Appendix D

HYDROLOGY AND DRAINAGE

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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/lcing 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]

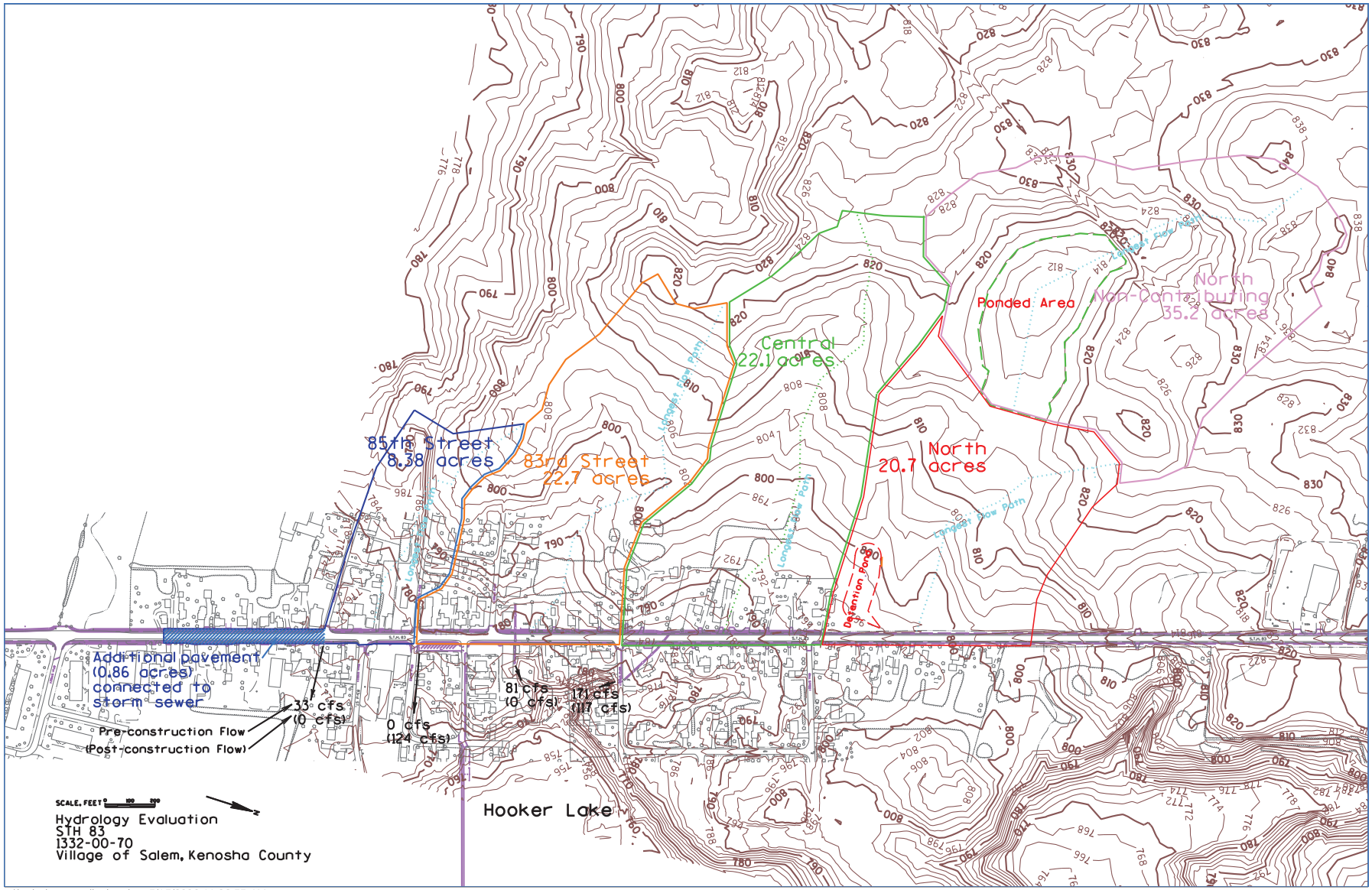
Any increases in water level seen on Hooker Lake are not due to changes associated with the reconstruction of STH 83.

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.

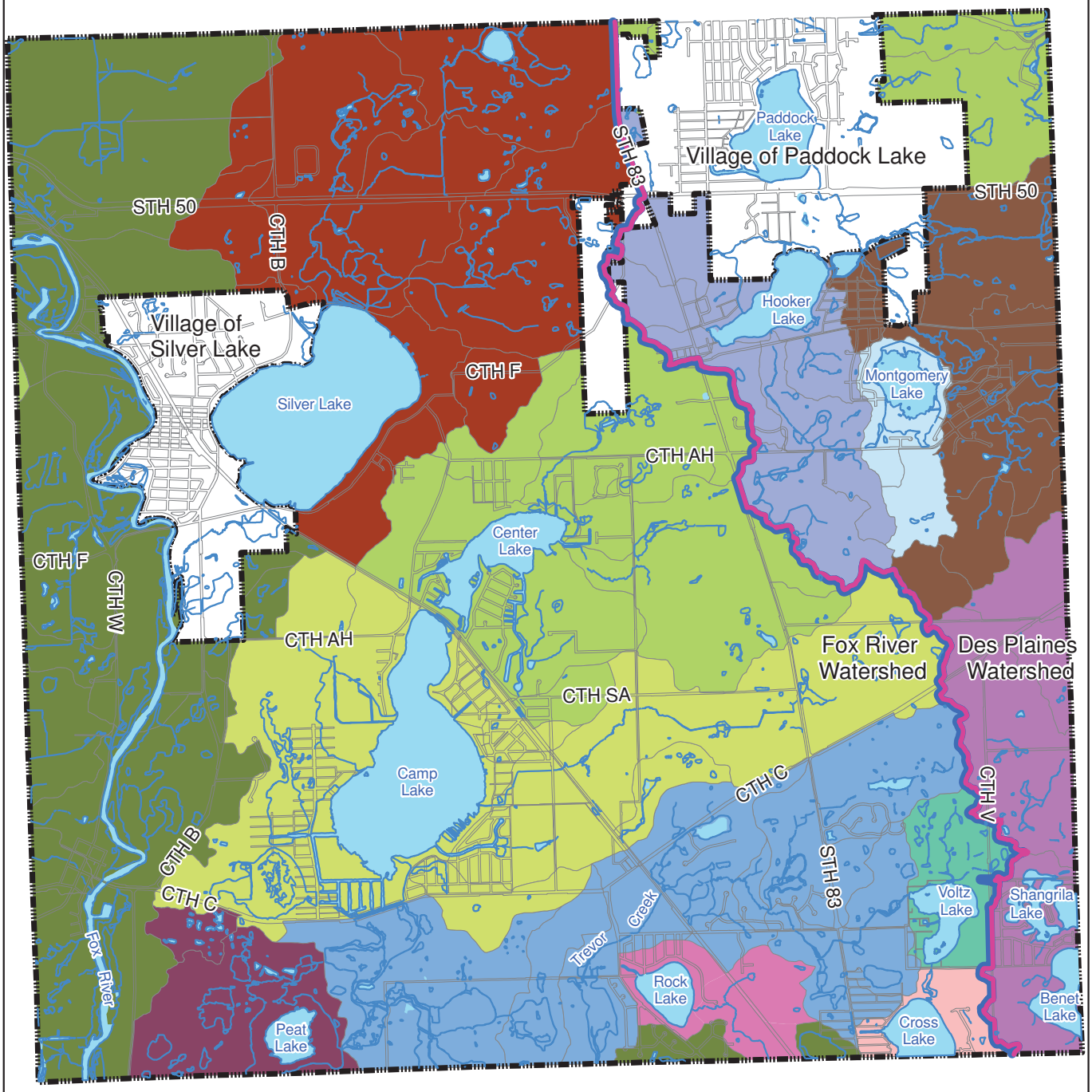
Runoff Curve Number

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

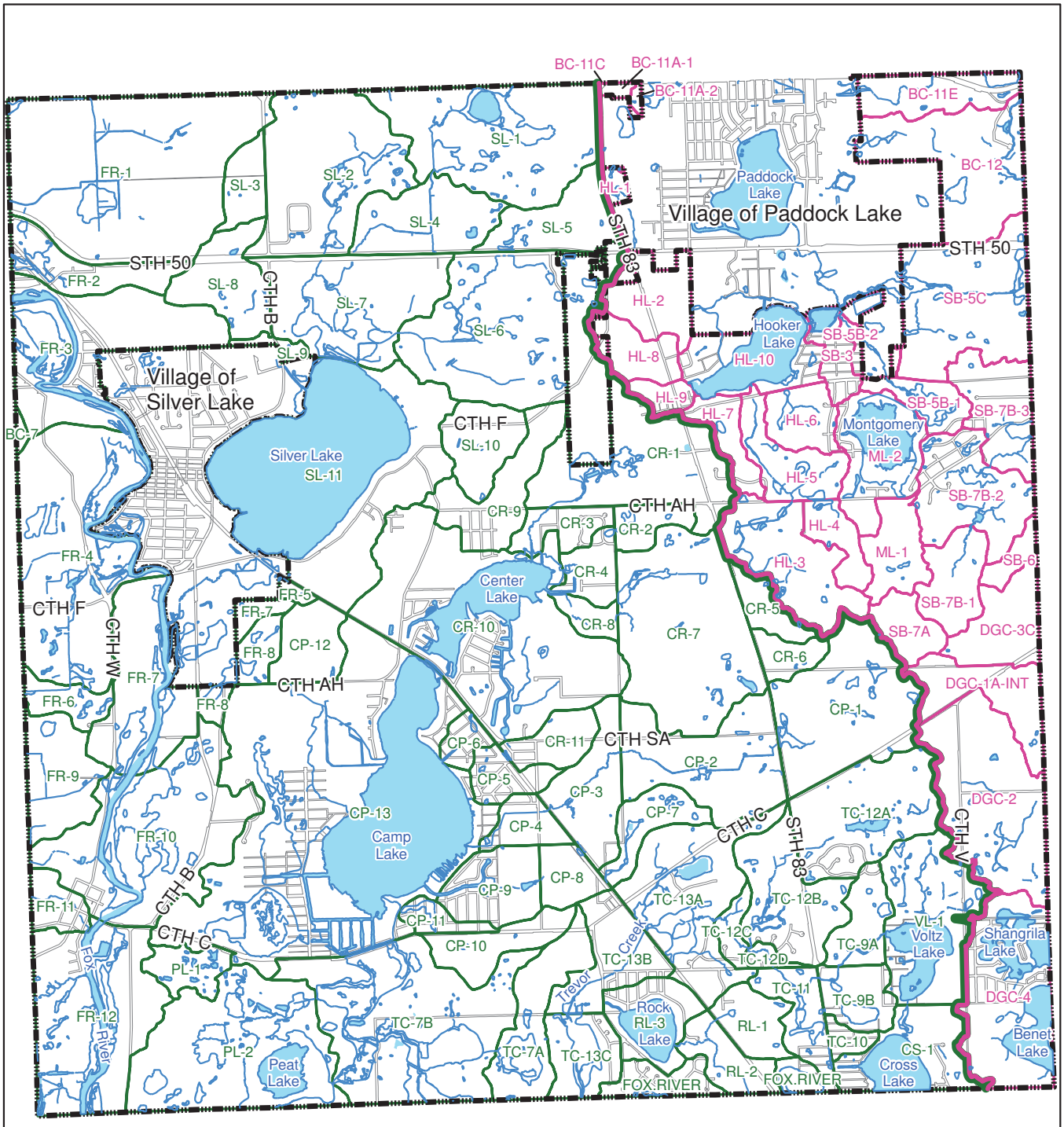

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FIGURE 4-2
TOWN OF SALEM
SUBBASIN BOUNDARIES EXHIBIT

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.

