

Minnesota  
F29-R30(1)  
Area 317  
Study 3

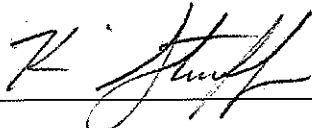
Minnesota Department of Natural Resources  
Division of Fish and Wildlife  
Section of Fisheries

Stream Survey Report

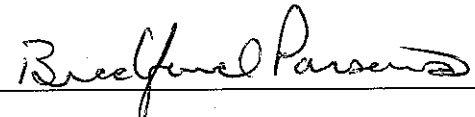
Salem Creek  
2011

By  
Jeffrey L. Weiss  
Fisheries Management Specialist

Lake City Area Fisheries Office

Approved:   
Area Fisheries Supervisor

Date: April 27, 2012

Approved:   
Regional Fisheries Manager

Date: 6-7-12



Your purchase of fishing equipment  
and motor boat fuel supports boating  
access and Sport Fish Restoration.



Funded under Federal Aid by the Sportfishing Restoration Act F-29-R

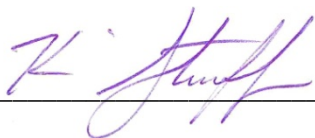
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## General Information

Stream Name:	Salem Creek
Tributary Number:	M-034-082
Counties:	Dodge, Olmsted
Nearest Towns:	Rochester
Source of Flow:	Drainage ditches and tiles, Dodge County
Stream Length:	23.29 miles
Waterway Sequence	South Fork Zumbro River to Zumbro River to Mississippi River
Ecological Classification:	Class IV-Coolwater/Warmwater

## Watershed Name and Number

Major Watershed:	Zumbro River (M-034)
Watershed Number:	41
USGS HUC-8:	07040004
Minor Watershed:	South Fork Zumbro River
Watershed Number:	41071

Metric		
<b>Basin Area</b>	39,782 ac	62.16 mi <sup>2</sup>
<b>Basin Length</b>	15.4 mi	
<b>Basin Relief</b>	322 ft	
<b>Basin Relief Ratio</b>	$R_r = 0.00396$	
<b>Basin Shape</b>	$R_e = 8.90$	
<b>Main Stream Order</b>	3	
<b>Main Stem Stream Length</b>	23.29 mi	
<b>Mean Stream Slope</b>	$S_c = 0.0023$	11.98 ft/mi
<b>Drainage Density</b>	0.37 mi/mi <sup>2</sup>	
<b>Sinuosity</b>	1.51	

## **Introduction**

Salem Creek is a warmwater tributary to the South Fork Zumbro River in Dodge and Olmsted counties. The stream source is a drainage ditch located four miles north of the City of Hayfield in Dodge County. The stream was divided into three similar reaches in the 1986 stream survey (Haugstad 1986). In 2011, boundaries for reaches I and II were changed and a fourth reach was added to better reflect differences in habitat due to pour points and geology. A Level I stream survey was conducted to evaluate the fish community and qualitatively assess stream physical features (MNDNR 2006). Stations sampled in 2011 were located near stations sampled in 1986, but not in the exact same locations (Table 1; Figure 1). Station lengths were 35 times the mean stream width which resulted in shorter station lengths than in the 1986 survey, particularly in reaches I and II. The Minnesota Pollution Control Agency will be sampling Salem Creek in 2012 in conjunction with biomonitoring of the Zumbro River watershed.

## **Watershed**

Salem Creek is a third order stream (Figure 2) with a drainage area of 39,782 acres. The drainage basin is 15.4 miles-long with a main channel length of 23.29 miles. The stream drops 322 ft in elevation from the source to the mouth. Row crops comprised 75.5% of the land cover in the watershed in 2006 (Table 2). The western third of the watershed is gently sloping and has poorly drained soils. The middle third of the drainage is characterized by increased relief due to the underlying karst geology (Figure 3). The lower third of the watershed becomes a wider, flat floodplain where it joins with the South Fork Zumbro River, four miles southwest of the City of Rochester.

