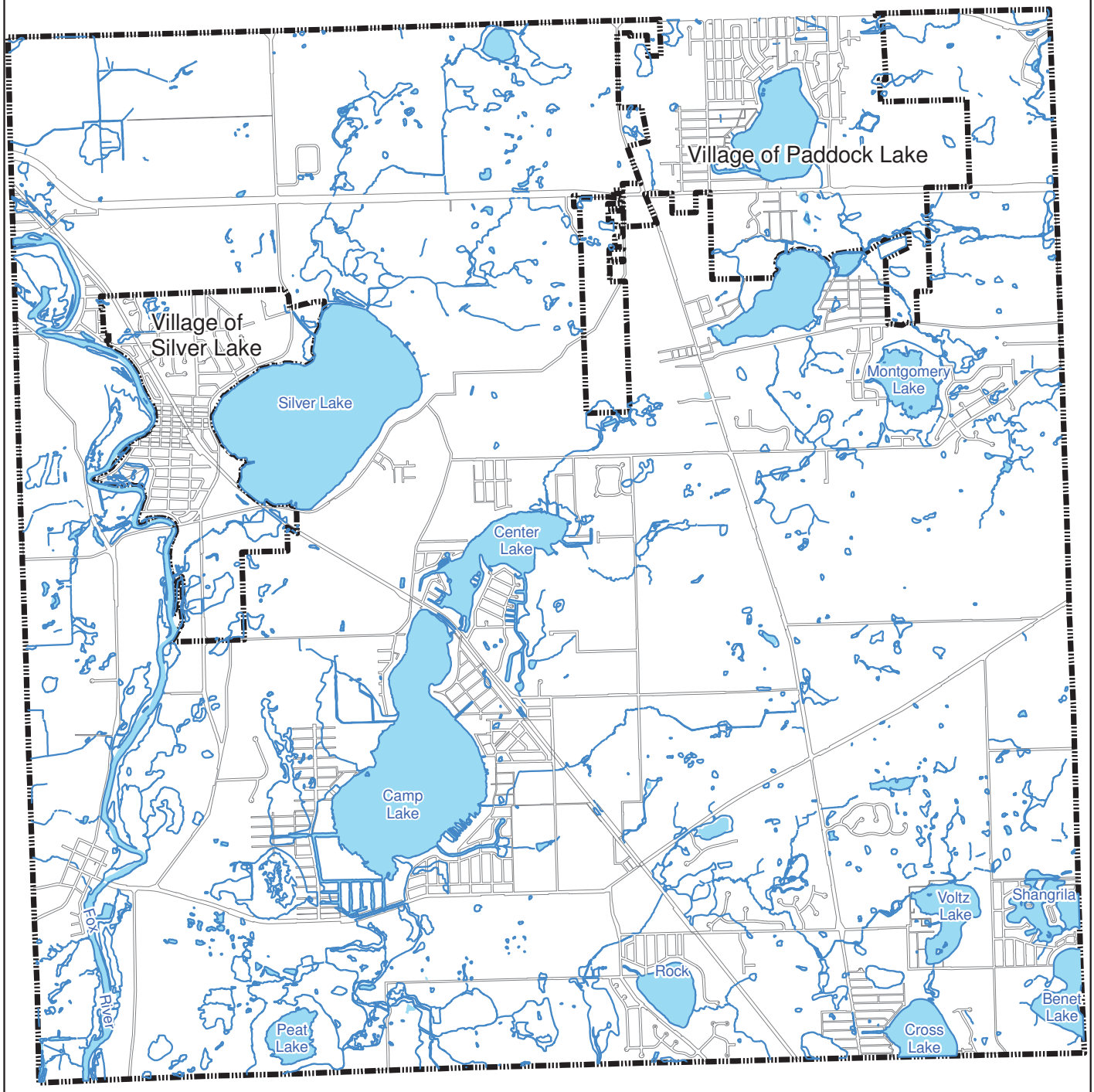
Table 4-1
Lakes in the Town of Salem

Lake Name	Official Dam Name[1]	Surface Area[2] (Ac)	Volume[2] (ac-ft)	Lake Association[3]	1% Annual Chance (100-year) Elevation[4] (ft, NGVD-29)
Camp Lake	Camp Lake	461	2,328	Camp/Center Lake Rehab District	742.7
Center Lake	Center Lake 2	129	1,136	Camp/Center Lake Rehab District	744.4
Cross Lake	Cross Lake	87	1,027	Cross Lake Improvement Association	N/A
Hooker Lake	Hooker Lake	87	983	Hooker Lake Management District	756.2
Montgomery Lake	N/A	N/A	N/A	N/A	800.9
Rock Lake	Rock Lake	44[1]	350[1]	Rock Lake Highlands Association	N/A
Benet/Shangrila Lake	Lake Shangrila	186[5]	874	N/A	N/A
Silver Lake	Silver Lake	464	4,819	N/A	749.4
Voltz Lake	Voltz Lake	52	362	Voltz Lake Management District	N/A

N/A Not Available
[1] WDNR website
[2] SEWRPC Memorandum Report No.93
[3] UW Extension Lakes
[4] SEWRPC correspondence dated July 31, 2009
[5] Includes six acres in Illinois

RESULTS OF HYDROLOGIC ANALYSIS

The peak flows for the 2000 and 2020 land use conditions were determined using PondPack for the 2-, 10-, 25-, and 100-year storm events for the Town subbasins illustrated in Figure 4-2. The results are summarized and compared in Appendix E. The existing 2000 analysis did not include existing detention facilities and natural floodwater storage areas and the 2020 land use analysis did not include any required post-construction stormwater controls. The comparison shows that in most cases, the proposed development would increase peak flows and the volume of runoff.


Village of Paddock Lake
Village of Silver Lake
Silver Lake
Montgomery Lake
Center Lake
Camp Lake
Fox River
Peat Lake
Rock
Voltz Lake
Shangrila
Benet Lake
Cross Lake

IDENTIFIED DRAINAGE PROBLEM AREAS

Early development in the Town was built without the benefit of planning for surface water drainage. This has created ongoing problems in a number of areas of the Town. The seven locations shown on Figure 4-4 have been identified as priority drainage problem areas due to the frequency and severity of flooding in these areas over time. Further details regarding the priority drainage problem areas are included below.

A - Salem Oaks Subdivision

Description

The drainage problems are mainly along 81st Street, 81st Place, and 82nd Street east of 235th Avenue. The existing storm water drainage patterns in this area can be characterized by a system of grass swales and culverts that drain from south to north through private properties and beneath Town roads. In general, the existing storm water drainage patterns do not allow for the efficient conveyance of storm water flows due to improvements on private properties and the lack of drainage easements and corridors.

Proposed Alternative

The proposed project includes a storm sewer conveyance system to capture runoff in Town right-of-ways and convey it underground to a stormwater management wet detention pond located on Town property south of 81st Street between 235th and 236th Avenues. The proposed drainage improvement plan is shown on Figure 4-5.

Benefits

The proposed project would reduce storm water flows through private properties in Salem Oaks east of 235th Avenue and provide water quality benefits to the Hooker Lake drainage basin via treatment of the storm water in the proposed wet detention pond.

Cost Estimate

Preliminary project costs have been estimated using Town mapping records, a site visit and the history of the drainage problems in this area of the Salem Oaks neighborhood.

Item	Quantity	Units	Unit Cost	Cost
Inlet	13	EA	$2,000	$ 26,000
Manhole	8	EA	$3,500	$ 28,000
Storm Sewer	2320	LF	$75.00	$174,000
Detention Pond	1	LS	$140,000	$140,000
			Subtotal	$368,000
			Contingencies	$ 74,000
			Engineering & Administration	$110,000
			Probable Construction Cost	**$552,000**

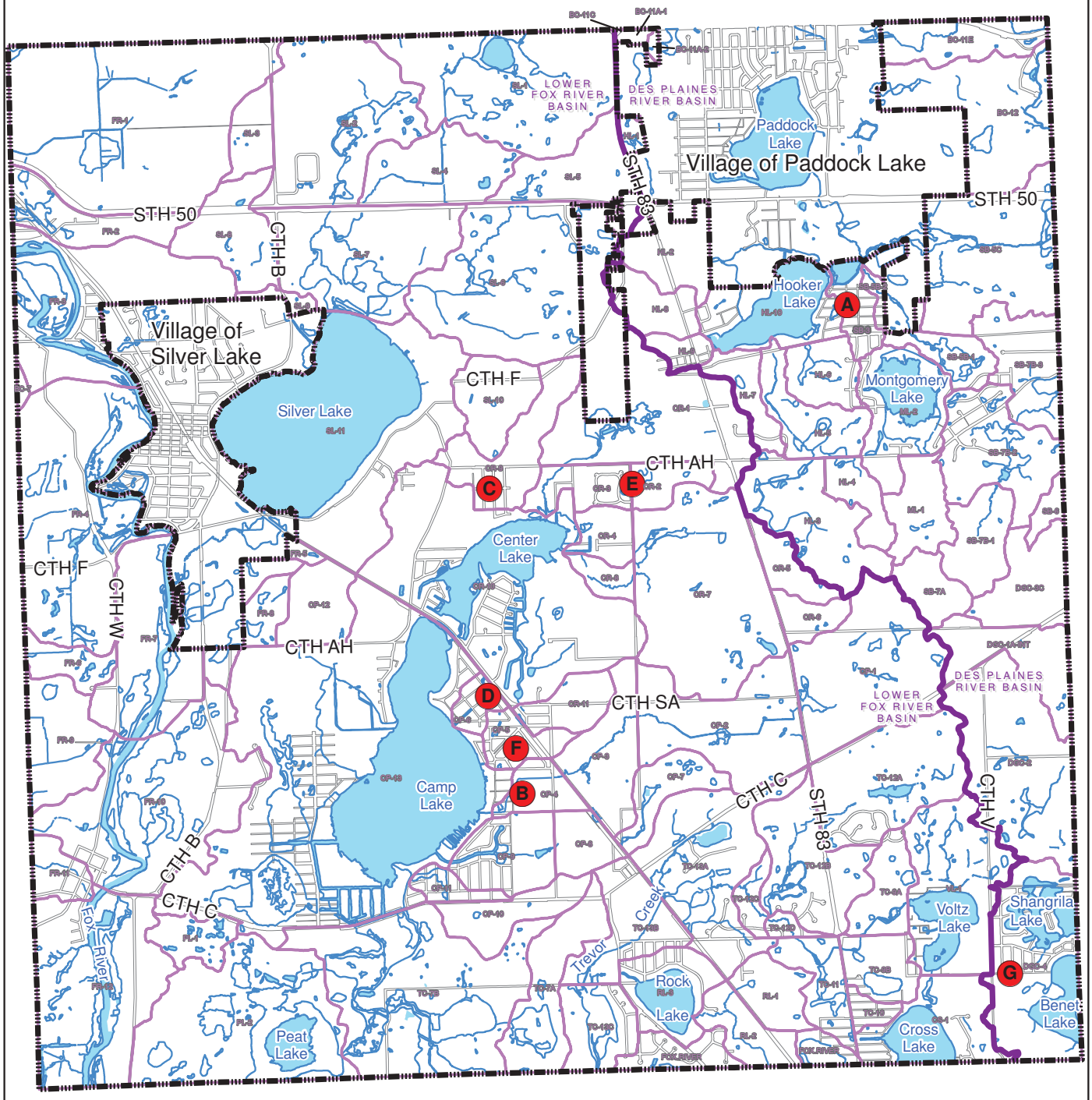


FIGURE 4-4
TOWN OF SALEM
PRIORITY DRAINAGE PROBLEM AREAS

DRAFT

Legend

- A — Priority Drainage Problem Areas
- MunicipalBoundary
- Subbasin Boundaries

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FIGURE 4-5
TOWN OF SALEM
SALEM OAKS SUBDIVISION

Legend

- Proposed Storm Sewer
- Proposed Catchbasin
- Proposed Manhole
- Proposed Outfall
- Proposed Outlet Control Structure
- Contours
- Proposed Fence
- Floodplain
- SEWRPC Wetlands
- Subbasin Boundaries
- MunicipalBoundary

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B - Shoreview Subdivision

Description

The Shoreview Subdivision is on the east side of Camp Lake north of 110th Street and west of 267th Avenue. The navigable stream that flows through the subdivision drains a primarily agricultural area of about 950 acres to the east (see Figure 4-6). The existing condition 100-year discharge through the subdivision developed during the hydrologic analysis is 875 cubic feet per second (cfs). The subdivision experiences overbank flooding and sediment deposition from the stream during heavy rainfall events.

Proposed Alternative

The proposed future land use map (Figure 3-2) shows the majority of the agricultural land in the drainage area will be developed as residential, with smaller areas converted to business and industrial land uses. The current storm water ordinance for this portion of the Town, which is within the Fox River Watershed, calls for the future 2-, 10-, and 100-year recurrence interval event runoff to be controlled to predevelopment levels. To lessen flooding in this neighborhood, we recommend that the more restrictive runoff regulations of 0.04 cfs/acre for the 2-year event and 0.30 cfs/acre for the 100-year event, as required in the Des Plaines Watershed, be applied to this drainage basin. The more restrictive runoff rates would help to reduce the flooding at no cost to the Town, but only as upstream development occurs.

To reduce flooding in the near future prior to new upstream development, one or more detention basins upstream of 267th Avenue could be constructed to reduce peak flood flows. The basins locations could be selected to be consistent with future land use plans and provide the flow reduction in advance of land development. Any detention basins located near the stream channel would need approval from the WDNR.

The channel through the subdivision is a navigable stream, which makes it difficult to obtain WDNR approval to enlarge or change the channel significantly to reduce flooding in this area. Flooding may be alleviated by removing the flood-prone homes or by creating a flood conveyance route outside the stream channel. Constructing an overbank conveyance area may involve removal of homes or garages, replacing culverts, and altering street grades. A WDNR permit would also be required.

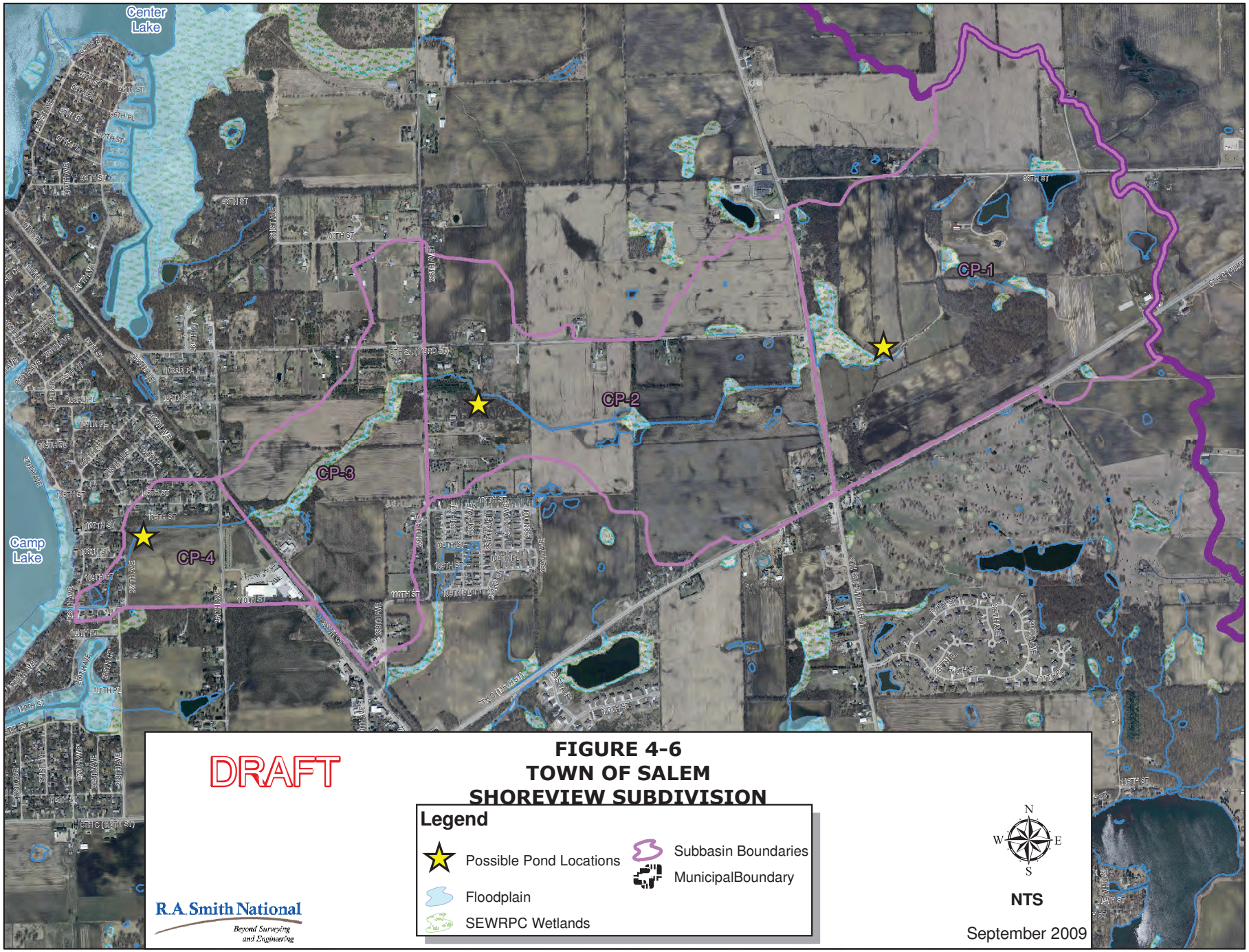
Further study of alternatives to address the flooding problem in this area is recommended. The study would include survey of home elevations, determining the capacity of the channel and culverts, identification of possible detention sites and overbank flood conveyance routes, and evaluation of land acquisition, structure removal, grading, and street crossing modifications necessary for each alternative. From this analysis and evaluation, the most effective solution to the flooding problem would be identified.

Benefits

Requiring future development to meet the more restrictive runoff requirements will decrease the future flood flows through the subdivision at no cost to the Town. Evaluating alternative solutions to the flooding and identifying an effective approach will provide the Town with a plan that can be implemented to resolve the flooding problems in Shoreview subdivision.

Cost Estimate

Due to the large amount of drainage area and the complexity involved with the navigable waterway flowing through this subdivision, extensive hydraulic and hydrologic modeling and analysis will be required. The cost of design, land acquisition and construction for this proposed project is estimated to be


Center Lake
Camp Lake
CP-1
CP-2
CP-3
CP-4
DRAFT
FIGURE 4-6
TOWN OF SALEM
SHOREVIEW SUBDIVISION
Legend
Possible Pond Locations
Floodplain
SEWRPC Wetlands
Subbasin Boundaries
MunicipalBoundary
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Beyond Surveying and Engineering

approximately $800,000. Implementing more restrictive runoff rates in the tributary drainage area will have no direct cost to the Town.

C - Timber Lane Subdivision

Description

The Timber Lane Subdivision is south of 89th Street between 268th and 271st Avenues. This subdivision has a multitude of drainage problems due to the lack of a planned drainage system. The storm water flow is generally through private properties, and there is currently no adequate route conveying the runoff south to Center Lake. Multiple homeowners on the block east of 270th Avenue and north of 90th Street have had damage to their homes during large rain events because it is a natural low area, and the ditches do not have the capacity to handle the amount of storm water draining to this area. The block west of 268th Avenue and north of 91st Place also has many drainage issues because it is also a natural low area that is nearly the same elevation as Center Lake. This area has had a history of drainage problems, possibly stemming from the addition of fill to the natural low lying detention areas with the construction of new homes. The landowner east of 268th Avenue also complains that he has standing water on his agricultural field after storm events due to possible damage or elimination of a previous downstream culvert or drain tile system many years ago.

Proposed Alternative

The proposed alternative includes a conveyance system and small wet detention pond. The conveyance system would include approximately 1,800 feet of storm sewer beginning on 270th Avenue north of 90th Street south to a constructed wet detention pond on the Town owned property on the northeast corner of 91st Street and 270th Avenue. This wet detention pond will provide water quality treatment for small rain events before discharging to the open ditch that flows to Center Lake. See Figure 4-7 for the proposed storm sewer and detention basin locations.

For the problems on the eastern portion of the subdivision, a conveyance system is proposed beginning on 268th Avenue north of 91st Place and west on 91st Place to the ditch that flows to Center Lake. See Figure 4-7 for the proposed storm sewer location. Another possible solution would be to restore the low lying areas that have been filled in west of 268th Avenue. Specifically, the Town could purchase the two partially developed properties on the west side of 268th Avenue, just south of 90th Street and re-establish these lots as a low area to provide storage for some of the drainage areas in this neighborhood. Because the surrounding lots are relatively low compared to the lake level, a wet detention basin in this area is not feasible.

The tributary drainage area is anticipated to become residential land use in the future. Since the predevelopment runoff is causing considerable flooding, the more restrictive regulations of 0.04 cfs/acre for the 2-year event and 0.30 cfs/acre for the 100-year event required in the Des Plaines Watershed portion of the Town are recommended to be required for this drainage area. As development occurs, the runoff restrictions would reduce the flooding problem at no direct cost to the Town.

Benefit

The proposed storm sewer will provide a conveyance system that will at a minimum reduce nuisance flooding for smaller events and to a lesser extent for larger events. The wet pond will provide water quality treatment for smaller rain events prior to discharge into Center Lake. Restoring the low lying detention areas would not provide any water quality benefits, but would help relieve flooding in this neighborhood during the smaller more frequent rainfall events. Requiring future development to meet the more restrictive runoff requirements will decrease the future flood flows through the subdivision.

DRAFT

FIGURE 4-7
TOWN OF SALEM
TIMBER LANE SUBDIVISION

Legend

- Proposed Storm Sewer
- Proposed Outlet Control Structure
- Proposed Inlet
- Proposed Manhole/Inlet
- Proposed Outfall
- Restore Low-Lying Detention Areas
- Contours
- Floodplain
- SEWRPC Wetlands
- Subbasin Boundaries
- MunicipalBoundary

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Cost Estimate

Preliminary project costs have been estimated using Town mapping records, a site visit and the history of the drainage problems in this area of the Timber Lane subdivision.

Item	Quantity	Units	Unit Cost	Cost
Inlet	10	EA	$2,000	$ 20,000
Manhole	7	EA	$3,500	$ 24,500
Storm Sewer	2000	LF	$75.00	$ 150,000
Detention Pond	1	LS	$85,000	$ 85,000
Land Acquisition	2	EA	$60,000.00	$ 120,000
Demolition & Grading	1	LS	$40,000.00	$ 40,000
			Subtotal	$ 439,500
			Contingencies	$ 88,000
			Engineering & Administration	$ 132,000
			Probable Construction Cost	**$ 659,500**

D - 99th Street and 270th Avenue

Description

The area southwest of the Wisconsin Central Railroad right-of-way between 270th Avenue and 271st Street is drained by an 8-inch drain tile in the backyards between 270th Avenue and 270th Court northeast of 100th Street. This tile frequently gets clogged with sediment and debris and the Town has routinely had to clean it out to help prevent flooding of this area.

The Town has recently become aware that the property owners adjacent to the private drain tile have collaboratively decided to fix the broken drain tile as a group of private property owners. Therefore, this project will remain in this report for future reference, but will not be recommended to be completed at this time.

Proposed Alternative

The proposed project includes a high water relief storm sewer in 270th Avenue between 99th and 100th Streets to capture storm water in this low area and convey it underground to the open channel southwest of 100th Street as shown on Figure 4-8.

Benefit

The storm sewer will alleviate flooding problems and remove the drainage facility from private property to Town right-of-way for easier access and a more efficient conveyance system.

Cost Estimate

This project is expected to be a fairly simple design, and therefore the design and construction of this proposed project is estimated as follows:

Item	Quantity	Units	Unit Cost	Cost
Inlet	2	EA	$2,000	$ 4,000
Manhole	2	EA	$3,500	$ 7,000
Storm Sewer	620	LF	$65.00	$ 40,300
			Subtotal	$ 51,300

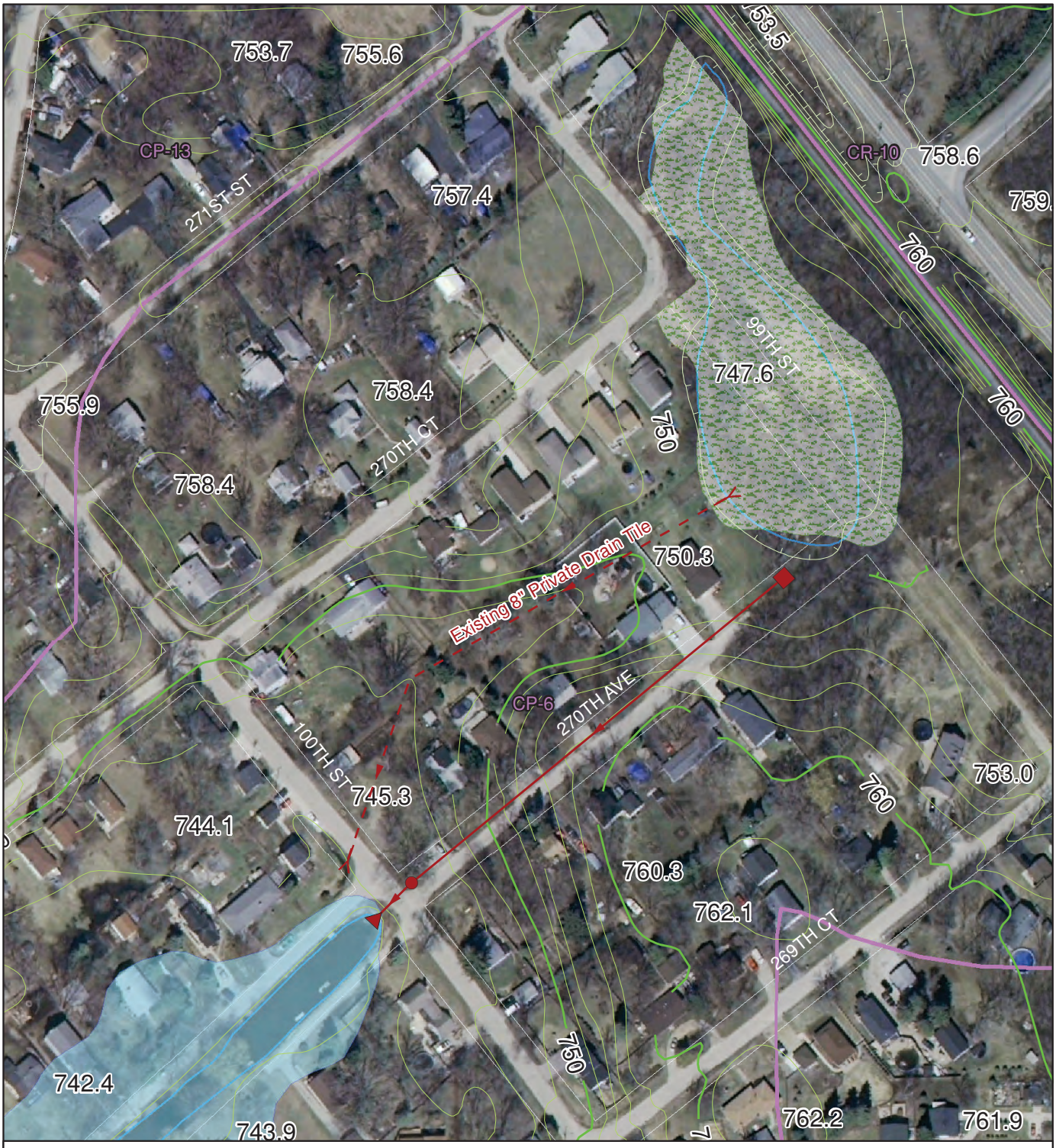

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FIGURE 4-8
TOWN OF SALEM
99TH ST. & 270TH AVE.

Legend

- Proposed Storm Sewer
- Proposed Inlet
- Proposed Manhole/Inlet
- Proposed Outfall
- Contours
- Floodplain
- SEWRPC Wetlands
- Subbasin Boundaries
- MunicipalBoundary

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Feet

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Contingencies	$ 10,000
Engineering & Administration	$ 15,000
Probable Construction Cost	**$ 76,300**

E - 256th Avenue and CTH AH (89th Street)

Description

There is wetland on the east and west sides of 256th Avenue about 700 feet south of CTH AH. During storm events, water collects in the wetlands and ponds to high levels, overflowing the bicycle path and road and causing flooding issues for area residents on the east side 256th Avenue. The downstream west wetland has no designated overflow route. As water rises in the east wetland, it overflows to the northeast toward the intersection of 256th Avenue and CTH AH and frequently causes flooding problems for the Albor and McLeran properties.

Proposed Alternative

The proposed alternative includes a high-flow relief storm sewer on 256th Avenue that would convey excess stormwater from the wetlands on both sides of the road northerly to the southwest corner of the intersection of 256th Avenue and CTH AH as shown in Figure 4-9. The storm sewer would be directed to the existing ditch flowing west from the intersection. The storm sewer would be designed to function only during wet weather periods that would cause high water problems for neighboring residents. This design would not drain or cause any detrimental impacts to the wetlands. A storm sewer is proposed in lieu of ditched flow in this location because there is a hill rising and falling about 8 feet between the wetlands and the intersection, which would not be conducive to a ditch design.

Benefits

This high-flow relief storm sewer will eliminate the chronic flooding problems that threaten adjacent properties. Once this storm water is discharged from the storm sewer, it will flow through approximately 1,800 feet of grassed ditch along CTH AH before entering the tributary to Center Lake, which would provide some water quality benefits. This ditch could also be redesigned to maximize the pollution reduction capacity as part of this project.

Cost Estimate

Preliminary project costs have been estimated as follows:

Item	Quantity	Units	Unit Cost	Cost
Special Manhole	1	EA	$6,500	$ 6,500
Manhole	1	EA	$3,500	$ 3,500
Storm Sewer	865	LF	$75.00	$ 64,875
			Subtotal	$ 74,875
			Contingencies	$ 15,000
			Engineering & Administration	$ 22,000
			Probable Construction Cost	**$ 111,875**

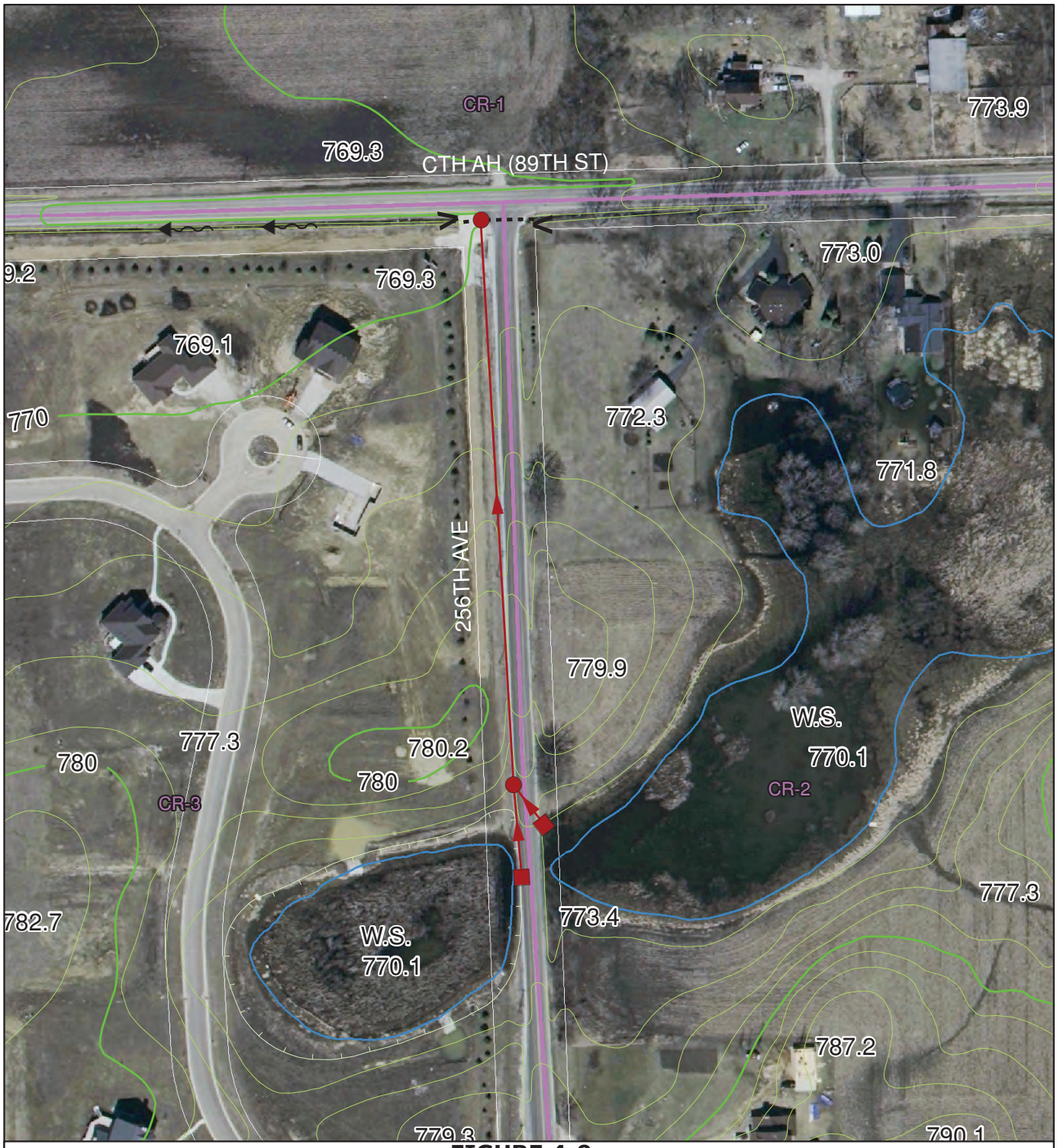

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FIGURE 4-9
TOWN OF SALEM
256TH AVE. & CTH AH (89TH ST.)

Legend

- Proposed Storm Sewer
- Existing Culvert
- Proposed Inlet
- Proposed Manhole/Inlet
- Subbasin Boundaries
- Contours
- Floodplain
- SEWRPC Wetlands
- MunicipalBoundary

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F - Sunset Oaks Subdivision

Description

This area is southwest of the Wisconsin Central Railroad right-of-way between 268th Court and 105th Street. The drainage in this area is through private properties with no well-defined route. Flow comes to the area from a 48" culvert under the railroad right-of-way. The Town owns a small detention pond upstream of the railroad that has a 12" outlet pipe that was constructed to help slow down the runoff that discharges to the railroad culvert and alleviate flooding in this neighborhood. However, during large storm events it appears that some of the runoff north of 104th Street and east of the railroad tracks that would normally go north to Center Lake, instead flows south to the railroad right-of-way and through the private properties causing additional flooding issues.

Proposed Alternative

The proposed project includes a storm sewer conveyance system in the Town right-of-way to carry flow from the railroad culvert to the outlet at Camp Lake, as shown on Figure 4-10. The project would also include retrofitting the Town-owned wet detention pond upstream of the railroad to provide additional water quantity and quality control to the maximum extent possible.

