

## Jennie Duncan

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**From:** Sarah Dvoracek <sarah.dvoracek@evart.org>  
**Sent:** Friday, January 11, 2019 2:52 PM  
**To:** Jennifer Duncan  
**Subject:** For council packets as an FYI  
**Attachments:** Chippewa Creek Osceola County 2018.pdf; Twin Creek Osceola County 2018.pdf; MDNR 2018 Survey Locations with well-dw rev.pdf

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

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**From:** Anderson-Vincent, Arlene, STANWOOD, NWNA Technical & Production MEC Springs <Arlene.Anderson-Vincent@waters.nestle.com>  
**Sent:** Friday, January 11, 2019 2:25 PM  
**To:** Sarah Dvoracek (sarah.dvoracek@evart.org) <sarah.dvoracek@evart.org>; mark.wilson@evart.org  
**Subject:** MDNR Stream Surveys - MI

Hello Sarah and Mark,

The Michigan Department of Natural Resources Fisheries Division conducted fisheries surveys of Twin and Chippewa Creeks in July of 2018. The fisheries evaluation of each creek serves as an independent scientific survey of each stream system and included the collection of habitat data, continual monitoring of water temperature from June through August 2018, along with fish community evaluations.

### Bottom Line

The MDNR described Twin Creek as a high-quality coldwater stream that supports self-sustaining populations of trout. Similarly, Chippewa Creek was described as a designated trout stream that supports a self-sustaining population trout. These results are consistent with the results of similar studies conducted since 2003 on these streams on behalf of Nestle Waters North America.

I have attached both MDNR reports for your information and also a figure that depicts the approx locations of the surveys.

Please feel free to share this information if you find it helpful.

Regards,

Arlene

*Arlene Anderson-Vincent*  
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Chippewa Creek 2018 Fisheries Survey Report  
Osceola County, MI  
Mark Tonello  
Fisheries Division, November 2018

### Introduction

Chippewa Creek is located in northwest Michigan and flows into the Muskegon River approximately one mile upstream from the Village of Ewart, in Osceola County. Chippewa Creek originates on privately-owned land in central Osceola County, just upstream from Spring Hill Camp. On the Spring Hill Camp property, Chippewa Creek flows through a series of impoundments known as the “Decker Ponds”, which are used for recreation at the camp. Chippewa Creek is a small watershed that flows generally southwest for approximately 3 miles before it joins the Muskegon River. There are several small tributaries within the Chippewa Creek watershed. Only one is named- Postal Creek (listed on some maps as “Posted Creek”).

Most of the Chippewa Creek watershed consists of privately-owned land (including Spring Hill Camp) that is a mix of forest and wetland, with agriculture nearby. As it nears the Muskegon River, Chippewa Creek again flows through two large impoundments, one just upstream of River Road, and one just downstream. These impoundments effectively block all fish passage for migratory fish species from the Muskegon River. Over its course, Chippewa Creek drops approximately 140 feet, for a gradient of approximately 46.7 ft/mi.

Chippewa Creek is a Designated Trout Stream and is regulated by Michigan Department of Natural Resources (MDNR) Fisheries Division as a Type 1 stream, open to all types of tackle from the last Saturday in April through September 30. The minimum size limits are 7” for Brook Trout, 8” for Brown Trout, and 10” for Rainbow Trout. Although Chippewa Creek has not been stocked in many years, it was stocked intermittently with Brook and Brown Trout by the Michigan Department of Conservation (MDOC; the precursor to the MDNR of today) in the 1930s, 1940s, and 1950s. Postal Creek was also stocked with Brown and Brook Trout by MDOC in the late 1930s and early 1940s.

### Historical Scientific Investigations

Chippewa Creek was first surveyed by MDOC personnel in 1968. This survey took place near the 90<sup>th</sup> Ave. crossing. The researchers electrofished approximately 400 feet of stream and caught 101 Brown Trout between 2.1 and 11.3 inches in length. The only other species mentioned as present were White Suckers.

Another electrofishing survey of Chippewa Creek was conducted by MDNR in July of 2000. The researchers shocked approximately 300 feet of stream just downstream of 90<sup>th</sup> Ave. and caught good numbers of Brown Trout up to 14 inches in length. Other species present included Blacknose Dace, Creek Chubs, Sculpins, and White Suckers. The purpose of this survey was to collect salmonids for Whirling Disease testing. Twenty Brown Trout were sacrificed for testing. The results were negative.