## **Hydrology**

A total of seven tributaries and five springs contribute to the drainage network. The largest tributaries are the North Fork Salem Creek, which is 8.4 miles-long and an unnamed creek (M-034-082-02) at 4.2 miles in length. Overall stream gradient is 11.5 ft/mi but varies from 7.9 ft/mi in reach I to 13.3 ft/mi in reach II. The changes in gradient correspond to a change in the underlying geology from outwash to karst formations. Agricultural drain tile seepage occurs throughout the stream but is particularly prevalent in the upper reach where wetlands have been drained for agricultural use. Extensive sections of the stream have historically been channelized in reach III. However, the stream has reestablished a meandering channel in many of these areas.

## **Water Quality**

Water quality sampling was not conducted in this survey. However, water quality data is available from MPCA, MNDNR-Waters, and in the United States Environmental Protection Agency STORET database (USEPA 2011). Based upon turbidity measurements obtained through the Citizens Stream Monitoring Program, Salem Creek was listed as impaired for

turbidity in 2006 (MNPCA 2006). A total maximum daily load has been developed for the Zumbro River and includes load ratings for Salem Creek. A listing of probable sources of suspended solids in this TMDL includes bank erosion, algae growth and death, ditching and stream channelization, row crops, inadequate buffer strips, and livestock in the riparian zone.

### **Habitat**

Physical habitat was qualitatively evaluated in each stream reach using the Minnesota Stream Habitat Assessment protocol (MNDNR 2006). Habitat quality was fair in reach I, good in reaches II and III, and fair in reach IV (Table 3). Reaches II and III had higher scores from riparian zone, substrate, and channel morphology versus reaches I and IV. Higher habitat quality in the middle stream reaches coincide with the geological change to karst formations. This has been observed on other streams in the Zumbro River watershed and has been attributed to a higher prevalence of natural stream corridors on the steep slopes that occur in these reaches (Weiss 2009; Weiss 2010). Large pools where bridges cross the stream are common and provide important deep water habitat for smallmouth bass, particularly in reaches II and III. Most cover is provided by depth and instream rock as woody cover is scarce.

### **Connectivity**

Salem Creek and its tributaries are crossed by many roads necessitating a high number of bridges and culverts. Improperly sized crossings are common and cause habitat degradation both upstream and downstream of the structures. Improperly sized bridges and culverts increase water velocity during high flow events causing downcutting and erosion downstream. Lateral connectivity has been influenced by the prevalence of drain tiles. Infiltration to groundwater has likely been reduced while direct flow to the stream channel has increased. The effects of drain tiles on stream water temperature in Salem Creek have not been evaluated.

### **Geomorphology**

Salem Creek exhibits changes in stream width that are consistent with increased flow volume where tributaries enter the main stream. The channel is widest in reaches II and III and narrows slightly in reach I where gradient decreases and sediment deposition increases. Sinuosity is consistent throughout all reaches except in stream segments that were channelized in the past. Prevalence of channel incision is highest in reaches I and IV which prevents the stream from accessing the floodplain. This increases bank erosion and sedimentation downstream from these incised areas.

### **Fish Community**

Fish were sampled with a tote barge using a DC generator in all stations except station 20.64 where a single backpack electrofisher was used. Electrofishing was conducted by a single upstream pass. All fish > 1 inch TL were collected. Fish were sorted by species, bulk weighed,

and a length range was attained following the Index of Biotic Integrity sampling protocol (MNDNR 2006). Fish populations were evaluated using the Wisconsin warmwater IBI for central and southern Wisconsin (Lyons 1992).

A total of 33 fish species from seven families were collected (Table 4). Species richness was similar in reaches I-III ranging from 20-23 species, and decreased to 14 species in reach IV. Central stoneroller *Campostoma anomalum* was the most abundant species comprising 48% of the total catch. Common shiner *Luxilus cornutus* (12%), white sucker *Catostomus commersoni* (10%), southern redbelly dace *Phoxinus erythrogaster* (4%), bluntnose minnow *Pimephales notatus* (4%), and creek chub *Semotilus atromaculatus* (4%), were common. Common shiner, central stoneroller, bluntnose minnow, creek chub, hornyhead chub *Nocomis biguttatus*, Ozark minnow *Notropis nubilus*, white sucker, fantail darter *Etheostoma flabellare*, and Johnny darter *Etheostoma nigrum* were collected in all sampling stations. Two smallmouth bass *Micropterus dolomieu*, three largemouth bass *Micropterus salmoides*, and 81 rock bass *Ambloplites rupestris* were the only gamefish collected. Rock bass had a mean length of 4.4 inches with the largest fish 7.9 inches (Table 5). The ozark minnow is listed as a threatened species in Minnesota and along with the black redhorse *Moxostoma duquesnei*, is considered a species of greatest conservation need in Minnesota's Comprehensive Wildlife Conservation Strategy (Berendzen et al. 2008; MNDNR 2010). Overall there are 11 fish species of greatest conservation need listed from the Rochester Plateau Habitat Subsection for small streams and rivers (MNDNR 2006b).