Benefits

A storm water conveyance system would be created and, therefore, drainage would be moved from private property as it exists today, to the Town right-of-way. This project would also provide reduced flooding problems and possibly some additional water quality management with updates to the Town pond outlet pipe.

Cost Estimate

Preliminary project costs have been estimated using Town mapping records, a site visit and the history of the drainage problems in this area of the Sunset Oaks subdivision.

Item	Quantity	Units	Unit Cost	Cost
Inlet	13	EA	$2,000	$ 26,000
Manhole	8	EA	$3,500	$ 28,000
Storm Sewer	2500	LF	$75.00	$ 187,500
Detention Pond	1	LS	$200,000	$ 200,000
			Subtotal	$ 441,500
			Contingencies	$ 88,000
			Engineering & Administration	$ 132,000
			Probable Construction Cost	**$ 661,500**

G - 122nd Street & 224th Avenue

Description

The drainage problems are mainly along 122nd Street east of 224th Avenue. The existing storm water drainage patterns in this area can be characterized by a system of french drain inlets that are directed to an old drain tile running down the middle of 122nd Street. At the intersection of 220th Avenue, this drain tile heads north and eventually discharges into Lake Shangri-La. In general, this system is very inefficient and

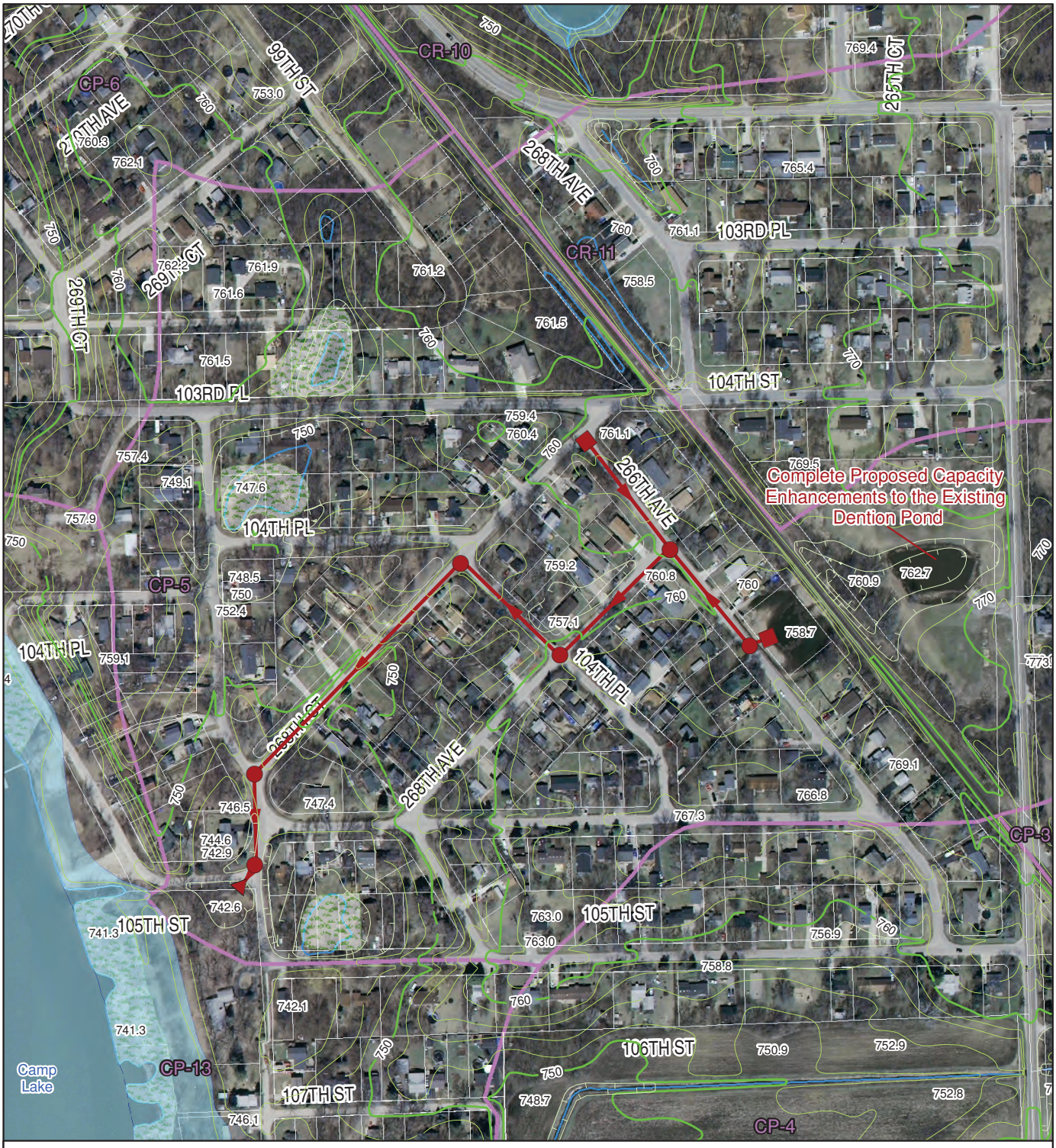

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FIGURE 4-10
TOWN OF SALEM
SUNSET OAKS SUBDIVISION

Legend

- Proposed Storm Sewer
- Proposed Inlet
- Proposed Manhole/Inlet
- Proposed Outfall
- Contours
- Floodplain
- SEWRPC Wetlands
- Subbasin Boundaries
- MunicipalBoundary

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does not seem to have enough capacity for this drainage area, which causes water to constantly pond on the adjacent properties and on the roadway.

Proposed Alternative

The proposed project includes a storm sewer conveyance system to capture runoff in Town right-of-ways and convey it more efficiently to Lake Shangri-La. This system should alleviate the nuisance drainage patterns that exist currently. The proposed drainage improvement plan is shown on Figure 4-11.

Benefits

The storm sewer conveyance system will alleviate nuisance flooding problems and provide a more efficient drainage route for runoff.

Cost Estimate

Preliminary project costs have been estimated using Town mapping records, a site visit and the history of the drainage problems in this area.

Item	Quantity	Units	Unit Cost	Cost
Inlet	8	EA	$2,000	$ 16,000
Manhole	8	EA	$3,500	$ 28,000
Storm Sewer	1,500	LF	$65.00	$ 97,500
			Subtotal	$141,500
			Contingencies	$ 28,300
			Engineering & Administration	$ 35,375
			Probable Construction Cost	**$205,175**

Additional Drainage and Flooding Complaints

In addition to these seven priority drainage problem areas, the Town has also received a large number of reports of other nuisance drainage and/or flooding complaints that are shown on Figure 4-12. The majority of these flooding complaints are either during large storm events, which unfortunately have occurred more frequently over the last few years, or are chronic wetness complaints during all types of rainfall events. R.A. Smith National has been assisting the Town in documenting all of these complaints in a database and following up with site visits to discuss the issue in detail with the resident who filed the complaint.

Within this database of drainage complaints, detailed information was compiled for each complaint including general field observations, whether it is a private property issue or a public concern, if the complaint is located within a floodplain, the approximate number of homes being affected, and the frequency and severity of the drainage complaint. An approximate cost to resolve the problem has also been assigned to each complaint. Due to elevation constraints, in many cases, the only feasible solution is for the Town to acquire the property and raze any of the buildings on the property for additional flood storage. In this case, the cost is shown as the 2009 assessed value of the property. Finally, each complaint was prioritized for Town action (ie. high, medium, low) to be addressed on an ongoing basis as funding is available through the existing storm water utility. The complete drainage complaint database for 2009 is included in Appendix N.

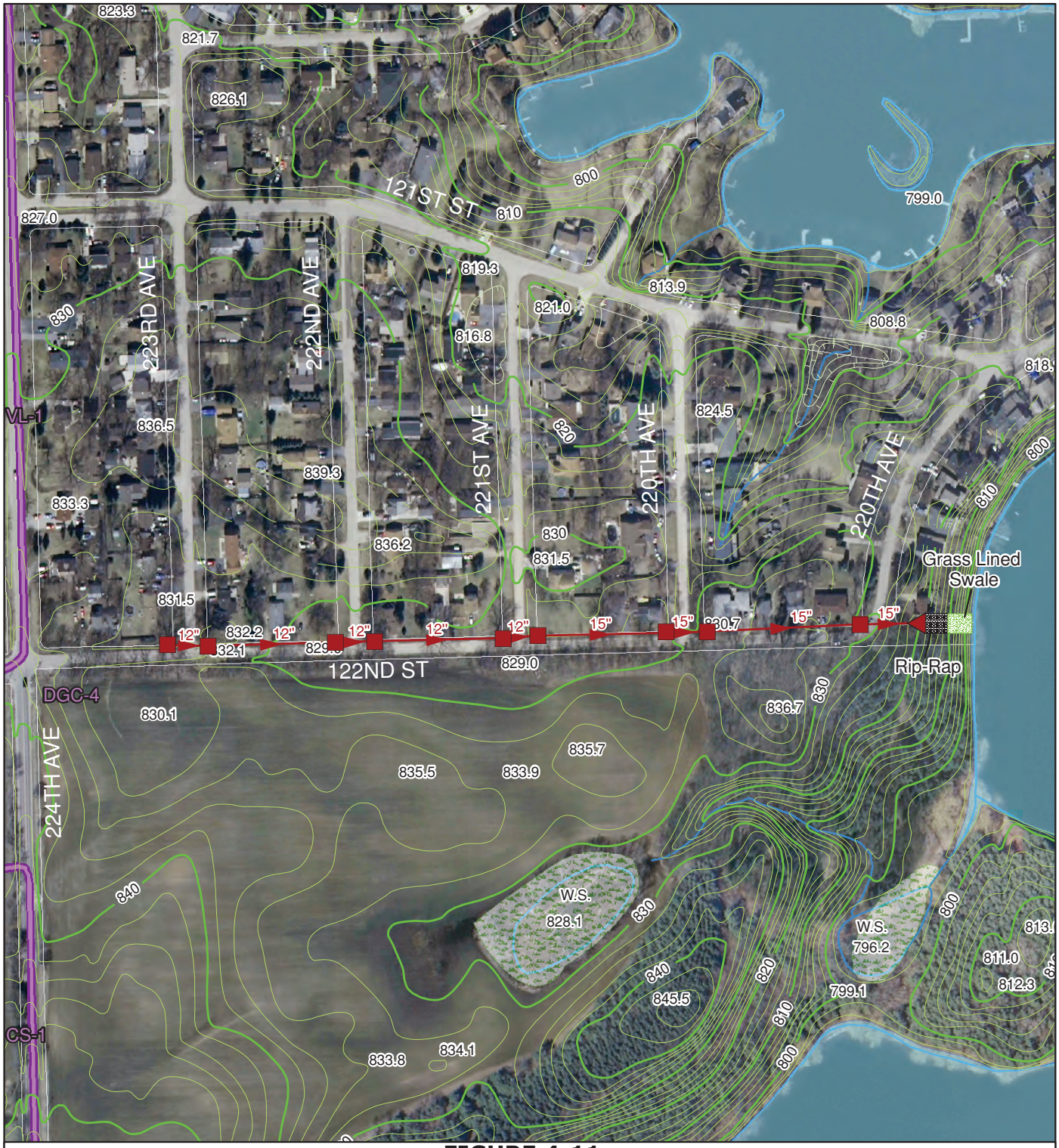

FIGURE 4-11
TOWN OF SALEM
122ND STREET & 224TH AVENUE

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Legend

- Proposed Storm Sewer
- Proposed Outfall
- Proposed Inlet
- Subbasin Boundaries
- Contours
- Floodplain
- SEWRPC Wetlands
- MunicipalBoundary

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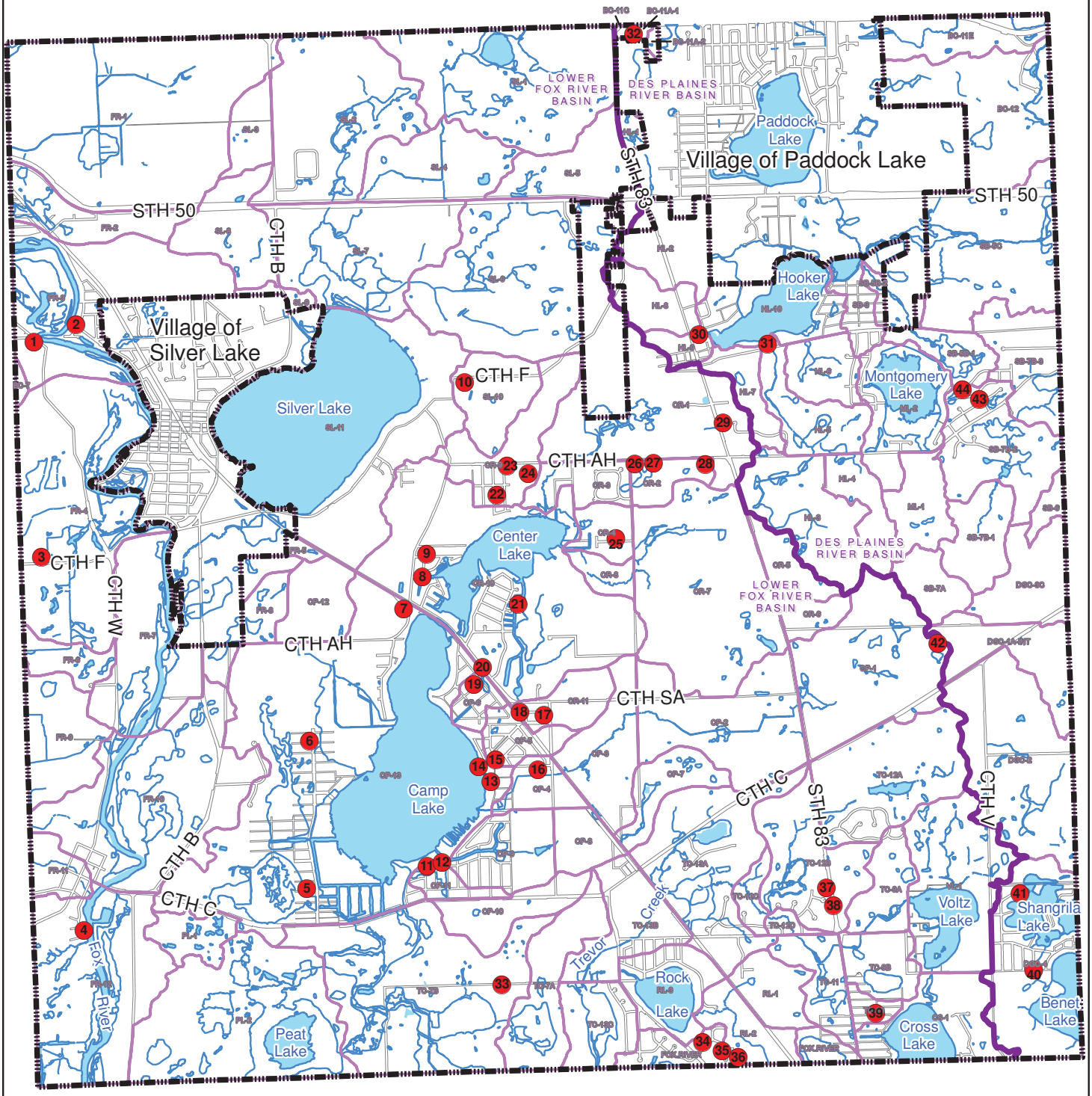

FIGURE 4-12
TOWN OF SALEM
DRAINAGE COMPLAINT INVENTORY

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Legend

- Drainage Complaints
- MunicipalBoundary
- Subbasin Boundaries

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December 2009

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Appendix E

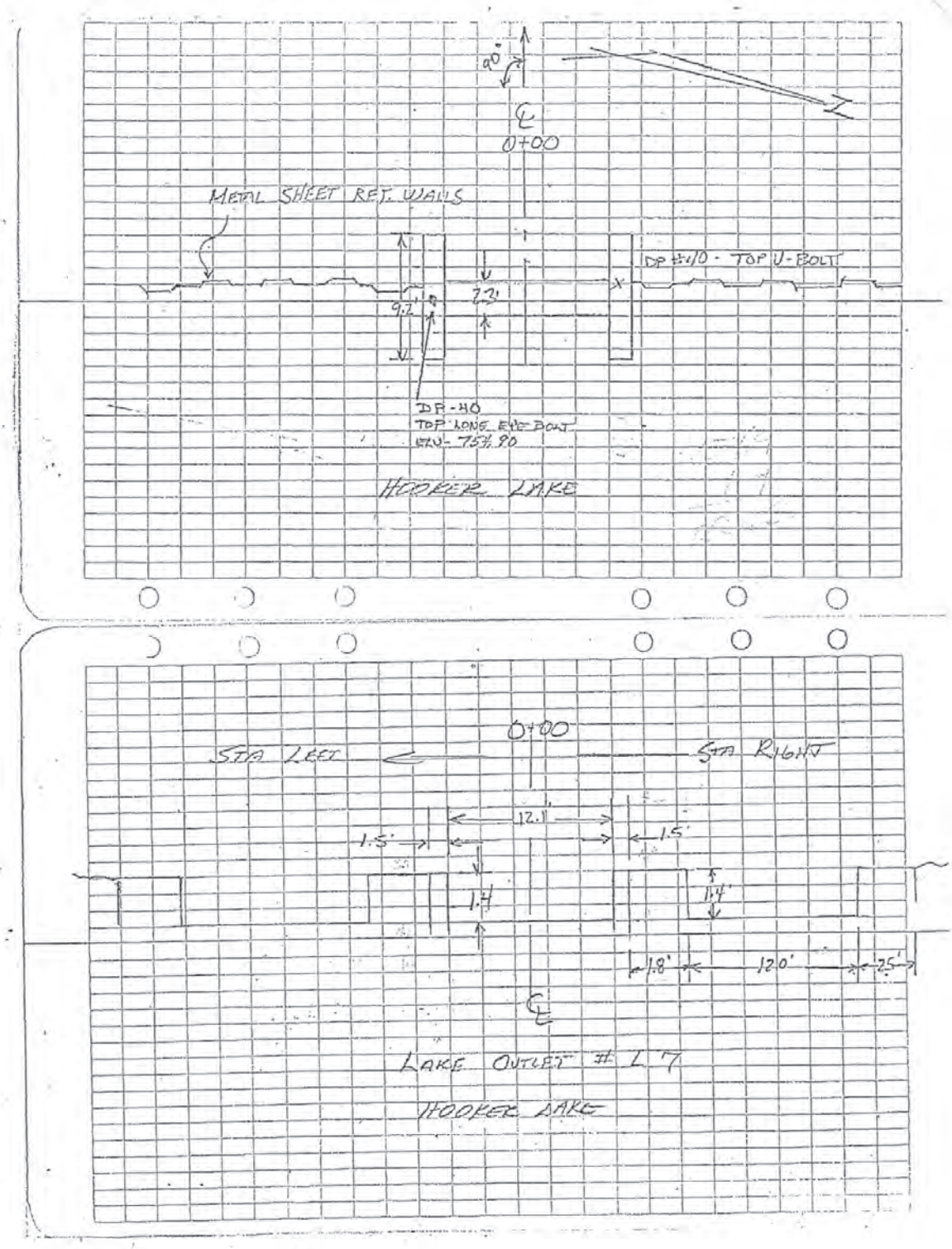
LAKE OUTLET DAM

STRUCTURE NO. L7
HOOKER LAKE OUTLET

LAKE OUTLET - L-M

JAN 25, 1977

T - M. SCHMITZ


90°
℄
0+00
METAL SHEET RET. WALLS
DP ±1/0 - TOP U-BOLT
9.2'
7.3'
DP-40
TOP LONG EYE BOLT
ELV- 75% 80
HOOKER LAKE
0+00
STA LEFT
STA RIGHT
12.1'
1.5'
1.5'
1.7'
1.4'
1.8'
12.0'
2.5'
℄
LAKE OUTLET # L 7
HOOKER LAKE

LAKE OUTLET - L-7

STA	B.S.	H.I	F.S.	ELV	
BM	3.23	758.13			
0+00			4.7	753.4	
0+06 L			4.7	753.4	
0+06 L			3.4	754.7	
0+09.3L			3.4	754.7	
0+09.3L			4.7	753.4	
0+21.3L			4.7	753.4	
0+21.3L			3.2	754.9	
0+23.8L			3.2	754.9	
0+23.8L			4.1	754.0	
1+00.L			3.23	754.90	754.91
	5.34	760.25			
TP			3.89	756.35	756.37
	6.53	762.90			
2+00L			4.2	758.70	
2+40 L	"		9.41	753.47	753.50
	11.83	765.33			
3+00			12.7	752.6	
3+65	L		11.3	754.0	
3+85	L		9.7	755.6	
4+00	L		8.7	756.6	
5+00	L		2.5	762.8	

DP #4/0 EL = 754.90

TOP CONC SPILLWAY

" "

TOP HEADWALL

TOP SHEET METAL

" " @ OPENING

" " "

TOP SHEET METAL

" "

GROUND

" "

TOP HILL

EDGE MARSH

MARSH

EDGE MARSH

BANK

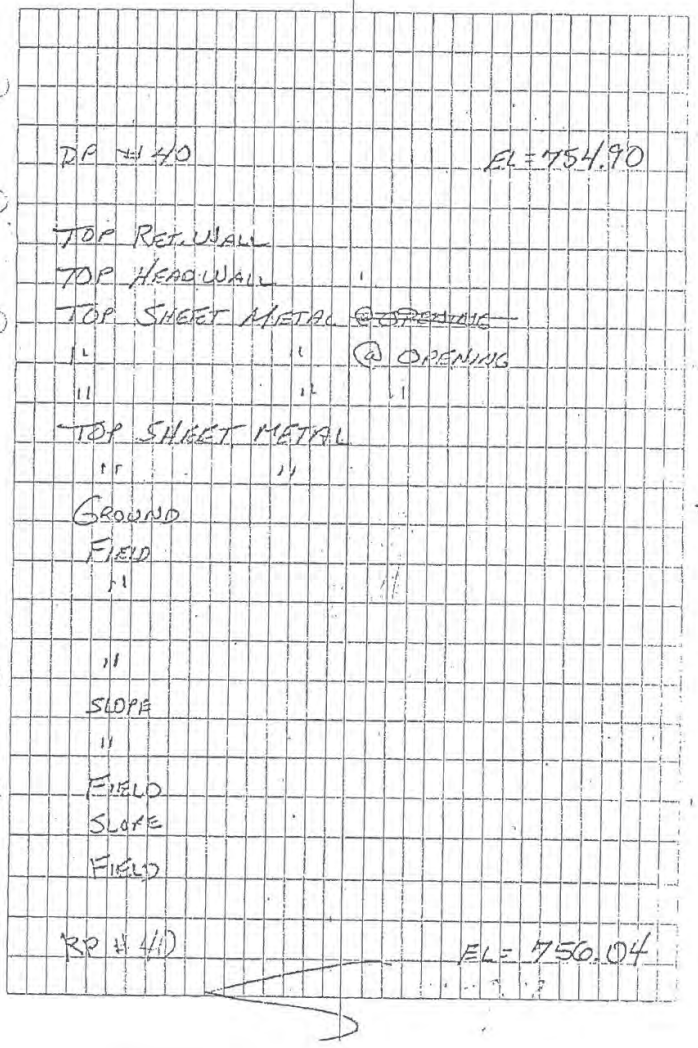
FIELD

"

Source: SEWRPC.

LAKE OUTLET - L-7

STA	B.S.	H.I.	F.S.	ELV.	
		765.33			
TP	7.19	760.70	11.80	753.50	753.53
BM			5.83	754.86	754.90
	6.10	761.00			
0+06 R			7.5	753.5	
0+66 R			6.2	754.8	
0+09.3 R			6.2	754.8	
0+09.3 R			7.5	753.5	
0+21.3 R			7.5	753.5	
0+21.3 R			6.1	754.9	
0+23.8 R			6.1	754.9	
0+23.8 R			6.7	754.3	
1+00 R			6.2	754.8	
2+00 R			6.63	754.37	754.39
	15.66	770.05			
3+00 R			13.6	756.5	
3+32 R			11.0	759.0	
3+72 R			7.5	762.6	
4+00 R			4.6	765.5	
4+75 R			7.3	762.8	
5+00 R			11.4	758.7	
BM			14.04	755.99	756.04



STRUCTURE 1000 A

	+	HI	−	
DP 41	5.50	762.92		
0+00			9.50	753.42
0+00			9.75	753.2
0+00			11.40	751.5
0+04.2L			9.40	753.5
0+04.2L			7.50	~~775.4~~ 755.4 ESS 8-8-…
0+07.2L			8.20	754.7
0+10.2L			7.60	755.3
0+20L			7.30	755.6
0+30L			6.45	756.5
0+40L			6.35	756.6
0+50L			6.10	756.8
0+04.1R			9.40	753.5
0+04.1R			7.60	755.3
0+06.6R			10.10	752.8
0+066R			8.00	754.9
0+12.1R			7.75	755.2
0+12.1R			8.90	754.0
0+23.8R			7.90	755.0
0+34R			6.80	756.1
0+44R			5.40	757.5
0+54R			4.30	758.6
0+64R			4.30	758.6
			9.28	753.6

DIETZGEN NO. 384-3

DP 41 757.42
Top of Wood overflow Plank
Ground @ Inlet side of Plank
" " Outlet " " "
Plank
Top of Steel Plate
Ground
Plate @ Ground
Ground
Wood Beam
Top of Steel Plate
Ground @ Concrete Headwall
Top of Concrete Headwall
Top End of Steel Plate Ground
End of Concrete Headwall @ Ground
100° Azimuth up Bank To
Gravel Road + Ground Shots
Water Surface

1000 A

143

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION
RECORD OF VERTICAL CONTROL STATION

SECTION 11, TOWNSHIP 1 N, RANGE 20

KENOSHA COUNTY

BENCH MARK NO. DP-1000A ELEVATION 757.299'

REFERENCE BENCH MARK NO. REF-1000A ELEVATION 758.614

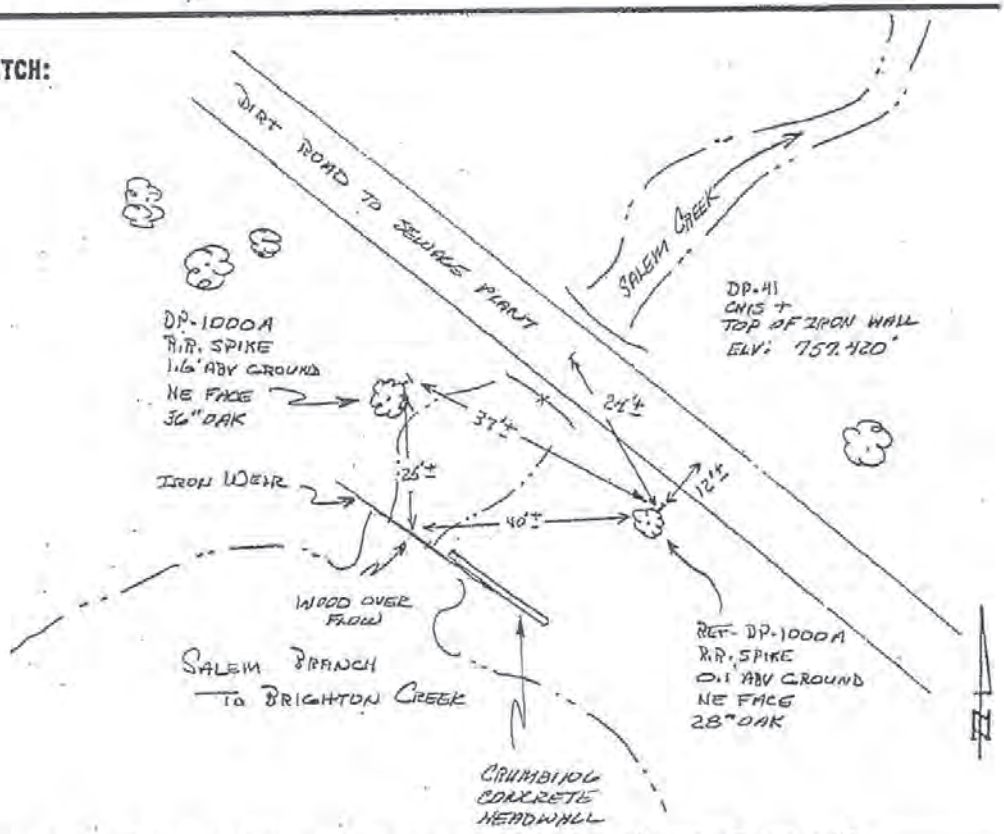
SET BY: OWEN AYRES & ASSOCIATES, ENGINEERS, MADISON, WISCONSIN

VERTICAL DATUM: MEAN SEA LEVEL, 1929 ADJUSTMENT

VERTICAL CONTROL ACCURACY: THIRD ORDER

DATE OF SURVEY: MARCH 1994 STRUCTURE #1000A

LOCATION SKETCH:



DETAILED DESCRIPTION: ABOUT 0.1 MILE WEST AND 0.2 MILE NORTH FROM THE EAST 1/4 CORNER OF SECTION 11, T1N, R20E. ABOUT 300' NW FROM THE END SEWAGE PLANT.

BOOK 1 - Pg 28

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION
RECORD OF VERTICAL CONTROL STATION

SECTION 11, TOWNSHIP 1 N, RANGE 20 E

Kenosha COUNTY

BENCH MARK NO. D.P. 41 ELEVATION 757.420'

REFERENCE BENCH MARK NO. R.P. 41 ELEVATION 758.174'

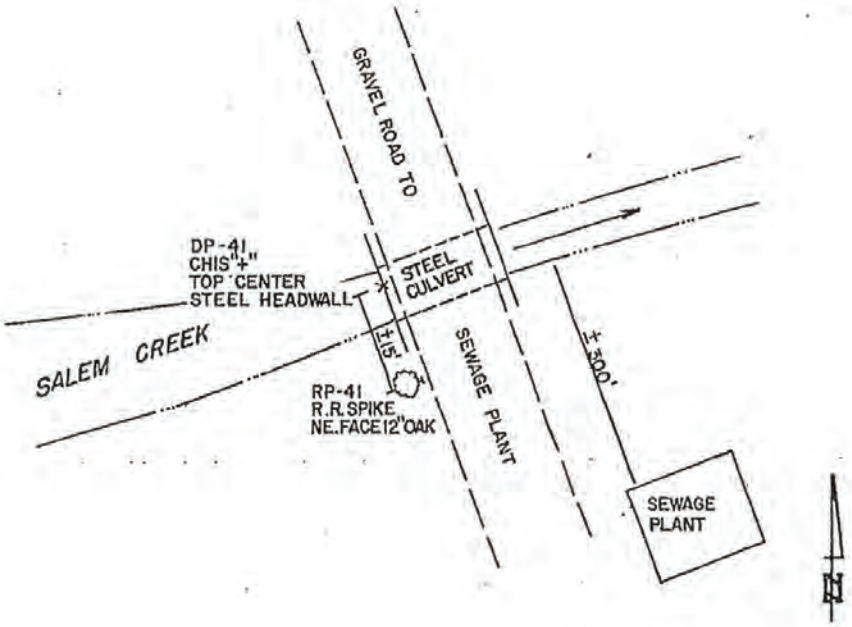
SET BY: ALSTER & ASSOCIATES, INC., ENGINEERS, MADISON, WISCONSIN

VERTICAL DATUM: MEAN SEA LEVEL, 1929 ADJUSTMENT

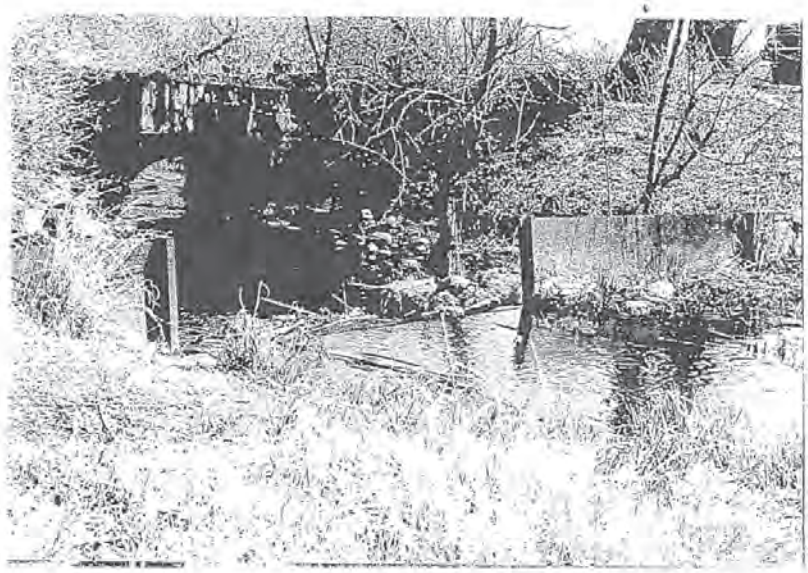
VERTICAL CONTROL ACCURACY:

DATE OF SURVEY: January 1977

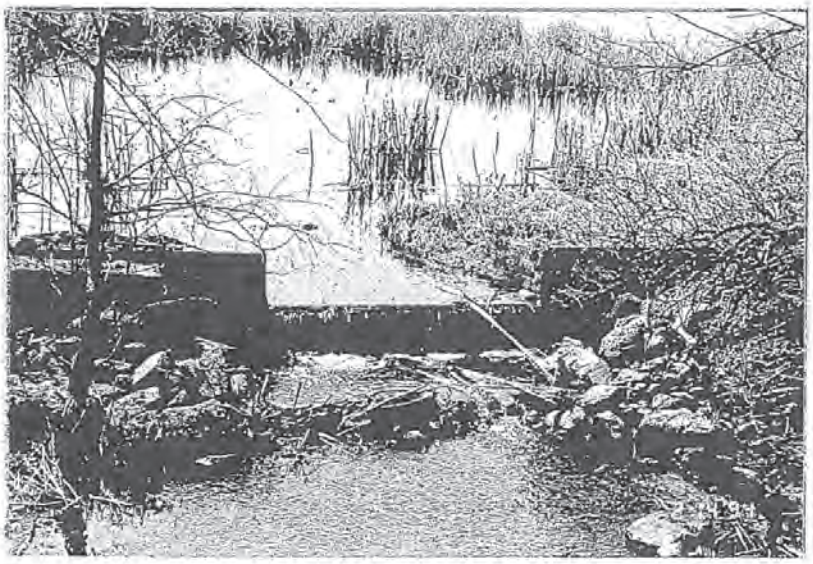
LOCATION SKETCH:



DETAILED DESCRIPTION: About 0.1 mile west and 0.2 mile north of the east one quarter corner of section 11, T 1 N, R 20 E; on structure #1000.



