Nine Mile Creek Photo by: M. Thorud

Nine Mile Creek Watershed District
2015 Annual Water Quality Monitoring Report

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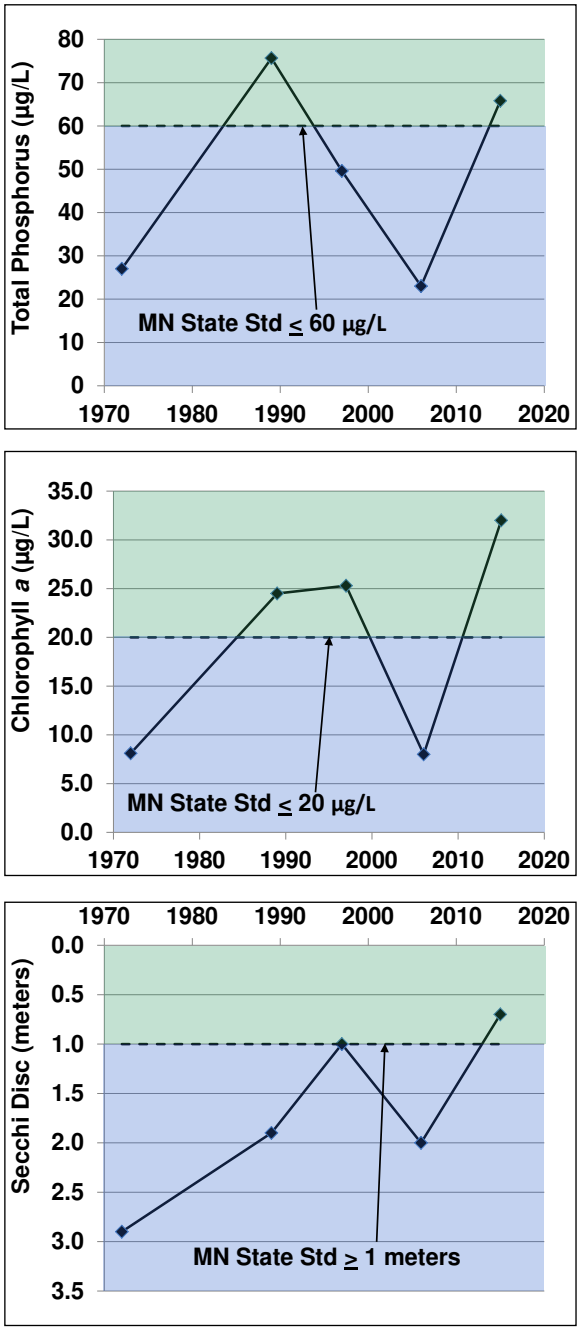
Summary of 2015 Water Quality Monitoring Programs

The 2015 Nine Mile Creek Watershed District (NMCWD) water quality monitoring programs included monitoring four lakes (Birch Island, Bryant, Cornelia, and Edina) and Nine Mile Creek.

Nine Mile Lake Monitoring

The 2015 NMCWD lake water quality monitoring program included monitoring four lakes (Birch Island, Bryant, Cornelia, and Edina). Each lake was monitored on six occasions for selected parameters including: total phosphorus, soluble reactive phosphorus (ortho phosphorus), pH, chlorophyll *a*, chloride, dissolved oxygen, temperature, specific conductance, turbidity, oxidation reduction potential (ORP), phytoplankton, and zooplankton. Aquatic plant (macrophyte) surveys were performed during June and August. Results of the 2015 lake monitoring program follow.



Birch Island Lake average summer total phosphorus (top), chlorophyll *a* (middle), and Secchi disc (bottom) values during 1972-2015.

Birch Island Lake

Birch Island Lake is a small lake with a surface area of 25 acres, a maximum depth of 14 feet, and a mean depth of 3.4 feet at a normal surface elevation of 880.6 M.S.L. The estimated natural overflow elevation is 898.0 M.S.L. The lake is shallow enough for aquatic plants to grow over

the entire lake bed. In addition, it is also a polymictic lake (mixing many times per year).