The fish IBI score in reach I was 57 (Good), declining to 47 and 42 (Fair) in reaches II and III, and 20 (Poor) in reach IV (Table 6). The IBI scores did not follow the same pattern as habitat quality scores which were highest in reaches II and III. The Minnesota Pollution Control Agency has developed a new warmwater IBI for use in southern Minnesota. However, this index was not available when this report was written. When available, this new index will be applied to the Salem Creek fish data to foster comparison with MNPCA biomonitoring data in the Zumbro River system.

The Jaccard Similarity Index, which is based on species presence/absence, was used for comparing fish species composition between the 1986 and 2011 surveys (Ludwig and Reynolds 1988). The index is calculated as:

$$JI =$$

similarity for the three stream reaches was 68%. This indicates a 32% change in fish community composition overall. Eight species were collected in 2011 that were absent in 1986; black redhorse *Moxostoma duquesnei*, bigmouth buffalo *Ictiobus cyprinellus*, southern redbelly dace, emerald shiner *Notropis atherinoides*, largescale stoneroller *Campostoma oligolepis*, brook stickleback *Culaea inconstans*, largemouth bass, and banded darter *Etheostoma zonale*. Species only collected in 1986 were redbfin shiner *Notropis umbratilis*, brassy minnow *Hybognathus hankinsoni*, and green sunfish *Lepomis gulosus*. Species persistence among surveys ranged from 75% to 88% and was 88% overall. We are unable to determine whether changes in species richness were sampling artifacts or due to changes in the stream environment. Redfin shiner is considered a species of greatest conservation need in Minnesota. In 1986, a total of 31 redbfin shiners were collected from five sampling stations. The species was not collected in 2011. Ozark minnow, another SGCN fish species was collected in all stations sampled in 2011 but abundance was lower than in 1986. Rainbow darter was the only darter species that has appeared to have increased its distribution and abundance in Salem Creek. Rainbow darters are considered intolerant to environmental degradation and the observed increase in distribution and abundance may indicate improved water quality and habitat in Salem Creek.

Smallmouth bass abundance was low in all stream reaches in 2011 but did not decline greatly from 1986 abundance. Two large pools that were too deep to electrofish by wading were sampled by angling in early September. Two anglers using artificial lures fished the pools to determine if gamefish were present. At bridge 4 (mile 7.47) nine smallmouth bass were caught ranging in size from 7.2 to 12.1 inches TL. Thirteen rock bass were captured with lengths ranging from 6 to 8.5 inches TL. At bridge 7 (mile 13.21) two smallmouth bass (10.5 and 13.0 inches TL) were caught along with four rockbass (5-7 inches TL). These data indicate that smallmouth bass abundance is higher than indicated by electrofishing and that fish >12.0 inches TL are present in Salem Creek.

## Summary

Salem Creek is in similar condition to that which occurred during the previous survey in 1986 even though major flooding occurred in fall 2010. The fish community has exhibited some important changes, notably the possible disappearance of redbfin shiners and increased abundance of rainbow darters. Smallmouth bass are present in reaches I-III and along with rock bass provide good angling opportunities. However, smallmouth bass abundance has declined since the 1974 stream survey when abundance in reach II was estimated at 130 fish/mile (Haugstad 1987). In 1986 abundance had declined to 26 fish/mile. Reasons for this decline remain unknown but may be related to poor recruitment. Young-of-the-year smallmouth bass were not collected in 2011 and only three were collected in 1986.



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- Weiss, J.L. 2010. Stream survey of the Middle Fork Zumbro River. Minnesota Department of Natural Resources, Lake City Fisheries Office, Lake City, MN.