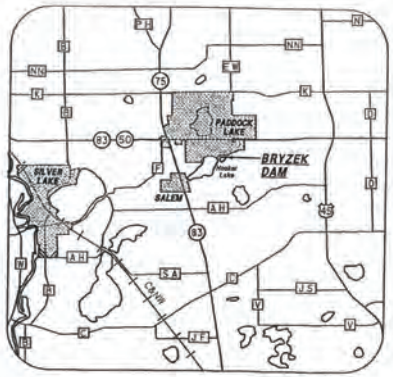
#1000A



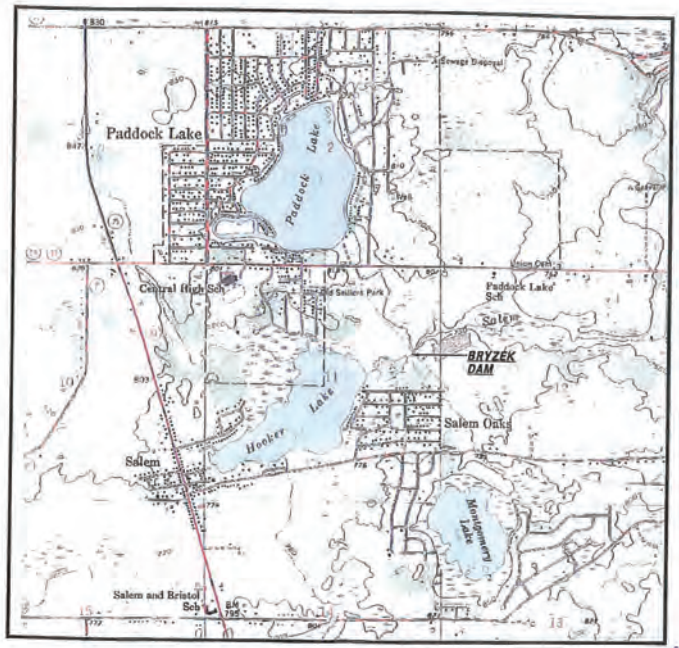
BRYZEK DAM – RECORD DOCUMENTS

HOOKER LAKE
KENOSHA COUNTY, WISCONSIN
TOWNSHIP 1 NORTH – RANGE 20 EAST

WISCONSIN MAP



PROJECT LOCATION MAP



U.S.G.S. QUADRANGLE MAP

DRAWING INDEX:

BENCHMARK INFORMATION:

MEANDER CORNER EAST OF CENTER OF SECTION 11, T1N, R20E, KENOSHA COUNTY, WISCONSIN. MEANDER CORNER IS A CONCRETE MONUMENT WITH A BRASS CAP, 0.1' BELOW GROUND LEVEL, LOCATED AT SOUTH SIDE OF 6" FENCE POST BRACED TO THE EAST. POINT FALLS ON THE NORTH LINE OF LOT 2, BLOCK 16 OF SALEM OAKS SUBDIVISION. ELEVATION OF CAP IS 754.96 FEET REFERENCED TO NGVD 1929.

EAST QUARTER CORNER OF SECTION 11, T1N, R20E, KENOSHA COUNTY, WISCONSIN. QUARTER CORNER IS A CONCRETE MONUMENT WITH A BRASS CAP, 0.5' BELOW GROUND LEVEL, LOCATED AT THE NE CORNER OF THE SALEM OAKS SUBDIVISION. ELEVATION OF CAP IS 767.67 FEET REFERENCED TO NGVD 1929.

RAILROAD SPIKE SET IN 36" DIAMETER OAK LOCATED EAST OF EAST END OF BRYZEK DAM AND WEST OF DIRT ROAD. ELEVATION OF TOP OF SPIKE IS 759.64 FEET REFERENCED TO NGVD 1929.

P.K. NAIL SET IN TOP OF EAST ABUTMENT OF BRYZEK DAM. ELEVATION OF POINT IS 755.29 FEET REFERENCED TO NGVD 1929.

P.K. NAIL SET IN TOP OF WEST ABUTMENT OF BRYZEK DAM. ELEVATION OF POINT IS 755.26 FEET REFERENCED TO NGVD 1929.

WISCONSIN
WARREN S. HAYDEN
31978
Madison, WI
6/27/05
PROFESSIONAL ENGINEER

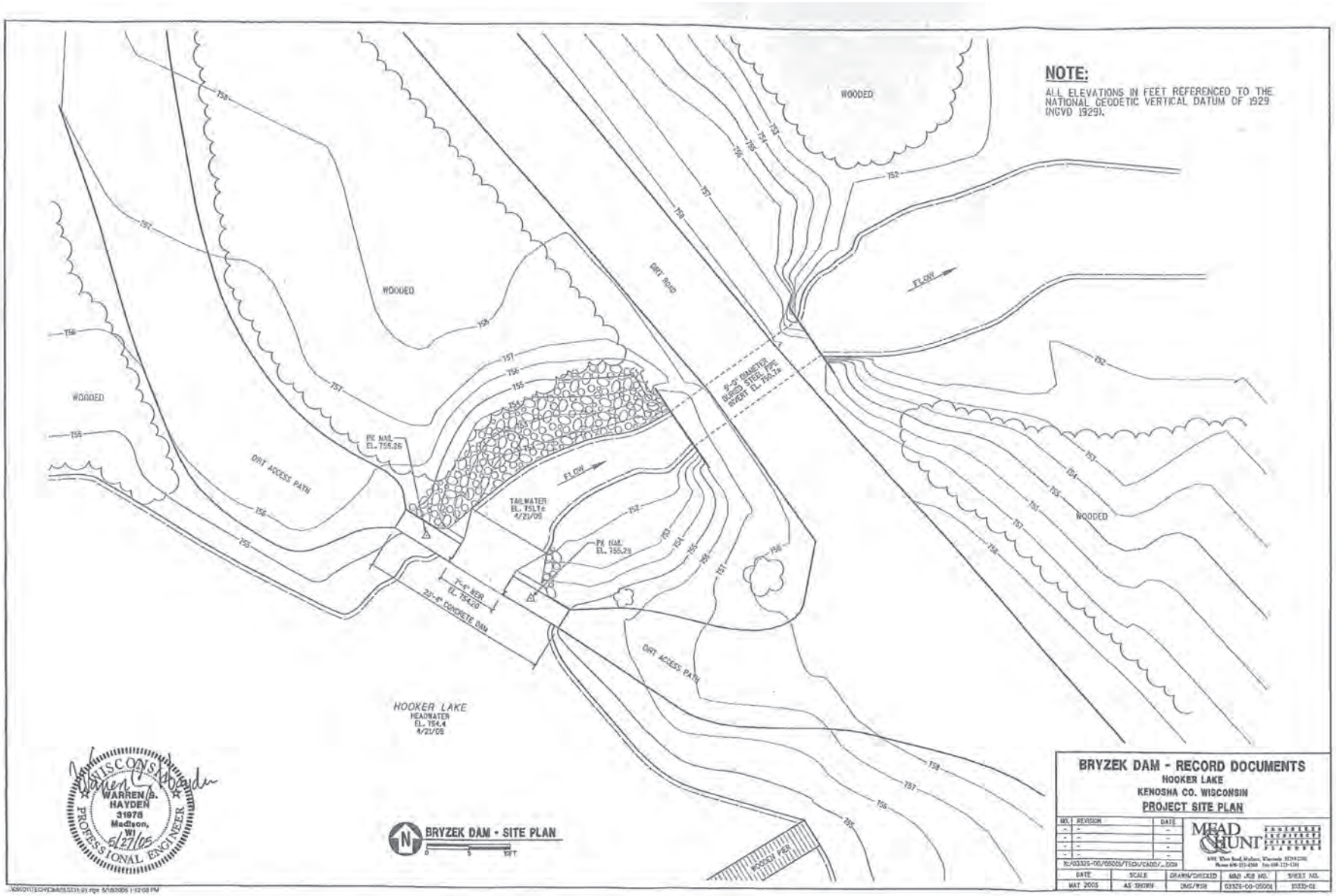
BRYZEK DAM - RECORD DOCUMENTS
HOOKER LAKE
KENOSHA CO. WISCONSIN
TITLE SHEET, DRAWING INDEX AND NOTES

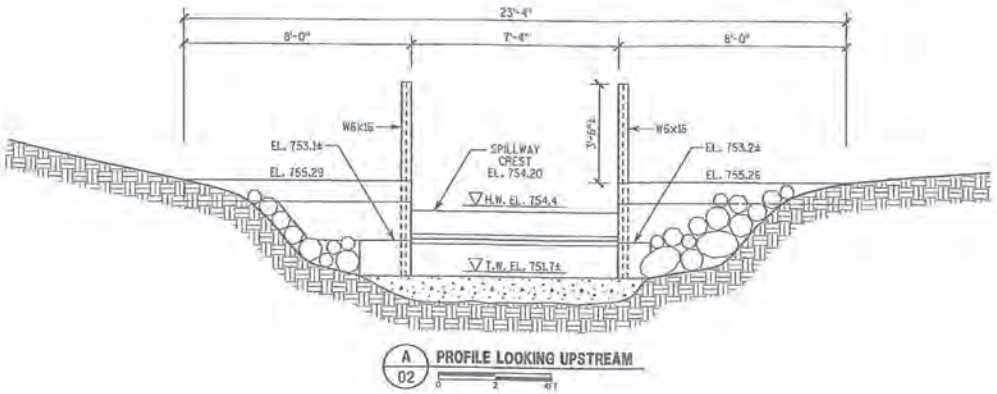
NO.	REVISION	DATE
-	-	-
-	-	-
-	-	-
-	-	-

J:\03326-00\05001\TECH\CADD\...DGN

MEAD & HUNT

DATE	SCALE	DRAWN/CHECKED	MAIN JOB NO.	SHEET NO.
MAY 2005	AS SHOWN	DMS/WSH	03326-00-05001	10331-T1


NOTE:
ALL ELEVATIONS IN FEET REFERENCED TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 1929).
WOODED
DIRT ROAD
FLOW
WOODED
WOODED
DIRT ACCESS PATH
PK NAIL EL. 755.26
TAILWATER EL. 751.1± 4/21/05
PK NAIL EL. 755.29
7'-4" WIER EL. 754.20
23'-4" CONCRETE DAM
DIRT ACCESS PATH
WOODED
HOOKER LAKE
HEADWATER EL. 754.4 4/21/05
WOODED FEN
BRYZEK DAM - SITE PLAN
0 5 10FT
WISCONSIN
WARREN B. HAYDEN
31978
Madison, WI
6/27/05
PROFESSIONAL ENGINEER
BRYZEK DAM - RECORD DOCUMENTS
HOOKER LAKE
KENOSHA CO. WISCONSIN
PROJECT SITE PLAN
NO. REVISION DATE
MEAD & HUNT
DATE MAY 2005
SCALE AS SHOWN
DRAWN/CHECKED DMG/WSH
M&H JOB NO. 03325-00-05005
SHEET NO. 0333-01

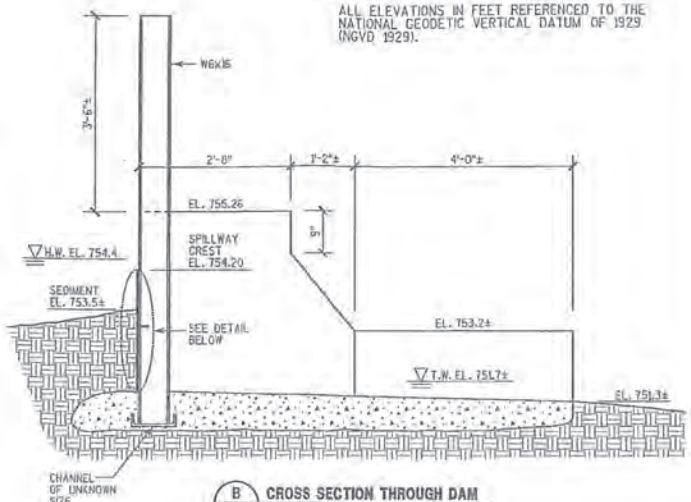


A/02 PROFILE LOOKING UPSTREAM

0 2 4FT

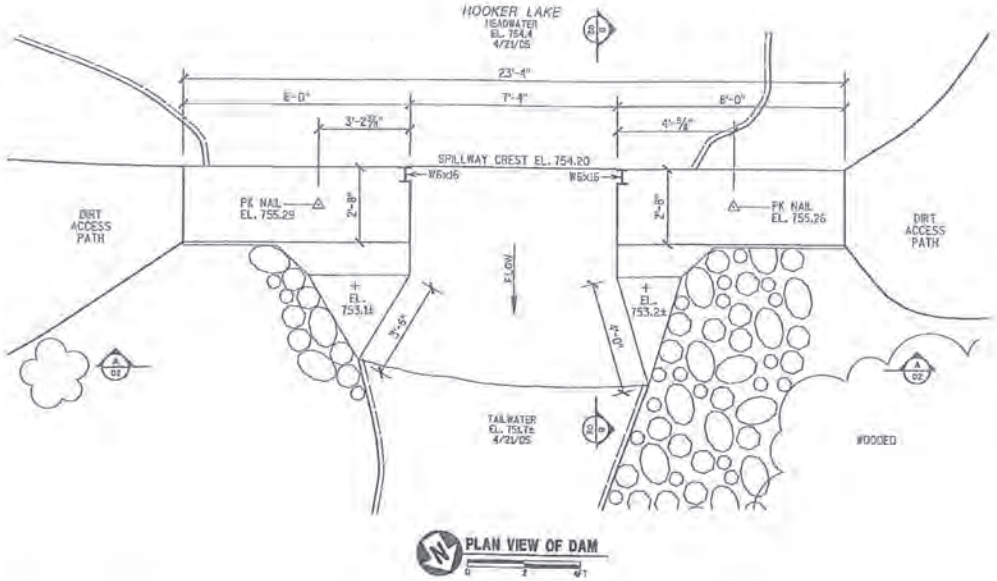
NOTE:

ALL ELEVATIONS IN FEET REFERENCED TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 1929).



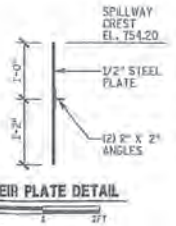
B/02 CROSS SECTION THROUGH DAM

0 1 2FT



N PLAN VIEW OF DAM

0 2 4FT



WEIR PLATE DETAIL

0 1 2FT

BRYZEK DAM - RECORD DOCUMENTS

HOOKER LAKE

KENOSHA CO. WISCONSIN

PROFILE, PLAN AND SECTION OF DAM

NO.	REVISION	DATE

MEAD & HUNT

X:\03326-00\05000\TECH\CADD_.DGN

DATE	SCALE	DRAWN/CHECKED	MH JOB NO.	SHEET NO.
MAY 2005	AS SHOWN	DMS/WSH	03326-00-05000	03326-02

Detailed Information for Dam HOOKER LAKE

Dam Key Seq No	1269	Field File No	30.02
Size	SMALL	NID	10259
Popular Name	CARL BRYZEK	Former Name	

Location

County	Kenosha		
Latitude	42.561602	Longitude	-88.095638
Permitted TRS		**Located TRS**	
QQQ:NE QQ:SW Q:NE - Sec:11 T:01N R:20		QQ:SW Q:NE - Sec:11 T:1N R:20	

Contacts

Owner		**Alternate**	
Organization	Carl Bryzek Farm, LLC	Organization	BS Machine
Name	Frank Bryzek	Name	Steve Bryzek

Waterbody

Drainage Basin (sq mi)	2.00		
Stream		**Impoundment**	
Local Name	OUTLET HOOKER LAKE	Local Name	HOOKER LAKE
Row and Official Name		Row and Official Name	
Navigable?	non-navigable	Size (acres)	87.00
When was navigability determined?		Maximum Depth (ft)	24.00

Regulatory / Inspection

NR 333 Years	EAP: IOM: HYD: STAB:2005 ZONE:		
Auth. Approval Desc	WP 413	Regulatory Agency	WIDNR
Hazard Rating	None	Estimated Hazard Rating	Low
Ferc. No		Exempt Issue Date	
Ferc. Inspection Year		License Expiration Year	

Construction Characteristics

Normal Storage (acre-ft)	90.00	Max Storage (acre-ft)	180.00
Structural Height (ft)	3.00	Hydraulic Height (ft)	1.00
Crest Length (ft)	0.00	Spillway Type	
Discharge Through Principal Spillway (cfs)	40.00	Width/Diameter of Principal Spillway (ft)	12.00
Total Discharge Through All Spillways (cfs)	40.00	Total Width/Diameter of All Spillways (ft)	
Core Type		Position	
Foundation Type		Foundation Certainty	
Purposes		Structural Types	

Detailed Information for Dam HOOKER LAKE

Water Levels

	Normal		Winter	
	MSL	Datum	MSL	Datum
Minimum				
Normal				
Maximum				

Construction History

Designer	Construction Firm	Complete Year
		1931
		2002

Outlet Gates

No data found.

Inspection History

Inspection Date	Inspection Report Date	DNR Engineer Initials	Inspection Type
5/20/2009			LEVEL
8/23/2007	8/23/2007	TLM	CHECK
1/20/2003		MJB	OTHER
7/21/1969			
7/21/1969	8/6/1969	XXX	LEVEL
4/2/1965	4/6/1965	XXX	LEVEL
6/14/1961		XXX	GEN
6/14/1961	6/27/1961	XXX	LEVEL
6/2/1947		XXX	GEN
6/2/1947	6/4/1947	XXX	LEVEL
7/9/1941	4/16/1942	XXX	LEVEL
6/29/1931	6/30/1931	XXX	LEVEL
9/13/1929	9/23/1929	XXX	GEN
8/28/1929		XXX	OTHER

Followups

Type of Followup	Due Date	Extension Date	Completion Date
OTHER	12/15/2009		10/28/2009
OTHER	3/1/2009		
OTHER	3/1/2009		5/20/2009

Approvals

Approval Month	Approval Year	Docket ID	Approval Type	DNR Engineer Initials
0	2005	IP-SE-2005-30-730RP	PERMIT TO CONSTRUCT-NAV STREAM; STAT 31.06	WDS
9	2005	IP-SE-2005-30-730RP	STABILITY ANALYSIS	WDS
1	1931	WP-413	LEVELS; STAT 31.02	XXX

Orders

Issue Date	Complied On Date	Docket ID	Order Description
11/8/2010		IP-SE-2010-30-04701	Modify dam, obtain easements, or remove

Inspection Schedule

No data found.

Source: Wisconsin Department of Natural Resources.

Survey Results
Bryzek and Hooker Lake Dams (Field File # 30.02)

Date of Survey: May 20, 2009

Dennis Siegrist - WDOT Surveyor Senior
Kurt Immler – WDOT Engineering Technician Transportation
Brent Binder, PE - WDNR Water Management Engineer
Tanya Meyer - WDNR Water Management Engineer

Background

The purpose of the survey was to assess potential discrepancies between the former and reconstructed Bryzek Dam. Our records indicate it was reconstructed in December, 2002. Over the past two years, residents have contacted the Department regarding high water levels and flooding at Hooker Lake. The Bryzek Dam could contribute to higher water levels on lakefront properties if it was not reconstructed to match historic dimensions.

The Department reviewed and approved Mr. Bryzek's after-the-fact application on September 30, 2005. During the plan approval process, it was indicated the dam was reconstructed in-kind. This means the spillway of the dam should have been built to the same width, elevation, and capacity as the former structure. The new dam would have maintained historical water levels on the impoundment because the spillway dimensions were unchanged. However, it appears the spillway dimensions are not the same.

The Department acquired additional data that puts into question information provided during the permit process. The Department acquired survey data for the former dam and compared it to dimensions for the reconstructed dam. From the comparison, it appears the reconstructed dam has a decreased spillway capacity. A decreased spillway capacity would allow less flow to pass through the dam during flood events, causing an increase in lake levels.

Summary of Findings

Bryzek Dam

Benchmarks were recorded in 2005, 1994, and 1977. Dimensions and elevations for the reconstructed dam were recorded in 2005. Dimensions and elevations for the former dam were recorded on May 23, 1994.

All benchmark and dam elevations surveyed on May 20, 2009 correlate to these recorded elevations. **Results indicate that the Bryzek Dam was reconstructed with smaller spillway dimensions:**

Summary of Findings (continued)

Bryzek Dam

	Reconstructed Bryzek Dam [1]	Former Bryzek Dam [2]
Width (feet)	7.3	8.2
Elevation (feet) [3]	754.2	753.5

Hooker Lake Dam

The reconstructed Bryzek Dam has a higher spillway elevation than the Hooker Lake Dam:

	Reconstructed Bryzek Dam	Hooker Lake Dam
Elevation (feet) [3]	754.2	753.4

Removing some cattails might provide relief from higher lake levels during small storm events. However, a SEWRPC report [4] indicates the Hooker Lake Dam is not the controlling structure during the 10, 50, and 100-year flood events. Instead, it indicates that the Bryzek Dam creates the backwater effect.

Corrective Action for the Bryzek Dam

Permits and plan approvals under Chapter 31, Wisconsin Statutes, require flowage easements or appropriate legal arrangements from all property owners affected by increases in flood elevations up to the 100-year flood. In lieu of flowage easements, another option would be to modify the dam to achieve former spillway dimensions and to restore historic water levels. The Department would need to issue a plan approval prior to any modifications or design changes.

Survey Results
Bryzek and Hooker Lake Dams (Field File # 30.02)

Survey Data

Benchmarks

Benchmark	Description	Recorded Elevation [3]	Surveyed Elevation [3] (05/20/09)	Comparison
DP-1000A [5]	Railroad spike 1.6 ft above ground; NE face of 36" dia oak	757.299	757.30	Reference Point
REF DP-1000A [5]	Railroad spike 0.1 ft above ground; NE face of 28" dia oak	758.616	758.58	-0.04
#1 PK nail [1]	PK nail on left abutment of Bryzek Dam	755.26	755.265	0.00
#2 PK nail [1]	PK nail on right abutment of Bryzek Dam	755.29	755.29	0.00
DP-41 [6]	Chiseled + located on top of iron wall	757.420	757.41	-0.01

Bryzek Dam

Station	Elevation [3]	Description [7]
1	755.28	Right Concrete Abutment (Right)
2	755.30	Right Concrete Abutment (Left)
3	754.22 [8]	Spillway Crest (Right)
4	753.25	Flange (Right)
5	752.03	Downstream Concrete Sill (Right)
6	754.39	Water Level (Pier)
7	755.20	Left Concrete Abutment (Left)
8	755.28	Left Concrete Abutment (Right)
9	754.24 [8]	Spillway Crest (Left)
10	753.28	Flange (Left)
11	751.99	Downstream Concrete Sill (Left)
12	749.38	Culvert Invert (Upstream)
13	751.97	Water Level (Upstream of Road Culvert)
14	750.40	Creekbed (Upstream of Road Culvert)
15	749.58	Culvert Invert (Downstream)
16	751.90	Water Level (Downstream of Road Culvert)
17	751.08	Creekbed (Downstream of Road Culvert)

Survey Results
Bryzek and Hooker Lake Dams (Field File # 30.02)

Hooker Lake Dam

Station	Elevation [3]	Description [7]
1	754.95	Left Abutment
2	755.06	Top of Sheet Piling (Left)
3	753.39	Concrete Spillway (Left)
4	753.22	Concrete Spillway (Center)
5	753.44	Concrete Spillway (Right)
6	754.51	Right Abutment
7	754.80	Top of Sheet Piling (Right)
8	754.80	Water Level
9	752.64	Center Channel Shot (Bed) - approx 10 ft d/s of dam
10	752.27	Center Channel Shot (Bed)
11	754.40	Center Channel Shot (Water Level)
12	755.24	Embankment (Edge of Cattails)
13	756.11	Embankment Edge

1 Elevations, dimensions, and benchmarks obtained from *Evaluation Report - Bryzek Dam*, Mead & Hunt, May 2005.

2 Elevations and dimensions obtained from May 23, 1994 survey used in preparing the Southeastern Wisconsin Regional Planning Commission (SEWRPC) Planning Report No. 44, *A Comprehensive Plan for the Des Plaines River Watershed*, June 2003.

3 All elevations in feet referenced to the National Geodetic Vertical Datum of 1929 (NGVD29)

4 Table F-18, Southeastern Wisconsin Regional Planning Commission (SEWRPC) Planning Report No. 44, *A Comprehensive Plan for the Des Plaines River Watershed*, June 2003.

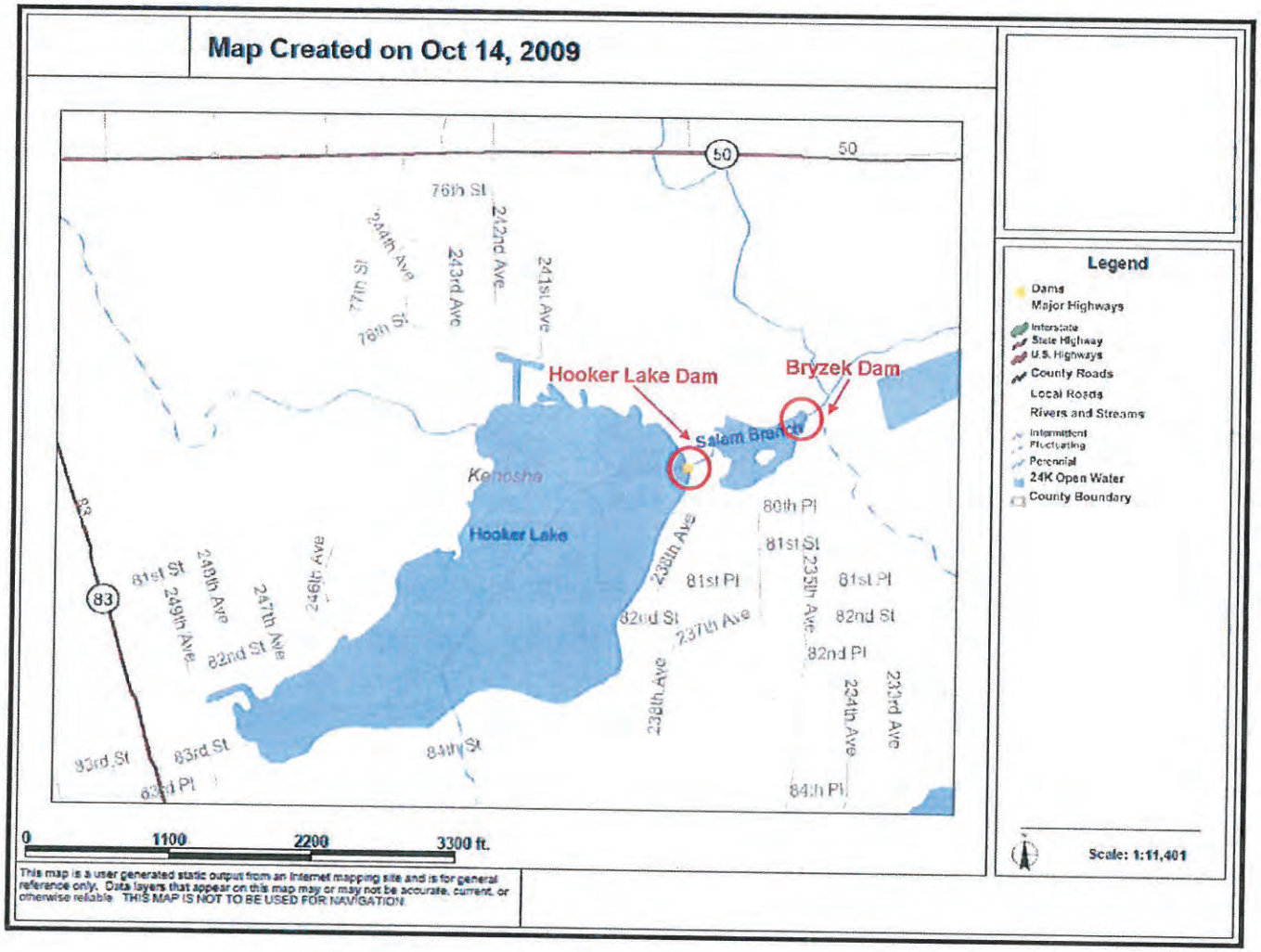
5 Southeastern Wisconsin Regional Planning Commission Record of Vertical Control Station, Structure #1000A, March 1994

6 Southeastern Wisconsin Regional Planning Commission Record of Vertical Control Station, Structure #1000, January 1977

7 Note that right and left are referenced while looking downstream

8 Elevation correlates with record documents in 2005 Mead and Hunt Evaluation Report

Survey Results
Bryzek and Hooker Lake Dams (Field File # 30.02)



Survey Results - Photo Log
Bryzek and Hooker Lake Dams (Field File # 30.02)

Photo #1 – Bryzek Dam
(May 20, 2009)

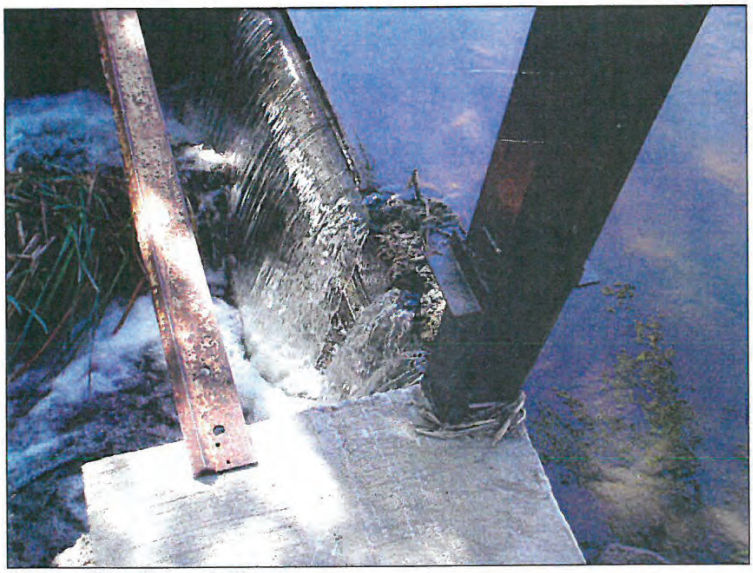


Photo #2 – Bryzek Dam
(May 20, 2009)

Survey Results - Photo Log
Bryzek and Hooker Lake Dams (Field File # 30.02)

Photo #3 – Benchmark REF DP-1000A (railroad spike)
(May 20, 2009)

Photo #4 – Benchmark REF DP-1000A (railroad spike)
(May 20, 2009)

Photo #5 – Benchmark DP-41 (iron wall)
(May 20, 2009)

Survey Results - Photo Log
Bryzek and Hooker Lake Dams (Field File # 30.02)

Photo #6 – Benchmark DP-1000A (railroad spike)
(May 20, 2009)

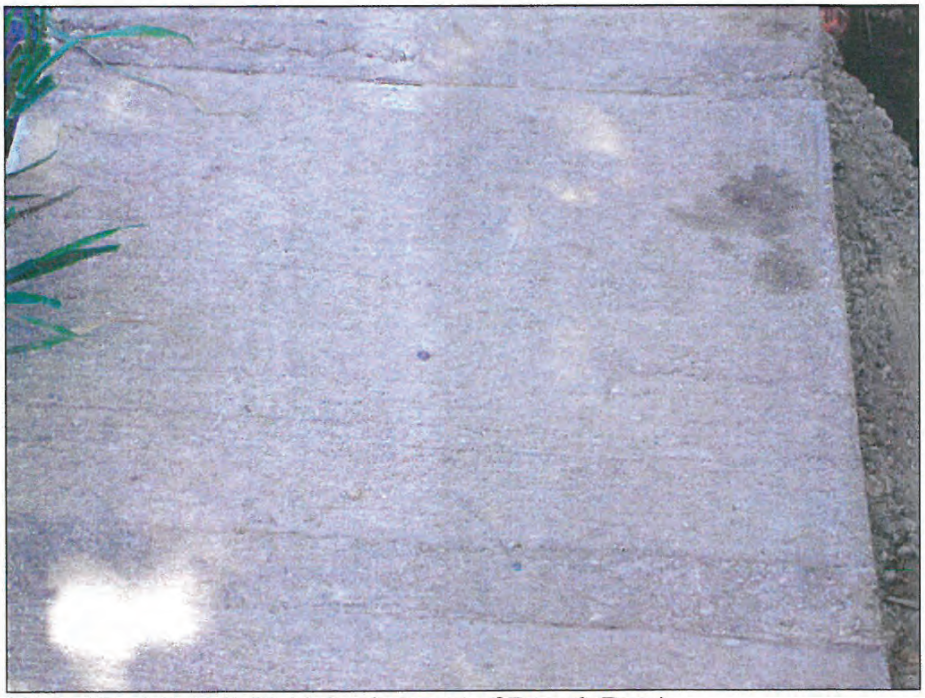


Photo #7 – PK Nail #2 (right abutment of Bryzek Dam)
(May 20, 2009)

Survey Results - Photo Log
Bryzek and Hooker Lake Dams (Field File # 30.02)

Photo #8 – Hooker Lake Dam
(May 20, 2009)

Photo #9 – Hooker Lake Dam (deteriorated left abutment)
(May 20, 2009)

Survey Results - Photo Log
Bryzek and Hooker Lake Dams (Field File # 30.02)

Photo #10 – Hooker Lake Dam (deteriorated spillway)
(May 20, 2009)

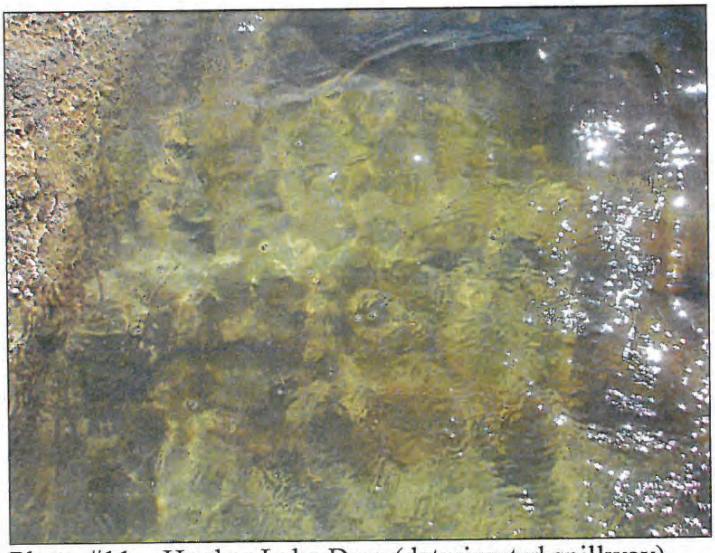


Photo #11 – Hooker Lake Dam (deteriorated spillway)
(May 20, 2009)

Photo #12 – Cattails (at dam looking downstream)
(May 20, 2009)

Photo #13 – Cattails
(May 20, 2009)

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
Southeast Region
141 NW BARSTOW
Waukesha WI 53188

Scott Walker, Governor
Cathy Stepp, Secretary
Telephone 262-574-2188
Toll Free 1-888-936-7463
TTY Access via relay - 711

IP-SE-2010-30-04701

Certified Mail, Return Receipt Requested

May 18, 2016

Frank Bryzek
Family Agent (President)
Carl Bryzek Farm, LLC
8011 288th Avenue Lot W
Salem WI 53168

Expedited delivery via email: paladin09@peoplepc.com

Subject: Time Extension - Order to Reconstruct or Abandon Hooker Lake (Bryzek) Dam, Field File 30.02, Kenosha County

Dear Mr. Bryzek:

On November 8, 2010, the Department sent Carl Bryzek Farm, LLC an Administrative Order to Reconstruct or Abandon Hooker Lake (Bryzek) Dam. The Order was required to protect health, safety and property concerns, and to ensure the dam meets acceptable design standards. The Order established a deadline for restoring the historic spillway elevation for the dam. It also provided an option for obtaining flowage easements or abandoning/removing the dam in lieu of restoring the spillway elevation. A copy of the Order is attached for your reference.