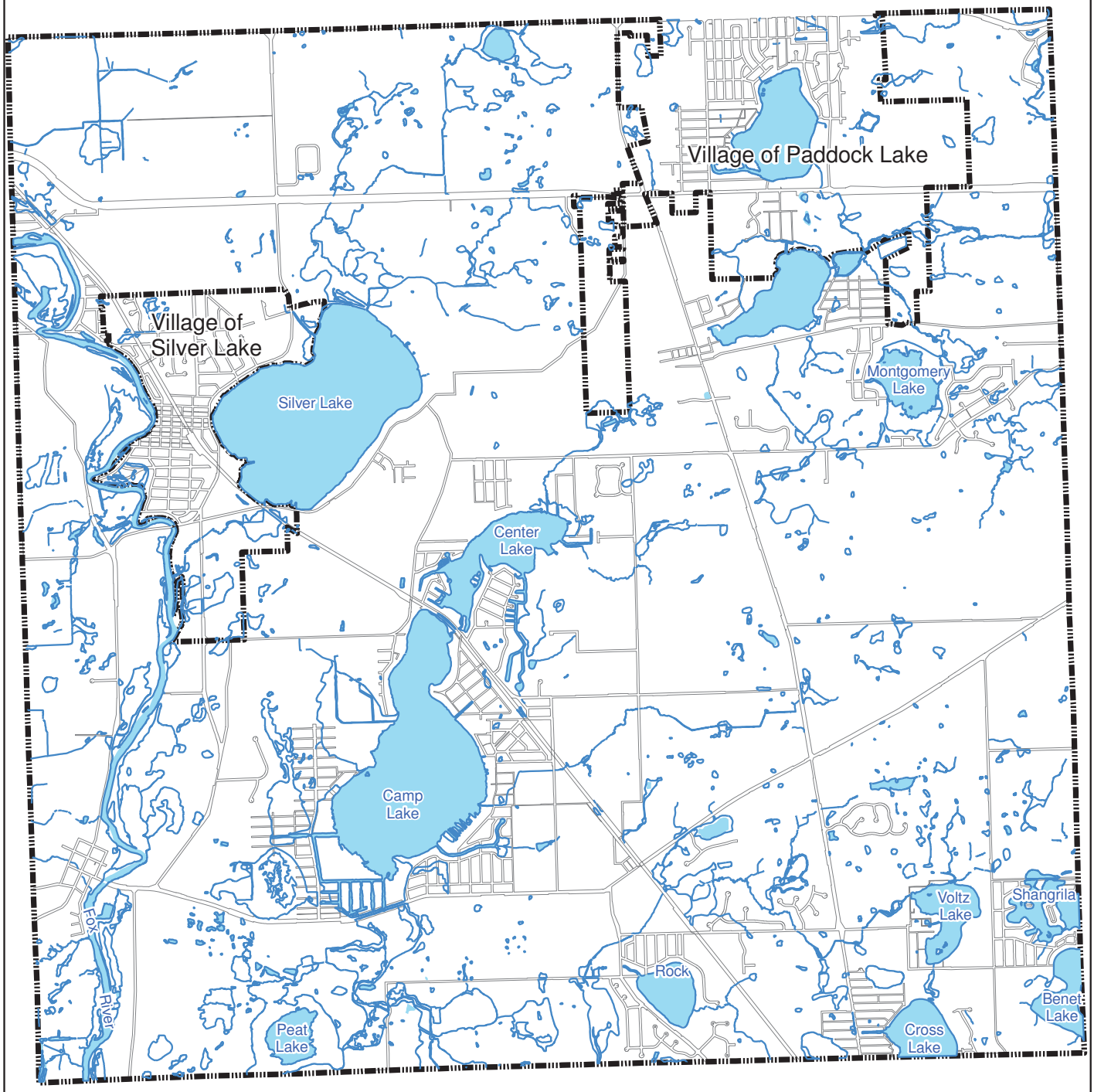
Table 4-1
Lakes in the Town of Salem

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**

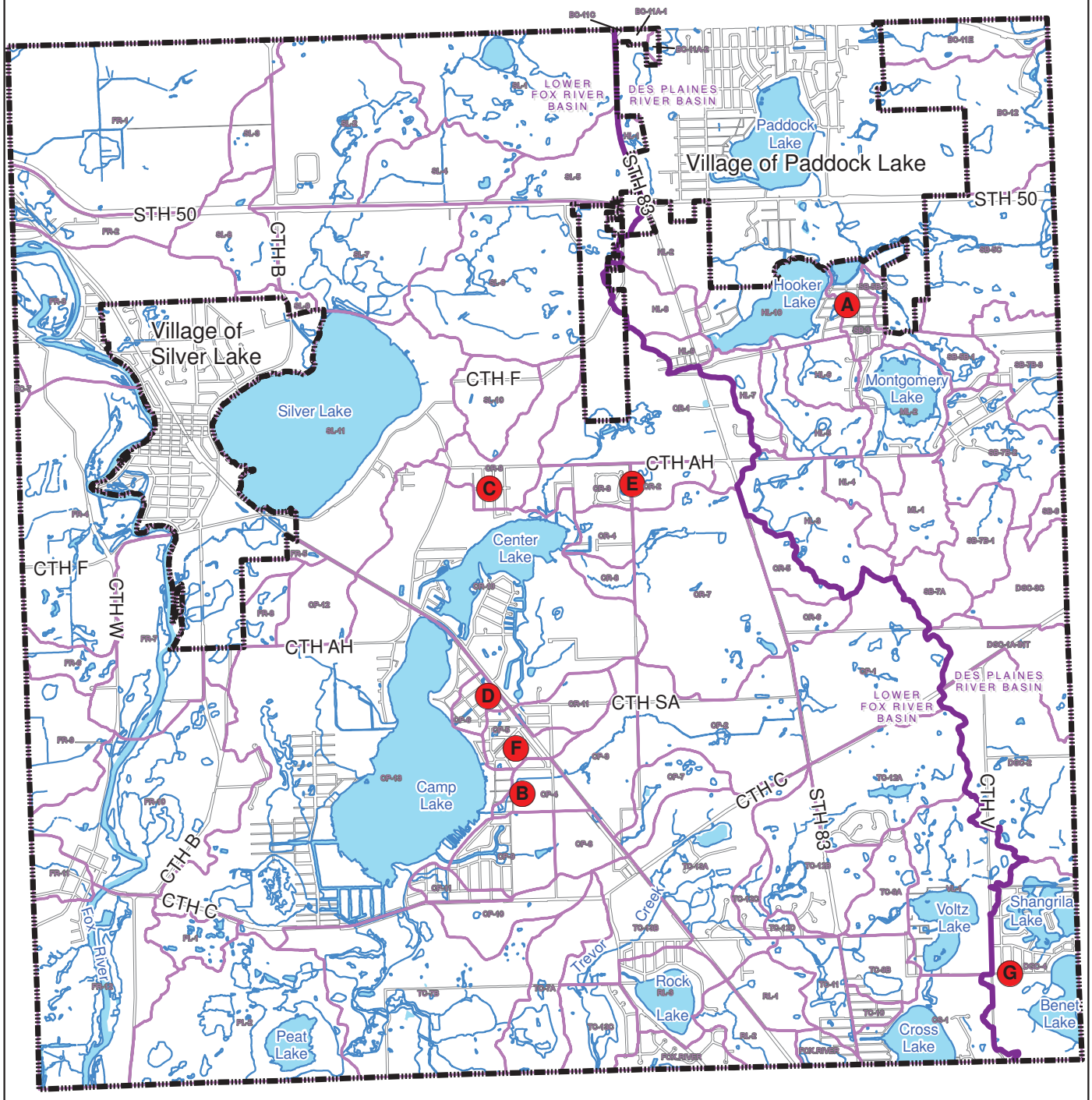


FIGURE 4-4
TOWN OF SALEM
PRIORITY DRAINAGE PROBLEM AREAS

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.

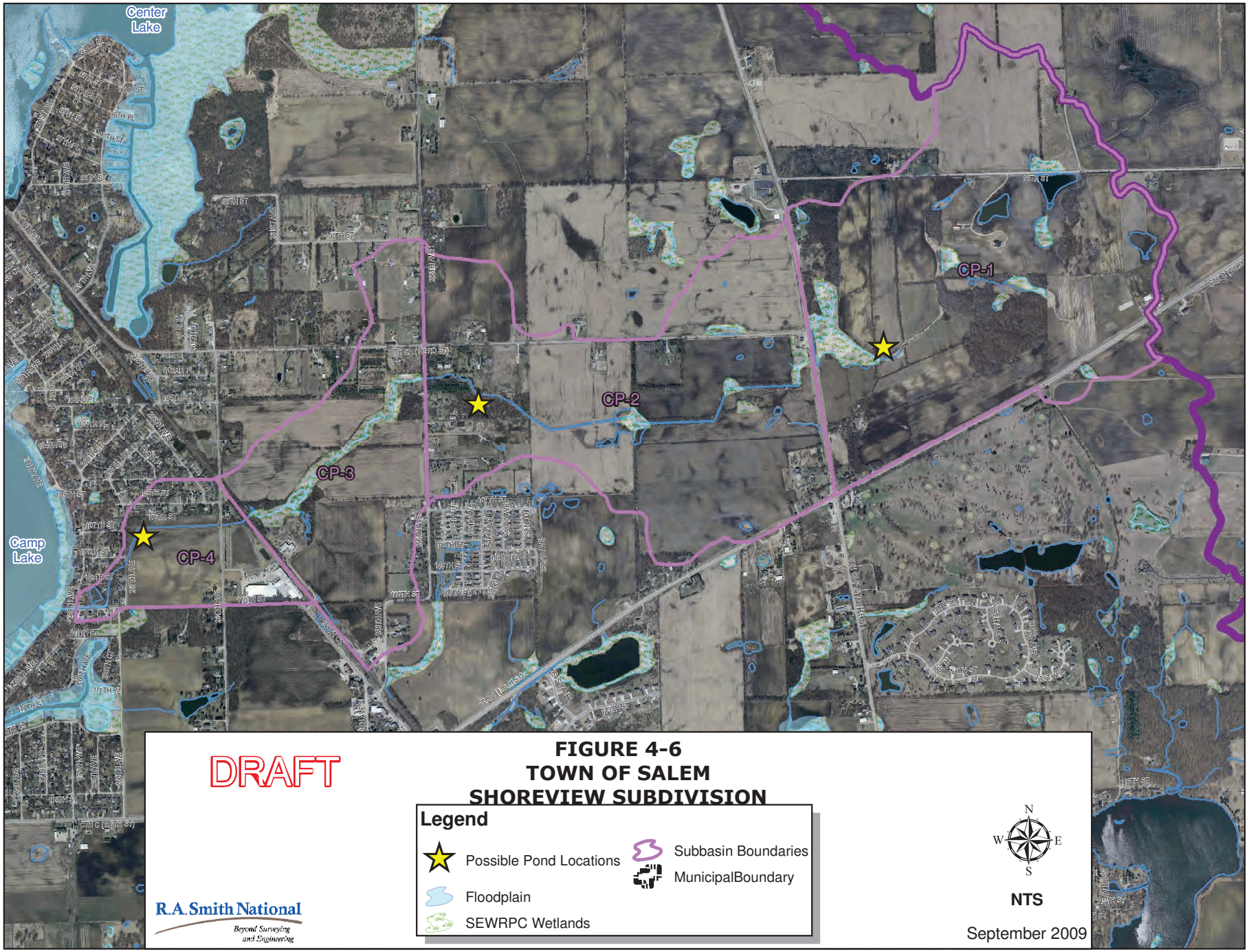
Further study of alternatives to address the flooding problem in this area is recommended. The study would include survey of home elevations, determining the capacity of the channel and culverts, identification of possible detention sites and overbank flood conveyance routes, and evaluation of land acquisition, 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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September 2009

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.

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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

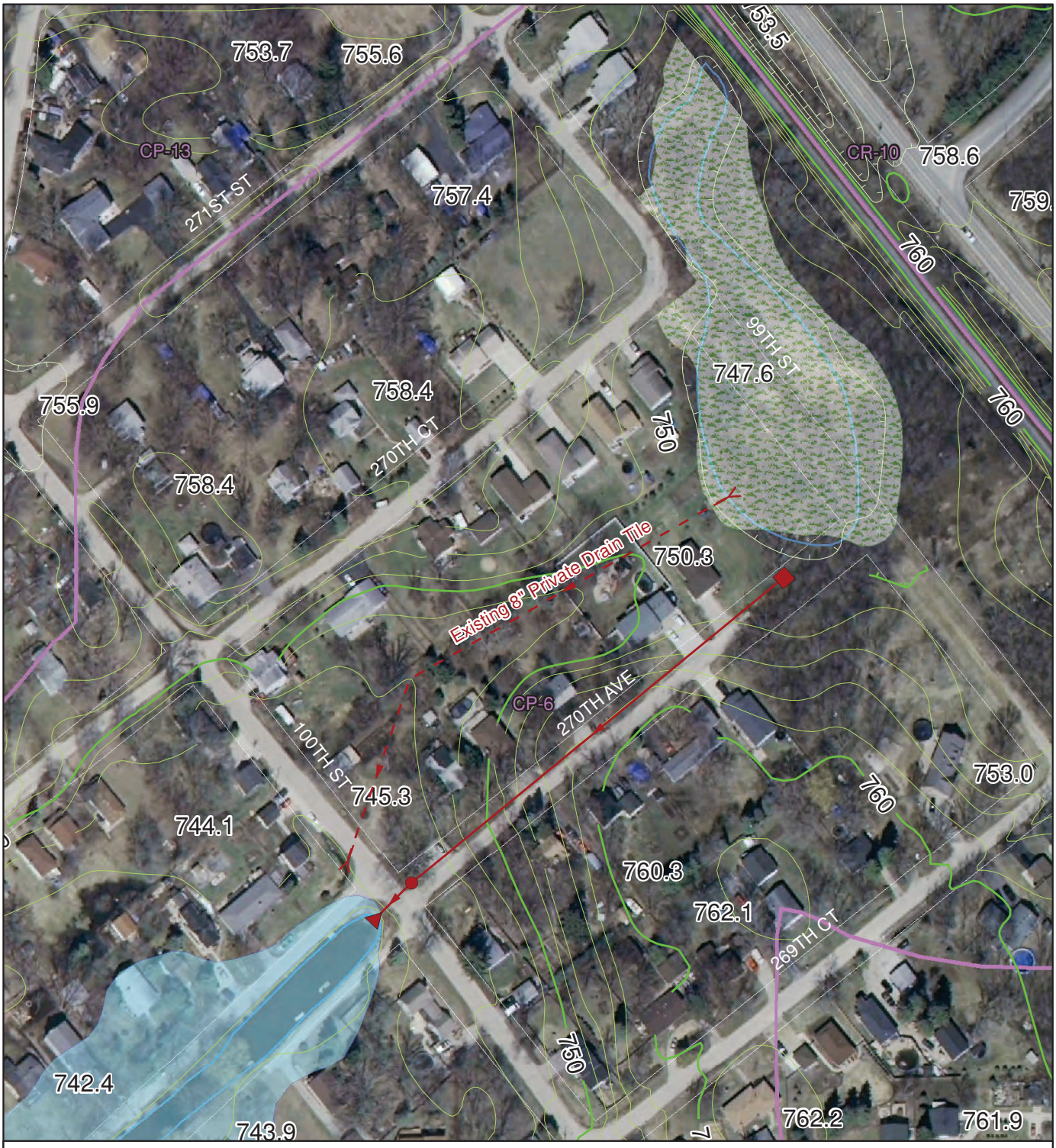

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FIGURE 4-8
TOWN OF SALEM
99TH ST. & 270TH AVE.