In 2015, water quality was poor. The lake's average summer total phosphorus and chlorophyll *a* concentrations were 66 µg/L and 32 µg/L, respectively. The lake's average summer Secchi disc transparency was 0.7 meters. The lake's average summer total phosphorus and chlorophyll *a* concentrations and Secchi disc transparency failed to meet the Minnesota State Water Quality Standards for shallow lakes in the North Central Hardwood Forest Ecoregion published in Minnesota Rules 7050 (Minn. R. Ch. 7050.0222 Subp. 4) which are $\leq$ 60 µg/L, $\leq$ 20 µg/L, and $\geq$ 1 meter, respectively.

In 2015, Birch Island Lake observed the poorest water quality to date - highest average summer chlorophyll *a* concentration and lowest Secchi disc transparency. In previous years, average summer chlorophyll *a* concentrations ranged from 8 to 25 µg/L, compared with 32 µg/L in 2015. Secchi disc transparencies have ranged from 1.0 to 2.9 meters compared with 0.7 meters in 2015. The 2015 average summer total phosphorus concentration of 66 µg/L was within the historical range of 23 to 76 µg/L, but was the second highest to date.

Birch Island Lake, pictured above, observed poor water quality in 2015.

A total of 12 aquatic plant species, including a healthy mixture of submerged, floating leaf, and emergent species were observed. Submerged aquatic plants were observed to a relative depth of 7 feet. Plant species observed in 2015 were consistent with species observed in previous years.

As pictured above, most of the lake's cattails in 2015 were dead cattails from a 2014 die-off that was preceded by a rapid rise in water levels.

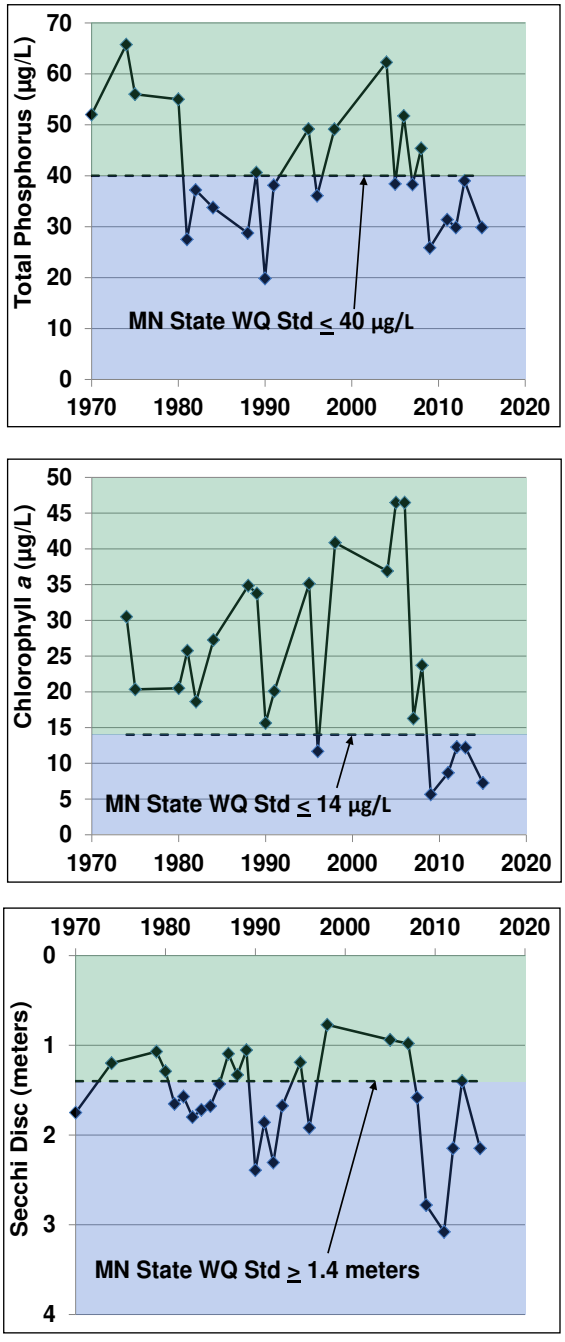
Typically the plant community in the western two thirds of the lake is primarily comprised of cattails (*Typha sp*.) and other wetland vegetation. However, heavy rainfall during June of 2014 raised the water level in the lake by 6 feet (i.e., from 877.06 in May to 883.82 M.S.L in June), causing cattails to die off. In 2015, some sporadic new growths of cattails were observed, but most of the lake's cattails were remains from the 2014 die-off.