It appears there was a misunderstanding and it was thought that the matter had been resolved after a portion of the steel weir was removed from the spillway. With your permission, the Department conducted a survey on April 6, 2016 to verify the steel weir spillway elevations of the dam. Note that elevations are in feet using National Geodetic Vertical Datum of 1929.

2016 Top of steel weir spillway	754.2 ft.
2009 Top of steel weir spillway	754.2 ft.
1994 Top of steel weir spillway	753.5 ft.
1977 Top of concrete spillway	753.4 ft.

Even with the adjustment made to the steel weir, elevations are still higher than the historic spillway elevation. To account for this the Department is extending the deadlines for the Hooker Lake (Bryzek) Dam Administrative Order, as follows:

1. The owner and/or agent of the Hooker Lake Dam shall restore the historic spillway elevation for Hooker Lake Dam no sooner than July 1, 2016 and no later August 1, 2016, by removing 0.7 feet from the top of the steel weir.

2. The owner and/or agent shall schedule a site visit with the Department to confirm the planned modifications have been made and to verify elevations. The site visit should be scheduled by August 1, 2016 and occur by September 1, 2016.

3. In lieu of provision #1, the owner and/or agent of the Hooker Lake Dam shall petition to raise and enlarge the dam by submitting an application to the Department by August 1, 2016. Flowage easements or appropriate legal arrangements are required from all property owners with lands that are affected by increases in water levels.

4. In lieu of provisions #1 and #3, the owner and/or agent of the Hooker Lake Dam shall submit an application for a permit to abandon the dam pursuant to section 31.185, Wisconsin Statutes, by August 1, 2016. If an application is submitted, the owner and/or agent of the Hooker Lake Dam shall remain responsible for the dam until a permit to abandon the dam is issued and all the conditions of that permit have been met.

5. The owner of the Hooker Lake Dam shall provide the Department written notification of its intent to modify, raise and enlarge, or abandon the dam, by **July 1, 2016**.

S. 710.11, Wis. Stats. states that dam owners may not accept transfer of ownership of a specific piece of land on which a dam is physically located unless they comply with S. 31.14(4), Wis. Stats. which requires proof of financial responsibility to repair, operate and maintain a dam for at least a 10 year period. S. 31.185, Wis. Stats. requires dam owners to get a permit from the Department before they transfer a dam to a new owner.

The transfer process requires an inspection by a professional engineer, a plan to complete any necessary repairs and proof of financial responsibility as mentioned above. Proof of ownership for all portions of the dam or access easements need to be included in the transfer of dam ownership application. Once the transfer is approved, the permit needs to be recorded with the Register of Deeds. The conditions of the Order for Hooker Lake (Bryzek) Dam would also need to be met as part of a transfer of dam ownership.

If you have any questions regarding these time extensions to the Order, please call me at (262) 574-2188, or email Nathan.Zoch@wisconsin.gov, or write to the address above. Thank you for your cooperation.

Sincerely,

Nathan Zoch
Water Management Engineer

cc: Bill Sturtevant, P.E., WDNR, State Dam Safety Engineer – GEFII, WT/3 (email)
Meg Galloway, P.E., WDNR, Dam Safety & Floodplain Section Chief, WDNR – GEF II, WT/3 (email)
Michelle Scott, WDNR, Waterway & Wetlands Field Supervisor (email)
John McEntegarts, Hooker Lake Management District (email)

Appendix F

HOOKER LAKE
AQUATIC PLANT SPECIES DETAILS

Figure A-1

RAKE FULLNESS RATINGS

Source: Wisconsin Department of Natural Resources and SEWRPC.

SOURCES OF INFORMATION:

Borman, S., Korth, R., & Temte, J. (2014). *Through the Looking Glass: A Field Guide to Aquatic Plants, Second Edition.* Stevens Point, WI, USA: Wisconsin Lakes Partnership.

Robert W. Freckman Herbarium: *http://wisplants.uwsp.edu*

Skawinski, P. M. (2014). *Aquatic Plants of the Upper Midwest: A Photographic Field Guide to Our Underwater Forests, Second Edition*. Wausau, Wisconsin, USA: Self-Published.

University of Michigan Herbarium: *http://www.michiganflora.net/home.aspx*

Ceratophyllum demersum — Coontail

Native

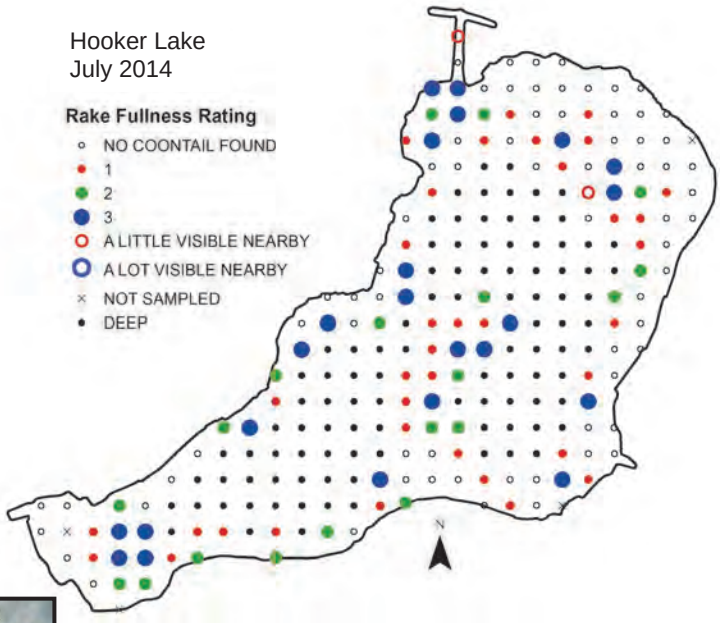
Identifying Features

- Often bushy near tips of branches, giving the raccoon tail-like appearance ("coontail")
- Whorled leaves with one to two orders of branching and small teeth on their margins
- Flowers (rare) small and produced in leaf axils

Coontail is similar to spiny hornwort (*C. echinatum*) and muskgrass (*Chara* spp.), but spiny hornwort has some leaves with three to four orders of branching, and coontail does not produce the distinct garlic-like odor of muskgrass when crushed

Ecology

- Common in lakes and streams, both shallow and deep
- Tolerates poor water quality (high nutrients, chemical pollutants) and disturbed conditions
- Stores energy as oils, which can produce slicks on the water surface when plants decay
- Anchors to the substrate with pale, modified leaves rather than roots
- Eaten by waterfowl, turtles, carp, and muskrat

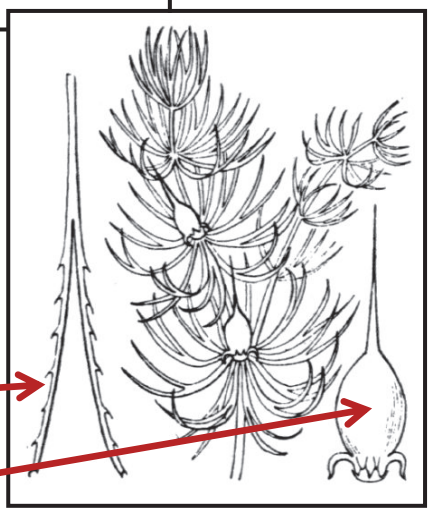


Second-Order Leaf Branching

First-Order Leaf Branching

Toothed Leaf Margins

Fruit (rare)



Chara spp.
Native

Muskgrasses
Algae (not vascular plants)

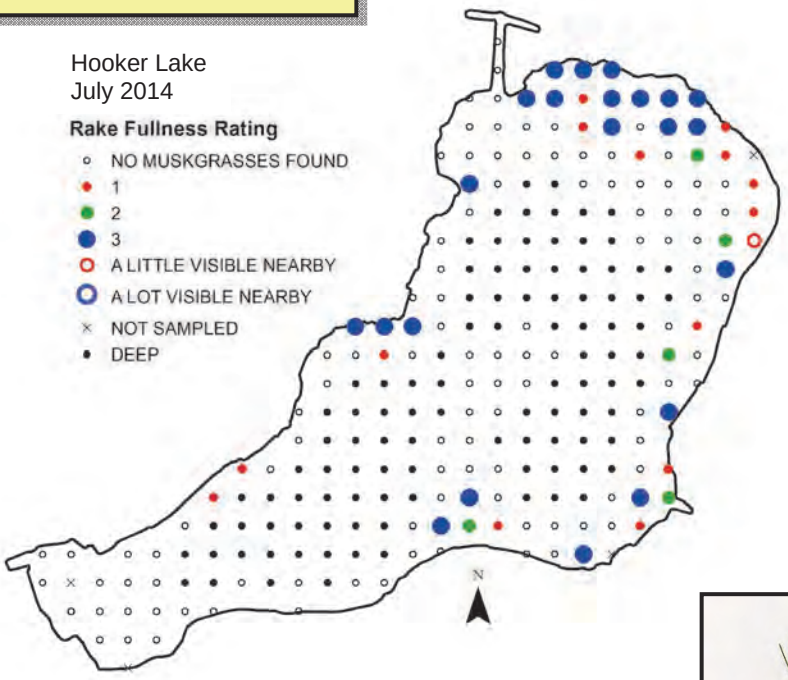
Identifying Features

- Leaf-like, ridged side branches develop in whorls of six or more
- Often encrusted with calcium carbonate, which appears white upon drying (see photo on left, below)
- Yellow reproductive structures develop along the whorled branches in summer
- Emits a garlic-like odor when crushed

Stoneworts (*Nitella* spp.) are similar large algae, but their branches are smooth rather than ridged and more delicate

Ecology

- Found in shallow or deep water over marl or silt, often growing in large colonies in hard water
- Overwinters as rhizoids (cells modified to act as roots) or fragments
- Stabilizes bottom sediments, often among the first species to colonize open areas
- Food for waterfowl and excellent habitat for small fish




Daniel Carter


Christian Fischer

Elodea canadensis — Common Waterweed

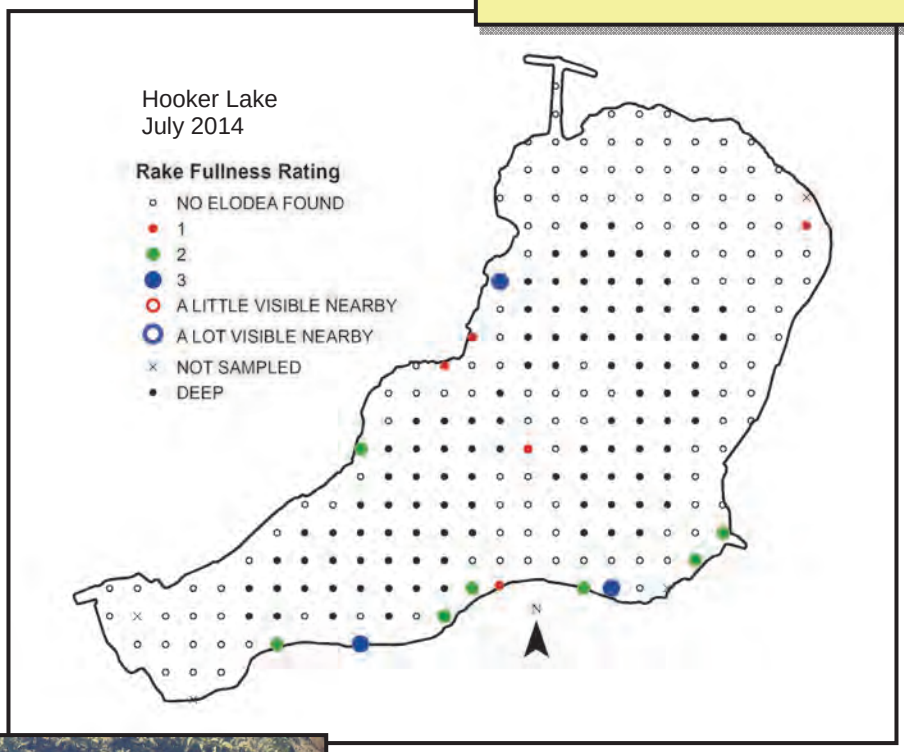
Native

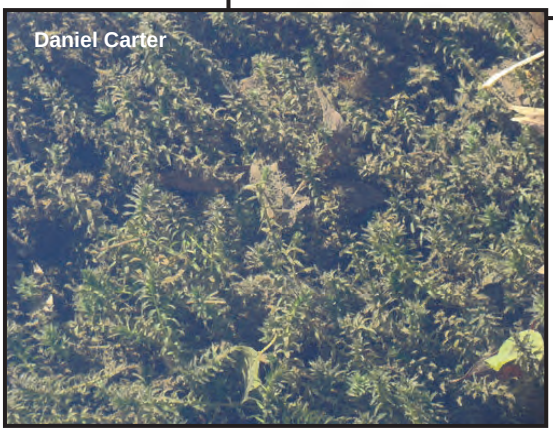
Identifying Features

- Slender stems, occasionally rooting
- Leaves lance-shaped, in whorls of three (rarely two or four), 6.0 to 17 mm long and averaging 2.0 mm wide
- When present, tiny male and female flowers on separate plants (females more common), raised to the surface on thread-like stalks

Ecology

- Found in lakes and streams over soft substrates tolerating pollution, eutrophication and disturbed conditions
- Often overwinters under the ice
- Produces seeds only rarely, spreading primarily via stem fragments
- Provides food for muskrat and waterfowl
- Habitat for fish or invertebrates, although dense stands can obstruct fish movement





Myriophyllum spicatum — Eurasian Water Milfoil

Nonnative/Exotic

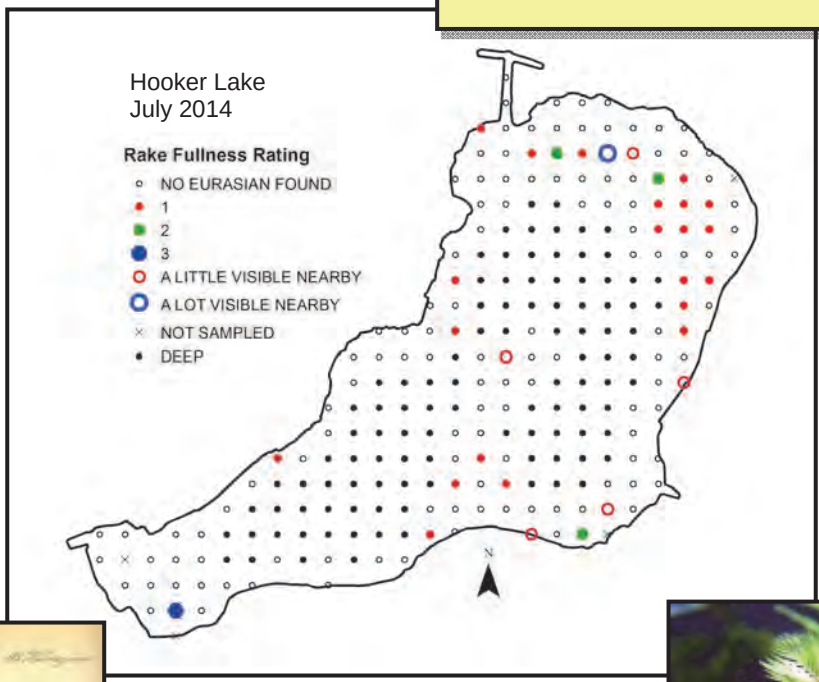
Identifying Features

- Stems spaghetti-like, often pinkish, growing long with many branches near the water surface
- Leaves with 12 to 21 pairs of leaflets
- Produces no winter buds (turions)

Eurasian water milfoil is similar to northern water milfoil (*M. sibiricum*). However, northern water milfoil has five to 12 pairs of leaflets per leaf and stouter white or pale brown stems

Ecology

- Hybridizes with northern (native) water milfoil, resulting in plants with intermediate characteristics
- Invasive, growing quickly, forming canopies, and getting a head-start in spring due to an ability to grow in cool water
- Grows from root stalks and stem fragments in both lakes and streams, shallow and deep; tolerates disturbed conditions
- Provides some forage to waterfowl, but supports fewer aquatic invertebrates than mixed stands of aquatic vegetation



Najas flexilis
Native

Bushy Pondweed or Slender Naiad

Identifying Features

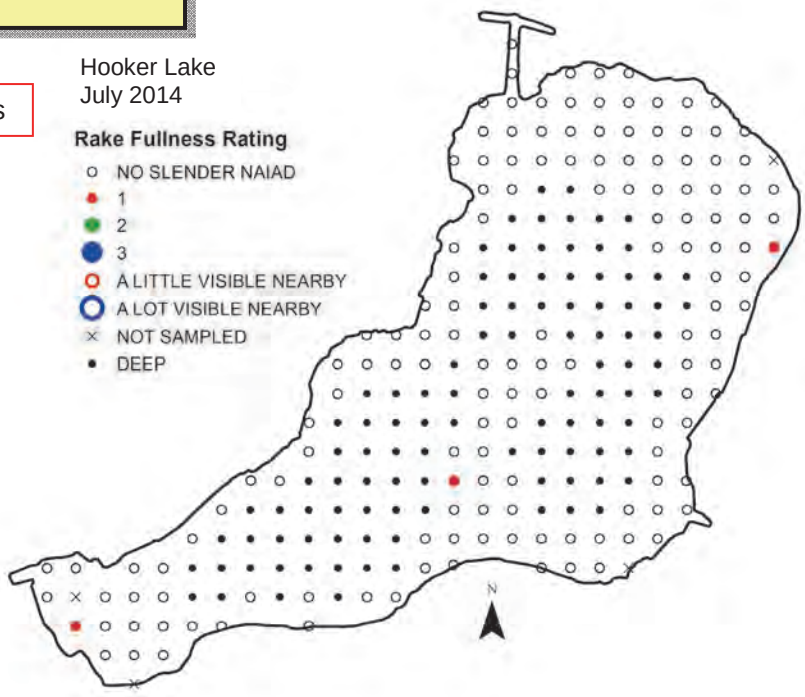
- Leaves narrow (0.4 to 1.0 mm) and pointed with broader bases where they attach to the stem and finely serrated margins
- Flowers, when present, tiny and located in leaf axils
- Variable size and spacing of leaves, as well as compactness of plant, depending on growing conditions

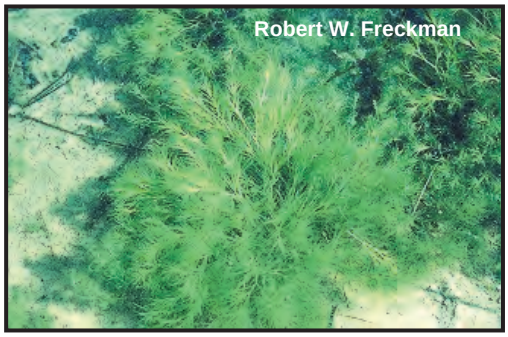
Two other *Najas* occur in southeastern Wisconsin. Southern naiad (*N. guadalupensis*) has wider leaves (to 2.0 mm). Spiny naiad (*N. marina*) has coarsely toothed leaves with spines along the midvein below

Ecology

- In lakes and streams, shallow and deep, often in association with wild celery
- *One of the most important forages of waterfowl*
- An annual plant that completely dies back in fall and regenerates from seeds each spring; also spreading by stem fragments during the growing season

Leaves narrow with serrated edges





Nuphar variegata — Spatterdock

Native

Identifying Features

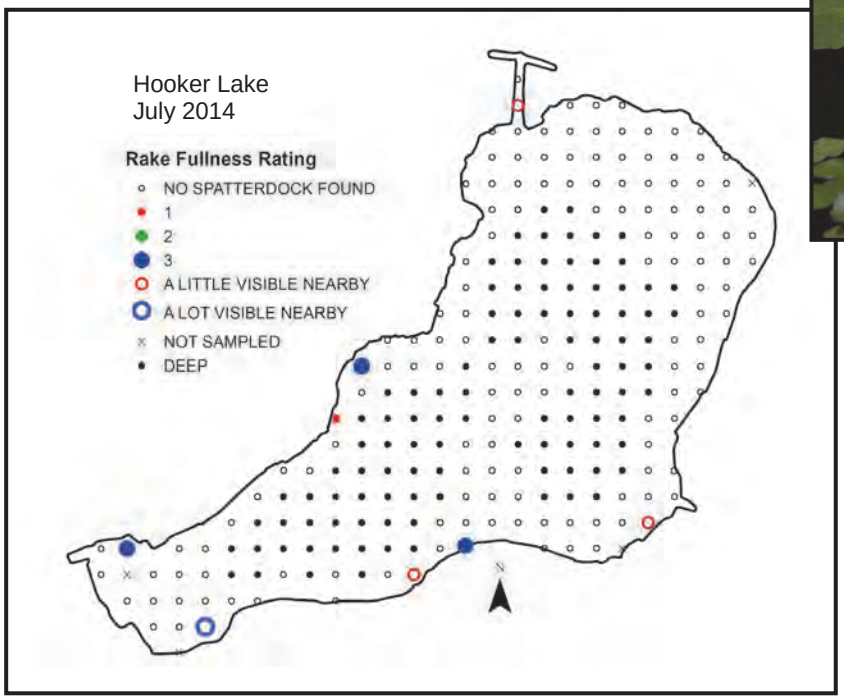
- Leaf stalks winged in cross-section
- Most leaves floating on the water surface, heart-shaped, and notched, with rounded lobes at the base
- Yellow flowers, 2.5 to 5.0 cm wide, often with maroon patches at the bases of the sepals (petal-like structures) when viewed from above

Unlike spatterdock, the similar yellow pond lily (*Nuphar advena*) has leaf stalks that are not winged in cross-section, leaves that more often emerge above the water surface, and leaf lobes that are more pointed. Spatterdock is superficially similar to water lilies (*Nymphea* spp.), but it has yellow versus white flowers and leaves somewhat heart-shaped versus round. American lotus (*Nelumbo lutea*) is also similar, but its leaves are round and un-notched, and its flowers are much larger

Ecology

- In sun or shade and mucky sediments in shallows and along the margins of ponds, lakes, and slow-moving streams
- Overwinters as a perennial rhizome
- Flowers opening during the day, closing at night, and with the odor of fermented fruit
- Buffers shorelines
- Provides food for waterfowl (seeds), deer (leaves and flowers), and muskrat, beaver, and porcupine (rhizomes)
- Habitat for fish and aquatic invertebrates


Ron Edwards




Jason Hollinger

Nymphaea odorata — White Water Lily

Native

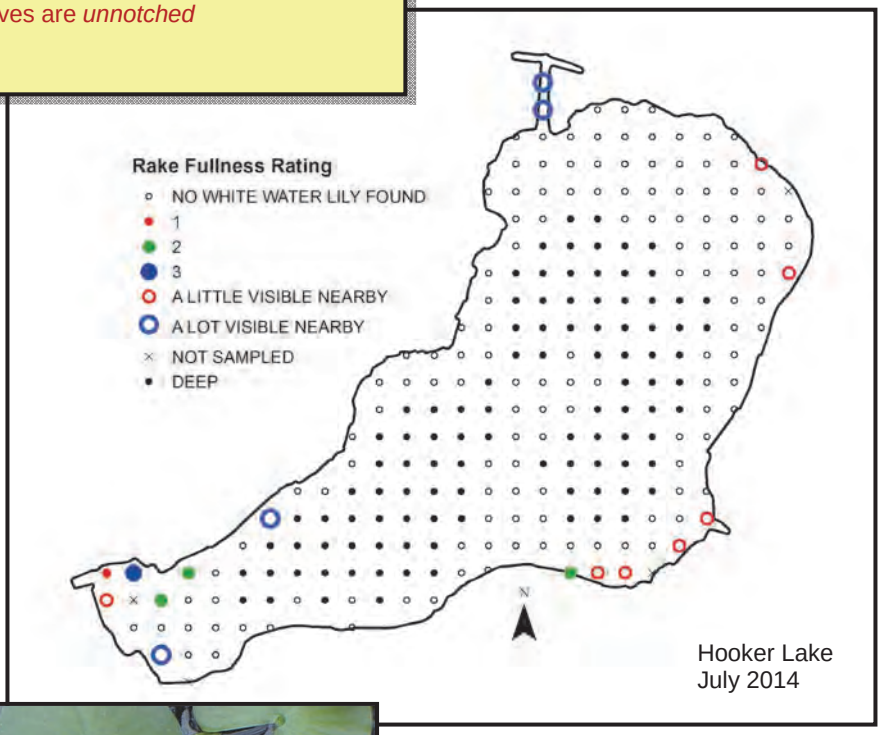
Identifying Features

- Leaf stalks round in cross-section with four large air passages
- Floating leaves round (four to 12 inches wide under favorable conditions), *with a notch* from the outside to the center, and reddish-purple underneath
- Flowers white with a yellow center, three to nine inches wide

Pond lilies (*Nuphar* spp.) are superficially similar, but have yellow flowers and leaves somewhat heart-shaped. American lotus (*Nelumbo lutea*) is also similar, but its leaves are *unnotched*

Ecology

- Found in shallow waters over soft sediments
- Leaves and flowers emerge from rhizomes
- Flowers opening during the day, closing at night
- Seeds consumed by waterfowl, rhizomes consumed by mammals



Hooker Lake
July 2014

Stuckenia pectinata — Sago Pondweed

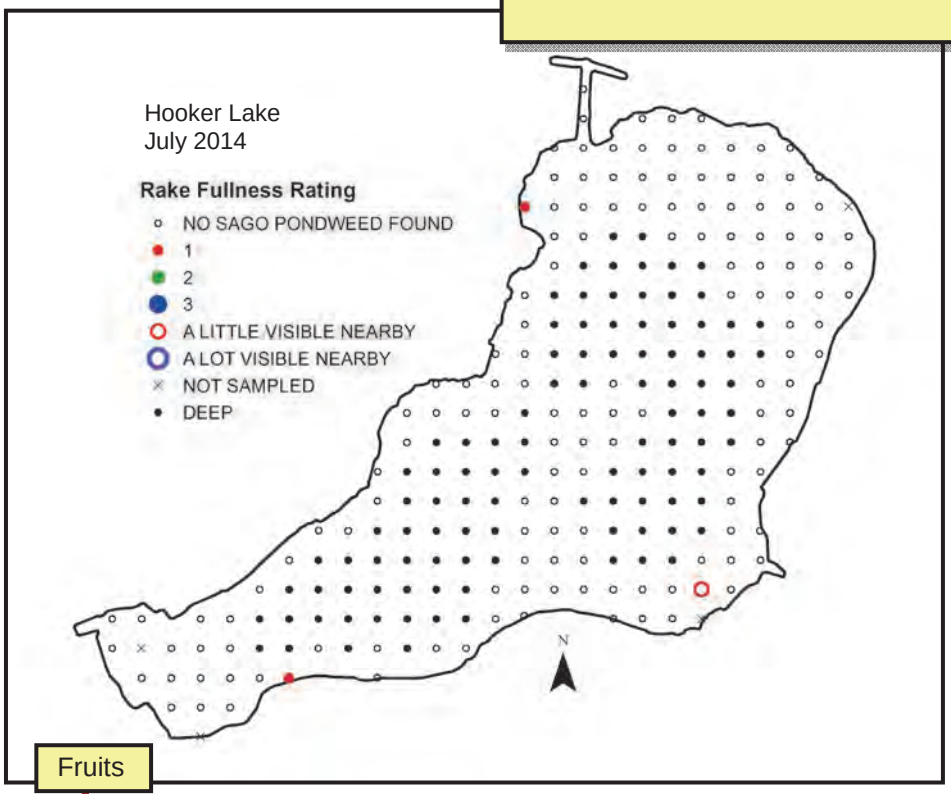
Native

Identifying Features

- Stems often *slightly zig-zagged* and forked multiple times, yielding a fan-like form
- Leaves one to four inches long, very thin, and ending in a sharp point
- Whorls of fruits spaced along the stem may appear as beads on a string

Ecology

- Lakes and streams
- Overwinters as rhizomes and starchy tubers
- Tolerates murky water and disturbed conditions
- Provides abundant fruits and tubers, which are an *important food for waterfowl*
- Provides habitat for juvenile fish



Vallisneria americana — Eelgrass

Native

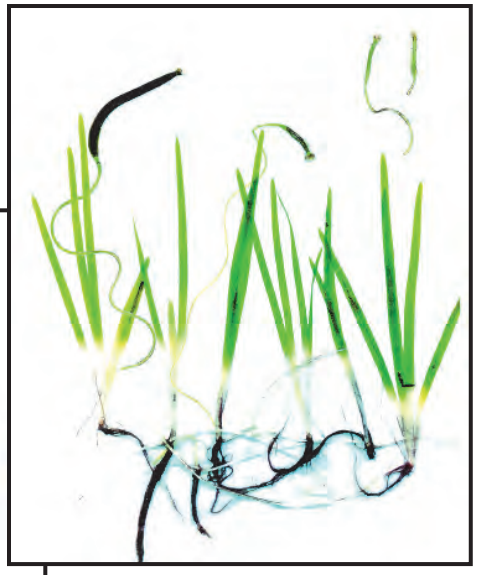
Identifying Features

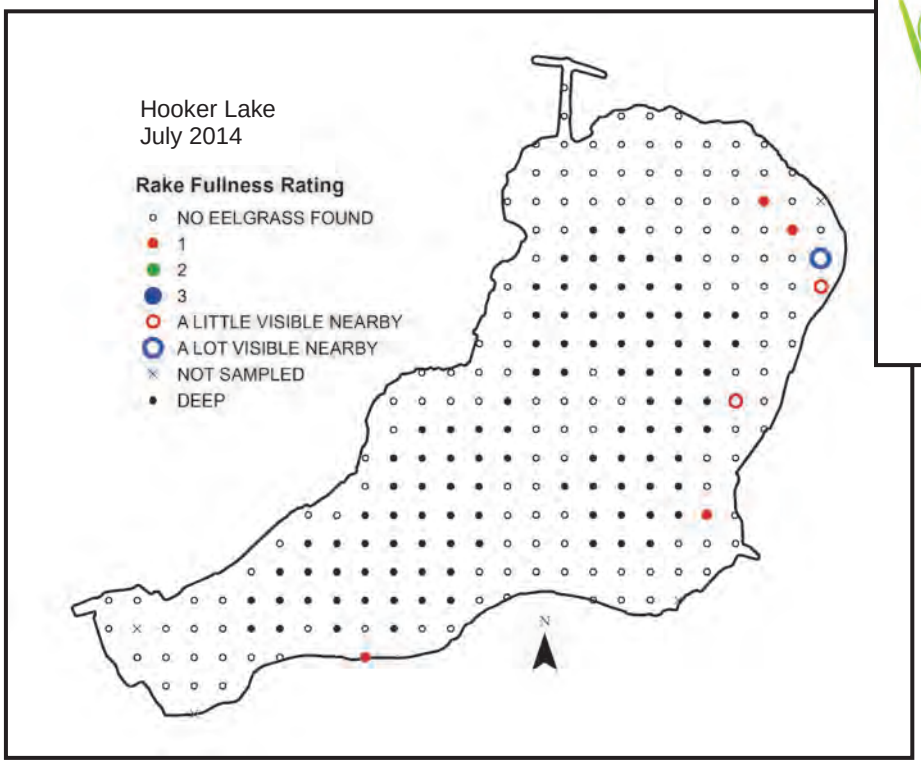
- Leaves ribbon-like, up to two meters long, with a prominent stripe down the middle, and emerging in clusters along creeping rhizomes
- Male and female flowers on separate plants, female flowers raised to the surface on spiral-coiled stalks

The foliage of eelgrass could be confused with the submersed leaves of bur-reeds (*Sparganium* spp.) or arrowheads (*Sagittaria* spp.), but the leaves of eelgrass are distinguished by their prominent middle stripe. The leaves of ribbon-leaf pondweed (*Potamogeton epihydrus*) are also similar to those of eelgrass, but the leaves of the former are alternately arranged along a stem rather than arising from the plant base

Ecology

- Firm substrates, shallow or deep, in lakes and streams
- Spreads by seed, by creeping rhizomes, and by offsets that break off and float to new locations in the fall
- All portions of the plant consumed by waterfowl; an especially important food source for Canvasback ducks
- Provides habitat for invertebrates and fish





Zosterella dubia — Water Stargrass

Native

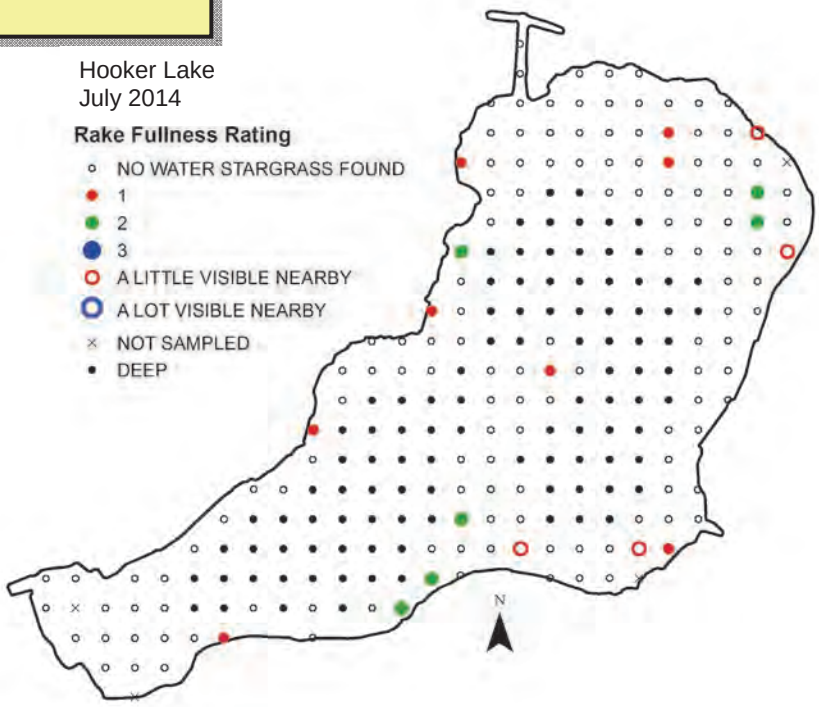
Identifying Features

- Stems slender, slightly flattened, and branching
- Leaves narrow, alternate, with no stalk, and lacking a prominent midvein
- When produced, flowers conspicuous, yellow, and star-shaped (usually in shallow water) or inconspicuous and hidden in the bases of submersed leaves (in deeper water)

Yellow stargrass may be confused with pondweeds that have narrow leaves, but it is easily distinguished by its lack of a prominent midvein and, when present, yellow blossoms

Ecology

- Found in lakes and streams, shallow and deep
- Tolerates somewhat turbid waters
- Overwinters as perennial rhizomes
- Limited reproduction by seed
- Provides food for waterfowl and habitat for fish




Scott Loarie

Appendix G

INVASIVE AQUATIC AND WETLAND SPECIES

Regulated Aquatic Invasive Plants in WI

Please report any **prohibited** species (as indicated by the red frame box) to the WDNR.
Report by email to: Invasive.Species@wi.gov or **by phone at: (608) 266-6437**
OR to find out more information, for information on reporting restricted species and whom to contact go to:
http://dnr.wi.gov/invasives/aquatic/whattodo/

Flowering rush
(Butomus umbellatus)

Purple loosestrife
(Lythrum salicaria)

Curly-leaf pondweed
(Potamogeton crispus)

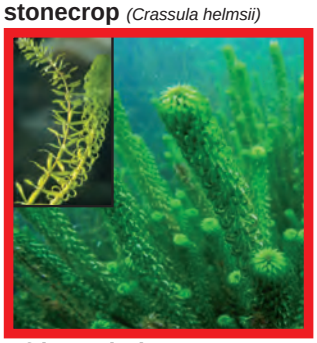
Eurasian water milfoil
(Myriophyllum spicatum)

Australian swamp stonecrop *(Crassula helmsii)*

Brazilian waterweed
(Egeria densa)

Hydrilla
(Hydrilla verticillata)

European frog-bit
(Hydrocharis morsus-ranae)



African elodea
(Lagarosiphon major)

Parrot feather
(Myriophyllum aquaticum)

Brittle waternymph
(Najas minor)

Yellow floating heart
(Nymphoides peltata)

Water chestnut
(Trapa natans)

Fanwort
(Cabomba caroliniana)

Didymo or rock snot (alga)
(Didymosphenia geminata)

Starry stonewort (alga)
(Nitellopsis obtusa)

Restricted Species Prohibited Species

For more information about NR 40 (WI's Invasive Species Rule), Restricted, or Prohibited species please visit: **www.dnr.wi.gov/invasives/classification**

Bureau of Watershed Management
Wisconsin Department of Natural Resources
Box 7921
Madison, WI 53707-7921

DNR PUB-WT-960-2011

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WISCONSIN DEPT. OF NATURAL RESOURCES

Design and Layout by Bonnie Reichert

Chapter NR 40:
Invasive Species Identification Classification and Control
Aquatic Invasive Plants Summary

The Invasive Species Rule (Chapter NR 40) went into effect on September 1, 2009. The rule establishes a comprehensive, science-based way to classify and regulate invasive species in Wisconsin. The rule divides species into 2 categories, "Prohibited" and "Restricted," with different regulations and control requirements. The rule also establishes "Preventative Measures" to show what actions we can take to slow the spread of invasive species. Chapter NR 40 covers over 128 species, including plants, animals, and microorganisms.