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**

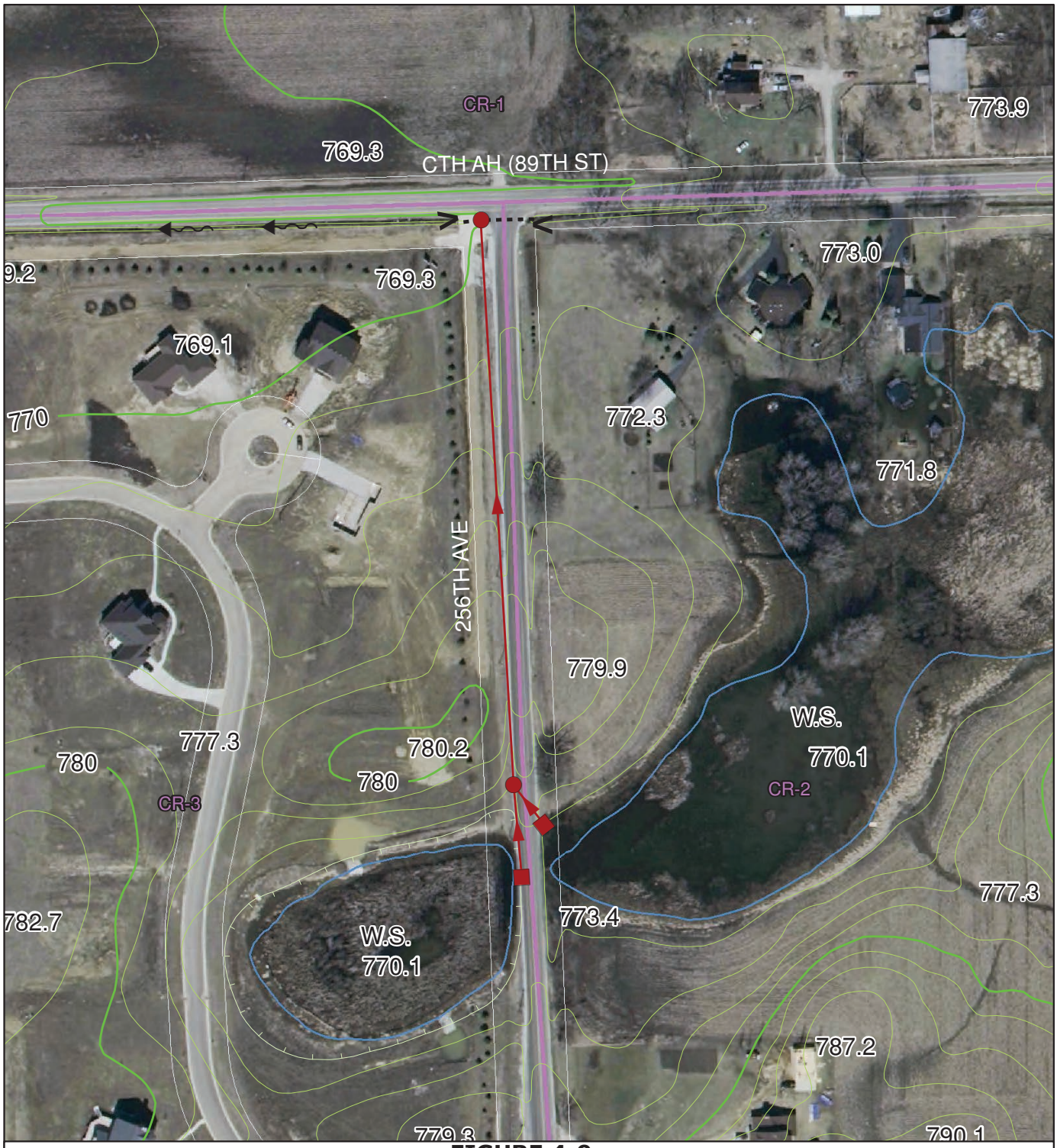

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FIGURE 4-9
TOWN OF SALEM
256TH AVE. & CTH AH (89TH ST.)

Legend

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

N W E S

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Feet

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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

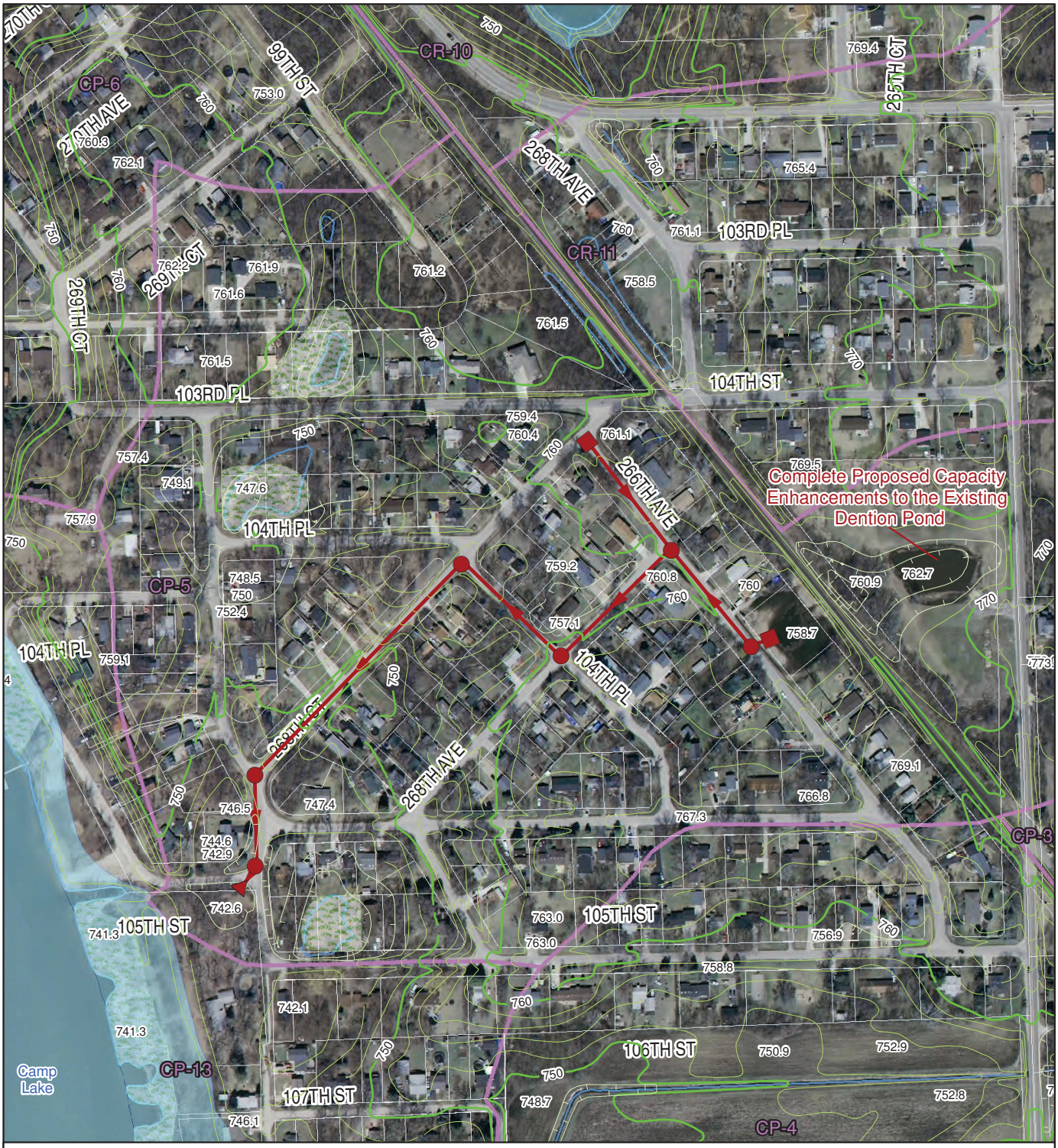

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FIGURE 4-10
TOWN OF SALEM
SUNSET OAKS SUBDIVISION

Legend

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

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Feet

September 2009

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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.

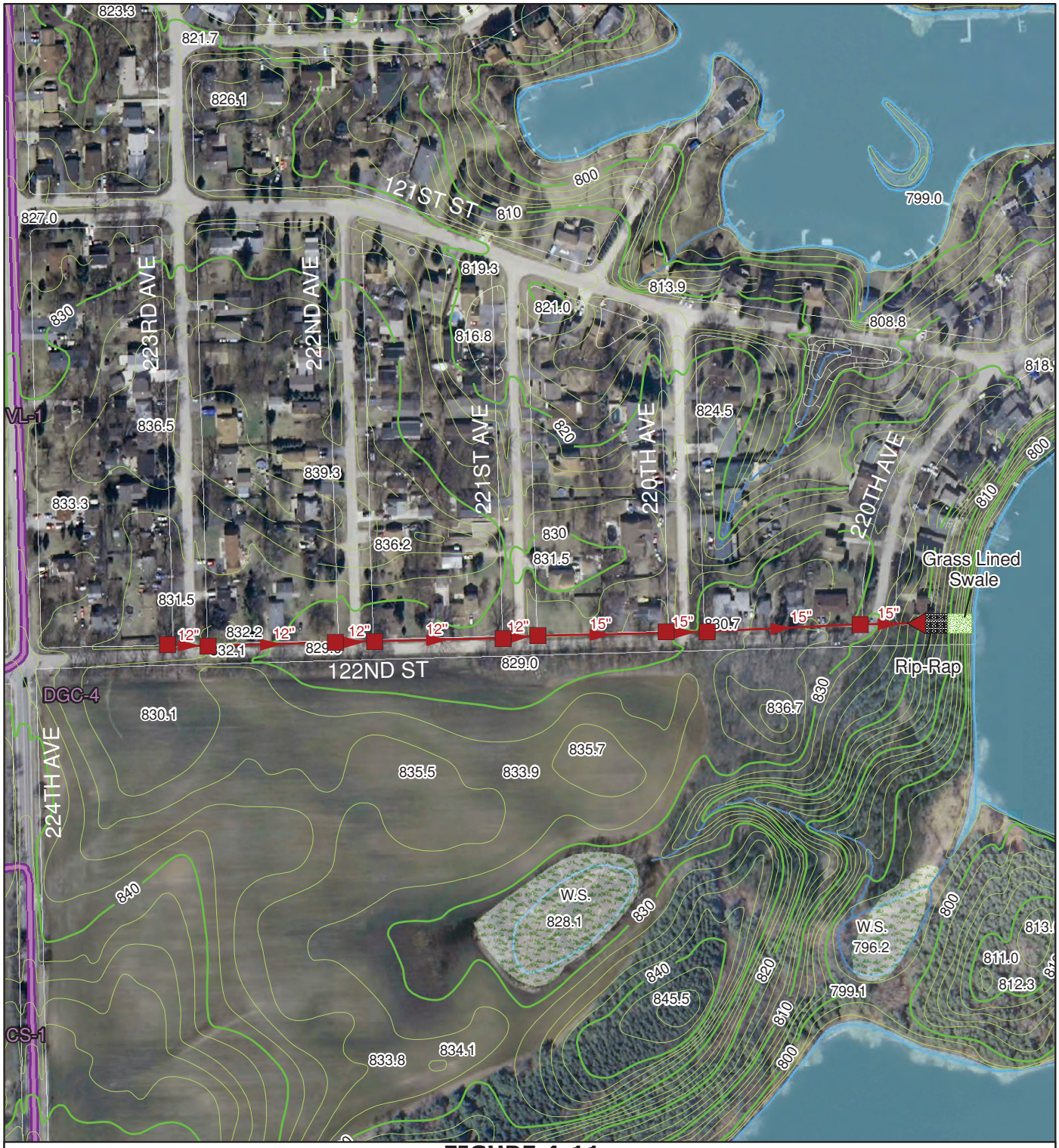

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FIGURE 4-11
TOWN OF SALEM
122ND STREET & 224TH AVENUE

