
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.

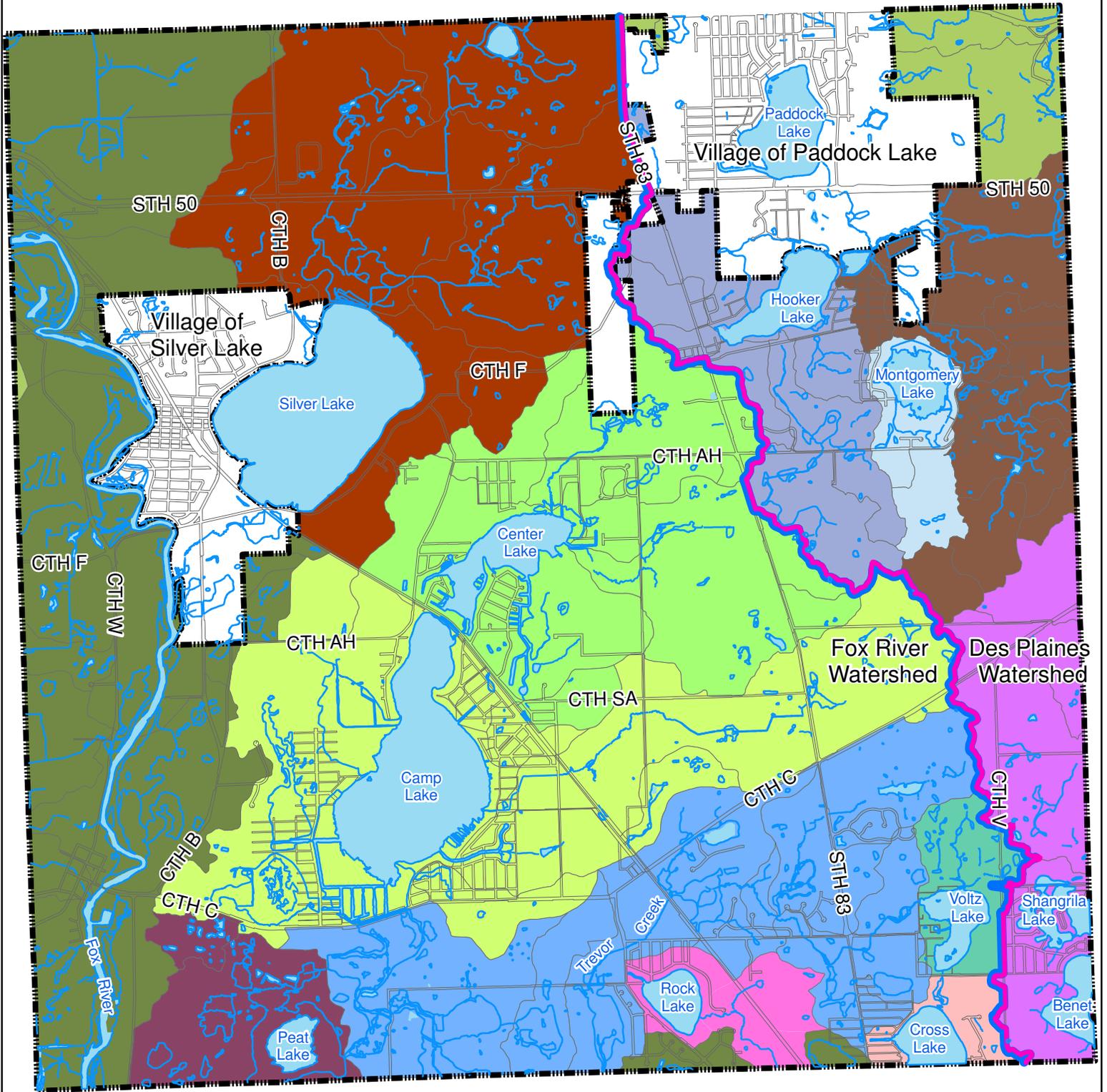
Runoff Curve Number

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.