The 2015 plant community included one invasive species, purple loosestrife (*Lythrum salicaria*), observed along the east side during June, but not observed during August.

Bryant Lake

Bryant Lake has a surface area of approximately 170 acres, a maximum depth of approximately 45 feet, and a mean depth of 15 feet. The surface outlet of Bryant Lake is the South Fork of Nine Mile Creek, located in the southeastern corner. Outflow is controlled by two 35-foot long 42-inch span corrugated metal arch culverts beneath Willow Creek Road. The surface outlet control level of the lake is Elevation 850.5 M.S.L.

In 2015, Bryant Lake water quality was good. The lake's average summer total phosphorus and chlorophyll *a* concentrations were 14 µg/L and 7.3 µg/L, respectively. The lake's average summer Secchi disc transparency was 2.6 meters. The lake's average summer total phosphorus and chlorophyll *a* concentrations and Secchi disc transparency met the Minnesota State Water Quality Standards for lakes in the North Central Hardwood Forest Ecoregion published in Minnesota Rules 7050 (Minn. R. Ch. 7050.0222 Subp. 4) which are ≤ 40 µg/L, ≤ 14 µg/L, and ≥ 1.4 meters, respectively.



Bryant Lake average summer total phosphorus (top), chlorophyll *a* (middle), and Secchi disc (bottom) values during 1970-2015.

An alum treatment during late fall of 2008 substantially improved the lake's water quality.

- **28 percent decline in total phosphorus** - The lake's pre-treatment average summer total phosphorus concentration (i.e., average of 1970-2008) was 43 µg/L compared with a post-treatment concentration (i.e., average of 2009-2015) of 31 µg/L.

- **68 percent decline in chlorophyll *a*** - The lake's pre-treatment average summer chlorophyll *a* concentration (i.e., average of 1974-2008) was 28 µg/L compared with a post-treatment concentration (i.e., average of 2009-2015) of 9 µg/L.

- **53 percent increase in Secchi disc transparency** - The lake's pre-treatment average summer Secchi disc transparency (i.e., average of 1970-2008) was 1.5 meters compared with a post-treatment transparency (i.e., average of 2009-2015) of 2.3 meters.

The water quality of Bryant Lake, pictured above, improved substantially following alum treatment in late fall of 2008.

In 2015, a total of 18 aquatic plant species, including a healthy mixture of submerged, floating leaf, and emergent species were observed in Bryant Lake. The plant community included three invasive species – Eurasian watermilfoil, curly-leaf pondweed, and purple loosestrife. Eurasian watermilfoil has been documented in the lake since 1995 and dense problematic growths have occurred since 1998. In 2015, Eurasian watermilfoil was present throughout the littoral area and dense growths were observed in the 2-to 6-foot depth range. Mechanical harvesting of Eurasian watermilfoil was conducted by Three Rivers Park