Legend

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

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Feet

December 2009

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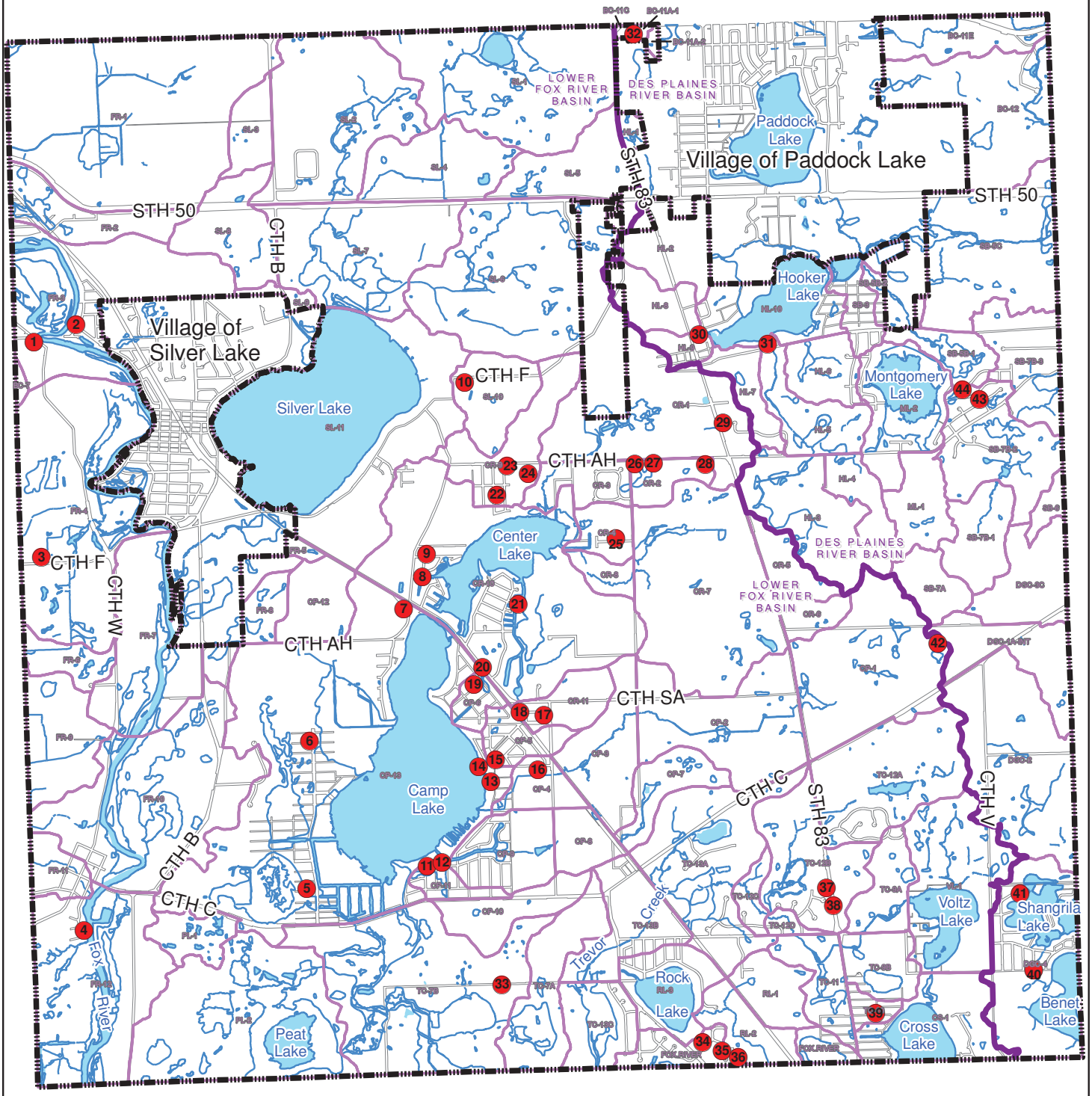

FIGURE 4-12
TOWN OF SALEM
DRAINAGE COMPLAINT INVENTORY

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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

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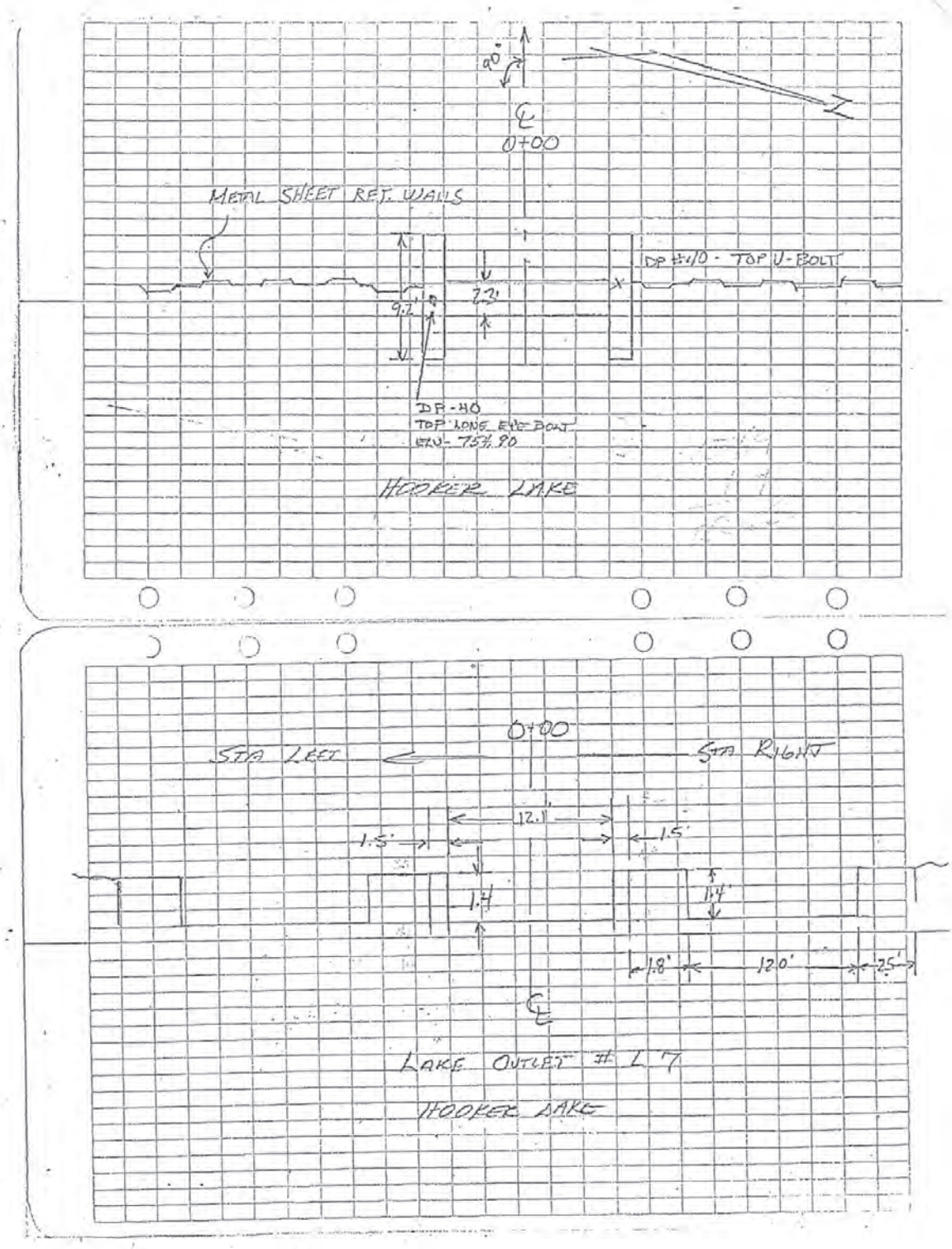
STRUCTURE NO. L7
HOOKER LAKE OUTLET

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'
7.5'
℄
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	TP		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

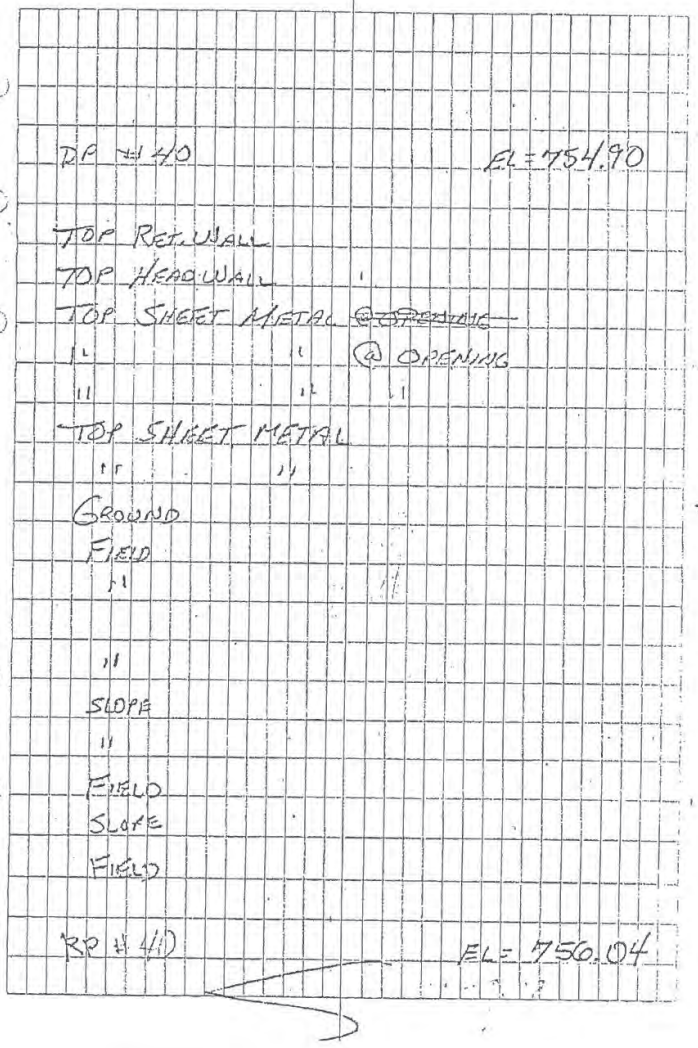
FIELD

" "

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+06 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



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AYRES ASSOCIATES

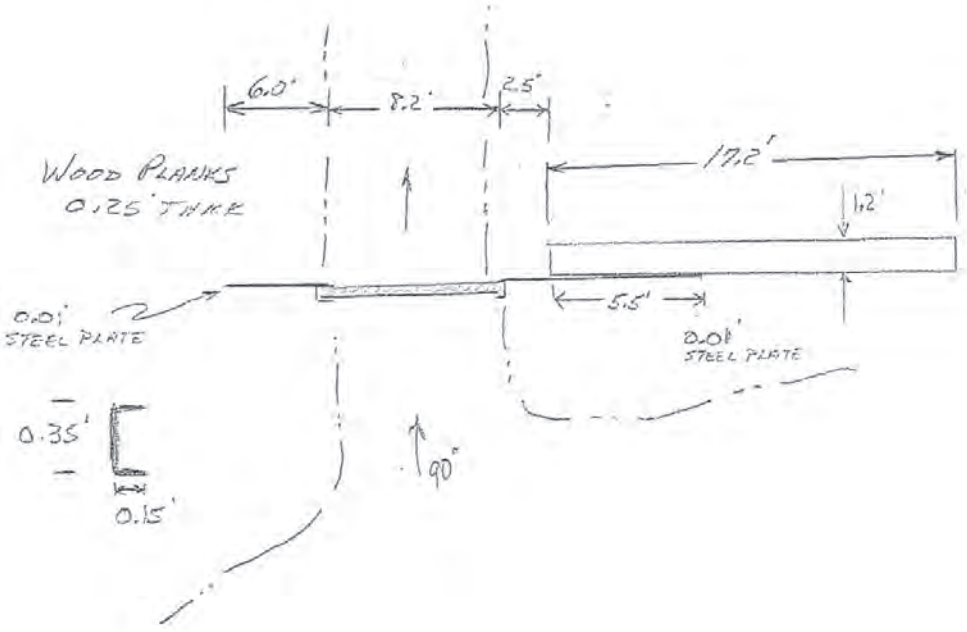
Page _____ of _____

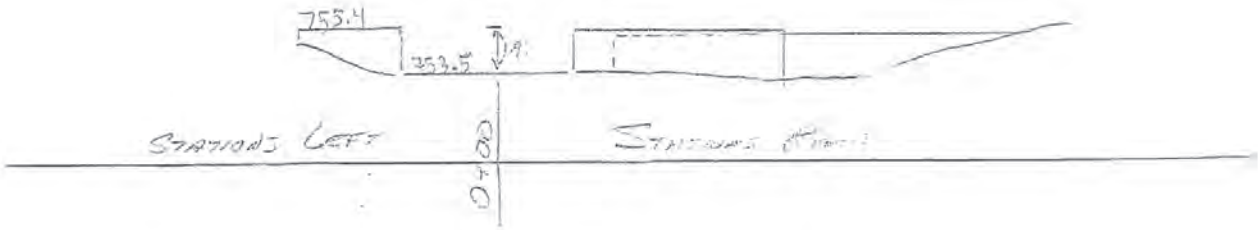
FIELD REPORT DATE: 23 MAY 94 JN: 22-0135.00 INITIALS LC

STRUCTURE # 1000A

SALEM BRANCH OF BRIGHTON CREEK

DP-1000A IS 1.0 M TREE
25' ± NORTH OF STRUCTURE





STRUCTURE 1000 A

	+	HI	−	
TP 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
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+06.6R			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

TP 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
Ground Top End of Steel Plate
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 758.616