**FIGURE 4-1
TOWN OF SALEM
SUBWATERSHED BOUNDARIES EXHIBIT**

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



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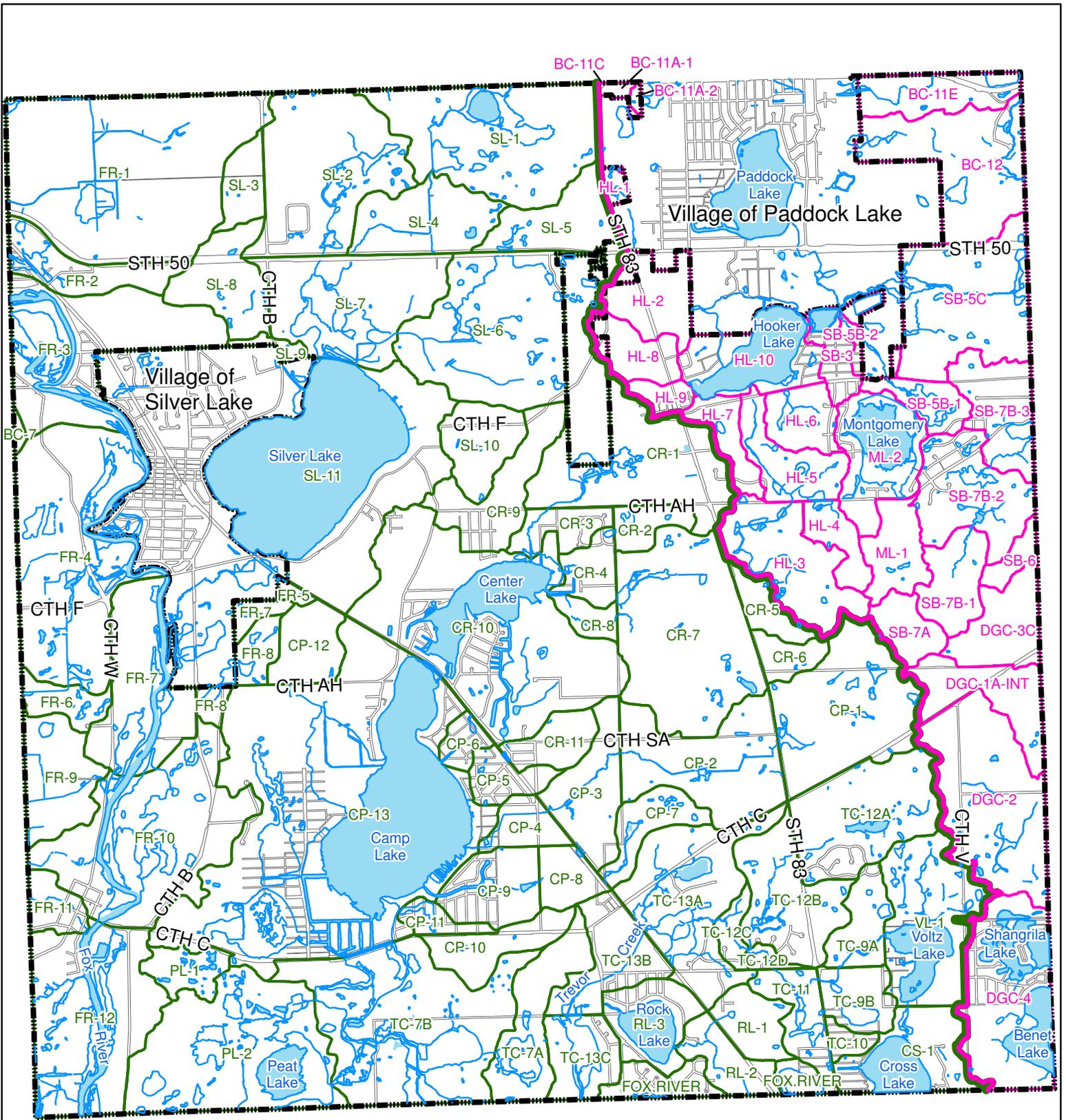


FIGURE 4-2
TOWN OF SALEM
SUBBASIN BOUNDARIES EXHIBIT

Legend	
	Municipal Boundary
	Major Watershed Division
	Des Plaines Watershed
	Fox River Watershed
	Subbasin ID



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

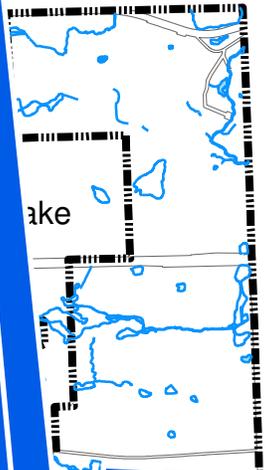
³ UW Extension Lakes

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.



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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.