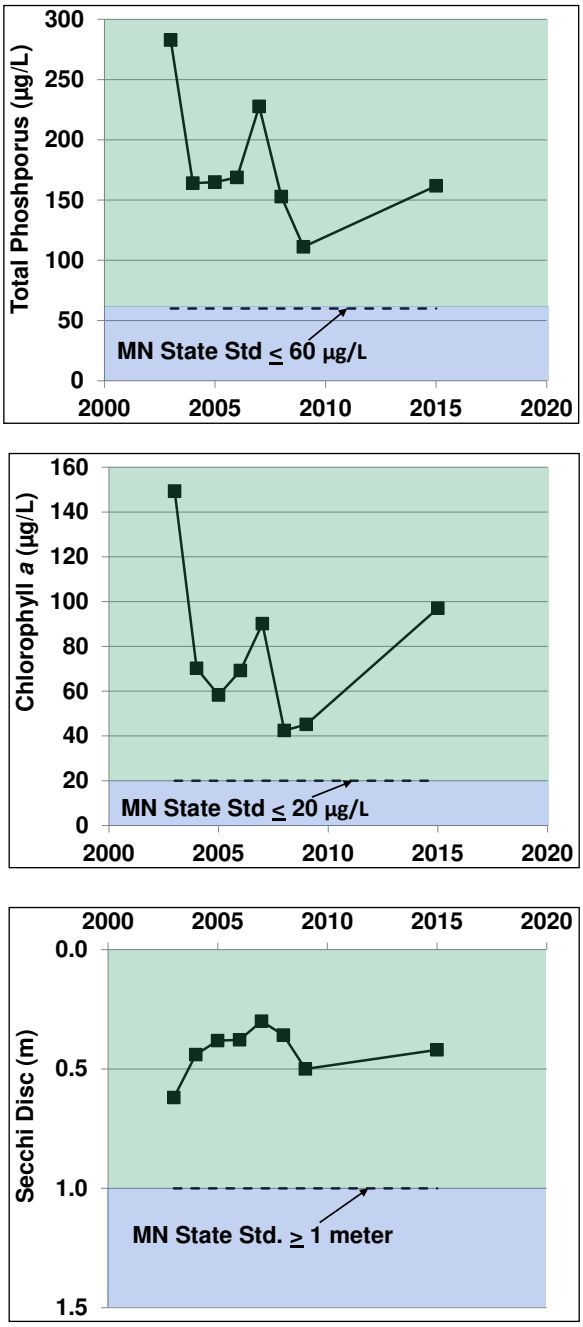
District in June of 2015. In August, Eurasian watermilfoil was present, but was below the surface.

Curly-leaf pondweed has been documented in Bryant Lake since 1998. Although not problematic in 1998, dense problematic growths of curly-leaf pondweed were observed throughout the 2- to 6-foot depth range of the lake during June of 2015. Because curly-leaf pondweed dies off in late June and begins a new growing season in fall, curly-leaf pondweed was not present in August.

In 2015, purple loosestrife was observed at the north and south ends of the lake during June and August.

In 2015, dense growths of Eurasian watermilfoil and curly-leaf pondweed were observed in Bryant Lake, pictured above.

Lake Cornelia



North Cornelia average summer total phosphorus (top), chlorophyll *a* (middle), and Secchi disc (bottom) values during 2003-2015.

Lake Cornelia is located in the north central portion of Edina. The lake is a natural marsh area. Lake Cornelia is comprised of North (North Cornelia) and South (South Cornelia) basins, connected by a 12-inch culvert under 66th Street (with an invert elevation of 859.0 feet MSL) on the south side of North Cornelia, and a secondary 12-inch pipe located on the southeast side of North Cornelia (with an invert elevation of 860.22 feet MSL). Ultimately the water levels in North Cornelia are controlled by the outlet structure at South Cornelia. The outflow from South Cornelia discharges directly over a 14-foot long weir structure with a control elevation of 859.1 feet MSL. Discharges from South Cornelia are conveyed to Lake Edina through an extensive storm sewer network. Due to limited stormsewer capacity downstream of Lake Cornelia, stormwater runoff backs-up into the lake during large storm events which provides temporary storage of the flood volumes.