Further studies of Chippewa Creek were conducted by Advanced Ecological Management (AEM) between 2003 and 2015 (Anonymous 2016a and b). The studies were part of a monitoring plan established when Nestle Waters North America Inc. began groundwater withdrawal within the Chippewa Creek watershed. The fish community, water quality, aquatic habitat, and macroinvertebrates were all studied by AEM. Fish species captured from Chippewa Creek over this period included American Brook Lamprey, Blacknose Dace, Brown Trout, Creek Chub, Mottled Sculpin, and White Sucker.



### Methods

The most recent MDNR Fisheries Division survey of Chippewa Creek was conducted on July 24, 2018. Sampling was conducted using a Wisconsin battery-powered 12-volt backpack shocker with one probe. Chippewa Creek was surveyed at the 90<sup>th</sup> Ave. crossing, following MDNR Status & Trends protocols described by Wills et al. (2011) for both fisheries and habitat assessments. Sampling consisted of one shocking pass. Temperature data was also collected at the 90<sup>th</sup> Ave. station for the summer of 2018 using a continuous recording thermometer that took hourly readings. Salmonids caught from the 90<sup>th</sup> Ave. station were aged using scale samples.

### Results

The sampling station established at 90<sup>th</sup> Ave. consisted of a 300-foot stream reach beginning downstream and proceeding upstream to the crossing. A total of 173 fish representing six different species were caught (Table 1). Mottled Sculpin and Brown Trout were the most common species. Within the survey reach, Chippewa Creek averaged 17.5 feet wide and 0.7 feet deep (Table 2). The maximum depth was 1.6 feet, and the discharge was estimated at 5.7 CFS. The primary substrate within the station was sand (74%; Table 2). The July average temperature within the station was 60.6°F, while the maximum temperature for the summer of 2018 was 68.5°F (Table 3; recorded on June 1). This reach flows through forested wetland with tag alder and cedar as the primary cover.

Both Brown and Brook Trout captured in the 2018 MDNR Chippewa Creek survey were aged by examining growth rings on the scales. Four different age classes of Brown Trout were present (Table 4). When combined, Brown Trout aged 0 through 2 were growing 0.1 inches faster than the State of Michigan average. The lone Brook Trout caught in the 2018 survey was age-0.

### Discussion

Prior to this survey, Fisheries Division had very little information on file for Chippewa Creek. The most intensive sampling of Chippewa Creek was conducted by AEM (Anonymous 2016 a and b), and those surveys were all conducted at different locations than the MDNR surveys conducted in 2018. The 2018 MDNR survey showed that Chippewa Creek is living up to its status as a Designated Trout Stream. Chippewa Creek supports a self-sustaining population of Brown Trout, with consistent, multiple year classes present. A total of six fish species were encountered in the 2018 survey. Of those six species, all but Brook Trout had been caught in previous surveys of Chippewa Creek, even though Brook Trout had been stocked by MDOC in the mid-1900s. AEM (Anonymous 2016a) reported catching American Brook Lamprey, but none were caught in the 2018 MDNR survey.

### Recommendations

Chippewa Creek is a Designated Trout Stream that supports a self-sustaining population of Brown Trout, along with a smaller number of Brook Trout. The numerous dams and impoundments in the watershed no doubt affect flow rates (through evaporation from the impoundments), water temperatures, and fish passage. In addition, future riparian development, environmentally unsound agricultural practices, and wetland loss would likely diminish the water quality and aquatic habitat of Chippewa Creek. In particular, wetland loss and additional impervious surfaces within the watershed would lead to more surface runoff, increased flashiness and higher water temperatures that would threaten the survival of Brown Trout and other coldwater species. The flow rates and water temperatures of Chippewa Creek should be closely monitored to understand the effects of the industrial-scale groundwater withdrawal that is occurring within the watershed. Reductions in flow rates could negatively affect Chippewa Creek by allowing the reduced water volume to warm more quickly. Warmer stream temperatures would negatively affect the Brown Trout population that is currently thriving in Chippewa Creek.



One particular management goal for Chippewa Creek should be improve the connectivity of the watershed. There are numerous-made dams throughout the short watershed. The possibilities of removing these dams and returning the stream to a free-flowing condition should be explored. In addition, all road/stream crossings in the watershed should be evaluated to determine whether they are negatively affecting the stream.