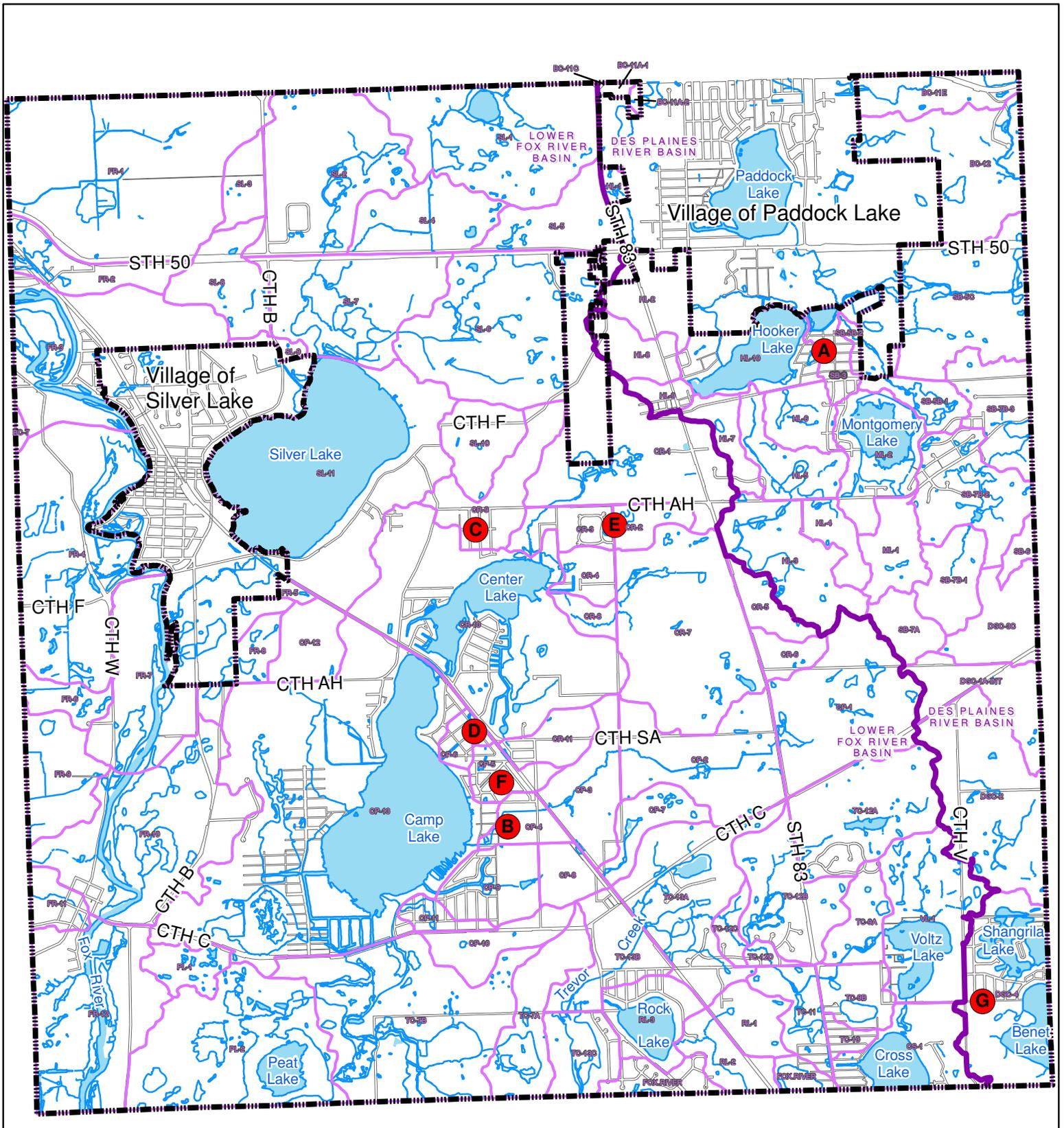
Benefits

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**

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Legend

- Priority Drainage Problem Areas
- Municipal Boundary
- Subbasin Boundaries



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December 2009

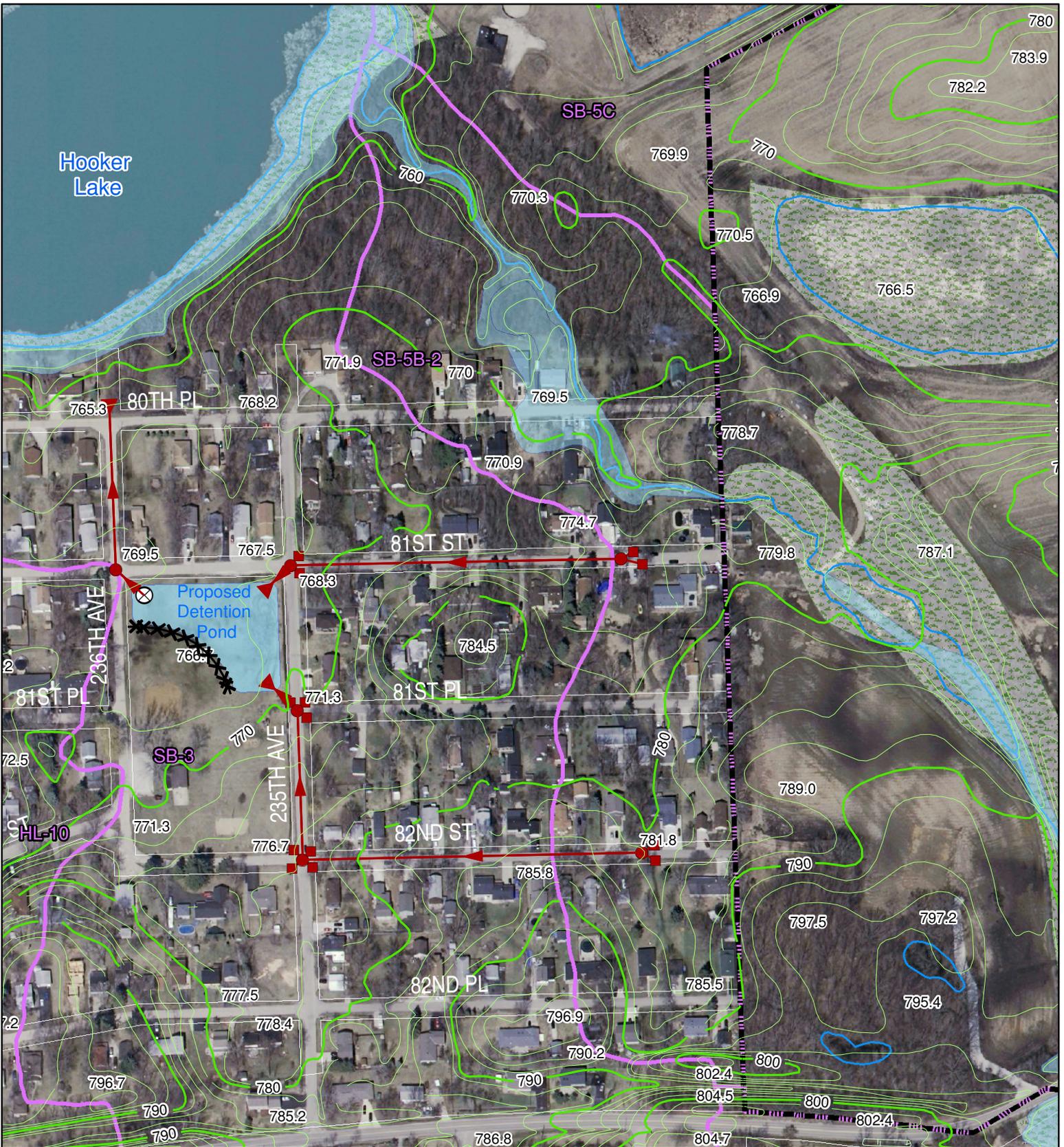
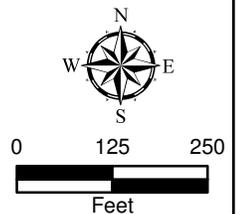


FIGURE 4-5
TOWN OF SALEM
SALEM OAKS SUBDIVISION

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Legend	
	Proposed Storm Sewer
	Proposed Catchbasin
	Proposed Manhole
	Proposed Outfall
	Proposed Outlet Control Structure
	Contours
	Proposed Fence
	Floodplain
	SEWRPC Wetlands
	Subbasin Boundaries
	Municipal Boundary



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.