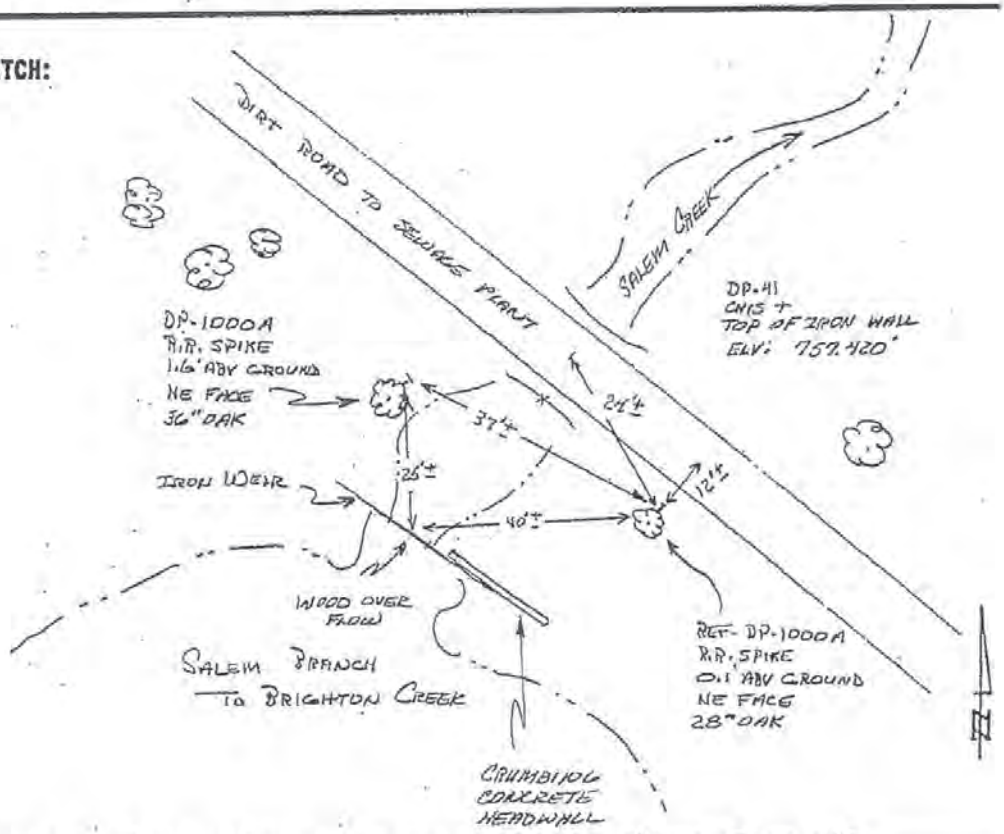
SET BY: OWEN AYRES & ASSOCIATES, ENGINEERS, MADISON, WISCONSIN

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'

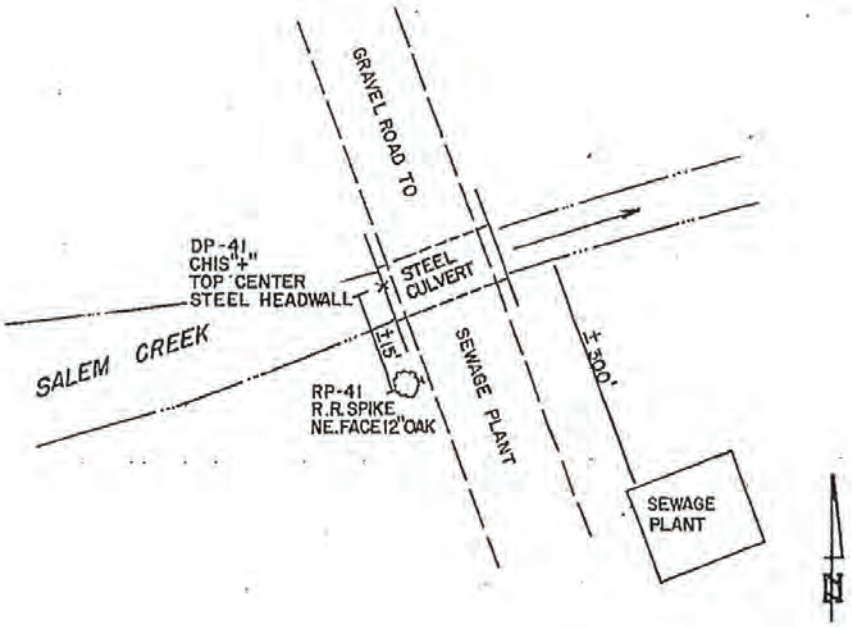
SET BY: ALSTER & ASSOCIATES, INC., ENGINEERS, MADISON, WISCONSIN

VERTICAL DATUM: MEAN SEA LEVEL, 1929 ADJUSTMENT

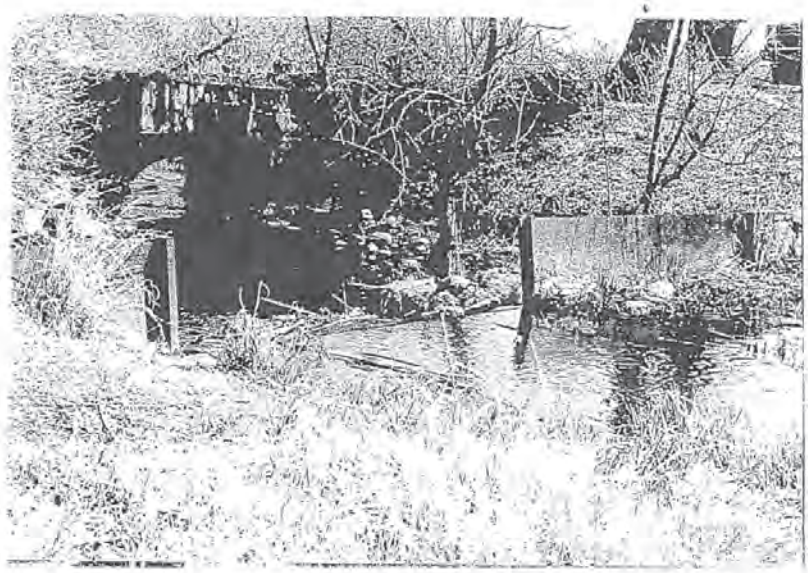
VERTICAL CONTROL ACCURACY:

DATE OF SURVEY: January 1977

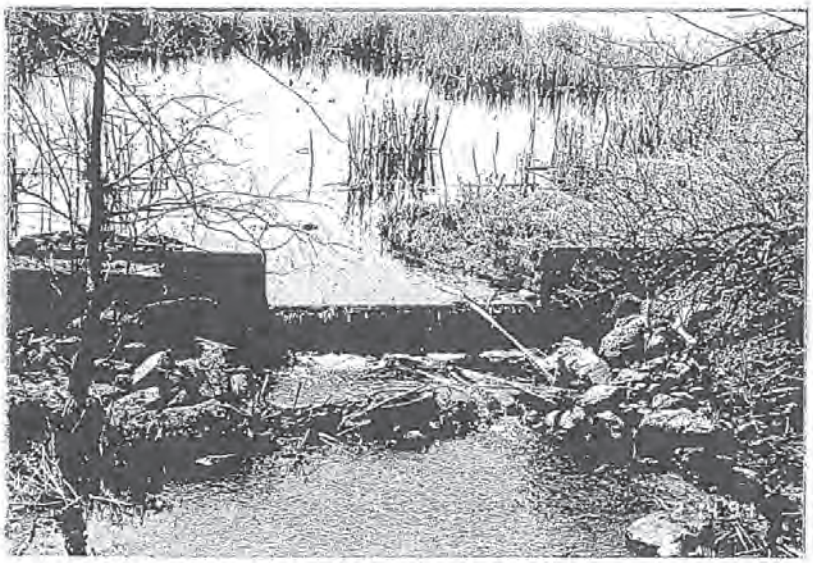
LOCATION SKETCH:



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



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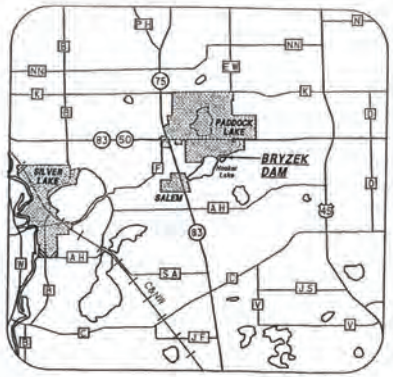
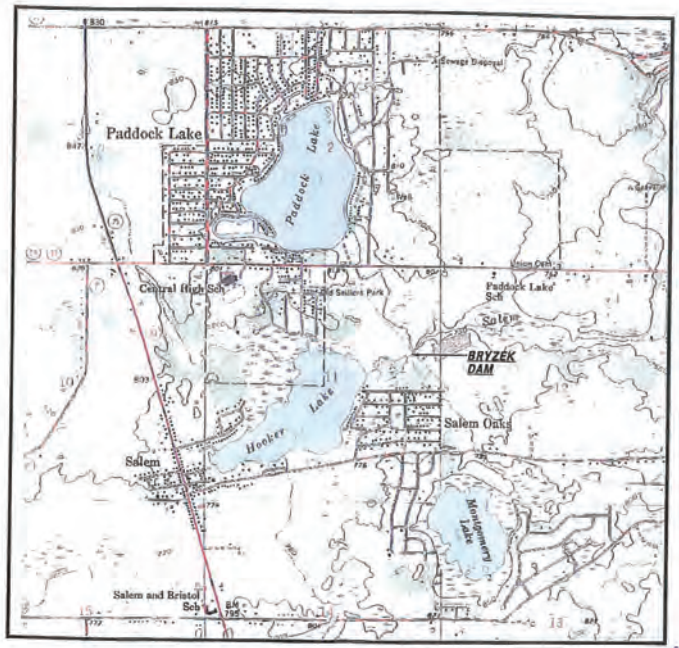
BRYZEK DAM – RECORD DOCUMENTS

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

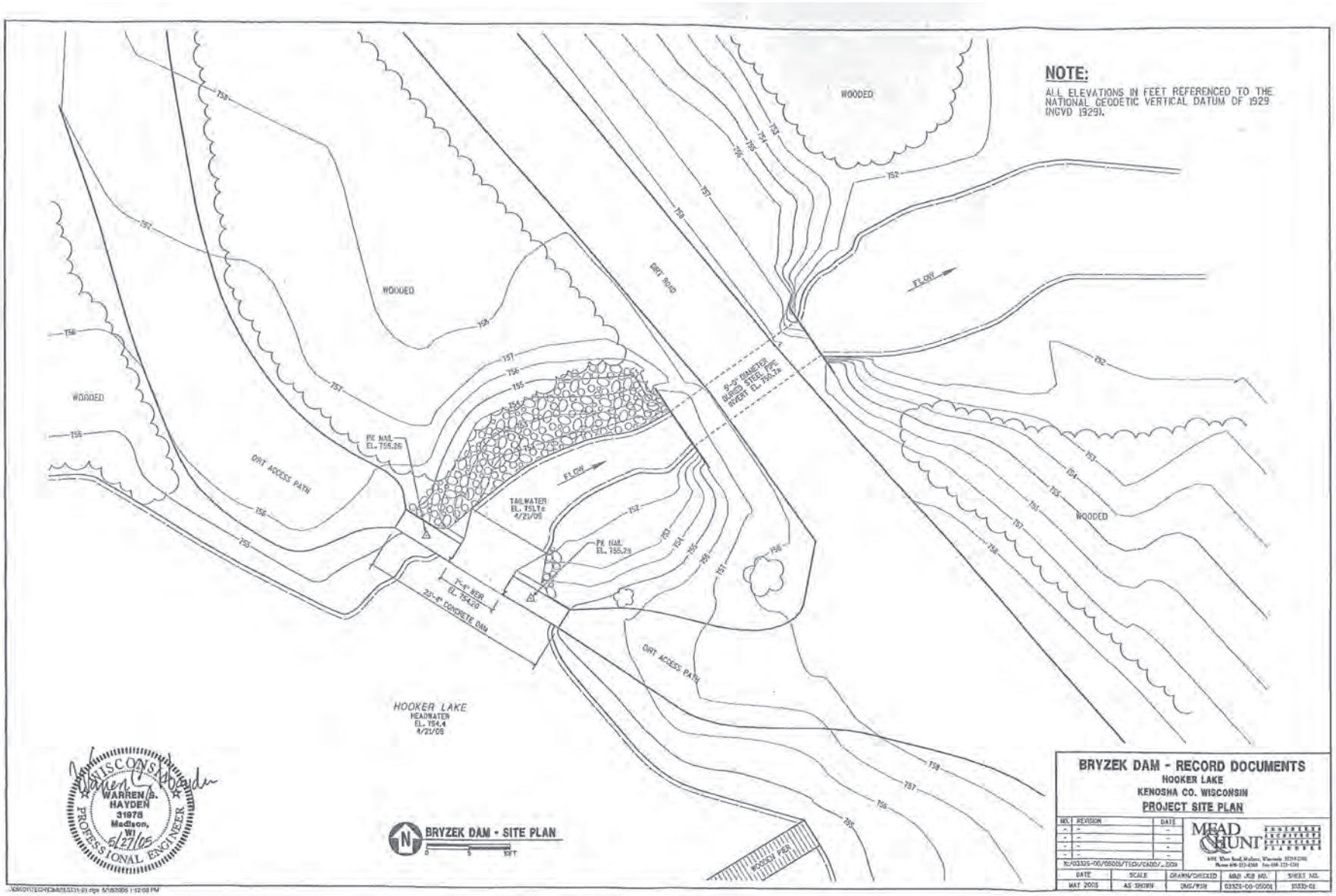
BRYZEK DAM - RECORD DOCUMENTS
HOOKER LAKE
KENOSHA CO. WISCONSIN
TITLE SHEET, DRAWING INDEX AND NOTES