WI Statute 23.22 defines **Invasive Species** as "nonindigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health." Not all nonnative plants are harmful, so NR 40 helps us determine which ones are invasive.

Prohibited Invasive Plants *

- These species are not yet in the state or only in a few places
- These species are likely to cause environmental and/or economic harm
- It is still possible to eradicate these species and prevent their spread statewide

Regulations: **Cannot transport, possess, transfer (buy or sell), or introduce without a permit**
Control Authority: Control is required. DNR may order or conduct a control effort

Restricted Invasive Plants *

- These species are already widely established in the state
- High environmental and/or economic impacts are evident with these species
- Complete eradication of these species is unlikely

Regulations: **Cannot transport, transfer (buy or sell), or introduce without a permit**
Control Authority: Control is encouraged but not required

*All viable part of the species (including seeds) are covered by these regulations.

What This Means for You

The primary goal of NR 40 is to slow the spread of invasive species in Wisconsin. The Department is using a "stepped enforcement" protocol, which emphasizes education and voluntary compliance. However, citations may be issued for aquatic invasive species violations. Remember:

- **It is illegal to buy, sell, give away, or barter any species listed under Chapter NR 40.**
- **Please become familiar with the listed plants and their regulated status for your county.**
- **You are responsible to comply with all elements of Chapter NR 40.**

Regulations differ slightly for certain species. Please go to the WDNR website to see listed exemptions for NR40, as well as the rule's implications for aquatic invertebrates, fish, and terrestrial species:

www.dnr.wi.gov/invasives/classification

For more information contact the WDNR
Invasive Species Project Coordinator at:
Email: Invasive.Species@wi.gov
Phone: (608) 266-6437

CS.v.8/30/11

Common Wetland Invasive Plants in WI

Please report **prohibited** species (as indicated by red on the maps) and all other species marked with an asterisk(*) when found in or near wetlands or shores. Provide the following data: exact location, land ownership (if known), population size, a photo or voucher specimen, and your contact information.

To report a sighting: send an email to: Invasive.Species@wi.gov or CALL 608-267-5066

Common buckthorn
(Rhamnus cathartica)

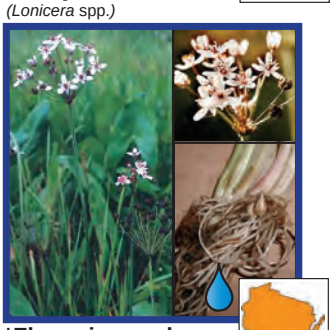
Glossy buckthorn
(Frangula alnus = Rhamnus frangula)

Non-native bush honeysuckles
(Lonicera spp.)

Canada thistle
(Cirsium arvense)

Common forget-me-not
(Myosotis scorpioides)

Dame's rocket
(Hesperis matronalis)

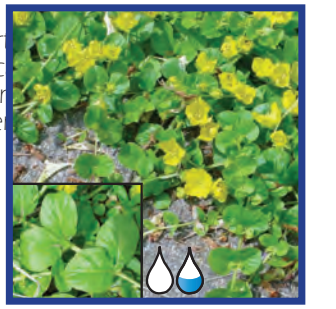


***Flowering rush**
(Butomus umbellatus)

***Garden valerian or heliotrope** *(Valeriana officinalis)*

Garlic mustard
(Alliaria petiolata)

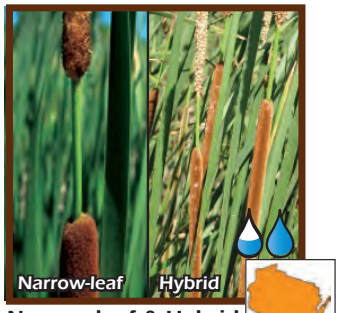
***Japanese & Giant knotweed** *(Polygonum cuspidatum & P. sachalinense)*



Moneywort
(Lysimachia nummularia)

***Purple loosestrife**
(Lythrum salicaria)

Watercress
(Nasturtium officinale)



Narrow-leaf & Hybrid cattail *(Typha angustifolia & T. x glauca)*

***Phragmites**
(Phragmites australis)

Reed canary grass
(Phalaris arundinacea)

Restricted Species | Prohibited/Restricted Species | Prohibited Species

Species without a map are not regulated by NR 40 (WI's Invasive Species Rule)

Tree | Vine | Grass | Shrub | Forb

SOMEWHAT WET (Floodplain forests, Seasonally flooded basins)

WET (Wet meadows, Shrub swamps, Wooded swamps)

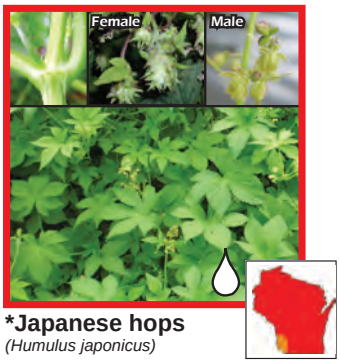
VERY WET (Deep marsh, Shallow marsh)

Early Detection Wetland Invasive Plants in WI

Early detection plants are either not yet present in WI or not widespread but have the potential to become widespread.

European high-bush cranberry *(Viburnum opulus* L. *subsp. opulus)*

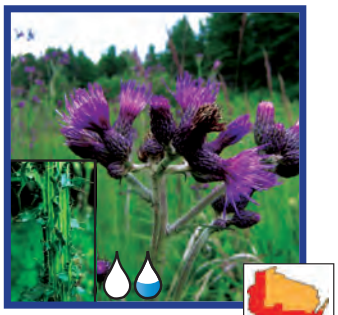
***Chinese yam** *(Dioscorea oppositifolia)*



***Japanese hops** *(Humulus japonicus)*

Annual salt marsh aster *(Symphyotrichum subulatum)*

Cut-leaved teasel *(Dipsacus laciniatus)*

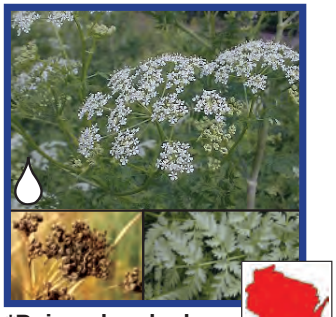


***European marsh thistle** *(Cirsium palustre)*

False spirea *(Sorbaria sorbifolia)*

***Giant hogweed** *(Heracleum mantegazzianum)*

***Hairy willow herb** *(Epilobium hirsutum)*



***Poison hemlock** *(Conium maculatum)*

Queen-of-the-meadow *(Filipendula ulmaria)*

Seaside goldenrod *(Solidago sempervirens)*

Yellow garden loosestrife *(Lysimachia vulgaris)*

***Yellow iris** *(Iris pseudacorus)*

***Japanese stilt grass** *(Microstegium vimineum)*

***Tall or Reed manna grass** *(Glyceria maxima)*

For more information about NR 40 (WI's Invasive Species Rule), Restricted, or Prohibited species please visit: www.dnr.wi.gov/invasives/classification

For more information about the plant species please visit: http://dnr.wi.gov/wetlands/invasive.html

Bureau of Endangered Resources
and Division of Forestry
Wisconsin Department of Natural Resources
Box 7921
Madison, WI 53707-7921

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DNR PUB-WT-930-2010

Design and Layout by Bonnie Reichert

Appendix H

2,4-D CHEMICAL FACT SHEET

2,4-D Chemical Fact Sheet

Formulations

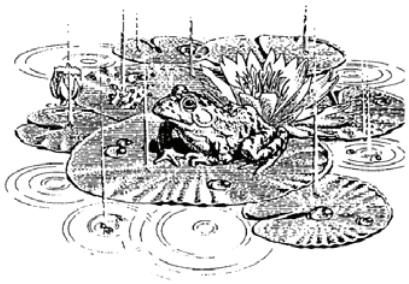
2,4-D is an herbicide that is widely used as a household weed-killer, agricultural herbicide, and aquatic herbicide. It has been in use since 1946, and was registered with the EPA in 1986 and re-reviewed in 2005. The active ingredient is 2,4-dichloro-phenoxyacetic acid. There are two types of 2,4-D used as aquatic herbicides: dimethyl amine salt and butoxyethyl ester. Both liquid and slow-release granular formulations are available. 2,4-D is sold under the trade names Aqua-Kleen, Weedar 64 and Navigate (product names are provided solely for your reference and should not be considered endorsements nor exhaustive).

Aquatic Use and Considerations

2,4-D is a widely-used herbicide that affects plant cell growth and division. It affects primarily broad-leaf plants. When the treatment occurs, the 2,4-D is absorbed into the plant and moved to the roots, stems, and leaves. Plants begin to die in a few days to a week following treatment, but can take several weeks to decompose. Treatments should be made when plants are growing.

For many years, 2,4-D has been used primarily in small-scale spot treatments. Recently, some studies have found that 2,4-D moves quickly through the water and mixes throughout the waterbody, regardless of where it is applied. Accordingly, 2,4-D has been used in Wisconsin experimentally for whole-lake treatments.

2,4-D is effective at treating the invasive Eurasian watermilfoil (*Myriophyllum spicatum*). Desirable native species that may be affected include native milfoils, coontail (*Ceratophyllum demersum*), naiads (*Najas* spp.), elodea (*Elodea canadensis*) and duckweeds (*Lemna* spp.). Lilies (*Nymphaea* spp. and *Nuphar* spp.) and bladderworts (Utricularia spp.) also can be affected.



Post-Treatment Water Use Restrictions

There are no restrictions on eating fish from treated water bodies, human drinking water or pet/livestock drinking water. Following the last registration review in 2005, the ester products require a 24-hour waiting period for swimming. Depending on the type of waterbody treated and the type of plant being watered, irrigation restrictions may apply for up to 30 days. Certain plants, such as tomatoes and peppers and newly seeded lawn, should not be watered with treated water until the concentration is less than 5 parts per billion (ppb).

Herbicide Degradation, Persistence and Trace Contaminants

The half-life of 2,4-D (the time it takes for half of the active ingredient to degrade) ranges from 12.9 to 40 days depending on water conditions. In anaerobic lab conditions, the half-life has been measured up to 333 days. After treatment, the 2,4-D concentration in the water is reduced primarily through microbial activity, off-site movement by water, or adsorption to small particles in silty water. It is slower to degrade in cold or acidic water, and appears to be slower to degrade in lakes that have not been treated with 2,4-D previously.

There are several degradation products from 2,4-D: 1,2,4-benzenetriol, 2,4-dichlorophenol, 2,4-dichloroanisole, chlorohydroquinone (CHQ), 4-chlorophenol and volatile organics.

Impacts on Fish and Other Aquatic Organisms

Toxicity of aquatic 2,4-D products vary depending on whether the formulation is an amine or an ester 2,4-D. The ester formulations are toxic to fish and some important invertebrates such as water fleas (*Daphnia*) and midges at application rates; the amine formulations are not toxic to fish or invertebrates at application rates. Loss of habitat following treatment may cause reductions in populations of invertebrates with either formulation, as with any herbicide treatment. These organisms only recolonize the treated areas as vegetation becomes re-established.

Available data indicate 2,4-D does not accumulate at significant levels in the bodies of fish that have been tested. Although fish that are exposed to 2,4-D will take up some of the chemical, the small amounts that accumulate are eliminated after exposure to 2,4-D ceases.

On an acute basis, 2,4-D is considered moderately to practically nontoxic to birds. 2,4-D is not toxic to amphibians at application rates; effects on reptiles are unknown. Studies have shown some endocrine disruption in amphibians at rates used in lake applications, and DNR is currently funding a study to investigate endocrine disruption in fish at application rates.

As with all chemical herbicide applications it is very important to read and follow all label instructions to prevent adverse environmental impacts.

Human Health

Adverse health effects can be produced by acute and chronic exposure to 2,4-D. Those who mix or apply 2,4-D need to protect their skin and eyes from contact with 2,4-D products to minimize irritation, and avoid inhaling the spray. In its consideration of exposure risks, the EPA believes no significant risks will occur to recreational users of water treated with 2,4-D.

Concerns have been raised about exposure to 2,4-D and elevated cancer risk. Some (but not all) epidemiological studies have found 2,4-D associated with a slight increase in risk of non-Hodgkin's lymphoma in high exposure populations (farmers and herbicide applicators). The studies show only a possible association that may be caused by other factors, and do not show that 2,4-D causes cancer. The EPA determined in 2005 that there is not sufficient evidence to classify 2,4-D as a human carcinogen.

The other chronic health concern with 2,4-D is the potential for endocrine disruption. There is some evidence that 2,4-D may have estrogenic activities, and that two of the break-down products of 2,4-D (4-chlorophenol and 2,4-dichloroanisole) may affect male reproductive development. The extent and implications of this are not clear and it is an area of ongoing research.

For Additional Information

Environmental Protection Agency
Office of Pesticide Programs
www.epa.gov/pesticides

Wisconsin Department of Agriculture, Trade, and Consumer Protection
http://datcp.wi.gov/Plants/Pesticides/

Wisconsin Department of Natural Resources
608-266-2621
http://dnr.wi.gov/lakes/plants/

Wisconsin Department of Health Services
http://www.dhs.wisconsin.gov/

National Pesticide Information Center
1-800-858-7378
http://npic.orst.edu/

Wisconsin Department of Natural Resources
Box 7921
Madison, WI 53707-7921

DNR PUB-WT-964 2012

Appendix I

LOCAL ORDINANCES RELATING TO HOOKER LAKE

Chapter 330. Lakes and Beaches

§ 330-1. Intent.

The intent of this chapter is to provide safe and healthful conditions for the enjoyment of aquatic recreation consistent with public needs and the capacity of the water resource.

§ 330-2. Applicability.

[Amended 4-10-2000 by Ord. No. 00-04-10] The provisions of this chapter shall apply to the lakes within the jurisdiction of the Town and to the rivers within the Town wherever the provisions of this chapter would be applicable to river traffic, except to the waters of Silver Lake, which shall be enforced exclusively by the Village of Silver Lake.

§ 330-3. Incorporation of state statutes.

A.

[HISTORY: Adopted by the Town Board of the Town of Salem 7-18-1991 by Ord. No. 91-07-18 (Ch. 20 of the 1991 Code). Amendments noted where applicable.] **GENERAL REFERENCES** Public Safety Department — See Ch. 119. Fees — See Ch. 272. Parks and recreation — See Ch. 396.

The following sections of the Wisconsin Statutes and any subsequent amendments thereto are hereby adopted and by reference made a part of this section as though fully set forth herein: [Amended 6-13-2011 by Ord. No. 11-06-13] **Wis. Stats. SectionTitle** 30.50Definitions 30.51Certificate of number and registration; requirements; exemptions 30.52Certificate of number and registration; application; certification and registration period; fees; issuance 30.53Certificate of origin; requirements; contents 30.531Certificate of title; requirements; exemptions 30.54(2)Lost, stolen or mutilated certificates 30.55Notice of abandonment or destruction of boat or change of address 30.60Classification of motorboats 30.61Lighting equipment 30.62Other equipment 30.635Motorboat prohibition 30.64Patrol boats

B.

Wis. Stats. Section 30.65 30.66 30.67 30.675 30.68 30.681 30.682 30.683 30.684 30.686 30.687 30.69 30.70 30.71 Any act required to be performed or prohibited by the provisions of any of the above-referenced statutory sections incorporated herein is required or prohibited by this section.

§ 330-4. Definitions.

http://ecode360.com/print/SA2942?guid=13944128&children=true

Title

Traffic rules Speed restrictions Accidents and accident reports Distress signal flag Prohibited operation Intoxicated boating Preliminary breath screening test Implied consent Chemical tests Report arrest to department Officers action after arrest for violating intoxicated boating law Water skiing Skin diving Disposal of waste from boats equipped with toilets

As used in this chapter, the following terms shall have the meanings indicated: **MOORAGE** An area where continuous mooring of boats for more than 24 hours is permitted. **PUBLIC ACCESS** A marina or landing facility and the adjoining public shoreline under the ownership of the state, county or other municipality. **SHORE ZONE** The water area within 200 feet of any lakeshore within the Town of Salem, except: [Amended 6-13-2011 by Ord. No. 11-06-13C] A. On Silver Lake, where the shore zone shall mean the water area from the shore to five-foot depth as shown on the hydrographic map bearing legend DNR 1968. B. On Lake Shangri-La, where the shore zone shall mean the water area within 100 feet of any lakeshore. **SLOW NO-WAKE BENCHMARK** The elevation of the surface of inland waters within the Town of Salem at which operation of motorboats on such waters at a speed in excess of slow no-wake speed tends to create or cause property damage or abnormal shore erosion due to excessive wake or wash. The slow no-wake benchmark shall be the surface elevation of such inland waters as indicated by markers established for that purpose, the locations of which are depicted on the attached Marker Maps A and B. [1] The slow no-wake benchmarks for inland waters within the Town shall be as follows: [Added 4-17-2008 by Ord. No. 08-04-17; amended 6-13-2011 by Ord. No. 11-06-13C] **Body of WaterMarker LocationMarker Level** Cross LakeN42° 29" 53.0', W88° 05" 39.3'4.00

Voltz Lake

Body of Water

Camp Lake

Center Lake

Lake Shangri-La

Hooker Lake

Marker Location Cross Lake Gauging Station No. 1 is located on the west side of Cross Lake approximately 160 feet north of the intersection of S.T.H. "83" and 127th Place. The datum elevation for Cross Lake Gauging Station No. 1 is 810.00. Cross Lake Gauging Station No. 1 is scaled from 3.33 to 6.67 feet. N42° 30" 32.8', W88° 08" 51.9' Camp Lake Gauging Station No. 1 is located on the south side of Camp Lake north of C.T.H. "C" approximately 800 feet southwest of 277th Avenue. The gauging station is located approximately 40 feet north of the center line of C.T.H. "C" and approximately 30 feet west of the dam. The datum elevation for Camp Lake Gauging Station No. 1 is 730.00. Camp Lake Gauging Station No. 1 is scaled from 10.00 to 16.67 feet. N42° 31" 56.7', W88° 08" 18.7' Center Lake Gauging Station No. 1 is located on the south side of Center Lake adjacent to Camp Lake Road (C.T.H. "SA") in the waterway that connects Center Lake and Camp Lake. The gauging station is located north of C.T.H. "SA" approximately 400 feet northwest of 271st Avenue. The gauging station is located approximately 60 feet north of the center line of C.T.H. "SA" and approximately 10 feet northwest of a small dam in the waterway. The datum elevation for Center Lake Gauging Station No. 1 is 730.00. Center Lake Gauging Station No. 1 is scaled from 10.00 to 16.67 feet. N42° 30" 31.7', W88° 04" 16.6' Lake Shangrila Gauging Station No. 1 is located on the north side of Lake Shangrila adjacent of 118th Street. The gauging station is located southeast of 118th Street approximately 800 feet southwest of 117th Street. The gauging station is located approximately 30 feet southeast of the center line of 118th Street and approximately 10 feet northeast of the culvert under 118th Street. The datum elevation for Lake Shangrila Gauging Station No. 1 is 790.00. Lake Shangrila Gauging Station No. 1 is scaled from 3.33 to 6.67 feet. N42° 33" 21.9', W88° 06" 26.9' Hooker Lake Gauging Station No. 1 is located on the southwest side of Hooker Lake approximately 300 feet east of the intersection of 83rd Street and 249th Avenue. The gauging station is located approximately 30 feet east of the east end of 83rd Street. The datum elevation for Hooker Lake Gauging Station No. 1 is 745.00. Hooker Lake Gauging Station No. 1 is scaled from 8.50 to 13.33 feet. N42° 30" 32.9', W88° 05" 17.1'

Marker Level

11.50

12.00

5.85

9.80

8.25

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Body of Water

§ 330-5. Speed restrictions.

Marker Location Voltz Lake Gauging Station No. 1 is located on the northwest side of Voltz Lake adjacent to 231st Court. The gauging station is located east of 231st Court approximately 250 feet south of 117th Street. The gauging station is located approximately 25 feet east of the center line of 231st Court and approximately 30 feet south of Trevor Creek. The datum elevation for Voltz Lake Gauging Station No. 1 is 805.00. Voltz Lake Gauging Station No. 1 is scaled from 6.67 to 10.00 feet.

Marker Level

SLOW NO-WAKE SPEED That speed at which a boat moves as slowly as possible while still maintaining steerage control. **SWIMMING ZONE** An authorized area marked by official buoys to designate a swimming area. [1]*Editor's Note: The maps are on file at the office of the Town Clerk.*

In addition to the speed restrictions set forth in § 330-3 of this chapter, adopting § 30.66, Wis. Stats., no person shall operate a boat in excess of the slow no-wake speed: [Amended 6-14-1993 by Ord. No. 93-06-14D; 6-19-1995 by Ord. No. 95-06-19; 3-9-1998 by Ord. No. 98-03-09B; 4-11-2005 by Ord. No. 05-04-11A] (1) On any lake within a defined shore zone. (2) Except as otherwise provided in this section, on any lake between the hours of 7:00 p.m. and 10:00 a.m. on either the shore zone or the traffic lane. [Amended 12-14-2009 by Ord. No. 09-12-14] (3) On that part of the Fox River bounded on the north by the Highway C bridge and on the south by the Wisconsin-Illinois border. (4) On that part of the Fox River bounded on the south by the south face of the bridge on CTH F and on the north by a slow no-wake regulatory buoy placed at 42.32768 north latitude, 88.10749 west longitude. Additional slow no-wake buoys shall be placed to implement the speed restriction as follows: 1 buoy at 42.32517 north latitude and 88.10305 west longitude 1 buoy at 42.32495 north latitude and 88.10413 west longitude 1 buoy at 42.32553 north latitude and 88.10492 west longitude 1 buoy at 42.32675 north latitude and 88.10492 west longitude 1 buoy at 42.32675 north latitude and 88.10509 west longitude 1 buoy at 42.32674 north latitude and 88.10730 west longitude 1 buoy at 42.32701 north latitude and 88.10761 west longitude (5) On Lake Shangri-La in the area of the lake known as "the narrows." Slow no-wake buoys shall be placed to implement the speed restrictions as follows: 1 buoy 140 feet from the shore of the property identified as 12026 214th Avenue. 1 buoy 140 feet from the shore of the property identified as 21401 121st Street (6)

On Camp Lake within the shore zone. Slow no-wake buoys shall be placed in the following locations to implement the restrictions: [Added 9-10-2007 by Ord. No. 07-09-10B; amended 4-5-2010 by Ord. No. 10-04-05] 1 buoy at 42.31749 north latitude and 88.08702 west longitude 1 buoy at 42.31914 north latitude and 88.08609 west longitude 1 buoy at 42.31990 north latitude and 88.08583 west longitude 1 buoy at 42.31958 north latitude and 88.08466 west longitude 1 buoy at 42.31811 north latitude and 88.08421 west longitude 1 buoy at 42.31697 north latitude and 88.08499 west longitude 1 buoy at 42.31544 north latitude and 88.08435 west longitude 1 buoy at 42.31691 north latitude and 88.08547 west longitude 1 buoy at 42.31467 north latitude and 88.08397 west longitude 1 buoy at 42.31472 north latitude and 88.08385 west longitude 1 buoy at 42.31545 north latitude and 88.08475 west longitude 1 buoy at 42.31401 north latitude and 88.08308 west longitude 1 buoy at 42.31296 north latitude and 88.08231 west longitude 1 buoy at 42.31196 north latitude and 88.08193 west longitude 1 buoy at 42.31132 north latitude and 88.08206 west longitude 1 buoy at 42.31005 north latitude and 88.08353 west longitude 1 buoy at 42.30942 north latitude and 88.08468 west longitude 1 buoy at 42.30870 north latitude and 88.08575 west longitude 1 buoy at 42.30833 north latitude and 88.08691 west longitude 1 buoy at 42.31211 north latitude and 88.08966 west longitude 1 buoy at 42.31501 north latitude and 88.08692 west longitude 1 buoy at 42.31601 north latitude and 88.08723 west longitude 1 buoy at 42.31699 north latitude and 88.08749 west longitude On Hooker Lake between the hours of sunset and 10:00 a.m. either in the shore zone or the traffic lane. [Added 12-14-2009 by Ord. No. 09-12-14; amended 10-14-2013 by Ord. No. 13-10-14] On Lake Shangri-La/Benet between the hours of sunset and 10:00 a.m. either in the shore zone or the traffic lane during the months of July and August. [Added 6-13-2011 by Ord. No. 11-06-13C] (9) On Camp Lake between the hours of sunset and 10:00 a.m. either in the shore zone or the traffic lane. [Added 6-13-2011 by Ord. No. 11-06-13C; amended 3-12-2012 by Ord. No. 12-03-12A] (10) On Center Lake within the restricted areas marked by buoys placed at the following locations: [Added 5-14-2012 by Ord. No. 12-05-14A; amended 11-12-2013 by Ord. No. 13-11-12] **LocationBuoy TypeLatitudeLongitude** Center Lake Woods Swim area42° 32' 16.04" N88° 8' 1.12" W Beach Center Lake Woods Swim area42° 32' 16.64" N88° 8' 0.82" W Beach Center Lake Woods Swim area42° 32' 16.80" N88° 7' 59.14" W Beach Center Lake Woods Swim area42° 32' 16.32" N88° 7' 58.62" W Beach Swim area42° 32' 15.78" N88° 7' 58.25" W

(7)

(8)

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Location Center Lake Woods Beach Boat launch channel Center Lake Beach Center Lake Beach Camp Wonderland Camp Wonderland Center Lake Beach Pursuant to § 30.635, Wis. Stats., no person shall operate a motorboat on Rock Lake in excess of the slow no-wake speed. No person shall operate a motorboat on any inland waters subject to the jurisdiction of the Town of Salem at a speed in excess of slow no-wake speed when the surface water level of such inland bodies of water exceeds the slow no-wake benchmark as indicated by markers placed and maintained by the Town for that purpose. [Added 4-17-2008 by Ord. No. 08-04-17]

No wake Swim area Swim area No wake No wake Swim area

Buoy Type

§ 330-6. Capacity restrictions.

§ 330-7. Buoys, piers and rafts.

Latitude

42° 32' 14.63" N 42° 32' 19.24" N 42° 32' 19.67" N 42° 32' 24.77" N 42° 32' 26.99" N 42° 32' 28.13" N

Longitude

88° 8' 20.60" W 88° 8' 15.21" W 88° 8' 15.01" W 88° 8' 6.58" W 88° 8' 3.86" W 88° 8' 1.81" W

No person shall operate or loan, rent or permit a boat to leave the place where it is customarily kept for operation on the waters covered by this chapter with more passengers or cargo than shall be stated on the capacity information plate as required by § 30.501, Wis. Stats.

Removal. The Town may remove or cause to be removed all buoys, markers, piers and their supports, privately owned or placed, which are not removed by December 1 of each year and charge the cost and expense of such removal to the riparian owner. If such charge is not paid within 30 days after request therefor, a penalty of 10% shall be added to such charge, and the same shall constitute a lien on the property of the riparian owner and be inserted on the Town tax roll by the Town Clerk upon order of the Town Board and after notice to the riparian owner. [Amended 4-10-2000 by Ord. No. 00-04-10] Compliance. All buoys and aids to navigation must comply with § 30.74(2), Wis. Stats., and administrative regulations and shall have affixed thereto such numbers as assigned to them by the permit. Such numbers shall be located at least 12 inches above the waterline and shall be not less than three inches in height. Wharves and piers. [Amended 4-10-2000 by Ord. No. 00-04-10; 11-13-2001 by Ord. No. 01-11-13C] (1) No person shall erect or maintain any wharf or pier contrary to the statutes and regulations of the state or extending more than 100 feet from the shore, unless prior written approval is obtained from the Town, on all lakes and waters within the Town's jurisdiction. (2) No person may erect, place or maintain a wharf or pier on waters within the Town's jurisdiction which is so old, dilapidated or out of repair as to be dangerous, unsafe or otherwise unfit for normal use. (3)

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If a water patrol officer or public safety officer shall determine that a violation of this section exists within the Town, the officer shall serve notice on the owner or occupant of the premises where such violation exists, either by personal delivery thereof to such person or by posting a copy of said notice in a conspicuous location on the premises. Such notice shall direct the owner or occupant of the premises to abate or remove such violation within 10 days. The notice shall also state that, unless such violation is so abated, the Town will cause the same to be abated and will charge the cost thereof to the owner or occupant of the premises where such violation exists. Pier or mooring buoy. No pier or mooring buoy shall be placed in the waters located within the boundary of a designated fire lane (extended into the water) unless so authorized, in writing, by the Town Board as to all waters under the jurisdiction of the Town Board, including those waters of Silver Lake into which designated Town fire lanes are extended. [Amended 4-10-2000 by Ord. No. 00-04-10] Rafts and platforms. (1) No person shall place or maintain any raft or platform more than 100 feet from shore. (2) Each raft or platform must: (a) Be firmly anchored with at least 18 inches of freeboard above the waterline; (b) Be painted white; and (c) Have attached thereto, not more than 12 inches from each corner or projection, a red reflector of not less than three inches in diameter. [Amended 3-11-1996 by Ord. No. 96-03-11] Buoy permits. (1) No bathing beach marker, speed zone marker, information marker, mooring buoy, fishing buoy or other marker shall be anchored or placed on any of the waters under the jurisdiction of the Town unless a written application therefor is made to and approved by the Town Board. The Town shall issue numbers for buoys as required in Subsection B above. [Amended 4-10-2000 by Ord. No. 00-04-10] (2) Permit fee established. Any person making application for the placement of a mooring buoy or other approved marker in the waters of any lake within the Town of Salem in accordance with the above section shall pay to the Clerk a permit fee as provided in Chapter 272, Fees, § 272-6. Such permit shall remain in effect so long as the applicant owns or rents the property for which such permit is granted. The permits granted hereunder shall automatically expire when an applicant sells or no longer occupies the premises for which the permit has been granted. Placement of authorized markers. The Chief of the Water Safety Patrol is authorized and directed to place authorized markers, navigation aids and signs in such water areas as shall be appropriate to advise the public of the provisions of this chapter and to post and maintain a copy of this chapter at all public access points within the jurisdiction of the Town.

§ 330-8. Swimming regulations.

Swimming from boats prohibited. No person shall swim from any unmanned boat unless such boat is anchored.

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Distance from shore or boats. No person shall swim beyond the shore zone or more than 50 feet from any pier unless within marked or authorized areas or more than 25 feet from anchored rafts or boats unless accompanied by a boat manned by a competent person and having readily available a ring buoy. Such boat shall stay reasonably close to and guard such swimmer; not less than one boat for each two swimmers. Hours limited. No person shall swim more than 200 feet from the shoreline between the hours of 7:00 p.m. and 10:00 a.m.

§ 330-9. Waterskiing regulations.

[Amended 12-14-2009 by Ord. No. 09-12-14; 6-11-2012 by Ord. No. 12-06-11] A. Hours. No person shall operate a boat for the purposes of towing a water skier, aquaplane or similar device or engage in waterskiing during those hours within which operation in excess of slow no wake is prohibited by § 330-5A. B. Traffic lane. Any boat engaged in towing a person on water skis, aquaplane or similar device must conform to all sections of this chapter and, in addition, must operate in a counterclockwise pattern on the lake in the traffic lane. There shall be no waterskiing, aquaplaning or similar activity within the shore zone. C. Water ski towing. (1) There shall not be more than two persons on water skis being towed by one boat at any one time, and each shall have an individual tow line. (2) Persons being towed must wear personal flotation devices as defined in § 30.62(3), Wis. Stats. (3) Persons being towed behind a vessel on water skis or similar device or engaged in a similar activity may not come or allow the tow rope to come within 100 feet of a personal watercraft. D. Towing of water tubes. (1) There shall not be more than two towing lines per boat. (2) The human capacity of each water tube shall not exceed that recommended by the manufacturer. (3) No vessel towing a person or persons on a water tube may come within 100 feet of other occupied anchored vessels, a personal watercraft, a buoy-marked swimming area or a public boat landing.
E. Exceptions. The limitations of this section shall not apply to participants in ski meets or exhibitions authorized and conducted as provided in § 330-11 of this chapter.

§ 330-10. Houseboats; littering prohibited.

Any boat or craft which is designed for persons to use for living, sleeping or camping activities, commonly referred to as a "houseboat," shall be equipped with suitable sanitation facilities and comply with § 330-3 of this chapter, adopting § 30.71, Wis. Stats. No person shall leave, deposit, place or throw on the waterways, ice, shores of waterways or upon any other public or private property adjacent to waterways any cans, bottles, debris, refuse or other solid waste material of any kind or any liquid waste, gasoline, oil or similar pollutant.

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[Amended 11-13-2001 by Ord. No. 01-11-13D]

§ 330-11. Races, regattas, sporting events and exhibitions.