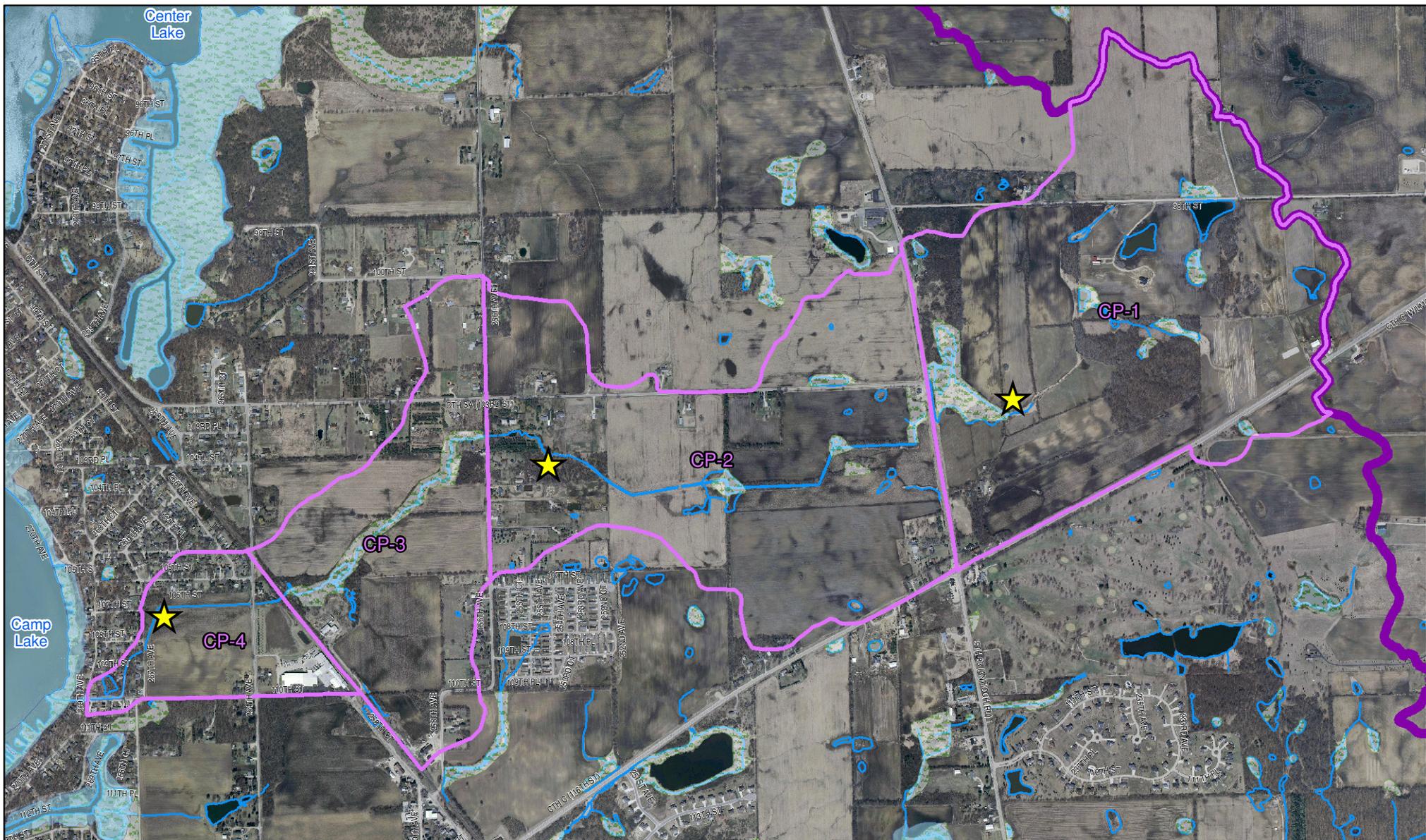
Further study of alternatives to address the flooding problem in this area is recommended. The study would include survey of home elevations, determining the capacity of the channel and culverts, identification of possible detention sites and overbank flood conveyance routes, and evaluation of land acquisition,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



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**FIGURE 4-6
TOWN OF SALEM
SHOREVIEW SUBDIVISION**

Legend

-  Possible Pond Locations
-  Subbasin Boundaries
-  Floodplain
-  Municipal Boundary
-  SEWRPC Wetlands



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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

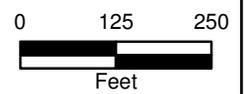
The proposed storm sewer will provide a conveyance system that will at a minimum reduce nuisance flooding for smaller events and to a lesser extent for larger events. The wet pond will provide water quality treatment for smaller rain events prior to discharge into Center Lake. Restoring the low lying 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.