Lake Cornelia is a Level 4 classification level, which is generally intended for runoff management and has no significant recreational value. However, the Minnesota Department of Natural Resources stocks

the lake annually with approximately 350 bluegills for the Kids Fishing Program and is therefore used for recreation.

North Cornelia

North Cornelia has a water surface of approximately 19 acres, a maximum depth of 5 feet, and a mean depth of approximately 3 feet at a normal water surface elevation of 859.1. The water level in the lake is controlled mainly by weather conditions (snowmelt, rainfall, and evaporation), by the outlet capacity of the pipe on North Cornelia, and by the elevation of the outlet structure located on South Cornelia. The lake is shallow enough for aquatic plants to grow over the entire lake bed. In addition, it is also a polymictic lake (mixing many times per year).

In 2015, North Cornelia water quality was very poor. The lake's average summer total phosphorus and chlorophyll *a* concentrations were 162 µg/L and 97 µg/L, respectively. The lake's average summer Secchi disc transparency was 0.4 meters. The lake's average summer total phosphorus and chlorophyll *a* concentrations and Secchi disc transparency failed to meet the Minnesota State Water Quality Standards for shallow lakes in the North Central Hardwood Forest Ecoregion published in Minnesota Rules 7050 (Minn. R. Ch. 7050.0222 Subp. 4) which are $\leq$ 60 µg/L, $\leq$ 20 µg/L, and $\geq$ 1 meter, respectively.

In 2015, water quality was very poor in North Cornelia, pictured above.

The very poor water quality observed in North Cornelia during 2015 was consistent with previous data. During 2003 through 2009, the lake's average summer total phosphorus concentrations ranged from 111 µg/L to 283 µg/L, average summer chlorophyll *a* concentrations ranged from 42 µg/L to 149 µg/L, and average summer Secchi disc transparency ranged from 0.3 to 0.6 meters.

In 2015, a total of 9 aquatic plant species, including a healthy mixture of submerged and emergent species were observed. The plant community included two invasive species – purple loosestrife and curly-leaf pondweed. Purple loosestrife, also observed in 2008, was present along the northwest shoreline in June of 2015. In August of 2015, purple loosestrife was again present along the northwest shoreline and was also observed along the southeast shoreline.

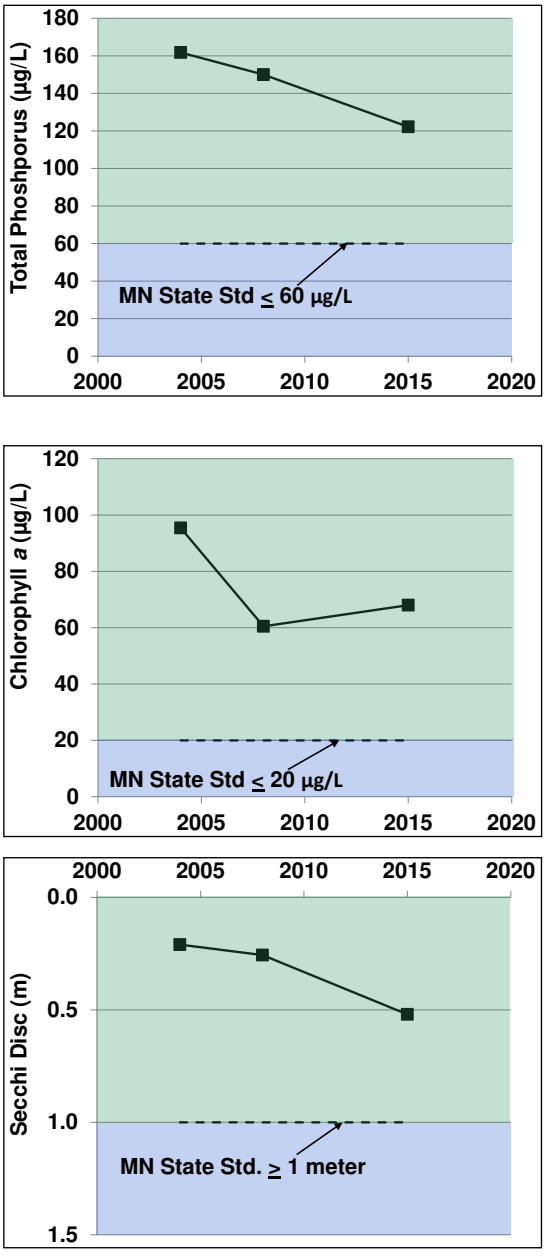
In 2015, curly-leaf pondweed in North Cornelia, pictured above, was dense and problematic along the southern, eastern, and northern shore.