Permit required. No person shall direct or participate in any boat race, regatta, water-ski meet or other water sporting event or exhibition on Silver Lake unless such event has been authorized jointly by the Village Board of Silver Lake and the Town Board. On all other waters under the jurisdiction of the Town, such permit shall be authorized by the Town Board. Permit. A permit issued under this section shall specify the course or area of water to be used by participants in such event, and the permittee shall be required to place markers, flags or buoys approved by the Chief of the Water Safety Patrol designating the specified area. Permits shall be issued only when the proposed use of the water can be carried out safely and without danger to or substantial obstruction of other watercraft or persons using the lake. Right-of-way of participants. Boats and participants in any such permitted event shall have the right-of-way on the marked area, and no other persons shall obstruct such area during the race or event or interfere therewith. Permit fee required. Upon making application for a special event permit, the applicant shall pay a permit fee as provided in Chapter 272, Fees, § 272-6, to the Town Clerk.

§ 330-12. Driving of motor-driven vehicles on ice.

Speed. No person shall use or operate any automobile at a speed in excess of 10 mph on the ice of any lake or waterway within the Town of Salem. Hours. No person shall use or operate any automobile on the ice of any lake or other waterway within the Town of Salem after 9:00 p.m. Definition. The word "automobile," as used in this chapter, shall be construed to mean all motor vehicles of the type and kind permitted to be operated on the highways in the state. Risk and liability. All traffic on the icebound waters within the Town of Salem shall be at the risk of the traveler as set forth in § 30.81(3), Wis. Stats. Nothing in this chapter shall be construed as rendering the Town liable for any accident to those engaged in permitted traffic while this chapter is in effect.

§ 330-13. Joint jurisdiction over Silver Lake.

Recognizing the joint jurisdiction of the Village of Silver Lake and the Town over the waters of Silver Lake, it is the intent of this chapter that the Village of Silver Lake and the Town shall cooperate and coordinate ordinances, rules and regulations and shall have joint jurisdiction for enforcement purposes, except that violations occurring in the Town shall be brought before the Municipal Court of the Town, and those violations under the jurisdiction of the Village of Silver Lake shall be brought before the Municipal Court of the Village of Silver Lake.

§ 330-14. Water patrol officers; public safety officers.

[Added 4-13-1992 by Ord. No. 92-04-13B; amended 4-12-1993 by Ord. No. 93-04-12]

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Qualifications. The Town Board of the Town of Salem may appoint one or more water patrol officers who shall be adults of good moral character with no prior criminal record. A water patrol officer shall be a certified law enforcement officer. Authority. Water patrol officers of the Town of Salem shall have the authority to make arrests in the course of duty enforcing the provisions of this chapter, including those provisions of the Wisconsin Statutes incorporated by reference. Water patrol officers shall have the authority to carry firearms in the course of duty, subject to the restrictions and policies established by the Town Board from time to time. [Amended 2-13-1995 by Ord. No. 95-02-13B] Public safety officers. Town of Salem public safety officers may perform the additional duties of water patrol officers and shall have the power of arrest and may issue citations for violations of this chapter, including those provisions of the Wisconsin Statutes incorporated by reference. Town of Salem public safety officers shall have the authority to carry firearms in the course of duty, subject to the restrictions and policies established by the Town Board from time to time. [Amended 11-13-2001 by Ord. No. 01-11-13D]

§ 330-15. Boats in marked swim areas prohibited; exceptions.

[Added 11-13-2001 by Ord. No. 01-11-13B] No boat of any type is permitted within a water area which has been clearly marked by buoys or some other distinguishing device as a bathing or swimming area. This section does not apply in the case of emergency or to patrol or rescue craft.

§ 330-16. Fertilizer applications.

[Added 6-12-2006 by Ord. No. 06-06-12B] A. Definitions. As used in this section, the following terms shall have the meanings indicated: **FERTILIZER** Has the meaning specified under § 94.64(1)(e), Wis. Stats. **IMPERVIOUS SURFACE** A highway, street, sidewalk, parking lot, driveway, or other material that prevents infiltration of water into the soil. **LAWN AND TURF FERTILIZER** Has the meaning specified under § 94.64(1)(e), Wis. Stats., except the manufacturer has designated the product to be used for the promotion of lawn and turf growth. B. It shall be unlawful for any person to apply within the Town any lawn and turf fertilizer, liquid or granular, that contains more than a trace of phosphorus or other compound containing phosphorus, such as phosphate. C. It shall be unlawful for any person to apply or deposit any fertilizer on an impervious surface. If such application occurs, the fertilizer must be immediately contained and either legally applied to turf or any other lawful site or returned to the original or other appropriate container. D. Time of application. It shall be unlawful for a person to apply lawn and turf fertilizer when the ground is frozen or when conditions exist which promote or create runoff.

E.

A.

B.

C.

D.

E.

Exceptions. (1) Subsection B shall not apply when: (a) A tissue, soil or other test by UW-Extension Laboratory, or another state-certified soil-testing laboratory, and performed within the last three years indicates that the level of available phosphorus in the soil is insufficient to support healthy turf growth, as determined by the University of Wisconsin Extension Service, provided that the proposed lawn and turf fertilizer application shall not contain an amount of phosphorus exceeding the amount and rate of application recommended in the soil test evaluation. (b) The property owner or an agent of the property owner is first establishing or reestablishing turf via seed or sod procedures, and only during the first growing season. (2) Subsection B shall not apply to fertilizers used in any agricultural use as defined in § 91.01(2), Wis. Stats., to promote crop or product growth. (3) Any person who applies a lawn and turf fertilizer containing phosphorus pursuant to the aforementioned exception shall, consistent with the product label instructions, water such lawn and turf fertilizer into the soil where it is immobilized and generally protected from loss by runoff.

§ 330-17. Operation of aircraft on water prohibited; exceptions.

[Added 9-10-2007 by Ord. No. 07-09-10A] No person, firm or corporation shall operate or authorize the operation of any aircraft capable of landing on water on any river or lake within the jurisdiction of the Town of Salem, with the exception of Camp Lake. For purposes of this section, the term "operation" shall include but not be limited to landing or takeoff and any contact of any portion of such aircraft with the surface of any affected body of water. This section shall not apply to any operation on such bodies of water by duly authorized government or law enforcement officials or any operation necessitated by an emergency situation outside of the control of the operator of such aircraft.

§ 330-18. Violations and penalties.

Unless otherwise provided herein, any person violating any provisions of this chapter shall, upon conviction, be subject to the penalty provided in § 1-4 of this Code. [Amended 6-13-2011 by Ord. No. 11-06-13] Any person violating the provisions of § 330-3 of this chapter, incorporating § 30.681 or 30.684, Wis. Stats., shall, upon conviction, be subject to a forfeiture of not less than $150 nor more than $300. Any person violating any provision of the Wisconsin Statutes incorporated herein, which violation is punishable by the imposition of a fine or imprisonment, or both, shall be referred to state authorities for prosecution. Citations for violations of this chapter shall be issued on forms prepared by the Department of Natural Resources, and the Uniform Wisconsin Schedule, adopted pursuant to § 23.66, Wis. Stats., shall be effective for the posting of bonds for violations under this chapter.

The provisions relating to citations, arrests, questioning, releases, searches, deposits and stipulations of no contest in §§ 23.51(1m), (3) and (8); 23.53; 23.54; 23.56 to 23.64; 23.66; and 23.67, Wis. Stats., shall apply to violations of this chapter. [Added 1-12-2004 by Ord. No. 04-01-12C]

§ 330-19. Operation of motorboats on Rock Lake.

[Added 8-13-2012 by Ord. No. 12-08-13; amended 12-10-2012 by Ord. No. 12-12-10A] The propulsion of boats on Rock Lake shall be limited to the use of oars, paddles, sails or electric motors. This section shall not apply to: A. Any operation by duly authorized government or law enforcement officials in the course of the performance of their duties. B. Any operation necessitated by an emergency situation outside of the control of the operator of the motor boat. C. Any operation necessary for the mechanical or chemical management of weeds or other aquatic growth or shoreline restoration on Rock Lake by the holder of a permit issued by the Wisconsin Department of Natural Resources. D. Any operation necessary to complete a salvage operation on Rock Lake.

§ 330-20. Boat launch fees.

[Added 10-14-2013 by Ord. No. 13-10-14A] A. Any person, firm or corporation launching a boat at any public boat launch on Camp Lake or Center Lake shall pay a fee, as established below: (1) Daily fee: Town of Salem resident (single boat/single day launches): $3. (2) Dally fee: nonresident (single boat/single day launches): $4.50. (3) Daily launch fee for senior citizens over the age of 65 years: $0. (4) Annual launch fee: Town of Salem resident (unlimited launches in calendar year): $20. (5) Annual launch fee: nonresident (unlimited launches in calendar year): $30. B. The Town shall install and maintain a secured collection box at the public launches to accept the daily fees, shall post notice of the fee requirement in a prominent place at the public launches, and shall provide envelopes for payment with a receipt. In addition, the Town shall make annual fee launch stickers available for purchase at the Town Hall during the Town's normal business hours. C. All persons launching a boat at a public boat launch on Camp Lake or Center Lake shall display, at the request of any water patrol or public safety officer, a receipt for payment of the daily fee. D. Any person launching a boat at the public launch on Camp Lake or Center Lake in violation of the provisions of this section shall be subject to forfeiture as provided in § 330-18 of this Code.

Chapter 16

REGULATION OF HOOKER LAKE

16.01 INTENT.

The intent of this Chapter is to provide safe and healthful conditions for the enjoyment of aquatic recreation consistent with public needs on the waters of Hooker Lake.

16.02 APPLICABILITY AND ENFORCEMENT.

The provisions of this Chapter shall apply to Hooker Lake and shall be compatible with Chapter 29 of the Ordinances of the Town of Salem, passed the 13th day of July, 1978, as said Town Ordinances relates to the waters of Hooker Lake. This Chapter shall be enforced jointly by the Water Patrol officers of the Town of Salem and the Village of Paddock Lake.

16.03 STATE BOATING AND WATER SAFETY LAWS ADOPTED.

The statutory provisions describing and defining regulations with respect to water traffic, boats, boating and related water activities in the following enumerated sections of the Wisconsin Statutes, exclusive of any provisions therein relating to the penalties to be imposed or the punishment for violation of said Statutes, are hereby adopted by reference and made a part of this Chapter:

30.50	Definitions.
30.51	Operation of unnumbered boats prohibited; exemptions.
30.52	Certificates of number; applications; issuance; renewals; fees.
30.53	Identification number to be displayed on boats; certificate to be carried.
30.54	Transfer of ownership of numbered boat.
30.55	Notice of abandonment or destruction of boat or change of address.
30.60	Classification of motorboats.
30.61	Lighting equipment.
30.62	Other equipment.
30.635	Motorboat prohibition.
30.64	Patrol boats exempt from certain traffic regulations.

30.65 Traffic rules.

30.66 Speed restrictions.

30.67 Accidents and accident reports.

30.675 Distress signal flag.

30.68 Prohibited operation.

30.69 Water skiing.

30.70 Skin diving.

30.71 Boats equipped with toilets.

16.04 DEFINITIONS.

(a) "Shore Zone" shall mean the water area within 200 feet of the lake shore.

(b) "Swimming Zone" shall mean an authorized area marked by official buoys to designate a swimming area.

(c) "Moorage" shall mean an area where continuous mooring of boats for more than twenty-four (24) hours is permitted.

(d) "Public Access" shall mean a marina or landing facility and the adjoining public shoreline under the ownership of the state, county or municipality.

(e) "Slow No Wake Speed" shall mean the slowest possible speed needed to maintain steerage.

(f) "Traffic Lane" shall mean the area beyond two hundred feet (200') of the shoreline.

16.05 SPEED RESTRICTIONS.

In addition to speed restrictions set forth in Sec. 16.03 of this Chapter adopting Sec. 30.66, Wis. Stats., no person shall operate in excess of the "slow no wake speed":

(a) Within a defined shoreline zone, or

(b) Between sunset and 10:00 a.m. in either the shore zone or the traffic lane.

(c) In the event that the Village Board declares a state of emergency because of high water or other reason, such speed limit to remain in effect until such time as the emergency

situation no longer exists as determined by the Board of Trustees.

16.06 CAPACITY RESTRICTIONS.

No person shall operate, loan, rent or permit a boat to leave the place where it is customarily kept for operation on the waters covered by this Chapter with more passengers or cargo than shall be stated on the Capacity Information Plate as required by Sec. 30.501, Wis. Stats.

16.07 BUOYS, PIERS, AND RAFTS.

(a) The Village of Paddock Lake or the Town of Salem may remove all buoys, markers, piers and their supports, privately owned or placed, which are not removed by December 1st of each year, and charge the cost and expense of such removal to the riparian owner. If such charge is not paid within thirty (30) days after request therefore, a penalty of ten percent (10%) shall be added to such charge and the same shall constitute a lien on the property of the riparian owner and be inserted on the Village of Paddock Lake tax roll by the Village Clerk/Treasurer upon order of the Village Board and after notice to the riparian owner.

(b) All navigation aids must comply to Sec. 30.74(2), Wis. Stats., and shall also have affixed to them any numbers issued by their permit pursuant to subsection (f) below. Such number shall be located at least twelve inches (12") above the water line, and shall not be less than three inches (3") in height.

(c) No person shall erect nor maintain any wharf or pier contrary to the Statutes and regulations of the State of Wisconsin, nor which extends more than one hundred (100') from the shore unless prior written approval is obtained from the Village of Paddock Lake and the Town of Salem.

(d) No pier or mooring buoy shall be placed in the waters located within the boundary of a designated fire lane (extended into the water) unless so authorized in writing by the Village Board of the Village of Paddock Lake and by the Town Board of the Town of Salem.

(e) Rafts and Platforms. No person shall place or maintain any raft or platform more than one hundred feet (100') from the shore. Rafts and platforms shall be anchored, have at least eighteen inches (18") of free board above the water line, be painted white, and have attached thereto, not more than twelve inches (12") from each corner or projection a red reflector at least three inches (3") in diameter.

(f) Buoy Permits. No bathing beach marker, speed zone marker, information marker, mooring buoy, fishing buoy or other marker shall be anchored or placed on Hooker Lake, unless a written application is approved by both the Village Board of the Village of Paddock Lake and the Town Board of the Town of Salem. As to such markers and buoys located on Hooker Lake, an application must be made jointly to the Village of Paddock Lake and to the Town of Salem and approved by both bodies. The Town of Salem shall issue numbers for such markers and buoys.

(g) Placement of Authorized Markers. The Chief of Water Safety Patrol is authorized and directed to place authorized markers, navigation aids and signs in such water areas as shall be appropriate to advise the public of the provisions of this Chapter and to post and maintain a copy of this Chapter at all public access points within the jurisdiction of the Village of Paddock Lake.

16.08 SWIMMING REGULATIONS.

(a) Swimming from Boats Prohibited. No person shall swim from any unmanned boat unless such boat is anchored.

(b) Distance from Shore or Boats. No person shall swim beyond the shore zone or more than fifty feet (50') from any pier (unless within marked authorized areas) or more than twenty-five feet (25') from anchored rafts or boats unless he is accompanied by a boat manned by a competent person and having readily available a ring buoy. Such boat shall stay reasonably close to and guard such swimmer, and there must be at least one (1) boat for each two (2) swimmers.

(c) Hours Limited. No person shall swim more than two hundred feet (200') from the shoreline between the hours of 7:00 p.m. and 10:00 a.m.

16.09 WATER SKIING.

(a) Hours. No person shall operate a boat for the purpose of towing a water skier, aquaplane or similar device between the hours of 7:00 p.m. and 10:00 a.m. tats.

(b) Traffic Lane. Any boat engaged in towing a person on water skis, aquaplane or similar device must conform to all sections of this Chapter and in addition, must operate in a counter-clockwise pattern on the lake in the traffic lane. There shall be no water skiing, aquaplaning or similar activity within the shore zone.

(c) Towing. There shall be not more than two (2) persons being towed by one (1) boat and each shall have an individual tow line. Persons being towed must wear personal

flotation devices as defined in Sec. 30.62(3), Wis. Stats.

(d) Exceptions. The limitations of this section shall not apply to participants in ski meets or exhibitions authorized and conducted as provided in Section 16.11 of this Code.

16.10 LITTERING WATERWAYS PROHIBITED.

(a) Any boat or craft which is designed for living, sleeping or camping activities (commonly referred to as a "House Boat") shall be equipped with suitable sanitation facilities and comply with Sec. 30.71, Wis. Stats.

(b) No person shall leave, deposit, place or throw on the waterways, ice, shores or waterways or upon any other public or private property adjacent to waterways, any cans, bottles, debris, refuse or other solid waste materials of any kind.

16.11 RACES, REGATTAS, SPORTING EVENTS AND EXHIBITIONS.

(a) Permit Required. No person shall direct or participate in any boat race, regatta, waterski meet or other water sporting event or exhibitions on Hooker Lake unless such event has been authorized by the Village Board of the Village of Paddock Lake and the Town Board of the Town of Salem.

(b) Permit. A permit issued under this section shall specify the course or area of water to be used by participants and require the permittee to place markers, flags or buoys approved by the Chief of the Water Safety Patrol designating the specified area. Permits shall be issued only when the proposed use of the water can be carried out safely and without danger to or substantial obstruction of other watercraft or persons using the lake.

(c) Right-of-way of Participants. Boats and participants in any such permitted event shall have the right-of-way on the marked area and no other persons shall obstruct such area during the race or event or interfere therewith.

16.12 DRIVING AUTOMOBILES OR OTHER VEHICLES ON THE ICE.

(a) Speed. No person shall use or operate any automobile at a speed in excess of ten (10) miles per hour on the ice.

(b) Hours. No person shall use or operate any automobile on the ice after 9:00 p.m.

(c) Definitions.

(1) "Automobile" as used in this Chapter shall be construed to mean all motor vehicles of the type and kind permitted to be operated on the highways in the State of Wisconsin.

(2) "Other Vehicles" includes, but is not limited to, snowmobiles, go-carts, bicycles and motorcycles not permitted on state highways.

(d) Risk and Liability. All traffic on the icebound waters shall be at the risk of the travelers as set forth in Section 30.18(3) of the Wisconsin Statutes. Nothing in this Chapter shall be construed as rendering the Village of Paddock Lake or the Town of Salem liable for any accident to those engaged in permitted traffic.

16.13 PENALTIES.

Any person violating any provision of this Chapter shall, upon conviction, be subject to a forfeiture of not more than Fifty Dollars ($50.00) for the first offense, and not more than One Hundred Dollars ($100.00), for each subsequent offense with one (1) year. Any person violating Section 30.67(1) or (2), Wis. Stats., or 30.68(1) or (2), Wis. Stats., shall be referred to State authorities for prosecution.

Citations for violations of this Chapter shall be drafted on forms prepared by the Department of Natural Resources. Bonds may be posted for violations pursuant to Section 23.66, Wis. Stats.

16.14 JURISDICTION.

Recognizing the joint jurisdiction of the Village of Paddock Lake and the Town of Salem over the waters of Hooker Lake, it is the intent of this Chapter that the Village of Paddock Lake and the Town of Salem shall cooperate and coordinate ordinances, rules and regulations and shall have joint jurisdiction for enforcement purposes. However, violations occurring in the jurisdiction of the Town of Salem shall be brought before the Municipal Court of the Town of Salem and those violations under the jurisdiction of the Village of Paddock Lake shall be brought in the Municipal Court of the Village of Paddock Lake.

16.15 USE OF HOOKER LAKE BOAT LAUNCH.

(a) Policy. It is the declared policy of the Village to encourage the use of the facilities constructed by the Village for access to Hooker Lake in a fashion so as to allow equal access to all who wish to use this facility.

(b) Prohibitions. No operator of any vehicle shall park or stop or leave standing such vehicle on any street or highway or public way or in any parking space at or adjacent to the Hooker Lake boat launch, except in conformance with the permitting provisions of this ordinance. For purposes of this ordinance, vehicles shall include all motor vehicles as well as trailers, boats, motor homes or any other device which is defined as a vehicle under the Wisconsin Statutes, which are incorporated herein by reference.

(1) Presumption. Ownership of a vehicle is sufficiently related to causing, allowing, permitting or suffering a vehicle parked so as to require the owner to be responsible for the parking of said vehicle. It shall be presumed, upon a showing by the Village, that a parking violation occurred and upon a showing that the party charged pursuant to this ordinance, was the registered owner of the unlawfully parked vehicle on the date of the violation that said registered owner is responsible for and guilty of the violation charged.

(2) Overcoming Presumption. The presumption stated in the preceding subparagraph, when established as therein specified, shall constitute a prima facie case and a basis for judgment, except where the person or other legal entity to which the vehicle is registered overcomes said presumption by the submission of proof of any of the following:

(a) The vehicle is stolen at the time the violation occurred, and reported as such to law enforcement authorities within a reasonable time thereafter.

(b) The vehicle was lawfully parked.

(c) The ownership of the vehicle was lawfully transferred to another prior to the violation.

(c) Parking Passes. Parking passes are printed passes issued by the Village for a designated period of time, to an individual for the purpose of allowing such individual to legally park in a properly marked parking stall at the Hooker Lake boat launch for the period of time specified on the pass. Parking passes shall be of two (2) types as follows: Daily and seasonal.

(d) Fees. Fees for parking passes shall be as follows:

(1) Seasonal (May 1 through October 31)

(a) Wisconsin resident - $35.00

(b) Non-resident - $40.00

(2) Daily - $7.00

(3) Seasonal (May 1 through October 31) good for both Paddock Lake and Hooker Lake

(a) Wisconsin resident - $45.00

(b) Non-resident - $55.00

(e) Properly Displayed Passes. A properly displayed parking pass means that the parking pass must be displayed in the inside lower left hand corner of the front windshield. Operators of vehicles lawfully possessing and displaying valid parking passes, shall be permitted the privilege of parking in a lawful and orderly manner in a properly marked parking stall at the Hooker Lake boat launch without incurring the issuance of legal process and the imposition of forfeiture or penalty for failure to pay said fee.

(f) Form. Parking passes shall be obtained from the office of the Village Clerk/Treasurer and shall contain the date(s) for which the pass is valid and the name and address of the parking pass holder.

(g) Fine. Violation of this section shall result in the imposition of a fine of Twenty-five ($25.00) Dollars for a first offense and Fifty ($50.00) Dollars for a second and any subsequent offense.

Source: Village of Paddock Lake.

Appendix J

WDNR SENSITIVE AREA REPORT FOR HOOKER LAKE

Hooker Lake (Kenosha County, Wisconsin)
Integrated Sensitive Area Report

Date of Original Assessment: September 4, 2001
Date of Reassessment: June 12th, 2007

Number of Sensitive Areas Surveyed: 2

Site Evaluators: Doug Welch, Fisheries Biologist
Heidi Bunk, Lakes Biologist
Marty Johnson, Wildlife Biologist
Heidi Hopkins, Water Management Specialist
Craig Helker, Water Quality Biologist

Authors: Gabriel Powers, Water Resource Specialist
Heidi Bunk, Lakes Biologist

General Lake Information

Hooker Lake is an 87-acre lake with a maximum depth of 24 feet. The lake is located in south central Kenosha County, Township 1 North, Range 20 East, Section 11. Hooker Lake is characterized as a drainage lake. The lake receives its water from two tributaries, groundwater seepage, precipitation, and runoff. An outlet connects the lake to Salem Brook which ultimately discharges to the Des Plaines River.

Two public boating access sites are located on Hooker Lake. One access meets the requirements of "adequate public access" as defined by NR 1.91(11), Wis. Adm. Code. Hooker Lake is host to a variety of recreational uses including, but not limited to fishing, hunting, canoeing, kayaking, boating and swimming. The Department of Natural Resources and Kenosha County both own land along the shoreline of Hooker Lake.

The mix of wetlands and submergent vegetation present on Hooker Lake provides critical habitat for a variety of fish and wildlife species. According to the DNR Fish Master File, 25 fish species have been documented in Hooker Lake. These species include: northern pike, largemouth bass, smallmouth bass, walleye, yellow perch, bluegill, pumpkinseed, black crappie, green sunfish, warmouth, grass pickerel, common carp, yellow bullhead, black bullhead, brown bullhead, channel catfish, Iowa darter, golden shiner, white sucker, common shiner, spotted sucker, emerald shiner, bluntnose minnow, central mudminnow and a State Special Concern species, lake chubsucker.

The aquatic plant management on Hooker Lake consists only of selective treatment of eurasian water milfoil with 2,4-D products. No mechanical harvesting takes place. Manual harvesting is conducted by many riparian landowners. The Hooker Lake Management District oversees aquatic plant management activities for Hooker Lake. In 2007, 9 acres in Hooker Lake were chemically treated for eurasian water milfoil.

Exotic Species

Exotic species, most notably curly leaf pondweed, eurasian water milfoil, and purple loosestrife have invaded southeastern Wisconsin lakes. Boaters traveling from lake to lake often facilitate the propagation of exotic species. The introduction of exotic species into a lake ecosystem can lead to a decline in the native plant population and cause problems with nutrient loading. Also, the disturbance of lake bottoms from human activity (boating, plant harvesting, chemical treatments, etc.) enhances the colonization and/or expansion of exotic species. Two simple steps to prevent the spread of exotic species include 1) Removing aquatic plants, animals, and mud from trailers and boats before leaving the water access; and 2) Draining water from boats, motors, bilges, live wells, and bait containers before leaving the water access.

Eurasian water milfoil is present in Hooker Lake. Eurasian water milfoil is one of eight milfoil species currently found in Wisconsin. It is often misidentified as one of its seven native cousins, and vice versa. In many areas within the Lakes, this non-native milfoil has established large monotypic stands that out compete many native plants. These dense beds of milfoil not only impede the growth of native plant species but also inhibit fish movement and create navigational problems for boaters.

The regenerative ability of eurasian water milfoil is another obstacle when attempting to control this species. Fragments of eurasian water milfoil detached by harvesting, boating, and other recreational activities can float to non-colonized areas of the lake or downstream to additional lakes in the drainage system and create new colonies. Therefore, when controlling eurasian water milfoil, selective chemicals and harvesting, coupled with skimming, often produces the best results. In some lakes, biological agents such as the milfoil weevil have helped suppress milfoil populations. However, the most effective "treatment" of exotic milfoil is prevention through public education.

Curly leaf pondweed is another submerged, exotic species found Hooker Lake. Like eurasian water milfoil, curly-leaf often grows into large, homogenous stands. It can crowd out native vegetation, create navigational problems, and limit fish movement. Curly-leaf pondweed dies off in mid-summer, increasing nutrient availability in the water column. This often contributes to summer algal blooms and decreasing water quality.

The unusual life cycle of curly leaf pondweed makes management difficult. The plant germinates as temperatures decrease in fall. Curly leaf is highly tolerant of cold temperatures and reduced sunlight, continuing to grow under lake ice and snow cover. With ice off and increasing water temperatures in the spring, the plant produces fruit, flowers, and buds (turions). Turions are the main reproductive mechanism of curly leaf. To control the species in lakes, the plant must be combated before turions become viable. Most plant harvesters have not started cutting when curly leaf is most susceptible and a small window of opportunity exists for chemical treatment. Therefore, prevention through public education is once again very important.

Purple loosestrife, a hardy perennial native to Europe, is another exotic species common to Wisconsin. Since its introduction to North America in the early 1800s, purple loosestrife has become common in gardens and wetlands, and around lakes, rivers, and roadways. The species is highly invasive and thrives in disturbed areas. Purple loosestrife plants often outcompete native plants, resulting in the destruction of food, cover, and nesting sites for wildlife and fish. Several stands of purple loosestrife have been documented on Hooker Lake.

Purple loosestrife most often spreads when seeds adhere to animals. Humans should be aware of picking up seeds on clothing and equipment when in the vicinity of the plant. Loosestrife can be controlled manually, biologically, or with a broad-leaf herbicide. Young plants can be pulled, but adult plants have large root structures and must be excavated with a garden fork. Biological control is most effective on large stands of purple loosestrife. Five different insects are known to feed on this plant. Four of those have been used as control agents in the United States. Of the five species, *Galerucella pusilla* and *G. calmariensis* are leaf-eating beetles; *Nanophyes brevis* and *N. marmoratus* are flower-eating beetles; and *Hylobius trasversovittatus* is a root-boring weevil. Only *N. brevis* has not been released in the United States (WDNR 2003). Lastly and most importantly, prevention through public education plays an important role in the management of this species.

Zebra mussels are native to the Baltic and Caspian Sea region or Eastern Europe, and were introduced to the great lakes via ballast water discharged from ocean-going vessels. These mussels attach to nearly every available surface – boats, docks, intake pipes, and are a great threat to native mussel populations. They are filter feeders, and thus eat plankton in the water column that many young fish and native mussels rely on for food. Zebra mussels begin their life cycle at a microscopic level. This stage of life stage is called a veliger. Water that is transferred from water body to water body can lead to new infestations by these veligers. Adults may also hitch a ride on aquatic plants that are transported from one body of water to another by means of boat trailers, river flow, or animal dispersion. Zebra mussels have not been documented in Hooker Lake.

Shoreland Management

Wisconsin's Shoreland Management Program, a partnership between state and local governments, works to protect clean water, habitat for fish and wildlife, and natural scenic beauty. The program establishes minimum standards for lot sizes, structural setbacks, shoreland buffers, vegetation removal, and other activities within the shoreland zone. The shoreland zone includes land within 1000 feet of lakes, 300 feet of rivers, and floodplains. Current research shows that present standards are probably inadequate for the protection of water resources. (Woodford and Meyer 2003, Garn 2002) Therefore, many communities have chosen to go beyond minimum standards to ensure protection of our natural resources. This report provides management guidelines for activities within the lake and in the immediate shoreland areas. Before any recommendations in this

report are completed, please check with the Department of Natural Resources and local units of government for required approvals.

A vital step in protecting our water resources is to maintain effective vegetative buffers. A shoreland buffer should extend from the water onto the land at least 35 to 50 feet. Studies have shown that buffers less than 35 feet are not effective in reducing nutrient loading. (Wenger, 1999) Wider buffers of 50 feet or more can help provide important wildlife habitat for songbirds, turtles, frogs, and other animals, as well as filter pollutants from runoff. (Castelle 1994) In general, no mowing should occur in the buffer area, except perhaps in a viewing access corridor. The plant composition of a buffer should match the flora found in natural Wisconsin lakeshores. A buffer should include three layers - herbaceous, shrub, and tree.

In addition, citizens living around Hooker Lake and the community at large should investigate other innovative ways to reduce the impacts of runoff flowing into the lake while improving critical shoreline habitat. (A. Greene 2003) This may include the use of phosphorus-free fertilizers, installing rain gardens, setting the lawnmower at a higher mower height, decreasing the area of impervious surfaces, or restoring aquatic plant communities.

Introduction

Department personnel conducted sensitive area designation surveys on Hooker Lake both on September 4th, 2001 and June 12th, 2007 following the Wisconsin Department of Natural Resources' sensitive area survey protocol. This study utilized an integrated team of DNR resource managers with input from multiple disciplines: water regulation and zoning, fisheries, lake biology, wildlife, and aquatic plant management. Two sites were identified on Hooker Lake as containing critical habitat and were therefore designated as sensitive areas. Map 1 provides the boundaries of each sensitive area.

Department biologists observed fifteen native aquatic plant species in sensitive area #1 and ten native aquatic plant species in sensitive area #2. Three exotic aquatic plant species were observed in these sensitive areas as well. These included eurasian water milfoil (*Myriophyllum spicatum*), curly leaf pondweed (*Potamogeton crispus*) and purple loosestrife (*Lythrum salicaria*).

Overview of Sensitive Area Designations

Sensitive areas have aquatic or wetland vegetation, terrestrial vegetation, gravel or rubble lake substrate, or areas that contain large woody cover (fallen trees or logs). These areas provide water quality benefits to the lake, reduce shoreline erosion, and provide habitat necessary for seasonal and/or life stage requirements of fish, invertebrates, and wildlife. A sensitive area designation alerts interested parties (i.e., DNR personnel, county zoning personnel, lake associations, etc.) that the area contains critical habitat vital to sustaining a healthy lake ecosystem, or may feature an endangered

plant or animal. Information presented in a sensitive area report is often utilized in the process of making Chapter 30 (Wisconsin State Statutes) permit decisions.

Sensitive areas are defined in Wisconsin Administrative Code NR 107.05 (3)(i)(1) as *areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or life stage requirements, or offering water quality or erosion control benefits to the body of water.* **Department resource managers determined that two areas of Hooker Lake met the criteria.**

Whole Lake Recommendations

These recommendations apply to Hooker Lake as a whole rather than a specific sensitive area.

1. Native aquatic plant beds should be protected and maintained for species diversity and to discourage invasion of exotic species.
2. Prevent the spread of exotic species through signage, education, etc. and control exotic species where established.
3. Compliance with Shoreland Zoning standards including setbacks, removal of nonconforming structures and limiting impervious surfaces.
4. Create shoreline buffers and maintain existing buffers, especially in areas not currently developed.
5. Monitor water quality for early detection of change and possible degradation.
6. Use phosphorus free lawn care to control nutrient runoff.
7. Establish a citizen lake monitor on Hooker Lake.

Resource Value of Sensitive Area #1

Sensitive Area #1 is located on the north side of Hooker Lake. The site is approximately 4000 feet long and has an average depth of 2 feet. Approximately two thirds of the frontage is owned by the Department of Natural Resources. This site was chosen because of the high value of the wetland plants for wildlife. Sensitive area #1 provides crucial habitat for many wildlife species. The aquatic bed/marsh wetland complex in this area provides quality habitat for marsh hawks, songbirds, ducks, geese, wading birds and some types of reptiles and amphibians. The wetland complex is important due to its relatively large size and adjacency to a large undeveloped upland corridor to the west.

The site was also chosen for the floating leaf and submergent aquatic vegetation, which provides spawning, nursery, feeding and protective habitat for northern pike, largemouth bass, panfish and minnow species. The aquatic plant diversity in this area is good with 16 native aquatic plant species documented as well 3 exotic aquatic plant species. Table 1 below lists the plant species observed and shows their relative abundance within sensitive area #1.

The plants create a nutrient buffer zone, utilizing lake nutrients (especially phosphorus) as part of their growth process, reducing the amount available for algal blooms. The root systems of the plants help stabilize the lake sediments. A biological and physical buffer zone is created by the dense plant beds. The dense beds reduce the ability for exotic plant species to invade Hooker Lake and protect properties from shoreline erosion. The shoreland buffer zone is wetland and dominated with herbaceous and shrub vegetation. The west half of the sensitive area's substrate is primarily silt, muck and detritus while the east portion is mostly sand. The natural scenic beauty in this area is average with minimal human impact.