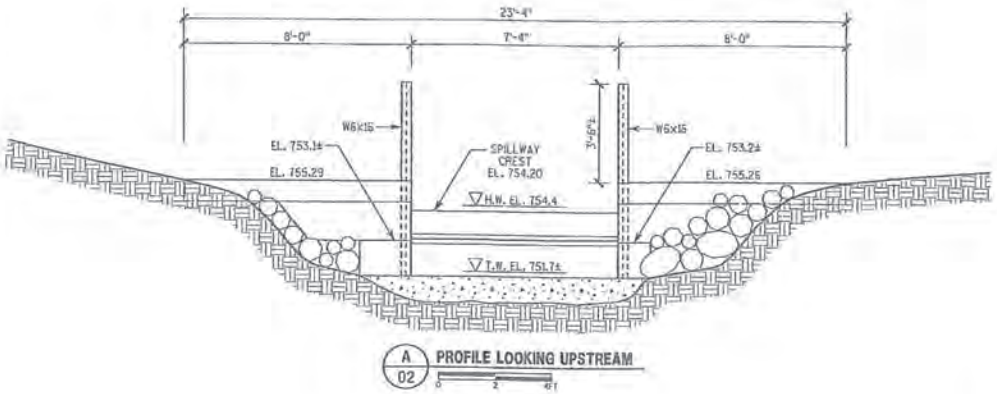
NO.	REVISION	DATE
-	-	-
-	-	-
-	-	-
-	-	-

MEAD & HUNT

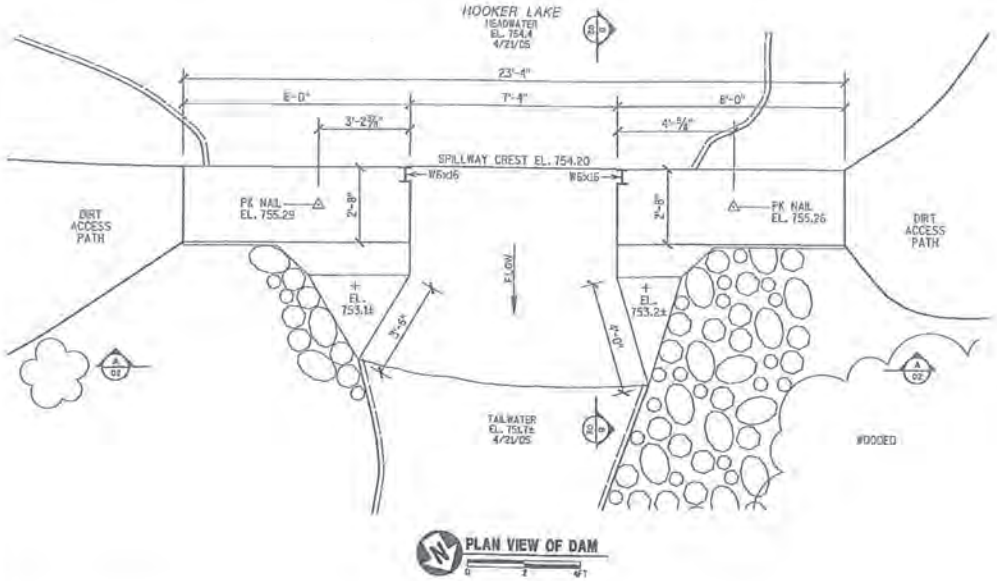
J:\03326-00\05001\TECH\CADD\...DGN

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. 03325-00-05001
SHEET NO. 1033-01



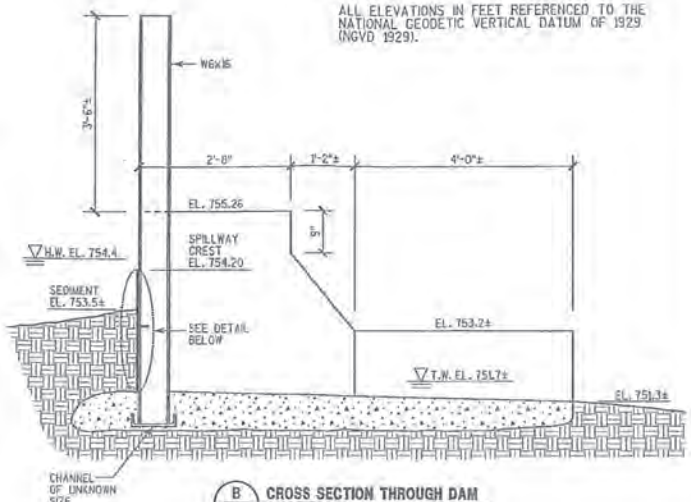
A/02 PROFILE LOOKING UPSTREAM



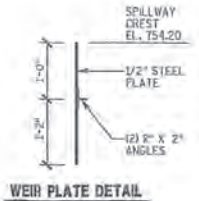
N PLAN VIEW OF DAM

NOTE:

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



B/02 CROSS SECTION THROUGH DAM



WEIR PLATE DETAIL

WISCONSIN
WARREN S. HAYDEN
31978
Madison, WI
5/27/05
PROFESSIONAL ENGINEER

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.

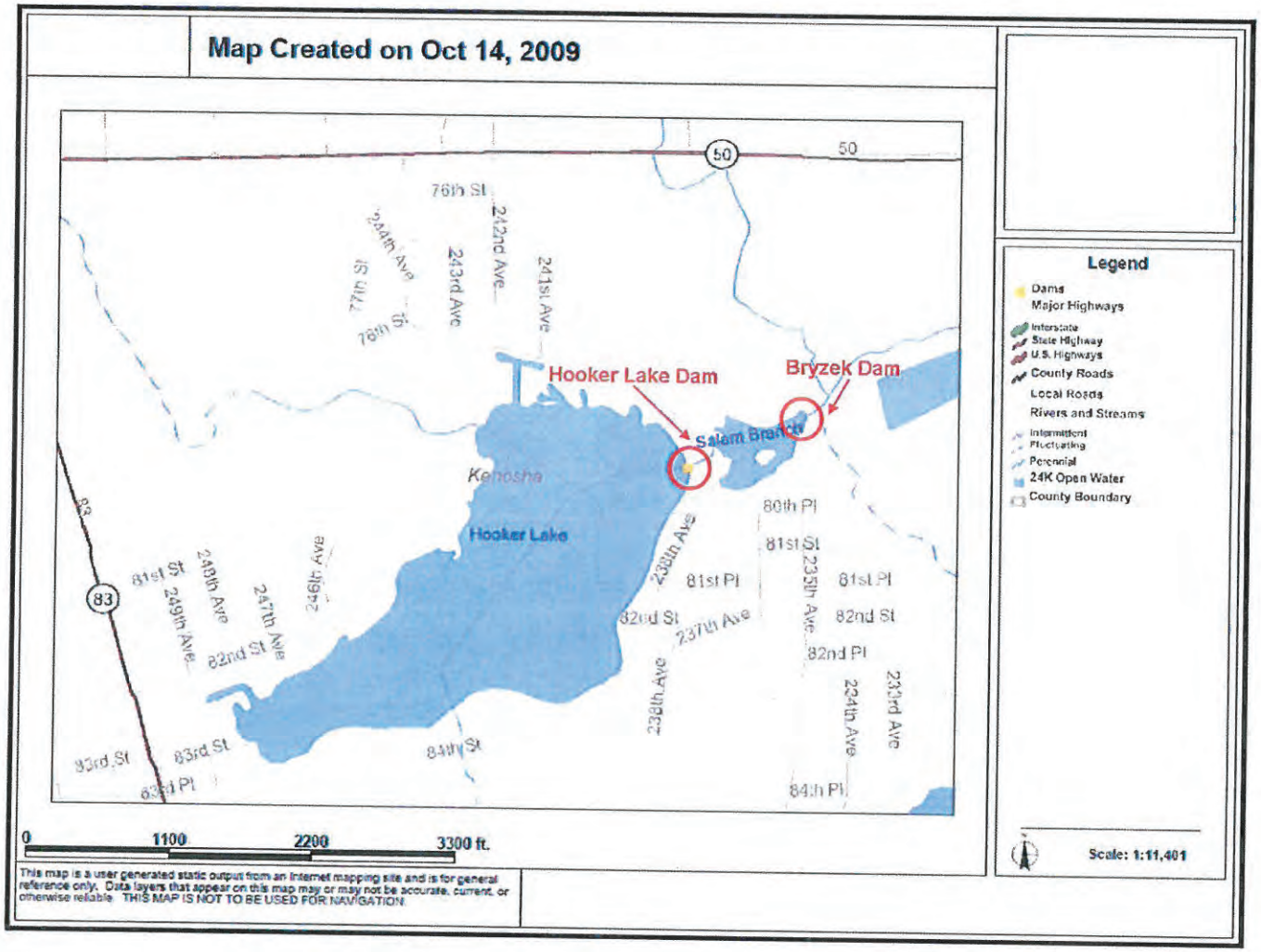
5 Southeastern Wisconsin Regional Planning Commission Record of Vertical Control Station, Structure #1000A, March 1994

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)

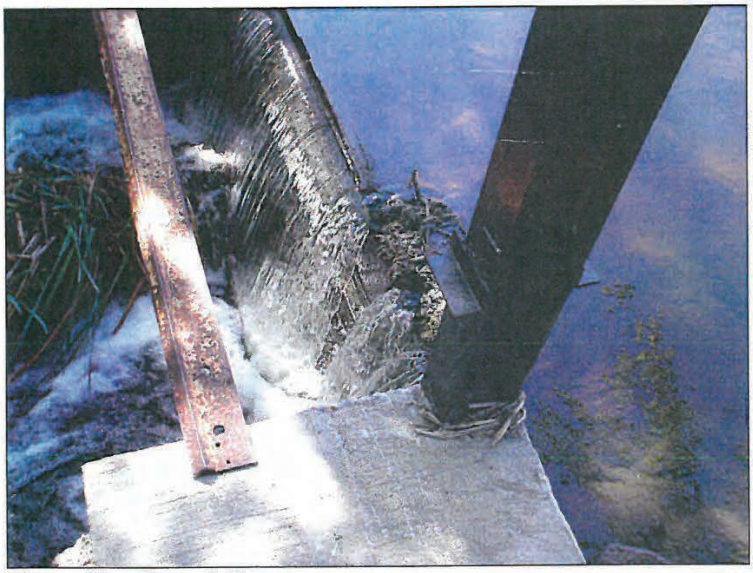


Photo #2 – Bryzek Dam
(May 20, 2009)

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)

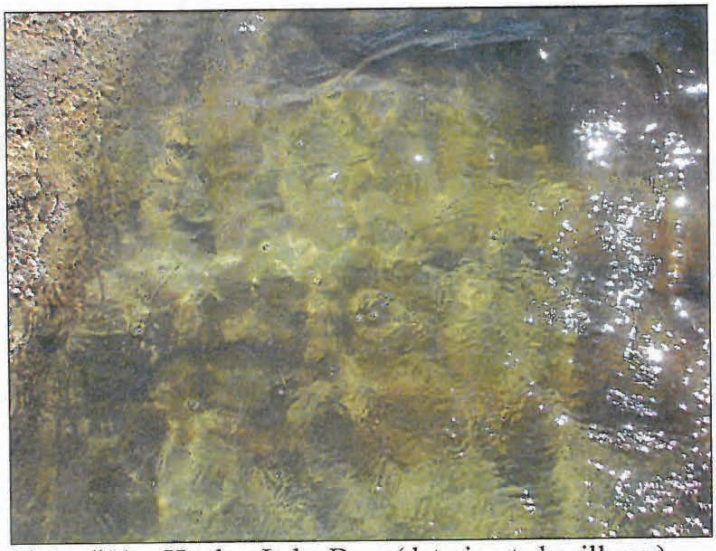


Photo #11 – Hooker Lake Dam (deteriorated spillway)
(May 20, 2009)

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)

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Appendix F

HOOKER LAKE
AQUATIC PLANT SPECIES DETAILS

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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

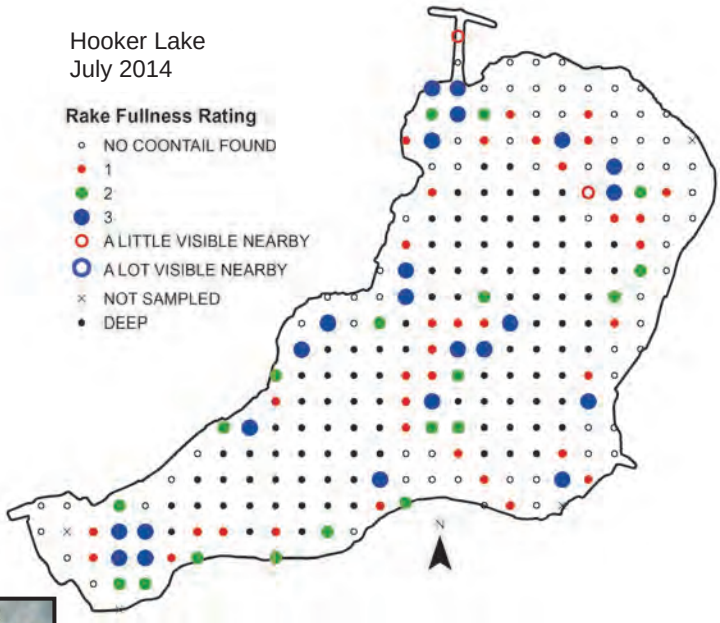
Identifying Features

- 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

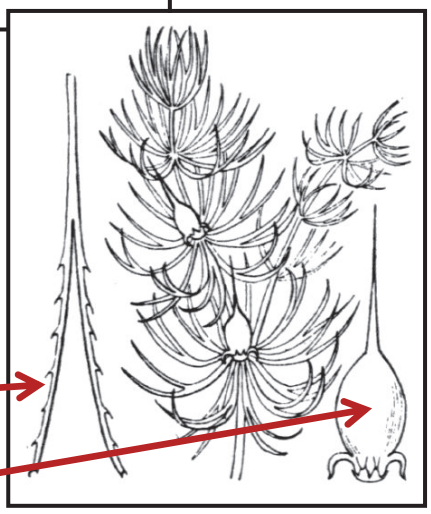


Second-Order Leaf Branching

First-Order Leaf Branching

Toothed Leaf Margins

Fruit (rare)