FIGURE 4-7
TOWN OF SALEM
TIMBER LANE SUBDIVISION

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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
	Municipal Boundary



September 2009

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

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

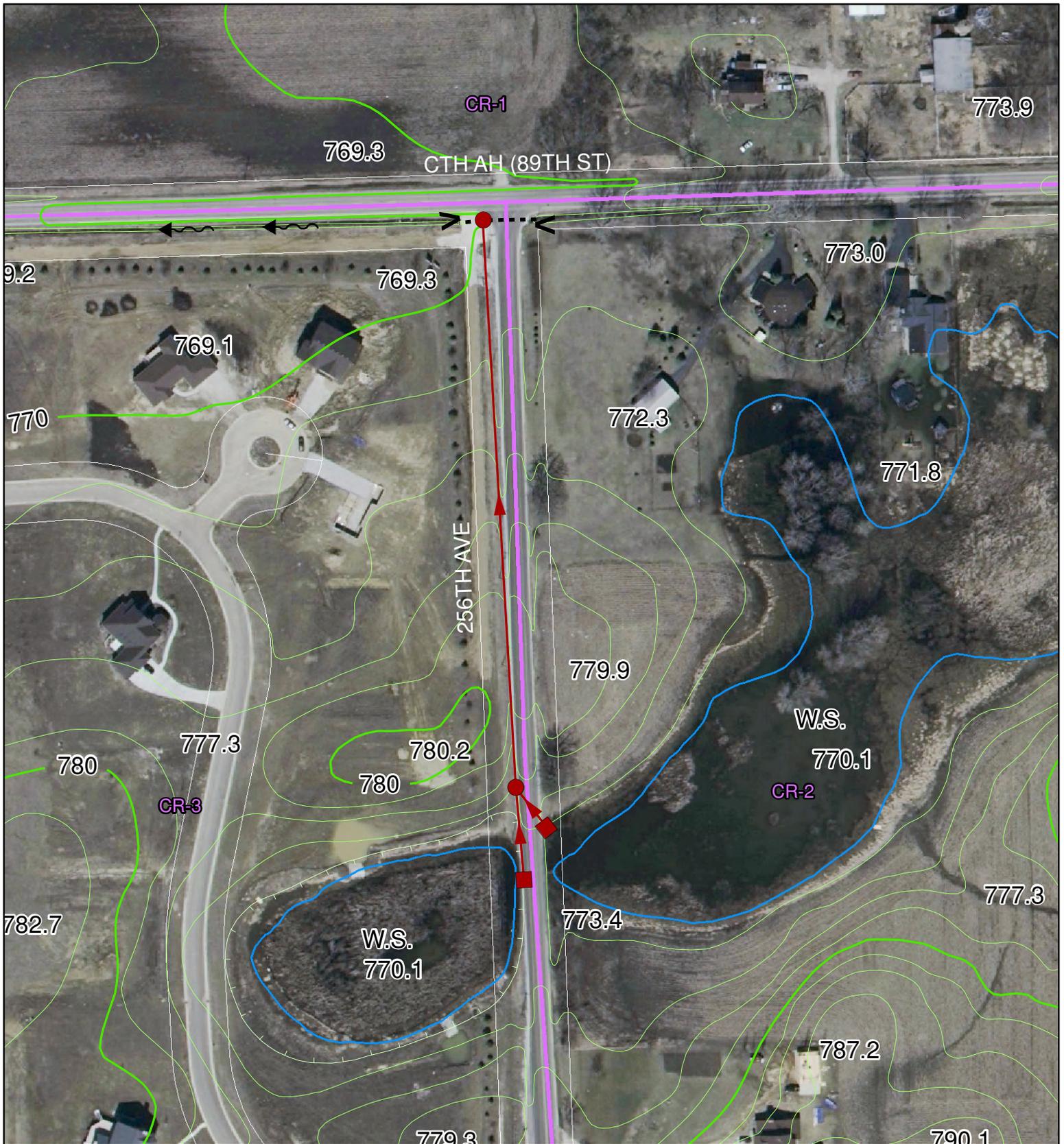
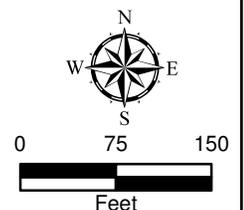


FIGURE 4-9
TOWN OF SALEM
256TH AVE. & CTH AH (89TH ST.)