References:

Anonymous. 2016a. White Pine Springs Evaluation of Fish, Macroinvertebrates, and Aquatic Habitat Resulting from an Increase in Groundwater Withdrawal. Advanced Ecological Management, Reed City, MI.

Anonymous. 2016b. White Pine Springs Threatened and Endangered Species Report. Advanced Ecological Management, Reed City, MI.

Wills, T. C., T. G. Zorn, A. J. Nuhfer, and D. M. Infante. 2011 Draft. Stream Status and Trends Program sampling protocols. Chapter 26 in Manual of fisheries survey methods. Michigan Department of Natural Resources, Fisheries internal document, Ann Arbor.

Table 1. Number of fish caught per inch group in a July 24, 2018 electrofishing survey of Chippewa Creek, Osceola County, MI. The station began 300 feet downstream of the 90th Ave. crossing and ran upstream for 300 feet to the 90th Ave. crossing.

Species	Inch class										Total:	
	1	2	3	4	5	6	7	8	9	10		
Brook Trout			1									1
Brown Trout		12	4	5	13	10	4	5	4	2		59
Central Mudminnow		9	1									10
Creek Chub	5	10	2	6								23
Mottled Sculpin	20	47	12									79
White Sucker			1									1



Table 2. Habitat evaluation from Chippewa Creek at the 90th Ave. survey station, July 24, 2018.

	2018
% Riffle	0
% Run	100
%Pool	0
Average width (ft)	17.46
Average depth (ft)	0.72
Max depth (ft)	1.60
Discharge (cfs)	5.67
Woody cover (sq ft)	0.00
Linear wood (ft)	126.00
<u>Substrate</u>	
clay	0.00%
detritus/silt	15.38%
sand	73.85%
gravel	4.62%
small cobble	0.00%
large cobble	0.00%
boulder	0.00%
wood	0.00%
island	6.15%

Table 3. Temperature data (degrees F) from the 90th St. survey station, Chippewa Creek, Osceola County, summer 2018.

	2018
June Minimum	52.2
June Average	59.3
June Maximum	68.5
July Minimum	56.2
July Average	60.6
July Maximum	68.0
Aug Minimum	55.4
Aug Average	60.5
Aug Maximum	65.2



Table 4. Average total weighted length (inches) at age, and growth relative to the state average, for fish sampled from Chippewa Creek at the 90th Ave. station by electrofishing. Number of fish aged is given in parenthesis. At least five individuals from any given age group must be caught to make statistical inferences regarding growth.

Year	Month	Species	Age				Mean Growth Index
			0	I	II	III	
2018	July	Brook Trout	3.7 (1)				--
		Brown Trout	2.8 (14)	5.6 (26)	8.8 (14)	9.2 (1)	+0.1



Twin Creek 2018 Fisheries Survey Report  
Osceola County, MI  
Mark Tonello  
Fisheries Division, November 2018

### Introduction

Twin Creek is located in northwest Michigan, flowing into the Muskegon River within the Village of Evert, in Osceola County. Twin Creek originates from a series of swamps and beaver ponds located on a large parcel of State-owned forest land in central Osceola County known locally as the "Evert Block". From there, Twin Creek flows generally southwest for approximately 6.3 miles before it joins the Muskegon River. Over its course, Twin Creek drops approximately 164 feet, for a gradient of approximately 25.8 ft/mi. Although Twin Creek originates on State-owned land, most of the watershed consists of privately-owned land that is a mix of forest and agriculture. For its last mile before joining the Muskegon River, Twin Creek is essentially an urban stream, flowing through the Village of Evert. Twin Creek has one small tributary stream that joins it from the north, approximately ½ mile downstream of the 110<sup>th</sup> Ave. crossing.

There are a number of old and current beaver-created impoundments on Twin Creek and one small privately owned man-made dam, located just upstream of 7 Mile Road. Also, the road crossing at 9 Mile Road essentially acts as a dam, creating an impounded area just upstream of the crossing. The remnants of an old dam are also present several hundred yards downstream of the US-10 crossing in the Village of Evert.

Twin Creek is a Designated Trout Stream and is regulated by Michigan Department of Natural Resources (MDNR) Fisheries Division as a Type 1 stream open to all types of tackle from the last Saturday in April through September 30. The minimum size limits are 7" for Brook Trout, 8" for Brown Trout, and 10" for Rainbow Trout. Although Twin Creek has not been stocked in many years, it was stocked with Brook and Brown Trout by the Michigan Department of Conservation (MDOC; the precursor to the MDNR of today) in the 1930s and 1940s.