Table 1. Plant Species Observed in Hooker Lake Sensitive Area #1

PRESENT (0-25%)	COMMON (26-50%)	ABUNDANT (51-75%)	DOMINANT (76-100%)
Shrubs *Salix* (willow)	**Emergents** *Impatiens* (jewelweed)	**Algae** Filamentous Algae	**Emergents** *Typha* (cattail)
Floating Leaf *Nuphar* (yellow water lily) *Nymphaea* (white water lilly)	**Pondweeds** *P. richardsonii* (clasping-leaf)	**Pondweeds** *Stuckenia pectinatus* (sago)	**Algae** *Chara* (muskgrass)
Submergents *Ceratophylum* (coontail) *Zosterella* (water stargrass) Native milfoil	**Exotics** *P. cripsus* (curly leaf) *Myriophyllum spicatum* (eurasian water milfoil)	**Submergents** *Vallisneria* (wild celery)	
Pondweeds *P.Illinoensis* (Illinois) *P. amplifolius* (Large-leaf pondweed) *P. Foliosus* (leafy pondweed)			
Exotics *Lythrum salicaria* (purple loosestrife)			

The vegetation and substrates in this area provide excellent spawning, nursery, feeding and protective habitat for northern pike and yellow perch. Largemouth bass and other sunfish will utilize this area for feeding, nursery and protective cover. In areas where the sunfish species can locate sand or sand/gravel bars under the fine substrates associated with this area, they too will use this area for establishing spawning nests. Table 2 below portrays the habitat each species relies on for the different stages of their respective life cycles.

Table 2. Sensitive Area #1 Plant Species and Substrates (Habitat) Utilized by Hooker Lake Resident Fish Species (2002 Survey)				
Fish Species	**Spawning**	**Nursery**	**Feeding**	**Protective Cover**
Walleye	Habitat lacking	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	Coontail, wild celery, milfoil, pondweeds	Coontail, milfoil, pondweeds
Northern Pike	Cattail, chara	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	water lily, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds
Smallmouth Bass	Habitat lacking	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	milfoil, pondweeds	Milfoil, pondweeds
Largemouth Bass	Coontail, watermilfoil Sand/gravel	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds, woody debris	Water lily, coontail, wild celery, milfoil, pondweeds, woody debris
Bluegill and Pumpkinseed	Sand/gravel	Cattail, water lily, chara, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds
Black Crappie	*Chara* (muskgrass) Fine gravel and sand	Water lily, chara, coontail, wild celery, milfoil, pondweeds	pondweeds, milfoil, woody debris	pondweeds, milfoil, woody debris
Yellow Perch	woody debris, cattail, coontail, milfoil, pondweeds	Water lily, chara, coontail, wild celery, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil
Golden Shiner	Submergent vegetation (coontail, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)

Bluntnose Minnow	Underside of submerged objects (logs, rocks, bark or mussel shells) Sand/gravel shoals	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)

Management Recommendations for Sensitive Area #1

1. Do not remove fallen trees along shoreline, except where navigation is impaired. If navigation is impaired by a fallen tree, cut into smaller pieces and place outside of boating lane.

2. No chemical treatment should be allowed except to target an infestation of an exotic species such as purple loosestrife, eurasian water milfoil or curly leaf pondweed. Biological controls such as the purple loosestrife beetle and the milfoil weevil should be considered where appropriate.

3. No chemical treatment of eurasian water milfoil should occur adjacent to stands of susceptible aquatic plant species such as bladderwort or northern water milfoil.

4. Maintain the "Slow, No Wake" ordinance in this area of Hooker Lake. This ordinance minimizes boat motor disturbance of aquatic plants, fish and wildlife.

5. Minimize disturbance of the diverse stands of native aquatic vegetation.

6. Provide seasonal protection of fish spawning habitat.

7. Minimize disturbance of herbs, shrubs and trees on the shoreline to maintain wildlife habitat.

8. Mechanical harvesting should not be permitted.

9. New piers may be considered for a permit. However, additional piers are restricted to the existing, privately owned, developed shoreline. The number of moorings allowed will be less than listed in State Statutes 30.12 (1g) (f). The number of moorings permitted will be limited and based on the carrying capacity of the resource.

10. Limit manual harvesting to minimal swim/wading areas along the privately owned frontage. No manual harvesting should take place along the frontage of the state owned property. (*Manual removal of aquatic plants in Sensitive Areas must be permitted by DNR according to Wis. Adm. Code NR 109*).

11. Shoreline stabilization should not be needed in most areas of Sensitive Area # 1. If shoreline stabilization is needed, it must be accomplished by bioengineering.

12. A DNR permit should not be issued for any of the following:

Dredging	Pea gravel/sand blankets
Filling of wetlands	Recreational floating devices
Aquatic plant screens	Boat Ramps
Sea Walls/Retaining Walls/Riprap	Boardwalks

Resource Value of Site #2

Sensitive Area #2 is located in the southwestern corner of Hooker Lake. The approximate length of this site is 1000 ft with an average water depth of 4.5 ft. Kenosha County owns a small parcel on the north/northwest part of the bay. The location of the sensitive area habitat is the shoreline and littoral zone. The lake bed substrate consists of sand and muck. The shoreland area is approximately 33% wetland and 66% developed land with an abundance of lawns, some trees and herbaceous plants as well as a few shrubs. The natural scenic beauty rating in this area is poor, with major human disturbance. Important habitat components present at this site are emergent and submergent aquatic vegetation, floating leaf vegetation, and over-hanging vegetation.

This site was chosen due to the value of the aquatic plants for fish, amphibians and reptiles, as well as migratory waterfowl. The emergent vegetation is utilized by birds, frogs and turtles. Floating vegetation provides overhanging cover and shading for fish species and resting areas for frogs. Insect larvae hide underneath the blades of the plants, providing food for fish, frogs, turtles and birds. Table 3 below exhibits the plant species observed in sensitive area # 2 on Hooker Lake.

Table 3. Plant Species Observed in Sensitive Area # 2

PRESENT (0-25%)	COMMON (26-50%)	ABUNDANT (51-75%)	DOMINANT (76-100%)
Emergents *Impatiens* (jewelweed)	**Emergents** *Typha* (cattail)	**Floating Leaf** *Nuphar variegata* (spatterdock) *Nymphaea odorata* (white water lily)	**Submergents** *Ceratophylum* (coontail) *Ranunculus longirostris* (white water crowfoot)
Submergents *Myriophylum sibiricum* (northern water milfoil)	**Pondweeds** *P. richarsonii* (clasping-leaf pondweed)	**Pondweeds** *P. illinoensis* (Illinois pondweed) P. zosteriformis (Flat stem pondweed)	**Exotics** *Myriophylum spicatum* (Eurasian Water milfoil)
		Exotics *P. cripsus* (curly leaf)	

The combination of emergent vegetation and the silt/muck substrate provide an ideal spawning habitat for northern pike. Largemouth bass and other sunfish species will seek out sand and gravel areas for placement of spawning nests. Yellow perch will drape fertilized egg masses over woody debris and existing vegetation where available. All fish species can utilize the vegetative cover in sensitive area #2 for feeding, cover and resting areas. Table 4 below illustrates how some of resident fish species on Hooker Lake utilize the habitat in sensitive area #2.

Table 4. Sensitive Area # 2 Plant Species and Substrates (Habitat) Utilized by Hooker Lake Resident Fish Species

Fish Species	Spawning	Nursery	Feeding	Protective Cover
Walleye	Habitat lacking	Cattail, water lily, coontail, milfoil, pondweeds	Coontail, milfoil, pondweeds	Coontail, milfoil, pondweeds
Northern Pike	Cattail	Cattail, water lily, coontail, milfoil, pondweeds	Water lily, coontail, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds
Smallmouth Bass	Habitat lacking	Cattail, water lily, coontail, milfoil, pondweeds	Milfoil, pondweeds	Milfoil, pondweeds
Largemouth Bass	Coontail, watermilfoil Sand/gravel	Cattail, water lily, coontail, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds, woody debris	Water lily, coontail, wild celery, milfoil, pondweeds, woody debris
Bluegill and Pumpkinseed	Sand/gravel	Cattail, water lily, coontail, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds	Water lily, coontail, wild celery, milfoil, pondweeds
Black Crappie	*Chara* (muskgrass) Fine gravel and sand	Water lily, coontail, milfoil, pondweeds	pondweeds, milfoil, woody debris	pondweeds, milfoil, woody debris
Yellow Perch	woody debris, cattail, coontail, milfoil, sago, clasping leaf	Water lily, coontail, milfoil, pondweeds	pondweeds, milfoil	pondweeds, milfoil

Golden Shiner	Submergent vegetation (coontail, milfoil, pondweeds)	Submergent vegetation (coontail, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)
Bluntnose Minnow	Underside of submerged objects (logs, rocks, bark or mussel shells) Sand/gravel shoals	Submergent vegetation (coontail, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)	Submergent vegetation (coontail, *Chara*, milfoil, pondweeds)

Management Recommendations for Sensitive Area #2

1. Do not remove fallen trees in the bay, except where navigation is impaired. If navigation is impaired by a fallen tree, cut into smaller pieces and place outside of boating lane.

2. No chemical treatment should be allowed except to target an infestation of an exotic species such as purple loosestrife, eurasian water milfoil or curly leaf pondweed. Biological controls such as the purple loosestrife beetle and the milfoil weevil should be considered where appropriate.

3. No chemical treatment of eurasian water milfoil should occur adjacent to stands of susceptible aquatic plant species such as bladderwort or northern water milfoil.

4. Maintain the "Slow, No Wake" ordinance in this area of Hooker Lake. This ordinance minimizes boat motor disturbance of aquatic plants, fish and wildlife.

5. Minimize disturbance of the diverse stands of native aquatic vegetation, especially the lily pads and bulrushes on the northern side of the bay.

6. Mechanical harvesting should not be permitted.

7. New piers may be considered for a permit. The number of moorings allowed will be equal to that listed in State Statutes 30.12 (1g) (f). The shoreline is already extensively developed. As a result, the number of additional moorings permitted will be limited and based on the carrying capacity of the resource.

8. Limit manual harvesting to minimal swim/wading areas along the privately owned frontage. (*Manual removal of aquatic plants in Sensitive Areas must be permitted by DNR according to Wis. Adm. Code NR 109*).

9. Any replacement of the existing shoreline stabilization practices must include an element of bioengineering such as vegetated rip rap and biologs.

10. Installation of buffer strips along the highly developed shoreline is strongly recommended.

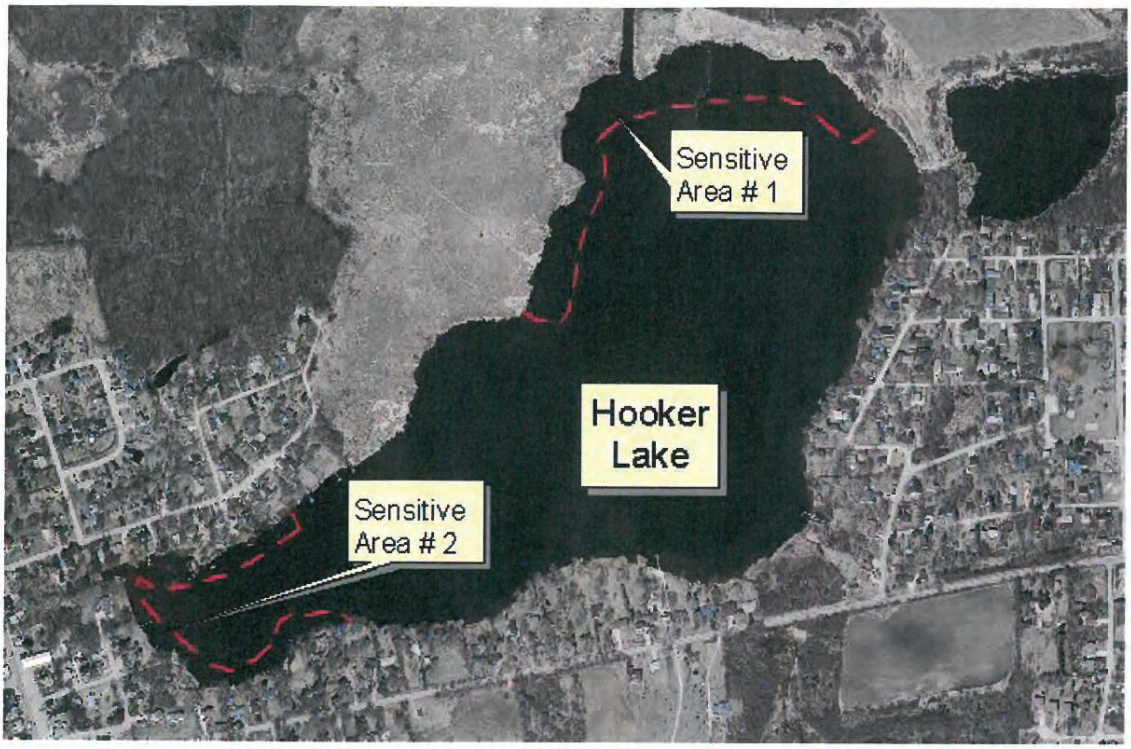
11. A DNR permit should not be issued for any of the following:

Dredging	Pea gravel/sand blankets
Filling of wetlands	Aquatic plant screens

Conclusion

Two sensitive areas were designated on Hooker Lake. Three quarters of the shoreline is highly developed. The lake is heavily used for fishing and pleasure boating. The wetland complex located on the north and northwest shorelines of the lake provides a reasonably large refuge for wildlife. The protection of the submergent and floating leaf aquatic plants found in the two sensitive areas is critical to maintaining the fishery in Hooker Lake.

Eurasian water milfoil has increased in coverage and density in recent years. Boating disturbance through the milfoil beds is likely the cause of much of the spread of eurasian water milfoil. The Hooker Lake Management District is currently applying for a lake planning grant. The grant, if awarded, would be used to conduct a plant survey and develop an aquatic plant management plan.



Source: Wisconsin Department of Natural Resources.

Appendix K

MEASURING STREAM FLOW

Water Action Volunteers

Volunteer Monitoring Factsheet Series

2006

Stream Flow:

Flow Speaks Volumes

Why are we concerned?

Stream flow, or *discharge*, is the volume of water moving past a cross-section of a stream over a set period of time. It is usually measured in cubic feet per second (cfs). Stream flow is affected by the amount of water within a *watershed*, increasing with rainstorms or snowmelt, and decreasing during dry periods. Flow is also important because it defines the shape, size and course of the stream. It is integral not only to water quality, but also to habitat. Food sources, spawning areas and migration paths of fish and other wildlife are all affected and defined by stream flow and velocity. Velocity and flow together determine the kinds of organisms that can live in the stream (some need fast-flowing areas; others need quiet, low-velocity pools). Different kinds of vegetation require different flows and velocities, too.

Stream flow is affected by both forces of nature and by humans. *(continued on page 2)*

Time Needed:

30 minutes

Equipment Needed:

— Tape Measure

— Yardstick or marked D-frame net pole

— Surveying flags/flagging

— Float (an orange works best)

— Net (Can use D-frame net to catch the float)

— Stopwatch or digital watch

— Calculator

— Form to record data

— Pencil

— Hip boots or waders

— String (optional)

— Stakes (optional)

Definition of Terms

Discharge: Another term for stream flow, or the volume of water moving past a designated point over a set period of time.

Flow Regime: The pattern of stream flow over time, including increases with stormwater runoff inputs and decreases to a base-flow level during dry periods.

Impervious Surface: A surface that does not allow water (e.g., rain) to pass through (infiltrate).

Rating Curve: A graphical representation of the relationship between the stage height and the discharge (flow).

Run: An area of a stream that has swift water flow and is slightly deeper than a riffle (a run will be about knee/thigh deep).

Stage Height: Height of the water in a stream above a baseline.

Watershed: An area of land that drains to a main water body.

In undeveloped watersheds, soil type, vegetation, and slope all play a role in how fast and how much water reaches a stream. In watersheds with high human impacts, water flow might be depleted by withdrawals for irrigation, domestic or industrial purposes. Dams used for electric power generation may affect flow, particularly during periods of peak need when stream flow is held back and later released in a surge. Drastically altering landscapes in a watershed, such as with development, can also change *flow regimes*, causing faster runoff with storm events and higher peak flows due to increased areas of *impervious surface.* These altered flows can negatively affect an entire ecosystem by upsetting habitats and organisms dependent on natural flow rates.

Tracking stream flow measurements over a period of time can give us baseline information about the stream's natural flow rate.

Safety considerations

You will need to enter the stream channel to make width and depth measurements and to calculate velocity. Be aware of stream velocity, water depth, and bottom conditions at your stream-monitoring site. Do not attempt to measure stream flow if water velocity appears to be fast enough to knock you down when you are working in the stream. If you are unsure of water depth across the width of the stream, be sure to proceed with caution as you move across the stream, or choose an alternate point from which to measure stream flow.

Determining Stream Flow (Area x Velocity = Flow)

The method you are going to use in determining stream flow is known as a velocity-area approach. The task is to find out the volume of water in a 20-ft. (at least) section of stream by determining both the stream's velocity and the area of the stream section. You will first measure the width of the stream, and then measure water depth at a number of locations across the width to find the average depth at your monitoring site. Then by multiplying the average depth by the width, you can determine the average cross-sectional area (ft^2) of the stream. Water velocity (ft/sec) is determined simply by measuring the number of seconds it takes a float to travel along the length of stream you are studying. Since water velocity varies at different depths, (surface water moves more quickly than subsurface water because water moving against rough bottom surfaces is slowed down by friction) you will need to multiply velocity by a correction factor to adjust your measurement to account for the effect of friction. The actual equation you will use to determine flow is this: Flow=Area x Corrected Velocity. This method was developed and adapted from several sources (see bibliography). Alternative methods that may be better for your monitoring site are featured in the sidebar below.

Stream Flow Monitoring Methods: Professional and Home-Made

The type of monitoring station used by professionals depends on the conditions at the site including size, slope, accessibility, and sedimentation of the stream. Flow can also be measured at spillways, dams, and culverts or by using a weir or flume, which are man-made structures within a stream that provide a fixed stage-flow relation. Another method, using a home-made combination staff/crest gage, allows volunteer monitors to measure the water level (stage) both at the time of inspection and at the highest level reached since last inspected. This tool is made of PVC pipe, granulated cork and other materials. For more information, including how to make your own, visit:

www.epa.gov/owow/monitoring/volunteer/newsletter/volmon07no2.pdf

Measuring and Calculating Stream Flow

Site location

1. At your monitoring site, locate a straight section of stream that is at least 20 feet in length and has a uniform width. The water should be at least 6 inches deep, and have some movement. Unobstructed runs or riffles are ideal sites to choose.

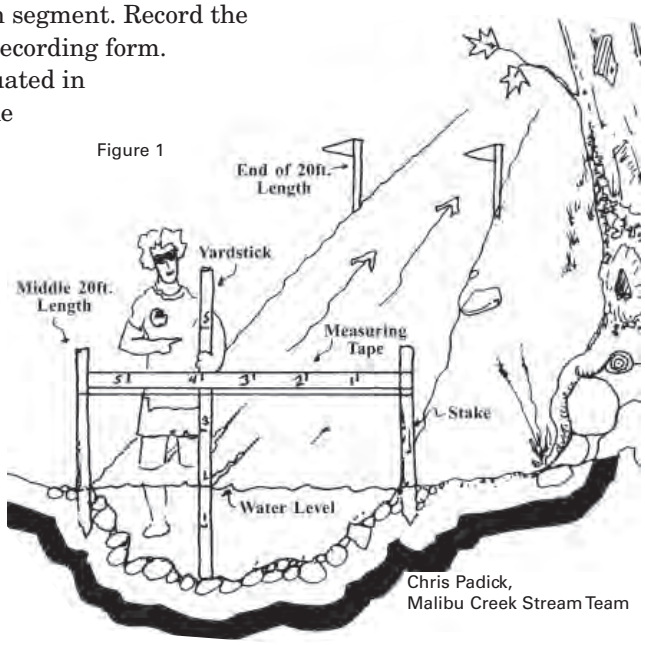
2. Measure 20 feet along the length of your chosen stream segment with your measuring tape and mark both the up and downstream ends of the section with flagging.

Width and depth measurements

3. Working with a partner, measure stream width (wetted edge to wetted edge) by extending a measuring tape across the stream at the midway point of your marked stream segment. Record the width in feet on your recording form. (A tape measure graduated in tenths of feet will make calculations easier.)

4. Secure the measuring tape to both shores so that the tape is taut and above the surface of the water. You might choose to attach the tape or a length of string to two stakes secured on opposite banks to create a transect line across the stream if it is impractical to secure the tape using shoreline vegetation. (Figure 1)

Figure 1



Chris Padick, Malibu Creek Stream Team

5. Using your yardstick or pre-marked (in tenths of feet) D-frame net pole, measure the water depth (ft) at one-foot intervals across the stream where you measured width (and secured the measuring tape). Be sure to measure depth in tenths of feet, not in inches (See conversion chart from inches to tenths of feet on data recording form). Record depth measurements (ft) on the recording form. If your stream is greater than 20 feet wide, measure depth in 20 equal intervals across the stream.

Velocity measurement

Velocity will be measured by tracking the time it takes a floating object to move the marked 20-foot length of stream. You will time the floating object (in seconds) a total of four times, at different locations across the stream. Repeating your measurements across the stream, in both slower and faster areas, will help to ensure the closest approximation to the stream's true velocity. This in turn will make your flow calculations more accurate. However, be sure your float travels freely downstream (during every float trial) without catching in slack water areas of the stream. For narrower streams (less than 10 feet), you can conduct only three float trials to assess velocity.

6. Position the person who will release the float upstream from the upper flag. Position the timekeeper on the stream bank (or out of the main flow path) at the downstream flag with the stopwatch. Position the person who will catch the float downstream from the timekeeper (Note: Unless velocity is very fast, the timekeeper should be able to catch the float with a net after they have finished timing its run down the stream).

7. The float-releaser will gently drop the float into the stream a few feet upstream from the upper flag, and will alert the timekeeper to begin timing as the float passes the upstream flag (the float should have time to get up to speed by the time it passes the upper flag into the marked length of stream). If the float gets stuck on a log, rock or other obstruction, it should be released from the starting point again.

8. The timekeeper should stop the stopwatch as the float passes the downstream flag and retrieve the float using the net.

9. Record the float time for the first trial on the recording form.

10. Repeat steps 7-9 for each of the remaining float time trials in different sections of the stream. Record the float time (seconds) for each trial on the recording form.

Calculating stream flow

11. To determine the average depth at the site, first find the sum of your depth measurements. Then divide the sum of the depths by the number of depth measurements (intervals) you made. Record the average depth (ft) in the appropriate location on your recording form.

12. Next, multiply your average depth by the stream width. This is the average cross-sectional area (ft^2) of the stream. Record this in the appropriate box on your recording form.

13. Determine the average float time by first determining the sum of float times measured. Then divide the sum of the times by the number of float time measurements taken. Record this average float time (seconds) on your recording form.

14. Divide the length of your stream segment (e.g., 20 feet) by the average float time (seconds) to determine the average surface velocity at the site. Record the average surface velocity (ft/sec) on your recording form.

15. Determine the correction factor below that best describes the bottom of your stream and multiply it by the average velocity measurement to account for the effects of friction with the stream bottom on water velocity. Record your corrected average surface velocity on your recording form.

a. Correction factor for rough, loose rocks, course gravel or weeds: 0.8

b. Correction factor for smooth mud, sand, or bedrock: 0.9

16. Multiply the average cross-sectional area (ft^2) by the corrected average surface velocity (ft/sec) to determine stream flow. Record stream flow (ft^3/sec or cfs) in the space provided on your recording form.

Bibliography:
We reviewed and adapted information and methods from Missouri Stream Team Program, the WI DNR, the *EPA Volunteer Stream Monitoring Methods Manual* (EPA 841-B-97-003), the *Nohr Network of Monitors,* the Washington Co. (WI) Waterways Program, Hoosier Riverwatch, Project SEARCH, and California's Nonpoint Source Pollution Control Program as well as other technical information.

Water Action Volunteers is a cooperative program between the University of Wisconsin-Extension and the Wisconsin Department of Natural Resources. For more information, contact the Water Action Volunteers Coordinator at 608/264-8948.

What is a Staff Gage?

A staff gage is a tool that is often used in conjunction with other methods to determine stream flow. It looks like a large ruler placed vertically within a stream in a position least likely to catch floating debris, and that will be stable during high water flows and the winter freeze. Staff gages are calibrated in tenths of feet and allow a monitor to read and record the stage height (the height of water in the stream at a certain level) any time a monitor has the opportunity to visit the stream site. Staff gages are often placed at the stream's edge on a bridge abutment. WAV monitors may choose to place a staff gage at their monitoring site. You may need a permit to do this, however. Contact your local DNR Service Center for more information on permits.

If a staff gage is installed, monitors can simply record the water level on the staff gage without measuring flow. This method will provide added detail when assessing other parameters. However, scores cannot be compared between sites because each reading is germane only to that site.

Monitors may also choose to install a staff gage at their monitoring site and then, at a number of different water levels, record the stage height and determine the flow in the stream by following methods provided in this fact sheet. This type of monitoring is similar to what professionals do to determine a *rating curve* for a stream discharge monitoring station. The rating curve will reveal the stream's unique relationship between flow and stage height. Eventually, a monitor could determine stream flow simply by reading the stage height on the staff gage and looking at the site's rating curve to see what the flow is at that stage height. Caution must be used with this method since weeds, ice, or other factors can cause ponding of the stream water or movement of the staff gage over time, thus affecting rating curve results.

UW Extension

WISCONSIN DEPT. OF NATURAL RESOURCES

Appendix L

HEALTHY LAKES INITIATIVE

Healthy Lakes

Green Lake, Green Lake County - Lisa Reas

WISCONSIN'S HEALTHY LAKES IMPLEMENTATION PLAN

2014-2017

WISCONSIN DEPT. OF NATURAL RESOURCES

Wisconsin Lakes Partnership

TABLE OF CONTENTS

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The statewide Healthy Lakes initiative is a true, collaborative team effort. The Healthy Lakes Implementation Plan describes relatively simple and inexpensive best practices that lakeshore property owners can implement. The Plan also includes funding/accountability, promotion, and evaluation information so we can grow and adapt the Plan and our statewide strategy to implement it into the future. Working together, we can make Healthy Lakes for current and future generations.

Design and layout by Amy Kowalski, UWEX Lakes

INTRODUCTION

Wisconsin's lakes define our state, local communities, and our own identities. Fond memories of splashing in the water, seeing moonlight reflect off the lake, and catching a lunker last a lifetime. With over 15,000 lakes dotting the landscape, it's no surprise that fishing alone generates a $2.3 billion economic impact each year , and the majority of property tax base rests along shorelines in some of our counties. Unfortunately, we've learned through science that our love for lakes causes management challenges, including declines in habitat and water quality. In fact, the loss of lakeshore habitat was the number one stressor of lake health at a national scale. Lakes with poor lakeshore habitat tend to have poor water quality. Working together to implement *Wisconsin's Healthy Lakes Implementation Plan* (Plan), we can improve and protect our lakes for future generations to enjoy, as well.

This Plan identifies relatively simple habitat and water quality best practices that may be implemented on the most typical lakeshore properties in Wisconsin. We encourage do-it-yourselfers to use these practices but have also created a Wisconsin Department of Natural Resources (DNR) Lake Classification and Protection Grant *Healthy Lakes* sub-category for funding assistance. Furthermore, local partners like lake groups and counties may choose to integrate the Plan into their lake management, comprehensive planning, and shoreland zoning ordinance efforts.

It's important to consider this plan in the context of the lake and local community's management complexity. The best practices' effectiveness will increase cumulatively with additional property owner participation and depend on the nature and location of the lake. For example, if every property owner implemented appropriate Healthy Lakes best practices on a small seepage lake, also known as a pothole or kettle lake, within a forested watershed, the impact would be greater than on a large impoundment in an agricultural region of Wisconsin. Nevertheless, all lakes will benefit from these best practices, and even with limited impact, they are a piece of the overall lake management puzzle that lakeshore property owners can directly control. More lakeshore property owners choosing to implement Healthy Lakes best practices through time means positive incremental change and eventually success at improving and protecting our lakes for everyone.

GOALS AND OBJECTIVES

Wisconsin's Healthy Lakes Implementation Plan goal is to protect and improve the health of our lakes by increasing lakeshore property owner participation in habitat restoration and runoff and erosion control projects.

- Statewide objective: single-parcel participation in Healthy Lakes will increase 100% in 3 years (i.e. 2015 to 2017).
- Individual lake objective: lake groups or other partners may identify their own habitat, water quality, and/or participation goal(s) through a local planning and public participation process.
  - Partners may adopt this Plan, as is by resolution, or integrate the Plan into a complimentary planning process such as lake management or comprehensive planning.

Wisconsin's Healthy Lakes Implementation Plan, and the diversion and rock infiltration practices in particular, are not intended for heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design. Technical assistance and funding are still available for these sites; contact your county land and water conservation department or local DNR lakes biologist for more information.

The target audience for this Plan and implementation of the associated practices is lakeshore property owners, including: permanent and seasonal homeowners, municipalities, and businesses.

It will be necessary to do additional planning work to implement Wisconsin's Healthy Lakes Plan and, again, the level of effort will depend on the complexity of the lake and its local community. Planning could be as simple as site-specific property visits and development of design plans, to integrating the Plan into a broader and more comprehensive effort. Your lake group, county land and water conservation department, non-profit conservation association, UW-extension lakes specialist or local educator, and/or DNR lake biologist can provide planning guidance or contacts.

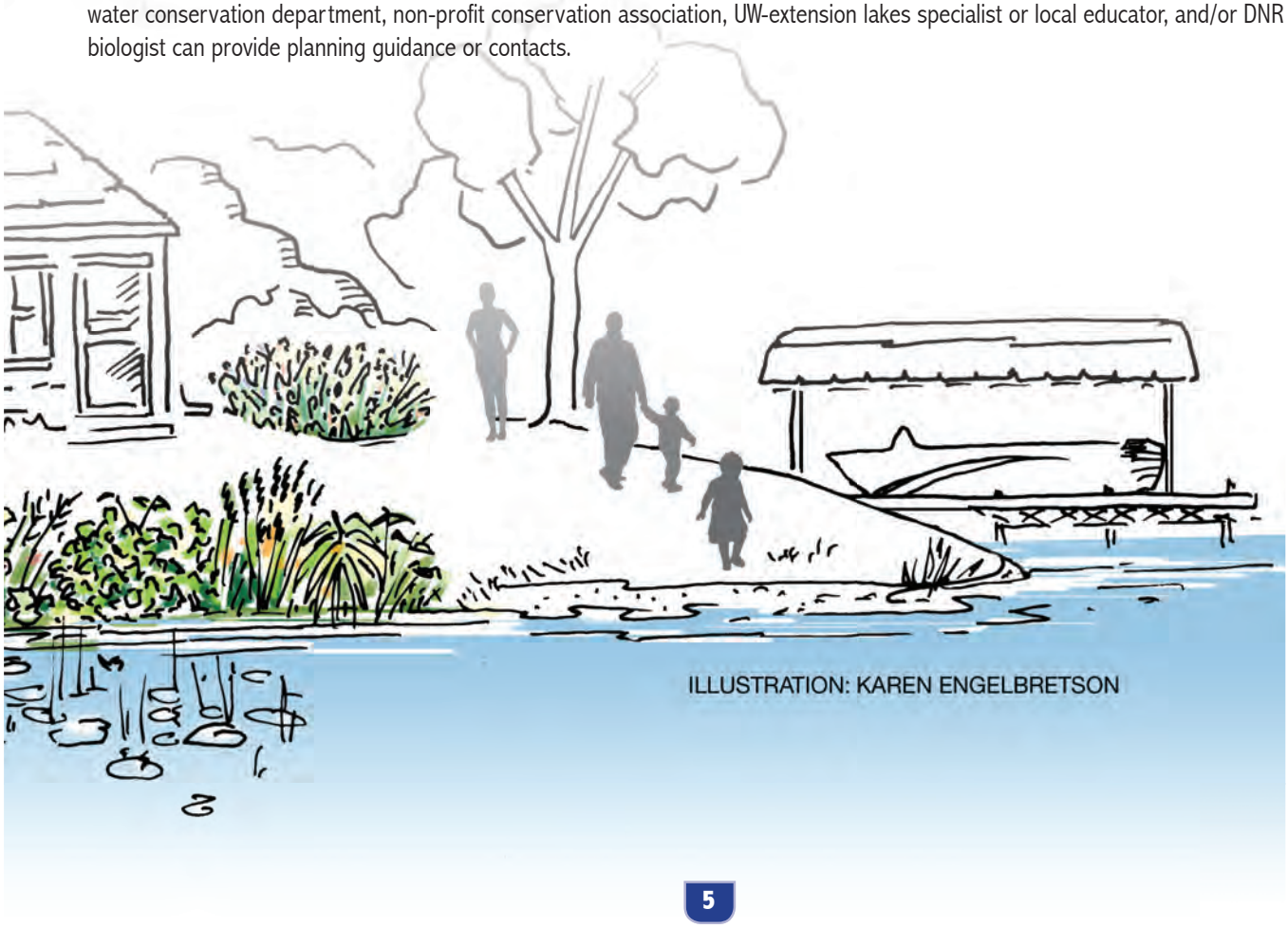


ILLUSTRATION: KAREN ENGELBRETSON

DEFINITIONS

Best practice: a working method, described in detail, which has consistently shown results.

Divert: redirect runoff water.

Habitat: where a plant or animal lives.

Infiltrate: soak into the ground.

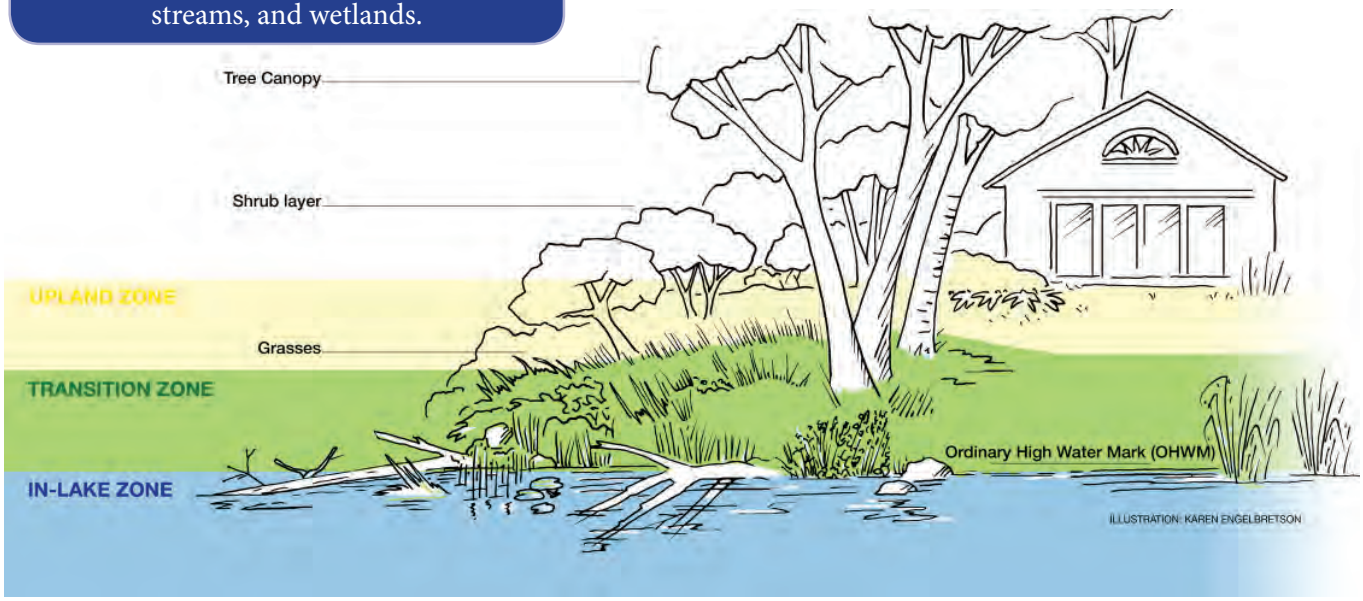
Installed: project cost that includes all materials, labor, and transportation.