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Legend	
	Proposed Storm Sewer
	Existing Culvert
	Proposed Inlet
	Proposed Manhole/Inlet
	Subbasin Boundaries
	Contours
	Floodplain
	SEWRPC Wetlands
	Municipal Boundary



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

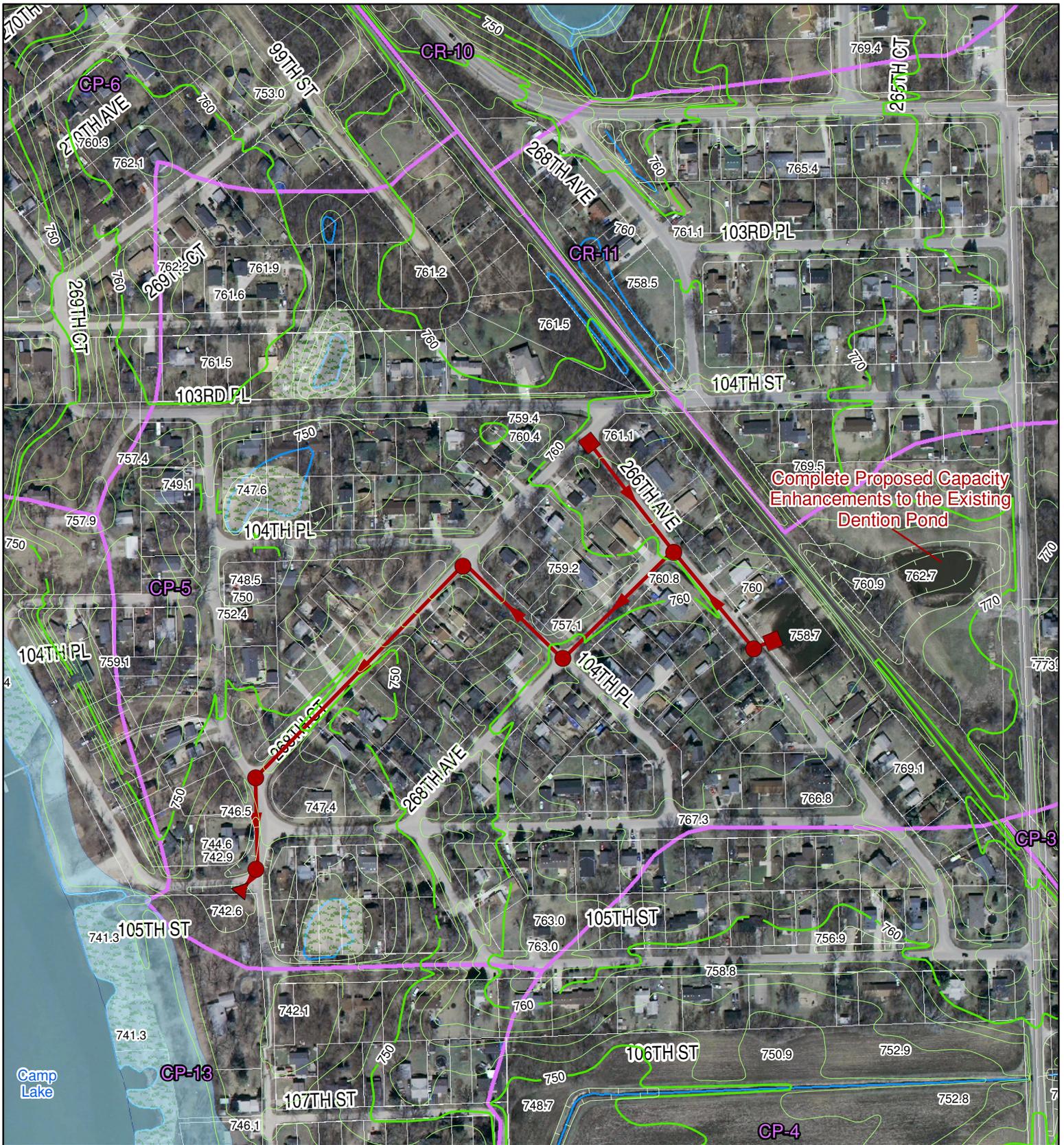
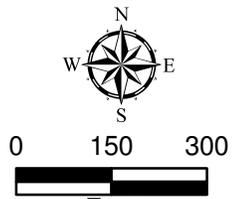