Table 1. Station and reach locations and characteristics for Salem Creek, 2011.

	<u>Station</u>			
River mile	3.15	8.04	14.12	20.64
utm <sub>x</sub>	531352	527057	520683	514773
utm <sub>y</sub>	4869640	4868668	4867929	4866830
Length (ft)	750	1,280	1,110	300
Width (ft)	30	32	29	9

	<u>Reach</u>			
	I	II	III	IV
Mile to mile	0-5.39	5.39-10.95	10.95-14.7	14.7-23.29
Gradient (ft/mi)	7.9	13.3	13.3	10.7
Sinuosity	1.5	1.5	1.5	1.7

Table 2. Land cover composition in the Salem Creek Watershed determined from the 2006 National Land Cover Data Set.

<b>Cover Type</b>	<b>Acres</b>	<b>Percent</b>
Open water	20	0.1
Developed Open Space	1,932	4.9
Developed Low Intensity	322	0.8
Developed Medium Intensity	24	0.1
Developed High Intensity	2	0.04
Deciduous Forest	2,052	5.2
Grassland/Herbaceous	2,472	6.2
Pasture/Hay	2,421	6.1
Cultivated Crops	30,041	75.5
Woody Wetlands	430	1.1
Emergent Herbaceous Wetlands	51	0.1

Table 3. Qualitative habitat quality ratings by sampling station determined from the Minnesota Stream Habitat Assessment protocol.

<b>Metric</b>	<b>Station</b>			
	3.15	8.04	14.12	20.64
Land Use Max=5	2.5	2.5	1	2.5
Riparian Zone Max=15	7	10	9	7
Substrate Max=27	13	18	20.5	14.5
Cover Max=17	10	11	12	11
Channel Morph. Max=36	21	26	26	21
<b>MSHA Score Max=100</b>	<b>53.5</b>	<b>67.5</b>	<b>68.5</b>	<b>56</b>
<b>Habitat Rating</b>	<b>Fair</b>	<b>Good</b>	<b>Good</b>	<b>Fair</b>

Table 4. Fish species and number collected by sampling station in Salem Creek, 2011.

Family Common Name	<i>Genus species</i>	Station				Species Total
		3.15	8.04	14.12	20.64	
<b>Petromyzontidae</b>						
American brook lamprey	<i>Lampetra lamottei</i>	2			2	4
<b>Cyprinidae</b>						
Common shiner	<i>Luxilus cornutus</i>	173	153	196	5	527
Bigmouth shiner	<i>Notropis dorsalis</i>	9	2		44	55
Carmine shiner	<i>Notropis percobromus</i>			2		2
Emerald shiner	<i>Notropis atherinoides</i>			2		2
Central stoneroller	<i>Campostoma anomalum</i>	641	769	672	46	2,128
Largescale stoneroller	<i>Campostoma oligolepis</i>	1				1
Blacknose dace	<i>Rhinichthys atratulus</i>	8	49		50	107
Longnose dace	<i>Rhinichthys cataractae</i>		5	1		6
Southern redbelly dace	<i>Phoxinus erythrogaster</i>			19	165	184
Bluntnose Minnow	<i>Pimephales notatus</i>	5	8	47	108	168
Fathead minnow	<i>Pimephales promelas</i>			2	5	7
Creek chub	<i>Semotilus atromaculatus</i>	21	31	81	31	164
Hornyhead chub	<i>Nocomis biguttatus</i>	6	22	40	1	69
Ozark minnow	<i>Notropis nubilus</i>	3	14	36	4	57
<b>Catostomidae</b>						
White sucker	<i>Catostomus commersoni</i>	157	97	203	5	462
Northern hogsucker	<i>Hypentelium nigricans</i>	56	68	22		146
Golden Redhorse	<i>Moxostoma erythrurum</i>	38	1	6		45
Black redhorse	<i>Moxostoma duquesnei</i>		2			2
Bigmouth buffalo	<i>Ictiobus cyprinellus</i>	1				1
<b>Ictaluridae</b>						
Stonecat	<i>Noturus flavus</i>	6	9	9		24
Tadpole madtom	<i>Noturus gyrinus</i>			1		1
Black bullhead	<i>Ameiurus melas</i>					
<b>Gasterosteidae</b>						
Brook stickleback	<i>Culaea inconstans</i>	2			8	10
<b>Centrarchidae</b>						
Smallmouth bass	<i>Micropterus dolomieu</i>	1	1			2
Largemouth bass	<i>Micropterus salmoides</i>	1		2		3
Rock bass	<i>Ambloplites rupestris</i>	8	21	52		81