Runoff: rain and snowmelt that doesn't soak into the ground and instead moves downhill across land and eventually into lakes, streams, and wetlands.

Wisconsin's Healthy Lakes Implementation Plan divides a typical lakeshore parcel into the following 3 management zones: 1) in-lake, 2) transition, and 3) upland (see illustration below). Best practices are identified for each zone. A team selected these practices based on customer feedback. These practices are:

- relatively simple and inexpensive to implement,
- appropriate for typical lakeshore properties, and
- beneficial to lake habitat and/or water quality.

The Plan also provides cost ranges and averages and technical, regulatory, and funding information for each practice. Fact sheets for each best practice support the Plan and provide more technical detail, and additional guidance is referenced if it currently exists. There is also a funding and administration FAQ fact sheet for those considering pursuing Healthy Lakes grants.



HEALTHY LAKES PLAN

Best practice descriptions follow. Each description defines the practice, identifies lake health benefits, provides cost ranges and averages based on recent projects, and identifies additional technical and regulatory information. The costs provided are installed costs, which include all materials, labor, and transportation but do not include technical assistance, including design and project management/administration work. Cost ranges are a result of geographic location, property conditions like soils and slopes, and contractor supply and proximity to the project site.

PRACTICE 1 | FISH STICKS

...large woody habitat structures that utilize whole trees grouped together resulting in the placement of more than one tree per 50 feet of shoreline. Fish Sticks structures are anchored to the shore and are partially or fully submerged.

Bony Lake, Bayfield County - Pamela Toshner

LAKE HEALTH BENEFITS	Improve fish and wildlife habitat Prevent shoreline erosion
COSTS	Range - $100-$1000 per cluster (3-5 trees), installed Average - Cost per unit (3-5 trees) averages $500, installed
TECHNICAL REQUIREMENTS	Healthy Lakes Fact Sheet Series: *Fish Sticks* http://tinyurl.com/healthylakes DNR Fish Sticks Best Practices Manual http://dnr.wi.gov (search for *Fish Sticks best practices*)
REGULATORY INFORMATION	DNR: **Habitat Structure - Fish Sticks General Permit** ($303 fee unless DNR grant-funded) Fish Sticks must comply with the local shoreland zoning ordinance. Consult with your county or municipal zoning staff.
HEALTHY LAKES GRANT FUNDING	Maximum of $1000/cluster of 3-5 trees Fish Sticks may be a stand-alone grant activity only if the vegetation protection area (i.e. buffer) complies with local shoreland zoning. If not, the property owner must commit to leaving a 350 ft^2 area un-mowed at the base of the cluster(s) or implement native plantings (Practice 2).

PRACTICE 2 | 350 FT² NATIVE PLANTINGS

...template planting plans with corresponding lists of native plants suited to the given function of the plan. The 350 ft² area should be planted adjacent to the lake and include a contiguous area, rather than be planted in patches. Functions are based on the goals for the site. For example, one property owner may want to increase bird and butterfly habitat while another would like to fix an area with bare soil. Native planting functions include the following: lakeshore, bird/butterfly habitat, woodland, low-growing, deer resistant, and bare soil area plantings.

Green Lake, Green Lake County - Lisa Reas

LAKE HEALTH BENEFITS	Improve wildlife habitat Slow water runoff Promote natural beauty
COSTS	**Range** - $480-$2400 for 350 ft² area, installed **Average** - $1000 per 350 ft², installed
TECHNICAL REQUIREMENTS	Healthy Lakes Fact Sheet Series: *350 ft² Native Plantings* http://tinyurl.com/healthylakes 350 ft² Native Plantings Best Practices Manual
REGULATORY INFORMATION	DNR: an aquatic plant chemical control permit may be necessary if using herbicides in or adjacent to the lakeshore. Native plantings must comply with the local shoreland zoning ordinance. Consult with your county or municipal zoning staff.
HEALTHY LAKES GRANT FUNDING	Maximum of $1000/350 ft² native plantings installed and implemented according to the technical requirements. Only one 350 ft² native planting per property per year is eligible for funding. The native plantings dimension must be 350 ft² of contiguous area at least 10 feet wide and installed along the lakeshore. Final shape and orientation to the shore are flexible.

PRACTICE 3 | DIVERSION PRACTICE

...includes a water bar, diverter, and broad-based dip. These practices use a berm or shallow trench to intercept runoff from a path or road and divert it into a dispersion area. Depending on the site, multiple diversion practices may be necessary.

http://awwatersheds.org

LAKE HEALTH BENEFITS	Divert runoff water.
COSTS	Range - $25-$3750, installed Average - $200, installed
TECHNICAL REQUIREMENTS	Healthy Lakes Fact Sheet Series: *Diversion Practice* http://tinyurl.com/healthylakes
REGULATORY INFORMATION	DNR: none. Diversion practices must comply with the local shoreland and floodplain zoning ordinance. Consult with your county or municipal zoning staff.
HEALTHY LAKES GRANT FUNDING	Maximum of $1000/diversion practice installed and implemented according to the technical requirements. Healthy Lakes diversion practice grant funding is not intended for large, heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design.

PRACTICE 3 | DIVERSION PRACTICE

...includes a water bar, diverter, and broad-based dip. These practices use a berm or shallow trench to intercept runoff from a path or road and divert it into a dispersion area. Depending on the site, multiple diversion practices may be necessary.

http://awwatersheds.org

LAKE HEALTH BENEFITS	Divert runoff water.
COSTS	Range - $25-$3750, installed Average - $200, installed
TECHNICAL REQUIREMENTS	Healthy Lakes Fact Sheet Series: *Diversion Practice* http://tinyurl.com/healthylakes
REGULATORY INFORMATION	DNR: none. Diversion practices must comply with the local shoreland and floodplain zoning ordinance. Consult with your county or municipal zoning staff.
HEALTHY LAKES GRANT FUNDING	Maximum of $1000/diversion practice installed and implemented according to the technical requirements. Healthy Lakes diversion practice grant funding is not intended for large, heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design.

PRACTICE 4 | ROCK INFILTRATION PRACTICE

...ian excavated pit or trench filled with rock that reduces runoff by storing it underground to infiltrate. A catch basin and/or perforated pipe surrounded by gravel and lined with sturdy landscape fabric may be integrated into the design to capture, pre-treat, and redirect water to the pit or trench. Pit and trench size and holding capacity are a function of the area draining to it and the permeability of the underlying soil.

Deer Lake, Polk County - Cheryl Clemens

LAKE HEALTH BENEFITS	Divert runoff water. Clean runoff water. Infiltrate runoff water. 
COSTS	Range - $510-$9688 per rock infiltration practice, installed Average - $3800 per rock infiltration practice, installed
TECHNICAL REQUIREMENTS	Healthy Lakes Fact Sheet Series: *Rock Infiltration Practice* http://tinyurl.com/healthylakes
REGULATORY INFORMATION	DNR: none. Rock infiltration practices must comply with the local shoreland zoning ordinance. Consult with your county or municipal zoning staff.
HEALTHY LAKES GRANT FUNDING	Maximum of $1000/rock infiltration practice installed and implemented according to the technical requirements. Healthy Lakes rock infiltration practice grant funding is not intended for heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design.

ZONE 3: UPLAND

PRACTICE 5 | RAIN GARDEN

...a landscaped shallow depression with loose soil designed to collect roof and driveway runoff.

Shell Lake, Washburn County - Brent Edlin

LAKE HEALTH BENEFITS	Improve wildlife habitat. Divert runoff water. Clean runoff water. Infiltrate runoff water. Promote natural beauty. 
COSTS	Range - $500-$9000 per rain garden, installed Average - $2500 per rain garden, installed
TECHNICAL REQUIREMENTS	Healthy Lakes Fact Sheet Series: *Rain Garden* http://tinyurl.com/healthylakes *Rain Gardens: A How-to Manual for Homeowners* http://dnr.wi.gov/topic/Stormwater/documents/RgManual.pdf
REGULATORY INFORMATION	DNR: none. Rain gardens must comply with the local shoreland zoning ordinance. Consult with your county or municipal zoning staff.
HEALTHY LAKES GRANT FUNDING	Maximum of $1000/rain garden installed and implemented according to the technical requirements. Healthy Lakes rain garden grant funding is not intended for heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design.

FUNDING AND ACCOUNTABILITY

Administrative details and the application process are described in detail in the DNR's Water Grant Application and Guidelines (http://dnr.wi.gov/ search for surface water grants) and the Healthy Lakes website (http://tinyurl/healthylakes) and *Administration and Funding FAQ* fact sheet.

Healthy Lakes grant funding highlights:

- 75% state share grant with a maximum award of $25,000, including up to 10% of the state share available for technical assistance and project management. Technical assistance and project management do not include labor and are based on the entire state share of the grant, not the best practice caps.
- 25% match from sponsors, participating property owners or other partners. The grant sponsor may determine individual property owner cost share rates, provided the state's share of the practice caps ($1000) and total grant award (75%) are not exceeded. The grant sponsor's match may include technical assistance and project management costs beyond the state's 10% share.
- Sponsor may apply on behalf of multiple property owners, and the property owners do not have to be on the same lake.
- Standard 2-year grant timeline to encourage shovel-ready projects.
- Landowners may sign a participation pledge to document strong interest in following through with the project.
- Standard deliverables, including a signed Conservation Commitment with operation and maintenance information and 10-year requirement to leave projects in place. Also:
  - Native plantings must remain in place according to local zoning specs if within the vegetation protection area (i.e. buffer).
  - Fish Sticks projects require a 350 ft^2 native planting at shoreline base or commitment not to mow, if the property does not comply with the shoreland vegetation protection area (i.e. buffer) specifications described in the local shoreland zoning ordinance.
- Standardized application and reporting forms and process.
- 10% of projects randomly chosen each year for self-reporting and/or professional site visits.

PROMOTION

Wisconsin's Healthy Lakes Implementation Plan will be supported and promoted as a statewide program. Lake groups, counties, towns, villages, cities, and other partners may choose to adopt and implement the Plan as is or to integrate into their own planning processes. Statewide promotion, shared and supported by all partners, includes the following:

- A Healthy Lakes logo/brand.
- A website with plan, practice, and funding detail to be housed on the Wisconsin Department of Natural Resources' and University of Wisconsin-Extension Lakes' websites. It may also include the following:
  - Link to science and supporting plans.
  - Shoreline restoration video.
  - How-to YouTube clips.
  - Tips on how to communicate and market healthy lakeshores.
  - Maps with project locations without personally identifiable information.

EVALUATION OF RESULTS

Wisconsin's Healthy Lakes Implementation Plan and results will be evaluated annually and updated in 2017, if warranted. Best practices may be modified, removed, or added depending on the results evaluation.

Lime Lake, Portage County - Robert Korth

The following information will be collected to support an objective evaluation:

- County and lake geographic distribution and participation in Healthy Lakes projects.
- Lakeshore property owner participation in Healthy Lakes projects, including numbers and locations of best practices implemented.
- Standardized Healthy Lakes grant project deliverable report including:
  - Numbers of Fish Sticks trees and clusters.
  - Dimensional areas restored.
  - Structure/floral diversity (i.e. species richness).
  - Impervious surface area and estimated water volumes captured for infiltration.

The results may be used to model nutrient loading reductions at parcel, lake, and broader scales and to customize future self-reporting options, like plant mortality and fish and wildlife observations, for lakeshore property owners.

ACKNOWLEDGEMENTS

Amy Kowalski

L to R: Patrick Goggin, Jane Malischke, Pamela Toshner, Carroll Schaal, Tom Onofrey, Dave Ferris

Wisconsin's Healthy Lakes Implementation Plan and corresponding technical information and grant funding are the results of a collaborative and participatory team effort. We would like to thank the staff, agency, business, and citizen partners, including *Advanced Lake Leaders*, who provided feedback for our team, including the many partners who completed a customer survey and provided valuable comments during the public review of proposed DNR guidance. We would like to express our gratitude to the following contributors and information sources, respectively: Cheryl Clemens, John Haack, Dave Kafura, Amy Kowalski, Jesha LaMarche, Flory Olson, Tim Parks, Bret Shaw, Shelly Thomsen, Scott Toshner, Bone Lake Management District, Maine Lake Smart Program, and Vermont Lake Wise Program.

We appreciate your continued feedback as our Healthy Lakes initiative evolves into the future. Please contact DNR Lake Biologist Pamela Toshner (715) 635-4073 or pamela.toshner@wisconsin.gov if you have comments or questions.

Appendix M

TREATING LAKES WITH ALUM

ALUM TREATMENTS TO CONTROL PHOSPHORUS IN LAKES

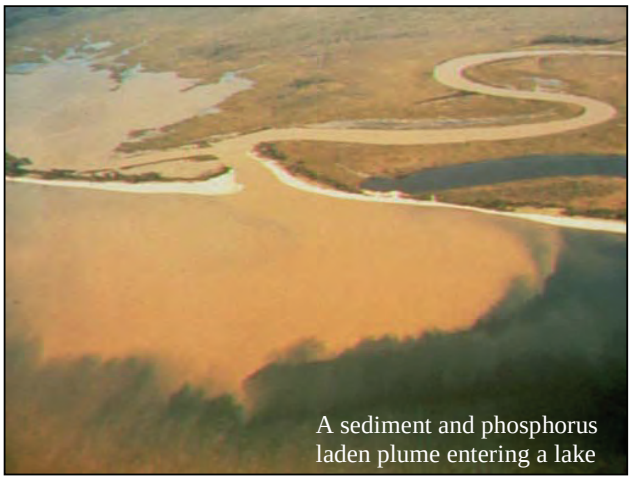
March 2003

What is alum and how does it work?

ALUM (aluminum sulfate) is a nontoxic material commonly used in water treatment plants to clarify drinking water. In lakes alum is used to reduce the amount of the nutrient **phosphorus** in the water. Reducing phosphorus concentrations in lake water can have a similar clarifying effect by limiting the availability of this nutrient for algae production. Phosphorus enters the water either **externally**, from run-off or ground water, or **internally**, from the nutrient rich sediments on the bottom of the lake. Phosphorus is released from the sediments under anoxic conditions that occur when the lake stratifies and oxygen is depleted from the lower layer. Even when external sources of phosphorus have been curtailed by best management practices, the internal recycling of phosphorus can continue to support explosive algal growth. Alum is used primarily to control this internal recycling of phosphorus from the sediments of the lake bottom. On contact with water, alum forms a fluffy aluminum hydroxide precipitate called **floc**. Aluminum hydroxide (the principle ingredient in common antacids such as Maalox) binds with phosphorus to form an aluminum phosphate compound. This compound is insoluble in water under most conditions so the phosphorus in it can no longer be used as food by algae organisms. As the floc slowly settles, some phosphorus is removed from the water. The floc also tends to collect suspended particles in the water and carry them down to the bottom, leaving the lake noticeably clearer. On the bottom of the lake the floc forms a layer that acts as a phosphorus barrier by combining with phosphorus as it is released from the sediments.

Why treat a lake with alum?

Increased nutrient loading, particularly phosphorus has accelerated eutrophication of lakes and consequently reduced their ecological health and recreational value. Frequent and pervasive algal blooms, low water transparency, noxious odors, depletion of dissolved oxygen, and fish kills frequently accompany cultural eutrophication. External sources of phosphorus delivered in run-off from the watershed are often the main contributor of excessive phosphorus to lakes.



A sediment and phosphorus laden plume entering a lake

Typically, the first steps taken in a lake rehabilitation effort target the control the external sources of phosphorus and can include: encouraging the use of phosphorus free fertilizers; improving agricultural practices, reducing urban run-off; and restoring vegetation buffers around waterways.

Lake researchers have learned that lakes are very slow to recover after excessive phosphorus inputs have been eliminated. Furthermore, it's extremely difficult to achieve recovery of lake conditions without additional in-lake management. This is due to the fact that lake sediments become phosphorus rich and can deliver excessive amounts of phosphorus to the overlying water. When dissolved oxygen levels decrease in the bottom waters of the lake (anaerobic conditions), large amounts of phosphorus trapped in the bottom sediments are released into the overlying water. This process is often called **internal** nutrient loading or recycling.

Is alum toxic to aquatic life?

Some studies have been conducted to determine the toxicity of aluminum for aquatic biota. Freeman and Everhart (1971) used constant flow bioassays, to determine that concentrations of dissolved aluminum below 52 μg Al/L had no obvious effect on rainbow trout. Similar results have been observed for salmon. Cooke, et al (1978) adopted 50 mg Al/L as a safe upper limit for post-treatment dissolved aluminum concentrations. Kennedy and Cooke (1982) indicate that: Since, based on solubility, dissolved aluminum concentrations, regardless of dose, would remain below 50 μg Al/L in the pH range 5.5 to 9.0, a dose producing post treatment pH in this range could also be considered environmentally safe with respect to aluminum toxicity. Guidelines for alum application require that the ph remain with the 5.5-9.0 range.

According to Cooke et al (1993) the most detailed study of the impact of alum treatments on benthic insects was that of Narf (1990). He assessed the long term impacts on two soft water and three hardwater Wisconsin lakes. He found that benthic insect populations either increased in diversity or remained at the same diversity after treatment. The treatment of lakes with alkalinities above 75 mg/L as $CaCO_3$ are not expected to have chronic or acute effects to biota. Fish related problems associated with alum treatments have been primarily documented in soft water lakes. However, many softwater lakes have been successfully treated with alum, when the treatments are ph buffered.

Health concerns for people?

Concerns about a connection between aluminum and Alzheimer's have been debated for some time. More recent research points to a gene rather than aluminum as the cause. In addition, aluminum is found naturally in the environment. Some foods, such as tea, spinach and other leafy green vegetables, are high in aluminum. Use of aluminum cookware has not been found to contaminate food sources.

How much does an alum treatment cost?

Costs of alum application are primarily dependent on the form of alum used (wet or dry), dosage rate, area treated, equipment rental or purchase, and labor. Liquid alum has been used when large alum doses were needed. Treatment costs range from $280/acre to $700/acre ($450=approximate average) depending on the dosage requirements and costs to mobilize equipment.

How effective are alum treatments, and how long do they last?

A number of case studies have been conducted on lakes that have undergone nutrient inactivation with alum. Eugene Welch and Dennis Cooke (1995) evaluated the effectiveness and longevity of treatments on twenty one lakes across the United States. They concluded that the treatments were effective in six of the nine shallow lakes, controlling phosphorus for at least eight years on average. Applications in stratified lakes were highly effective and long lasting. Percent reduction in controlling internal phosphorus loading has been continuously above eighty percent. The study did however find that alum treatment of lakes with high external loading was not effective.

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Appendix N

PREVENTING THE SPREAD OF AQUATIC INVASIVE SPECIES

FOR MORE INFORMATION

If you would like more information about aquatic invasive species, the problems they cause, regulations to prevent their spread, or methods and permits for their control, contact one of the following offices:

Wisconsin Department Of Natural Resources
888-WDNRINFO
DNR.WI.GOV search "Aquatic Invasives"

University of Wisconsin- Extension
(715) 346-2116
WWW.UWSP.EDU/CNR/UWEXLAKES

Wisconsin Sea Grant
(608) 262-0905
WWW.SEAGRANT.WISC.EDU
WWW.PROTECTYOURWATERS.NET

Thanks to the following for supporting educational efforts on aquatic invasive species:

- *U.S. Fish and Wildlife Service*
- *Great Lakes Indian Fish and Wildlife Commission*
- *National Park Service*

PUB WT-801 2011

Graphic Design by Amy Torrey, Environmental Resources Center, UW-Extension

Photo Credits: Sea Grant, UW-Extension, DNR

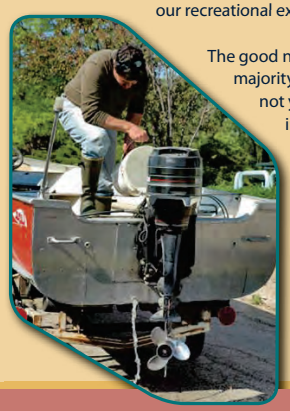
STOP Aquatic HITCHHIKERS

ENJOYING THE GREAT OUTDOORS

Enjoying the great outdoors is important to many of us. Boating, fishing, hunting, and wildlife watching are traditions that we want to preserve for our children and their children. Today, these traditions are at risk. Aquatic invaders such as zebra mussels, purple loosestrife, Eurasian water-milfoil, bighead and silver carp, threaten our valuable waters and recreation. These and other non-native, or exotic, plants and animals do not naturally occur in our waters and are called invasive species because they cause ecological or economic harm.

These invasive species can get into lakes, rivers, and wetlands by "hitching" rides with anglers, boaters, and other outdoor recreationists, who transport them from one waterbody to another.

Once established, these "aquatic hitchhikers," can harm native fisheries, degrade water quality, disrupt food webs and reduce the quality of our recreational experiences.

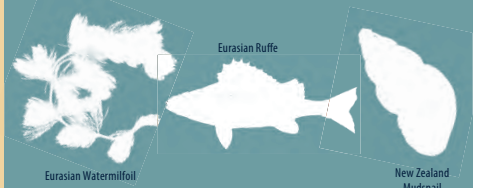


The good news is that the majority of waters are not yet infested with invasive species and by taking the necessary steps you can help protect our valuable waters.

If you think you have found an INVASIVE SPECIES:

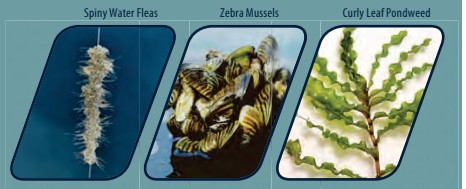
REPORT NEW SIGHTINGS

If you suspect a new infestation of an invasive plant or animal, save a specimen and report it to a local Department of Natural Resources or Sea Grant office. Wisconsin has "ID" cards, websites, and volunteer monitoring networks to help you identify and report invasive species.



CONSULT YOUR NATURAL RESOURCE AGENCY

Do-it-yourself control treatments may be illegal and can make matters worse by harming native fish, wildlife, and plants. Before attempting to control an invasive species or add new plants along your shoreline, contact your local Department of Natural Resources office. DNR staff can provide recommendations and notify you what permits are required.



DNR.WI.GOV search "Aquatic Invasives"

STOP AQUATIC HITCHHIKERS

IS A NATIONAL CAMPAIGN THAT HELPS RECREATIONAL USERS TO BECOME PART OF THE SOLUTION TO STOP THE TRANSPORT AND SPREAD OF AQUATIC INVASIVE SPECIES.

IN WISCONSIN IT IS THE LAW...

Aquatic hitchhikers can spread in many ways such as on recreational equipment, and in water. Fortunately, there are a few simple actions you can take to prevent them from spreading.

INSPECT boats, trailers, and equipment

REMOVE all attached aquatic plants, animals, and mud before launching and before leaving the water access.

Many invasive species spread by attaching themselves to boats, trailers, and equipment and "hitching a ride" to another waterbody. Therefore, Wisconsin law requires that you remove these aquatic hitchhikers before you launch your boat or leave the access area.

DRAIN all water from your boat, motor, bilge, live wells, bait containers and all equipment before leaving the water access.

Many types of invasive species are very small and easily overlooked. In fact, some aquatic hitchhikers, like zebra mussel larvae, are invisible to the naked eye. To prevent the transport of these aquatic hitchhikers drain water from all equipment before you leave the access area.

For more information visit:
DNR.WI.GOV and search "bait laws"

Draining ballast water and lake or river water can prevent the spread of aquatic invasive species and fish diseases, like VHS.

NEVER MOVE plants or live fish away from a waterbody.

In Wisconsin, it is illegal to transport any aquatic plants, mud, live fish or live fish eggs away from any state waterbody. This includes live gamefish and roughfish, like gizzard shad. There are exceptions for minnows obtained from a Wisconsin licensed bait dealer or registered fish farm, which may be transported away live and used again:

- ***On the same waterbody, or***
- ***On any other waterbody if no lake or river water, or other fish were added to their container***

BUY minnows from a Wisconsin licensed bait dealer.

For more information on collecting your own minnows visit:
DNR.WI.GOV and search "VHS Prevention"

DISPOSE of unwanted bait and other animals or aquatic plants in the trash.

When possible, dispose of unwanted bait in the trash at access points. Never release them into the environment.

If possible, dispose of ALL unwanted bait (including earthworms) in a trash can at the boat landing or access point. Otherwise, take them home and dispose of them by placing them in the trash, composting them, or using them in a garden as fertilizer. Likewise, other aquatic plants or animals that you collect, or buy in a pet store, should NEVER be released into the wild.

WISCONSIN REGULATION

Wisconsin has several laws to prevent the spread of aquatic invasive species and the fish disease Viral Hemorrhagic Septicemia (VHS). Failure to follow Wisconsin law can result in fines up to or exceeding **$2000**. Don't be caught unaware!

ADDITIONAL STEPS:

Although not required by WI law, additional steps are highly recommended, particularly if you are transporting a boat and/or equipment from one waterbody to another. Additional steps include:

SPRAY, RINSE, or DRY boats and recreational equipment to remove or kill species that were not visible when leaving a waterbody. Before transporting to another water: ***Spray/rinse with high pressure, and/or hot tap water (above 104° F or 40° C), especially if moored for more than a day. OR Dry for at least five days.***

DISINFECT boats and recreational equipment to kill species and fish diseases that were not visible when leaving a waterbody. Many aquatic hitchhikers can survive out of water for some period of time. ***To prevent their spread, you can sanitize your boat, trailer or equipment by washing it with a mixture of 2 Tbs of household bleach per 1 gallon of water.***

OTHER WATER USES:

Don't get caught spreading aquatic invasive plants or animals! Wisconsin laws, as highlighted above, can apply to many types of water activities, not just boating and fishing. Although these activities might not seem dangerous, they CAN establish and spread invasive species. It is important you follow the steps above for all water activities in order to prevent the spread of aquatic invasive species. These activities include:

- ***Using personal watercraft***
- ***Shore and fly-fishing***
- ***Sailing***
- ***Scuba Diving***
- ***Waterfowl hunting***

FAILURE TO FOLLOW WISCONSIN LAWS CAN LEAD TO FINES.

For additional information contact your local DNR staff or visit:
DNR.WI.GOV

Protect Your Boat

Zebra mussels attach to a variety of materials, including fiberglass, aluminum, wood, and steel and may damage a boat's finish. Veligers are extremely small and can be drawn into engine passages. Once they settle out in the engine cooling system, they can grow into adults and may block intake screens, internal passages, hoses, seacocks, and strainers. The best ways for boat owners to avoid these types of damage are:

- **Use a boatlift** to completely remove the watercraft from the water when not in use.

- **Run your boat regularly** if it is moored in zebra mussel infested waters. Run the engine at least twice a week at slow speeds (about 4-½ mph) for 10 to 15 minutes. Monitor engine temperatures – if you notice an increase, it may mean that zebra mussels are clogging your cooling system. Immediately inspect the system and remove any zebra mussels. The end of boating season is also a good time to inspect and clean the cooling system.
- **Lift the motor out of the water between uses if mooring.** Fully discharge any water that may still remain in the lower portion of the cooling system.
- **Tip down the motor and discharge the water when leaving a waterbody** to reduce the likelihood of transporting veligers (in water) to another waterbody.
- **Clean your boat and equipment.** Physically remove (scrape) adult mussels from your boat, trailer, and equipment by hand. Young zebra mussels and veligers may be too small to see. Wash your boat with high-pressure hot water (use water >104˚F if possible). Use high-pressure cold water if hot water is not available. *(Avoid pressure washing classic wooden boats or others not made of metal.)*
- **Apply anti-fouling paints or coatings to the hull and the engine's cooling system** to prevent zebra mussel attachment. It is best to purchase these from an area boat dealer or your local marina. Anti-fouling paints that are copper based can be used in Wisconsin, and typically need to be reapplied every one to two years. In-line strainers can also be installed in the engine's cooling system.
- **Use motor "muffs", also known as motor flushers, to remove zebra mussels and other materials from your boat engine or personal watercraft.** Clamp the motor flusher onto the lower unit over the cooling inlets on either side of the motor, and screw the nozzle of your garden hose into it. Run the boat engine for approximately 10 minutes or as suggested by the manufacturer.

Amy Bellows, WI DNR

Special note of caution for anglers

Dispose of unwanted bait in the trash - do not transfer bait or water from one waterbody to another. Larval zebra mussels or other invasive species could be present in the water with the bait.

Help prevent aquatic hitchhikers from catching a ride on your boat or equipment:

- ✓ **Inspect** and **remove** aquatic plants and animals,
- ✓ **Drain** water,
- ✓ **Dispose** of unwanted bait in the trash,
- ✓ **Rinse** with hot and/or high-pressure water, OR
- ✓ **Dry** for 5 days.

Clean Boats . . . Clean Waters

For a list of known zebra mussel infested waters, visit:
www.dnr.wi.gov/org/water/wm/GLWSP/exotics/zebra.html

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STOP AQUATIC HITCHHIKERS!
Prevent the transport of nuisance species. Clean all recreational equipment.
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Sea Grant
University of Wisconsin

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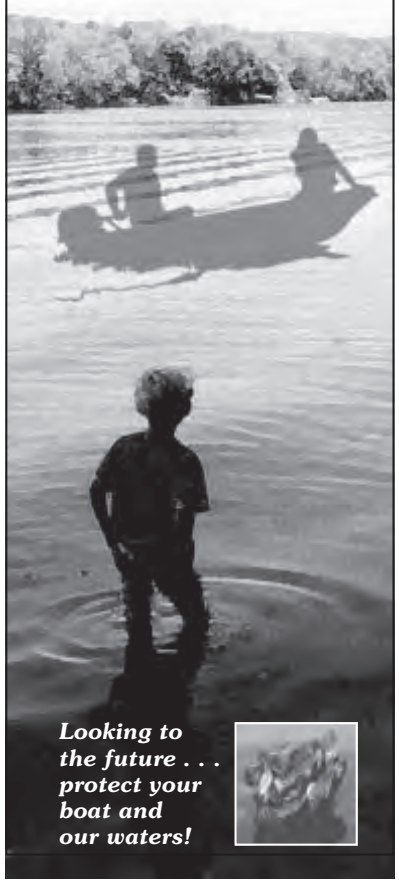
Designed by L. Pohlod, Blue Sky Design, LLC *PUB-WT-383 2004*

Zebra Mussel Boater's Guide



Looking to the future . . . protect your boat and our waters!

Zebra mussel identification and life cycle

Mature zebra mussels look like small D-shaped clams. Their yellowish-brown shells have alternating light and dark stripes.

Ohio Sea Grant

Zebra mussels can reach a maximum of 2 inches in length, though most are smaller than an inch. They are typically found attached to solid objects, often growing in large clusters.

Ontario Ministry of Natural Resources

Amy Bellows, WI DNR

Zebra mussels begin as eggs, then develop into free-swimming larvae (called **veligers**), which are microscopic. The veliger photos shown above were taken with the aid of a microscope. Veligers are spread by currents; after about three weeks, they settle out and firmly attach themselves to hard surfaces, where they grow into adults. Their lifespan is typically three to five years. They begin to reproduce after a year or two - females can release up to one million eggs per year!

James Lubner, University of Wisconsin Sea Grant

What do zebra mussels do?

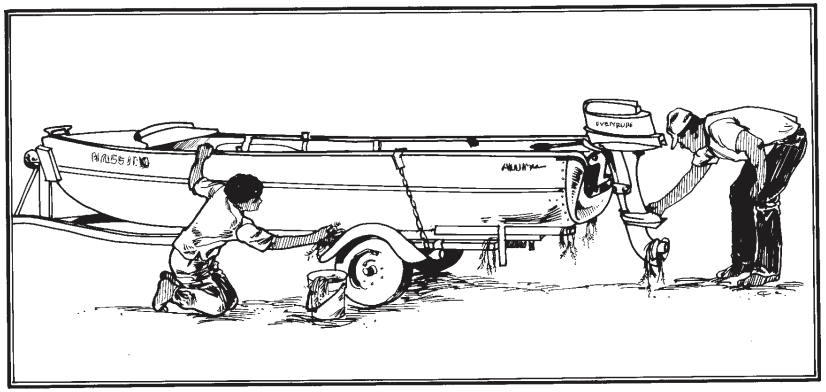
Zebra mussels are **filter feeders** that can filter large volumes of water (up to 1 Liter/day). In some cases they can filter the whole volume of a lake in a few months. They remove plankton – tiny plants and animals – from the water. What they eat (and what they don't eat) ultimately ends up on the lake or river bottom. Plankton is an important food source for young fish, native mussels, and other aquatic organisms. Zebra mussels may concentrate this food at the bottom, leaving open water species with **less to eat**!

Because they are so good at filtering, zebra mussels often **make water clearer**. This may force **light-sensitive fish**, like salmon and walleye, into deeper water to seek shelter from the sun. Increased light penetration allows aquatic plants to grow in deeper water and spread to a larger area. This may help smaller fish to survive by giving them places to hide, but makes it harder for large, predatory fish to find food. **Thicker plant growth** may also cause problems for boaters and anglers.

Don Schloesser, Great Lakes Science Center, National Biological Services

Zebra mussels cause people additional problems. They **clog water intakes and pipes** – large water users on the Great Lakes spent $120 million from 1989 to 1994 to combat zebra mussels. They also **attach to piers, boatlifts, boats, and motors**, which can cause damage requiring costly repair and maintenance. Even when they die, their **sharp shells** wash up on beaches, creating foul odors and cutting the feet of swimmers.

How can I help prevent the spread of zebra mussels?



Microscopic veligers may be carried in livewells, bait buckets, bilge water – any water that's transported to another waterbody. They can also travel in currents to downstream waters. Adults can attach to boats or boating equipment that are moored in the water. They frequently attach to aquatic plants, which themselves may hitch a ride on boats and equipment. For these reasons, it is important to take the following steps to prevent the spread of zebra mussels and other aquatic invasive species while boating:

Before moving your boat from one water body to another:

- ✓ **Inspect** and **remove** aquatic plants, animals, and mud from your boat, trailer, and equipment,
- ✓ **Drain** all water from your equipment (boat, motor, bilges, transom wells, live wells, etc.),
- ✓ **Dispose** of unwanted bait in the trash, not in the water,
- ✓ **Rinse** your boat and equipment with hot (> 104˚F) and/or high pressure water, particularly if moored for more than one day, OR
- ✓ **Dry** your boat and equipment thoroughly (in the sun) for five days.

Pressure washing note:

Avoid pressure washing classic and wooden boats, along with canoes and kayaks that are not made of metal. These types of boats should be drained, cleared of all plant and animal materials, and left in the sun to dry completely.

Effective May 2002, Section 30.715, WI Act 16 prohibits launching a boat or placing a boat or trailer in navigable waters if it has aquatic plants or zebra mussels attached.