### Historical Scientific Investigations

Twin Creek was first electrofished by MDOC personnel in 1952. This survey took place within the Village of Evert. The researchers were targeting American Brook Lamprey and captured three between 4.8 and 5.1 inches in length. No other species were recorded in the 1952 survey. Several electrofishing surveys were also conducted in 1968 at several different locations. Most of the fish recorded from these surveys were Brown Trout, although Brook Trout, "Muddlers" (likely Sculpins), and White Suckers were also recorded as present.

Another electrofishing survey of Twin Creek was conducted by MDNR in July of 2000. The researchers shocked several hundred feet of stream just downstream of US-10 and caught good numbers of Brown Trout. Smaller numbers of Brook Trout, Burbot, Sculpins, Creek Chubs, White Suckers, Blacknose Dace, and Green Sunfish were also observed. The purpose of this survey was to collect salmonids for Whirling Disease testing. Fifteen Brown Trout and five Brook Trout were sacrificed for testing. The results were negative.

Twin Creek was sampled by MDEQ in 2006 (Wesener 2010). The surveys consisted of aquatic macroinvertebrate and habitat evaluations. At 100<sup>th</sup> Ave. where the sampling was conducted, the macroinvertebrate populations of Twin Creek rated as "Excellent", and the aquatic habitat rated as





“Excellent (non-impaired)”. The water temperature on 8/24/2006 was 58.0 degrees F, while the discharge was estimated at 5.76 cubic feet per second (CFS).

Additional studies of Twin Creek were conducted by Advanced Ecological Management (AEM) between 2003 and 2015 (Anonymous 2016a and b). The studies were part of a monitoring plan established when Nestle Waters North America Inc. began withdrawing groundwater within the Twin Creek watershed. The fish community, water quality, aquatic habitat, and macroinvertebrates were all studied by AEM. Fish species captured from Twin Creek over this period included American Brook Lamprey, Blacknose Dace, Brook Trout, Brown Trout, Central Mudminnow, Creek Chub, Mottled Sculpin, Pumpkinseed Sunfish, and White Sucker.

### Methods

The most recent MDNR Fisheries Division survey of Twin Creek was conducted on July 23 and 25, 2018. Sampling was conducted using Wisconsin battery-powered 12-volt backpack shockers with one probe. Three different sites were surveyed: Oak St. (within the Village of Evart), 100<sup>th</sup> Ave., and 110<sup>th</sup> Ave. Sampling at the Oak St. station followed MDNR Status & Trends protocol described by Wills et al. (2011) for both fisheries and habitat assessments. Two backpack shocking units were utilized for the Oak St. station, while only one unit was used at the 100<sup>th</sup> and 110<sup>th</sup> St. stations. At all sites, sampling consisted of one shocking pass. Temperature data was also collected at the Oak St. station for the summer of 2018 using a continuous recording thermometer that took hourly readings. The sampling efforts at 100<sup>th</sup> Ave. and 110<sup>th</sup> Ave. were less intensive, consisting only of electrofishing and observational habitat estimations. Salmonids caught from the Oak St. station were aged using scale samples. No age determinations were made for salmonids from the other stations. The Oak St. station was the furthest downstream station, while 110<sup>th</sup> Ave. was the furthest upstream station.

### Results

The Oak St. sampling station began at the road crossing and proceeded upstream for 700'. A total of 124 fish representing nine different species were caught (Table 1). Brook and Brown Trout were the most common species. Burbot and Mottled Sculpin were also abundant. Within the Oak St. reach, Twin Creek averaged 16.7 feet wide and 1.1 feet deep (Table 2). The maximum depth was 2.0 feet, and the discharge was estimated at 12.2 CFS. The primary substrate within the Oak St. station was gravel (71%; Table 2). The July average temperature within the Oak St. station was 61.7°F, while the maximum temperature for the summer of 2018 was 70.8°F (Table 3; recorded on June 30). Although the Oak St. station falls within the Village of Evart, the reach flows through an urban woodlot with hardwood trees as the primary landcover. Vegetative cover in the riparian zone consisted of tag alder, raspberry bushes, and various overhanging grass and shrub species.

Both Brown and Brook Trout captured at the Oak Street station were aged by examining growth rings on the scales. Three different age classes were determined for Brook Trout, while four different age classes of Brown Trout were present (Table 4). The age-1 Brook Trout (the only year class which had enough samples to allow for statistical inferences to be made) were growing 1.6 inches faster than the State of Michigan average. When combined, all four-year classes of Brown Trout were growing 0.3 inches faster than the State of Michigan average.