Table 4 (continued)

Family	Common name	<i>Genus species</i>	Station				Species
			3.15	8.04	14.12	20.64	Total
<b>Percidae</b>							
	Rainbow darter	<i>Etheostoma caeruleum</i>	2	99	35		136
	Blackside darter	<i>Percina maculata</i>			1		1
	Banded darter	<i>Etheostoma zonale</i>	1	1			2
	Fantail darter	<i>Etheostoma flabellare</i>	5	13	6	4	28
	Johnny darter	<i>Etheostoma nigrum</i>	6	4	5	7	22
	Total Number per Station		1,153	1,369	1,440	483	4,449
	Number of Species		23	20	22	15	33

Table 5. Length frequency of gamefish collected from four stations on Salem Creek in 2011.

Length (inches)	Rock Bass	Smallmouth Bass	Largemouth Bass
1.0 - 1.9	1		
2.0 - 2.9	20		
3.0 - 3.9	12		2
4.0 - 4.9	19		
5.0 - 5.9	14		
6.0 - 6.9	10		
7.0 - 7.9	5	1	
8.0 - 8.9			
9.0 - 9.9			1
10.0 - 10.9		1	
Total Number	81	2	3

Table 6. Fish index of biotic integrity scores by sampling station in Salem Creek determined from the warmwater IBI of Lyons (1992) for central and southern Wisconsin. BP=Backpack electrofisher.

	<u>Station</u>			
	3.15	8.04	14.12	20.64
Gear	Barge	Barge	Barge	1BP
Length (ft)	750	1,280	1,110	300
Width (ft)	30	32	29	9
<b>Metric</b>				
Native spp.	23	20	22	14
Darter spp.	4	4	4	2
Sucker spp.	3	4	3	1
Sunfish spp.	1	1	1	0
Intolerant spp.	6	4	5	1
% Tolerant	17%	13%	20%	41%
% Omnivores	14%	7%	15%	24%
% Insectivores	26%	10%	10%	14%
% Carnivores	1%	2%	4%	0
% Lithophils	38%	19%	22%	47%
<b>IBI Score</b>	<b>57</b>	<b>47</b>	<b>42</b>	<b>20</b>
<b>IBI Rating</b>	<b>Good</b>	<b>Fair</b>	<b>Fair</b>	<b>Poor</b>
<b>Jacard Similarity</b>	<b>54%</b>	<b>68%</b>	<b>60%</b>	<b>NA</b>