FIGURE 4-10
TOWN OF SALEM
SUNSET OAKS SUBDIVISION

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Legend

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



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

Proposed Alternative

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

Benefits

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

Cost Estimate

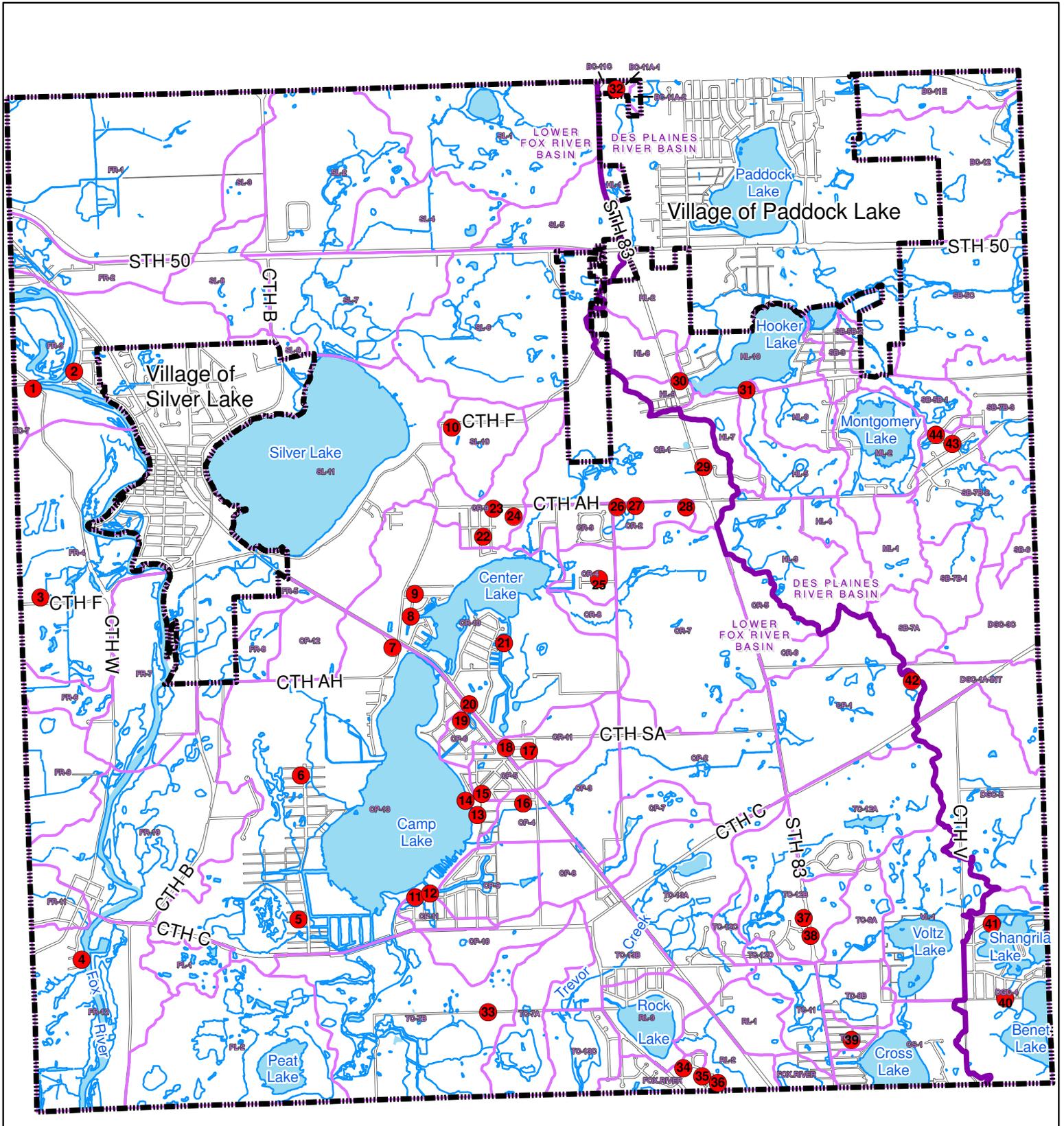
Preliminary project costs have been estimated using Town mapping records, a site visit and the history of the drainage problems in this area.

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

Additional Drainage and Flooding Complaints

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

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



**FIGURE 4-12
TOWN OF SALEM
DRAINAGE COMPLAINT INVENTORY**

DRAFT

Legend

- Drainage Complaints
- Municipal Boundary
- Subbasin Boundaries



NTS

December 2009