At the 100<sup>th</sup> Ave. station, a total of 98 fish representing five species were caught (Table 5). Brown Trout and Blacknose Dace were the most abundant species. Brook Trout were also present at this site. The largest Brown Trout captured at any of the three sites (15 inches) was captured at the 100<sup>th</sup> Ave. station. The habitat at this site was different from the other two sites. Here, the stream flowed through a forested wetland with tag alder being the primary riparian cover. The stream was braided with numerous channels.



islands, and undercut banks. The stream had decent gradient and had an estimated width of 20 feet. Average depth was 1 foot, while the deepest pool was 2 feet. Approximately 60% of the reach was pool, while 15% was run and 25% riffle. Substrates consisted of 40% sand, 40% gravel, 10% silt, 5% cobble, and 5% boulder. Cover was present in the form of undercut banks, overhanging sedges, woody debris, and root wads.

At the 110<sup>th</sup> Ave. station, a total of 77 fish representing 10 species were caught (Table 6). Mottled Sculpin, Brook Trout, and Brown Trout were the most abundant species. At this site, the stream flowed through a valley forested with white pine, cedar, and hardwoods. There were some wet, spring seep areas adjacent to the stream. This reach had higher gradient than the 100<sup>th</sup> Ave. station, and there were several man-made rock dams creating pool habitat within the station. Here the stream had an average width of approximately 10 feet, and an average depth of six inches. The deepest pool was 1.5 feet. Approximately 50% of the station was riffle habitat, while 30% was run, and 20% pool. Substrates consisted of 60% gravel, 10% boulder, 10% cobble, 10% sand, and 10% silt. Cover was present in the form of undercut banks, woody debris, and boulders. One dead mussel shell was collected at the 110<sup>th</sup> Ave. site, and it was later identified as a Wabash Pigtoe.

#### Discussion

Prior to this survey, Fisheries Division had very little information on file for Twin Creek. The most intensive sampling of Twin Creek was conducted by AEM (Anonymous 2016 a and b) and those surveys were all conducted at different locations than the 2018 MDNR surveys. The 2018 MDNR survey showed that Twin Creek is generally healthy and is living up to its status as a Designated Trout Stream. Twin Creek hosts self-sustaining populations of both Brown and Brook Trout, with consistent, multiple year classes of both species present. A total of twelve fish species were encountered in the 2018 survey. All but three of these species (Black Bullhead, Hybrid Sunfish, and Green Sunfish) had been caught in previous surveys of Twin Creek.

One of the Burbot caught in the Oak St. sampling effort was 17 inches in length, which is exceptionally large for a small stream like Twin Creek. It is very possible that the large Burbot was a migrant from the Muskegon River. Twin Creek likely offers habitat for different life stages of Burbot, including spawning and juvenile habitat.

Currently, migratory salmonids from Lake Michigan, including Chinook Salmon, Coho Salmon, and Steelhead, cannot access Twin Creek. This is due to three large hydroelectric dams (Croton, Hardy, and Rogers; owned by Consumers Energy) that block all upstream fish passage on the Muskegon River. However, if the dams were ever removed or fish passage was provided through other means, Twin Creek would provide excellent spawning and rearing habitat for the three species of migratory salmonids mentioned.

#### Recommendations

Twin Creek is a high-quality coldwater stream that supports self-sustaining populations of Brook Trout and Brown Trout. The stream remains intact and healthy because much of the watershed is in a forested, undeveloped state. However, future riparian development, environmentally unsound agricultural practices, and wetland loss would likely diminish the water quality and aquatic habitat of Twin Creek. In particular, wetland loss and additional impervious surfaces within the watershed would lead to more surface runoff, increased flashiness, and higher water temperatures that would threaten the survival of salmonids and other coldwater species. In addition, flow rates and water temperatures in Twin Creek should be closely monitored to understand the effects of the industrial-scale groundwater withdrawal that is occurring within the watershed.



One particular management goal for Twin Creek should be to improve the connectivity of the watershed. Removing the dam structure located just upstream from 7 Mile Rd. and replacing the 9 Mile Rd. stream crossing should be explored, as both likely have negative impacts on Twin Creek. In addition, all other road/stream crossings in the watershed should be evaluated to determine if they are negatively impacting the stream.