Figure 1. Salem Creek Sampling Stations 2011

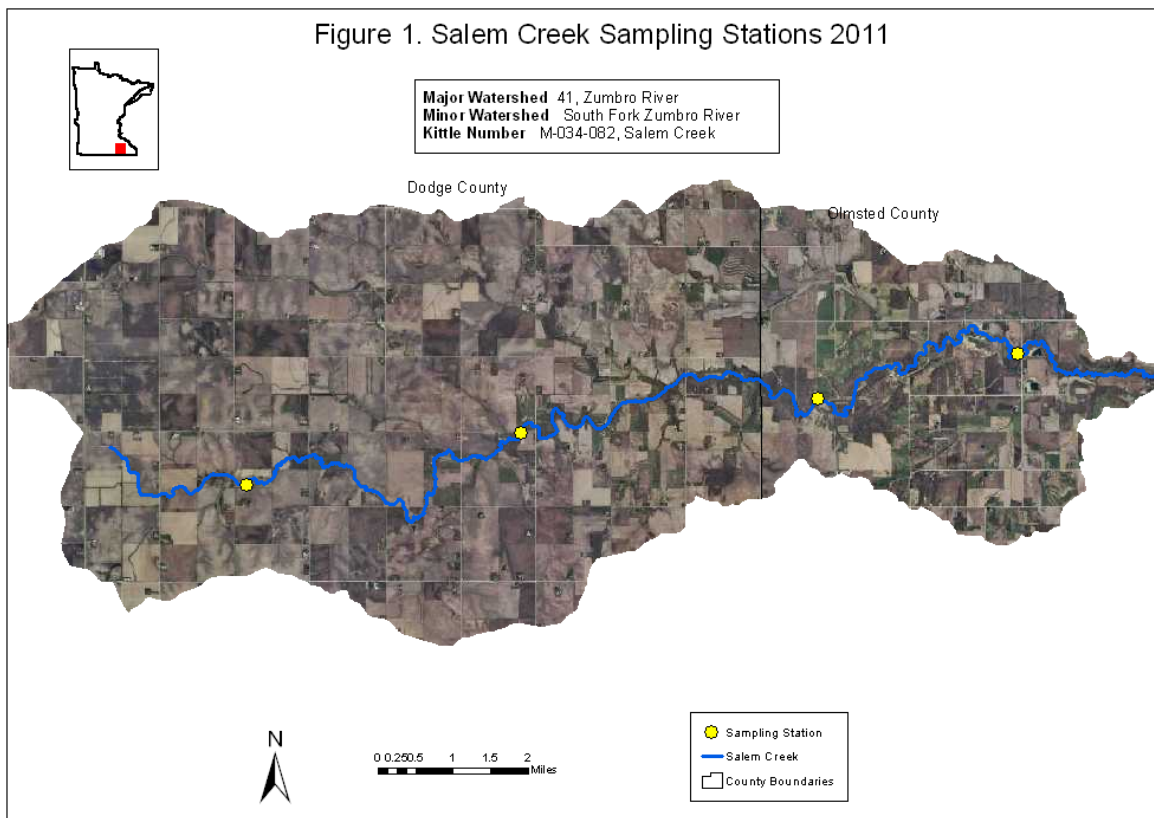


Figure 2. Stream order in the Salem Creek watershed.