Curly-leaf pondweed was not observed North Cornelia during 2004 and was present in a few small patches in 2008. In 2015, curly-leaf pondweed was present throughout the lake and was problematic. In June, density was light in the center of the lake, but was problematic along the northern, eastern, and southern shore. Curly-leaf pondweed was found throughout the lake in August. Although less dense than in June, a moderate to heavy density was observed near shore and a light density at the lake's center in August.

South Cornelia

South Cornelia has a water surface of approximately 31 acres, a maximum depth of 7 feet, and a mean depth of 4.2 feet at a normal surface elevation of 859.1. The water level in the lake is controlled by the elevation of the weir structure at the south side of the lake. The lake is shallow enough for aquatic plants to grow over the entire lake bed. In addition, it is also a polymictic lake (mixing many times per year).

In 2015, South Cornelia water quality was very poor. The lake's average summer total phosphorus and chlorophyll *a* concentrations were 122 µg/L and 68 µg/L, respectively. The lake's average summer Secchi disc transparency was 0.5 meters. The lake's average summer total phosphorus and chlorophyll *a* concentrations and Secchi disc transparency failed to meet the Minnesota State Water Quality Standards for shallow lakes in the North Central Hardwood Forest Ecoregion published in Minnesota Rules 7050 (Minn. R. Ch. 7050.0222 Subp. 4) which are ≤ 60 µg/L, ≤ 20 µg/L, and ≥ 1 meter, respectively.



South Cornelia average summer total phosphorus (top), chlorophyll *a* (middle), and Secchi disc (bottom) values during 2004-2015.

Although very poor water quality was observed in 2015, water quality was better than previous years - the total phosphorus concentration was lower (better) and the Secchi disc transparency was higher (better). Previous average summer total phosphorus concentrations ranged from 150 µg/L to 162 µg/L compared with 122 µg/L in 2015. Previous average summer Secchi disc transparencies ranged from 0.2 to 0.3 meters compared with 0.5 meters in 2015. The 2015 chlorophyll *a* concentration (68 µg/L) was within the range of previous years (61 µg/L to 95 µg/L).

In 2015, a total of 15 aquatic plant species, including a healthy mixture of submergent and emergent species were observed. The plant community included two invasive species – purple loosestrife and curly-leaf pondweed. Purple loosestrife, observed in the lake since 2004, was found sporadically along the entire shore during 2015. Curly-leaf pondweed was not observed in South Cornelia in 2004, but a small patch was observed in 2008. In 2015, curly-leaf pondweed was observed throughout the lake in both June and August. Densities were problematic throughout the lake in June. In August, curly-leaf pondweed was significantly less dense and the plants were dying off.