References:

Anonymous. 2016a. White Pine Springs Evaluation of Fish, Macroinvertebrates, and Aquatic Habitat Resulting from an Increase in Groundwater Withdrawal. Advanced Ecological Management, Reed City, MI.

Anonymous. 2016b. White Pine Springs Threatened and Endangered Species Report. Advanced Ecological Management, Reed City, MI.

Wesener, M. 2010. Biological Assessment of the Middle Muskegon River Watershed. Montcalm, Mecosta, Osceola, and Clare Counties, July-September 2006. MDEQ Report No. MI/DNRE/WB-10/013. Michigan Department of Environmental Quality, Water Bureau, Lansing, Michigan.

Wills, T. C., T. G. Zorn, A. J. Nuhfer, and D. M. Infante. 2011 Draft. Stream Status and Trends Program sampling protocols. Chapter 26 in Manual of fisheries survey methods. Michigan Department of Natural Resources, Fisheries internal document, Ann Arbor.

Table 1. Number of fish caught per inch group in a July 23, 2018 electrofishing survey of Twin Creek, Osceola County, MI. The station began at the Oak Street crossing, located within the village of Evart, and ran upstream for 700 feet.

Species	Inch class													Total:		
	1	2	3	4	5	6	7	8	9	10	11	12	13		17	
American Brook Lamprey				1				1								2
Brook Trout		1	2		2	13	6	3	2							29
Blacknose Dace	1	2	2													5
Brown Trout		13			3	12	2	5	2	4	1	2	1			45
Burbot					4	7	4	3	2			1		1		22
Creek Chub	1															1
Green Sunfish		1														1
Mottled Sculpin	1	7	10													18
White Sucker										1						1



Table 2. Habitat evaluation from Twin Creek at the Oak Street survey station, July 23, 2018.

	2018
% Riffle	15.38
% Run	84.62
% Pool	0
Average width (ft)	16.69
Average depth (ft)	1.06
Max depth (ft)	2.00
Discharge (cfs)	12.21
Woody cover (sq ft)	144.00
Linear wood (ft)	150.00
<u>Substrate</u>	
clay	0.00%
detritus/silt	8.06%
sand	8.06%
gravel	70.97%
small cobble	8.06%
large cobble	0.00%
boulder	4.84%
wood	0.00%
island	0.00%

Table 3. Temperature data (degrees F) from the Oak Street survey station, summer 2018.

	2018
June Minimum	51.5
June Average	59.8
June Maximum	70.8
July Minimum	54.8
July Average	61.7
July Maximum	70.3
Aug Minimum	55.5
Aug Average	61.4
Aug Maximum	67.8



Table 4. Average total weighted length (inches) at age, and growth relative to the state average, for fish sampled from the Twin Creek at the Oak Street station by electrofishing. Number of fish aged is given in parenthesis. At least five individuals from any given age group must be caught to make statistical inferences regarding growth.

Year	Month	Species	Age				Mean Growth Index
			0	I	II	III	
2018	July	Brook Trout	3.0 (3)	6.9 (21)	9.6 (2)		+1.6
		Brown Trout	2.6 (11)	6.3 (12)	8.9 (11)	12.1 (5)	+0.3