Chara spp.
Native

Muskgrasses
Algae (not vascular plants)

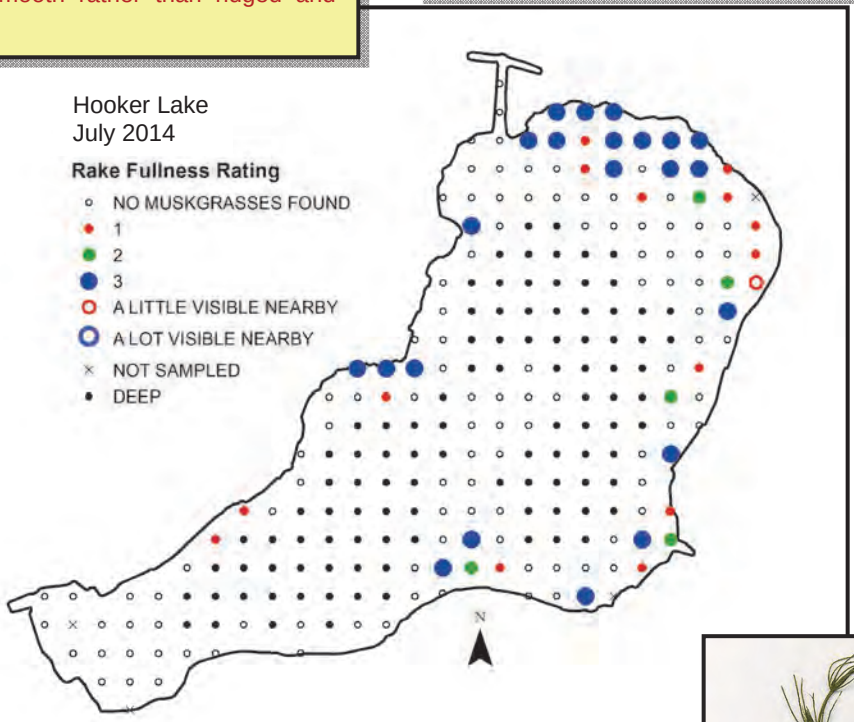
Identifying Features

- 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

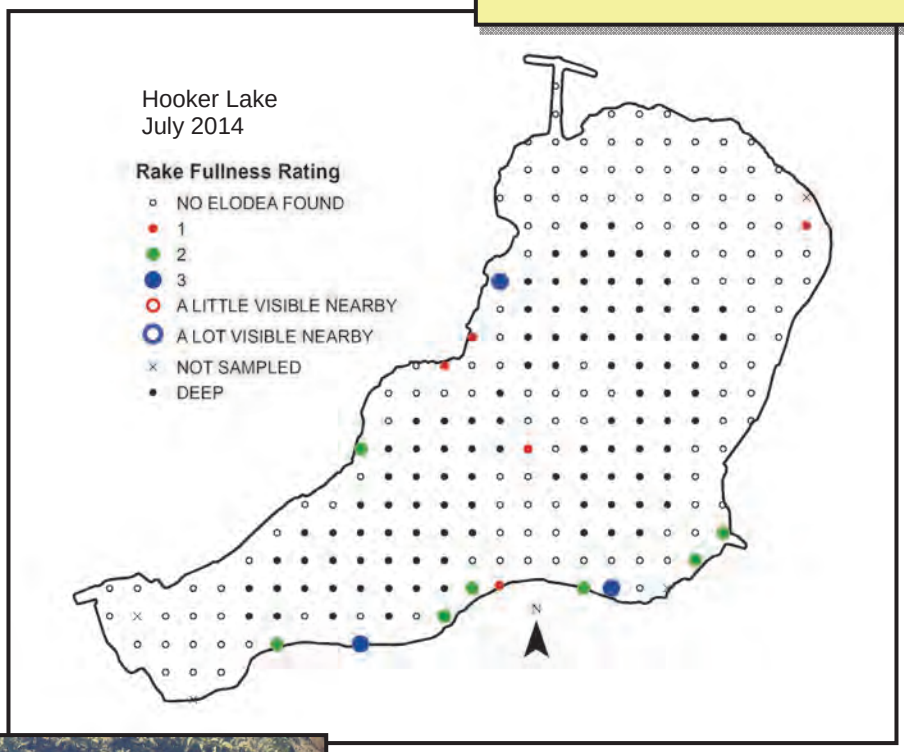
Native

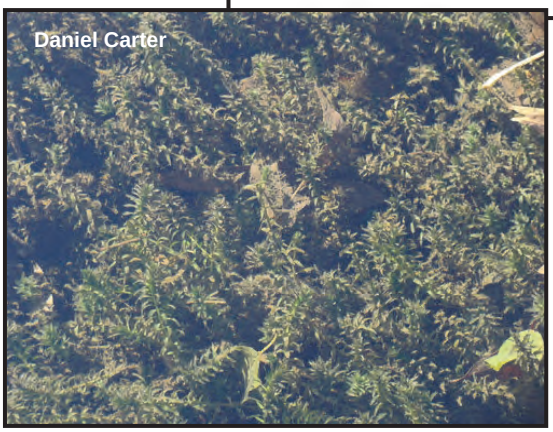
Identifying Features

- 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

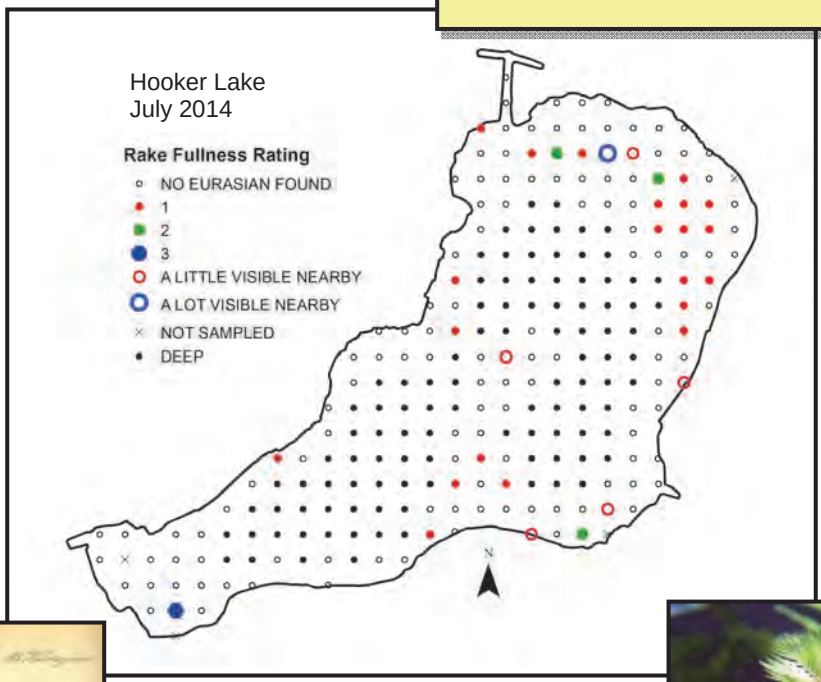
Identifying Features

- 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

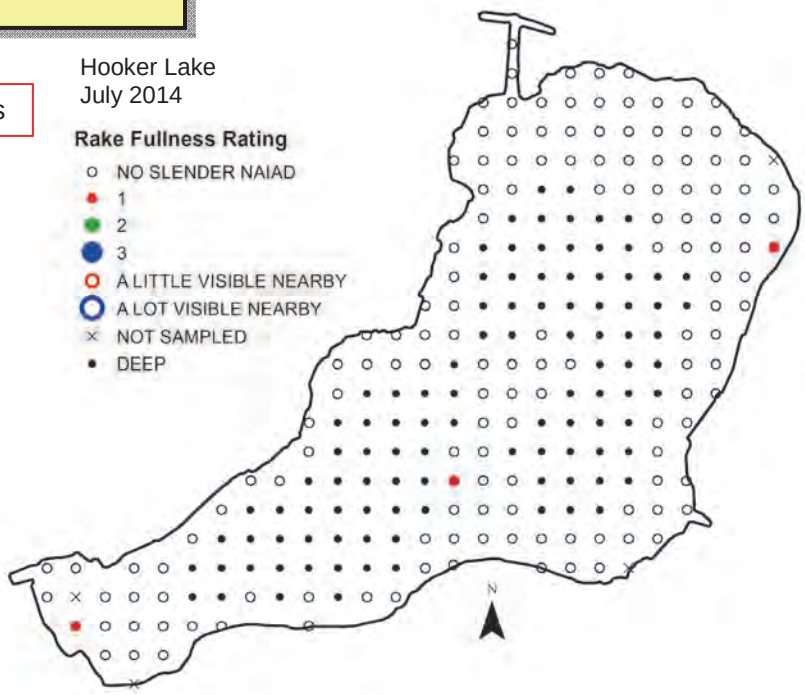
- Leaves narrow (0.4 to 1.0 mm) and pointed with broader bases where they attach to the stem and finely serrated margins
- Flowers, when present, tiny and located in leaf axils
- Variable size and spacing of leaves, as well as compactness of plant, depending on growing conditions

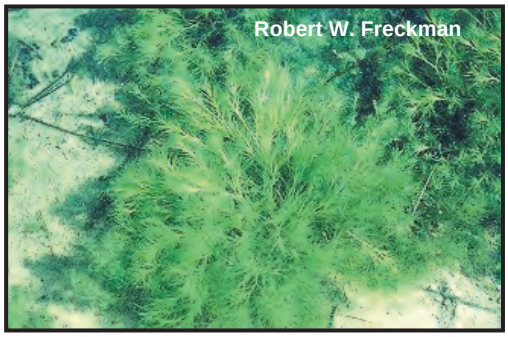
Two other *Najas* occur in southeastern Wisconsin. Southern naiad (*N. guadalupensis*) has wider leaves (to 2.0 mm). Spiny naiad (*N. marina*) has coarsely toothed leaves with spines along the midvein below

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

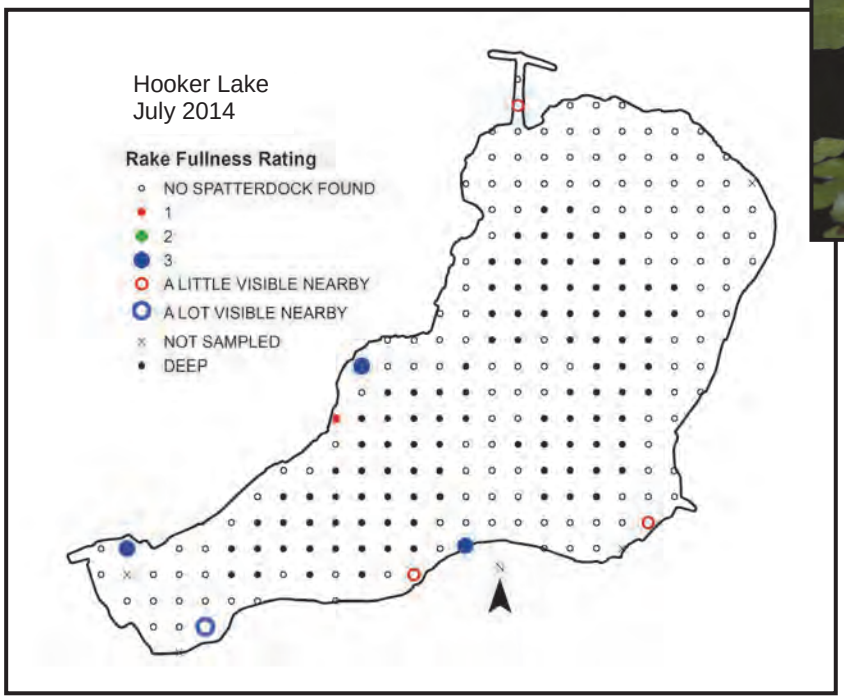
- Leaf stalks winged in cross-section
- Most leaves floating on the water surface, heart-shaped, and notched, with rounded lobes at the base
- Yellow flowers, 2.5 to 5.0 cm wide, often with maroon patches at the bases of the sepals (petal-like structures) when viewed from above