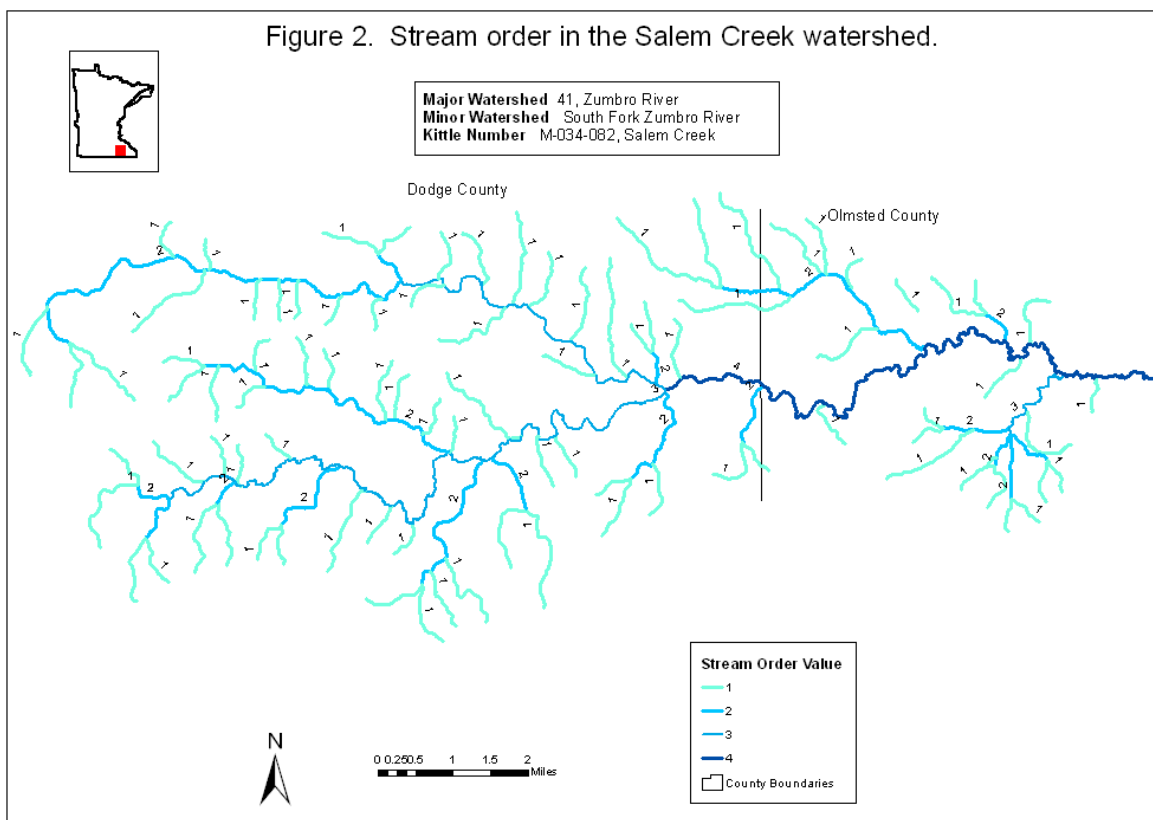


Figure 3. 2006 land cover in the Salem Creek watershed.

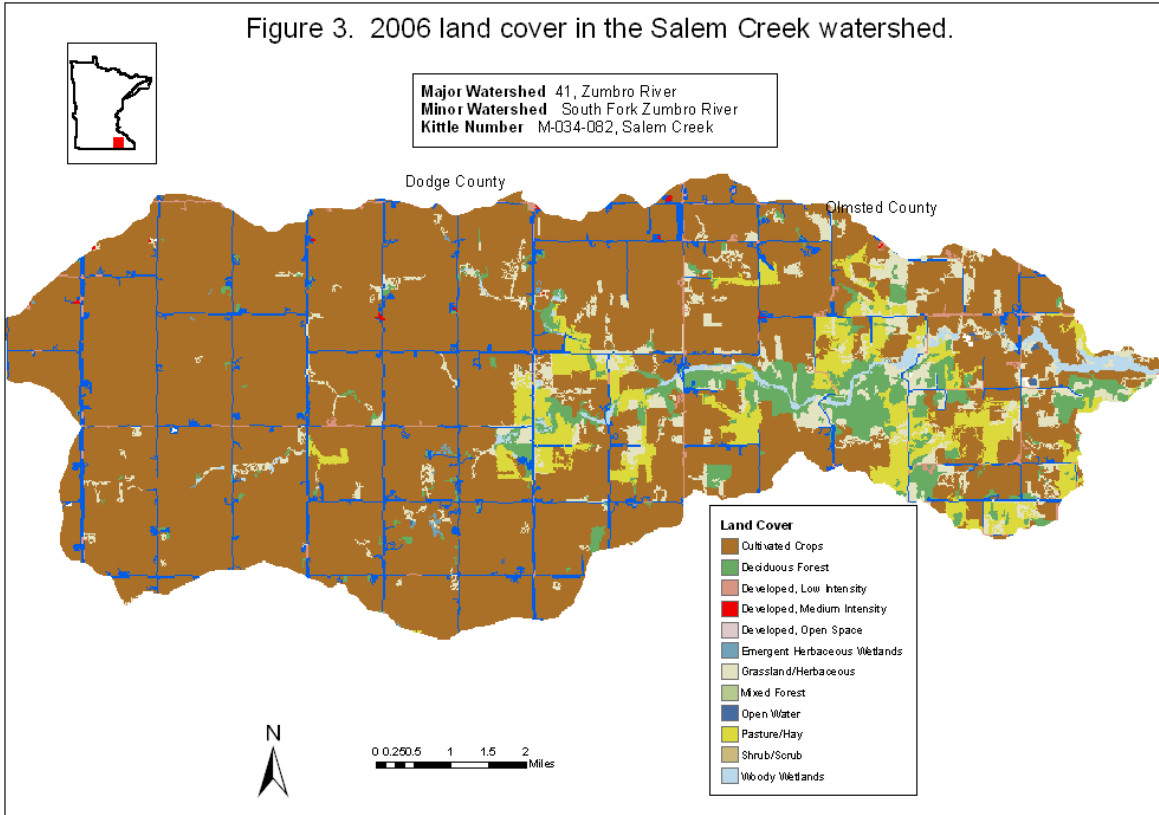


Figure 4. Karst features in the Salem Creek watershed.