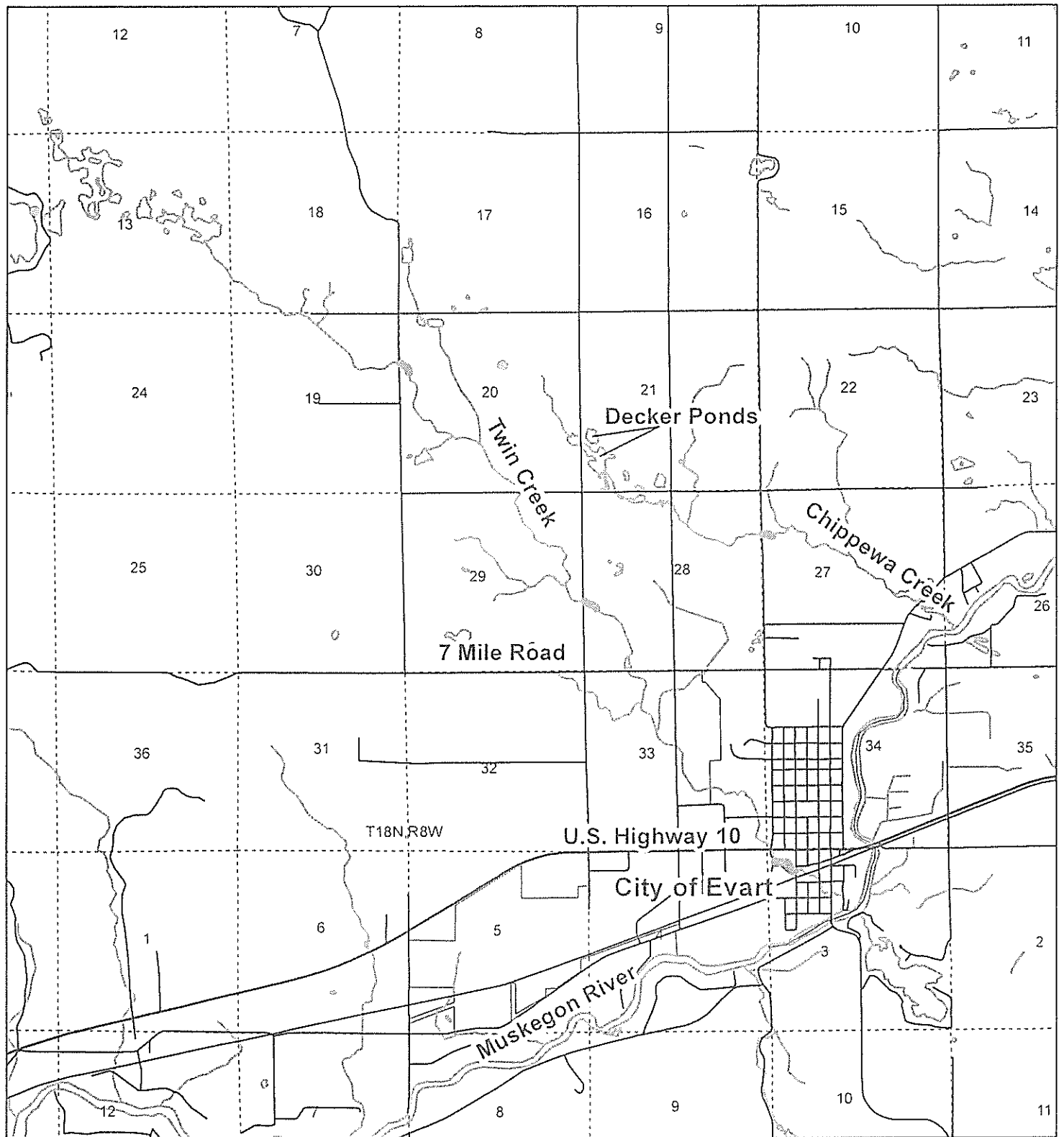
Table 5. Number of fish caught per inch group in a July 25, 2018 electrofishing survey of Twin Creek, Osceola County, MI. The station began approximately 300 feet below the 100th Ave. crossing and ran upstream to the crossing.

Species	Inch class													Total:	
	1	2	3	4	5	6	7	8	9	10	11	12	15		
Brook Trout		1			3	1									5
Blacknose Dace		31	4												35
Brown Trout		25		1	10	1	1	3	2	2	1	1	1		48
Central Mudminnow	2	1													3
Mottled Sculpin	1	3	3												7






Table 6. Number of fish caught per inch group in a July 25, 2018 electrofishing survey of Twin Creek, Osceola County, MI. The station began approximately 300 feet below the 110th Ave. crossing and ran upstream to the crossing.

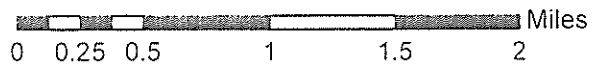
Species	Inch class									Total:
	1	2	3	4	5	6	7	8	9	
Brook Trout		9	1	2	5	1		3		21
Black Bullhead				1						1
Blacknose Dace		3								3
Brown Trout	1	1		2	4	3	3	1	2	17
Central Mudminnow		2								2
Creek Chub		1								1
Green Sunfish	1	2	2							5
Hybrid Sunfish			1							1
Mottled Sculpin	7	14	2							23
Pumpkinseed			3							3



Base map and aerial imagery obtained from Michigan Geographic Data Library

### Legend

-  Production Well PW-101 (approximate)
-  MDNR Survey Locations (approximate)
-  City Limits



TITLE	2018 MDNR Fish Survey Locations
FIGURE	1