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

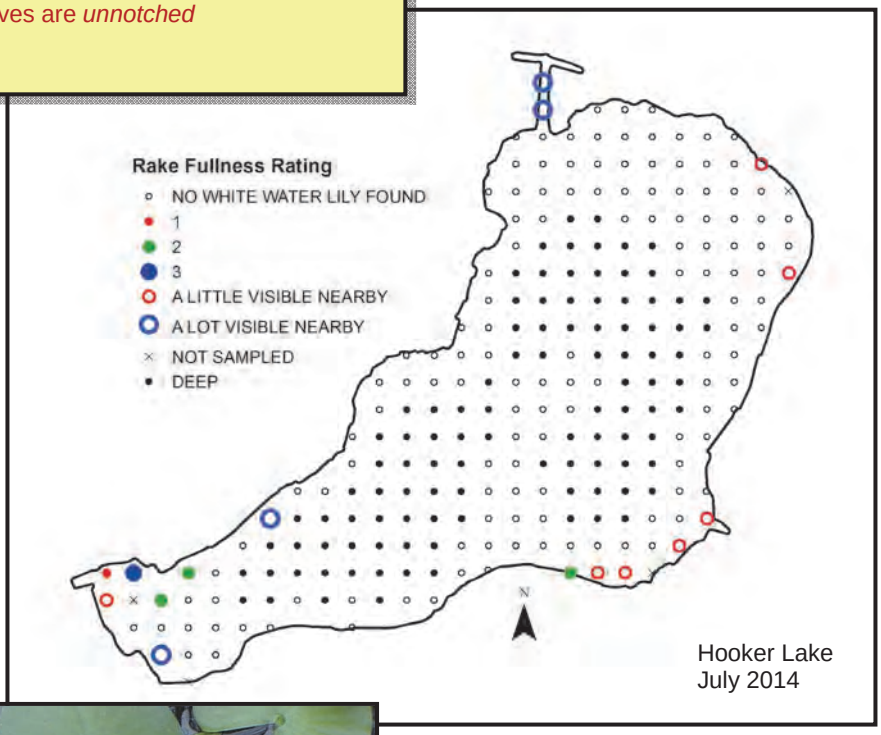
Identifying Features

- 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

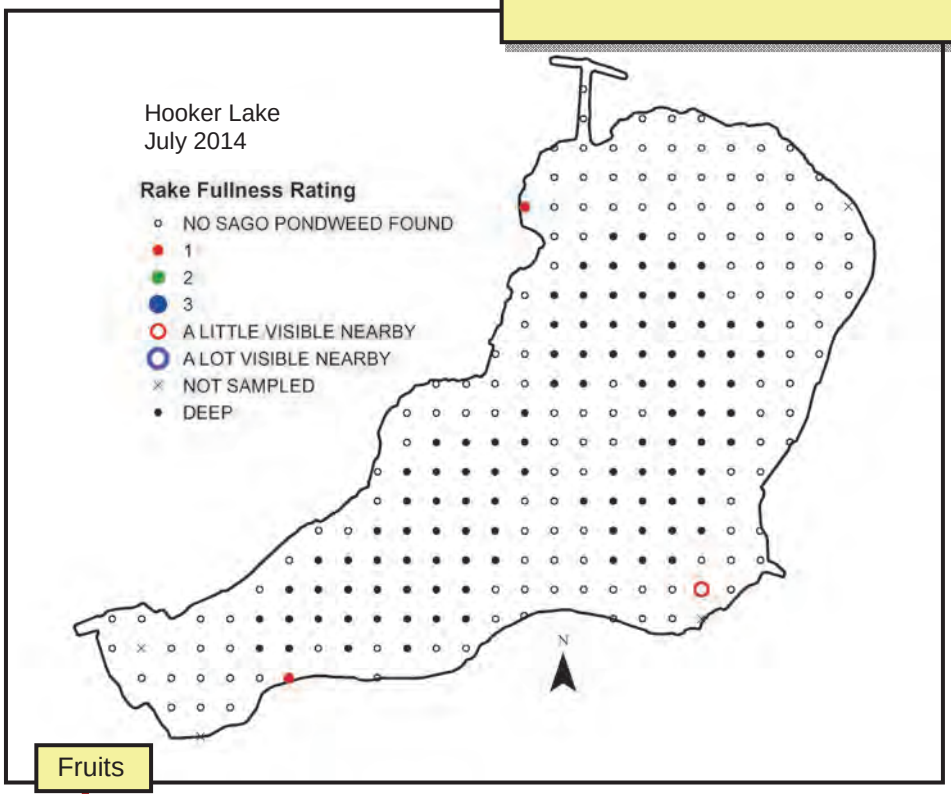
Native

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

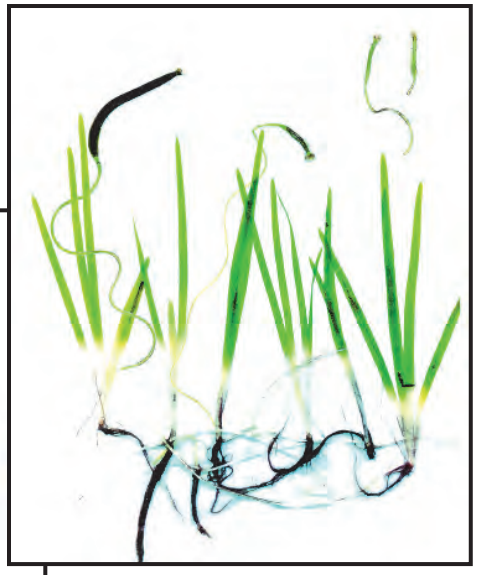
Identifying Features

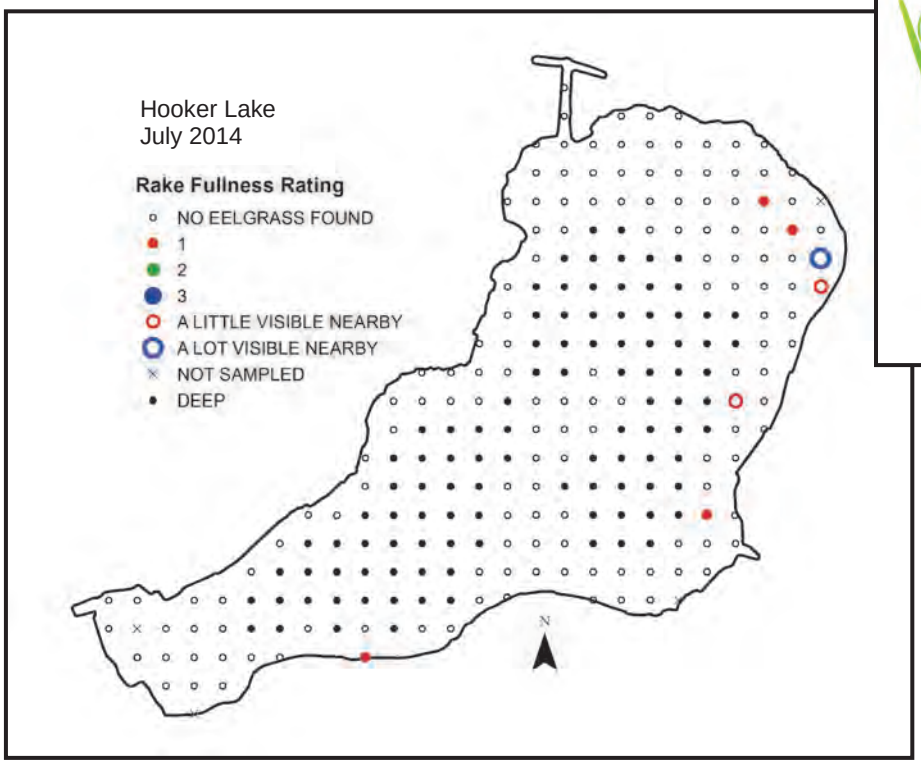
- Leaves ribbon-like, up to two meters long, with a prominent stripe down the middle, and emerging in clusters along creeping rhizomes
- Male and female flowers on separate plants, female flowers raised to the surface on spiral-coiled stalks

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

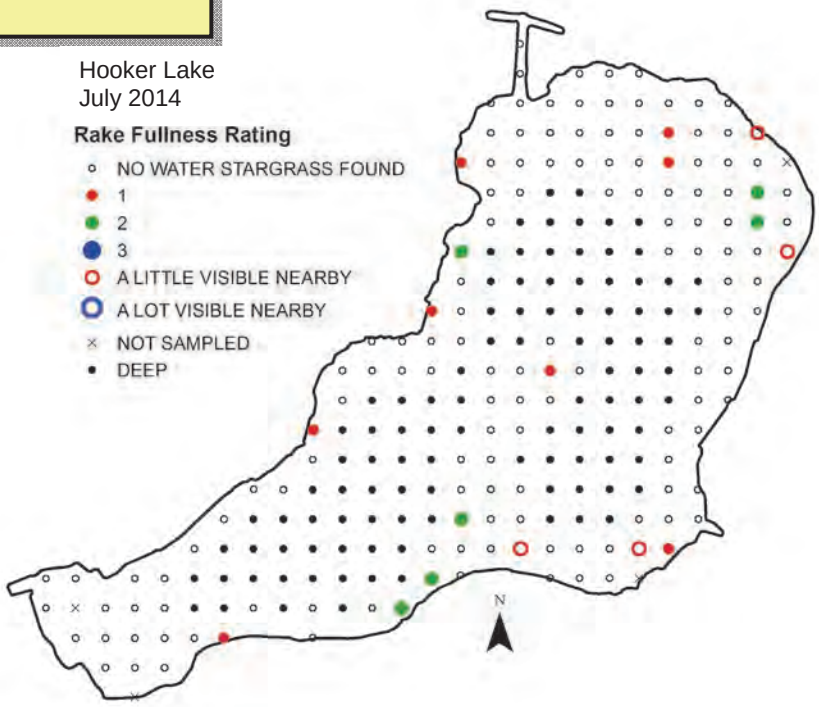
Identifying Features

- 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

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Appendix G

INVASIVE AQUATIC AND WETLAND SPECIES

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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)

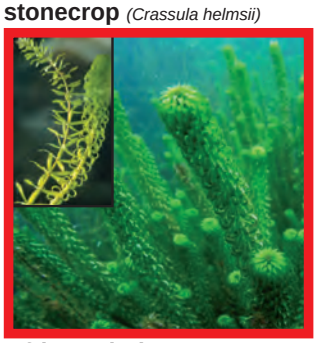
Eurasian water milfoil
(Myriophyllum spicatum)

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)

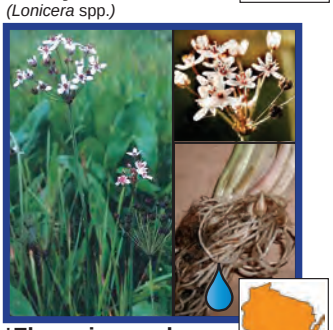
Glossy buckthorn
(Frangula alnus = Rhamnus frangula)

Non-native bush honeysuckles
(Lonicera spp.)

Canada thistle
(Cirsium arvense)

Common forget-me-not
(Myosotis scorpioides)

Dame's rocket
(Hesperis matronalis)

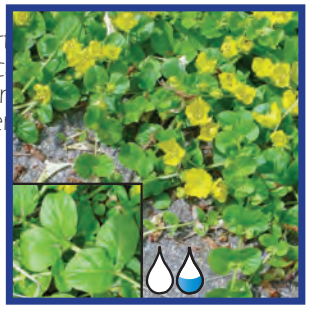


***Flowering rush**
(Butomus umbellatus)

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

Garlic mustard
(Alliaria petiolata)

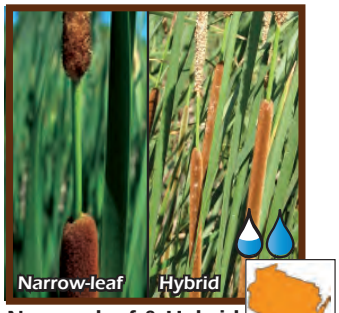
***Japanese & Giant knotweed** *(Polygonum cuspidatum & P. sachalinense)*



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)

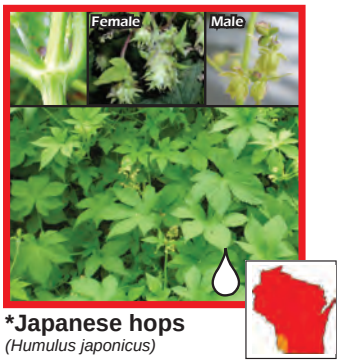
VERY WET (Deep marsh, Shallow marsh)

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)*

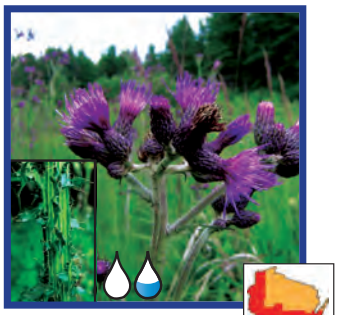
***Chinese yam** *(Dioscorea oppositifolia)*



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

Annual salt marsh aster *(Symphyotrichum subulatum)*

Cut-leaved teasel *(Dipsacus laciniatus)*

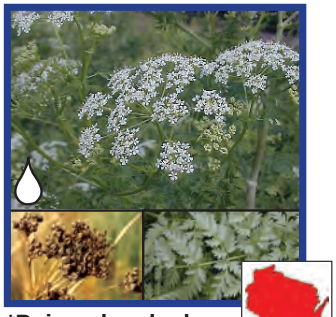


***European marsh thistle** *(Cirsium palustre)*

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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Appendix H

2,4-D CHEMICAL FACT SHEET

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2,4-D Chemical Fact Sheet

Formulations

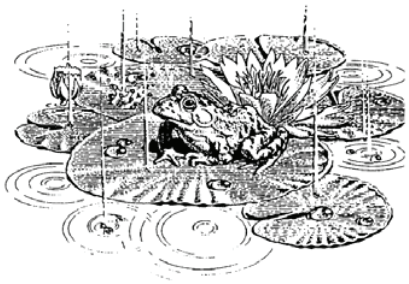
2,4-D is an herbicide that is widely used as a household weed-killer, agricultural herbicide, and aquatic herbicide. It has been in use since 1946, and was registered with the EPA in 1986 and re-reviewed in 2005. The active ingredient is 2,4-dichloro-phenoxyacetic acid. There are two types of 2,4-D used 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/

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