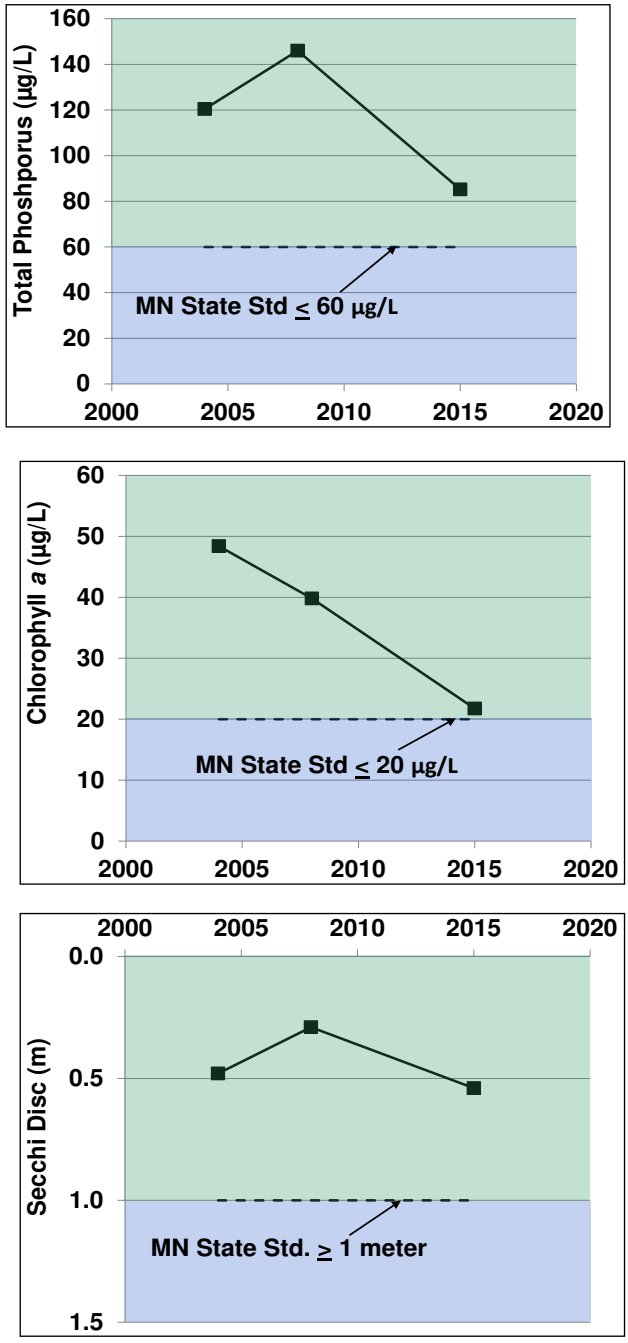
In 2015, water quality in South Cornelia, pictured above, was very poor, but better than previous years.

In 2015, curly-leaf pondweed was problematic throughout South Cornelia, pictured above.

Lake Edina

Lake Edina is a small shallow lake with a surface area of 24 acres and a maximum depth of 1.2 meters. The lake is shallow enough for aquatic plants to grow over the entire lake bed. In addition, it is also a polymictic lake (mixing many times per year).

In 2015, water quality was poor. The lake's average summer total phosphorus and chlorophyll *a* concentrations were 85 µg/L and 22 µg/L, respectively. The lake's average summer Secchi disc transparency was 0.5 meters. The lake's average summer total phosphorus and chlorophyll *a* concentrations and Secchi disc transparency failed to meet the Minnesota State Water Quality Standards for shallow lakes in the North Central Hardwood Forest Ecoregion published in Minnesota Rules 7050 (Minn. R. Ch. 7050.0222 Subp. 4) which are ≤ 60 µg/L, ≤ 20 µg/L, and ≥ 1 meter, respectively. Although very poor water quality was observed in 2015, water quality was better than previous years - the total phosphorus and chlorophyll concentrations were lower (better) and the Secchi disc transparency was higher (better) or the same. Previous average summer total phosphorus concentrations



Lake Edina average summer total phosphorus (top) chlorophyll *a* (middle) and Secchi disc (bottom) values during 2004-2015.

ranged from 120 µg/L to 146 µg/L compared with 85 µg/L in 2015. Previous average summer chlorophyll *a* concentrations ranged from 40 µg/L to 48 µg/L compared with 22 µg/L in 2015. Previous average summer Secchi disc transparencies ranged from 0.3 to 0.5 meters compared with 0.5 meters in 2015.

In 2015, the water quality of Lake Edina, pictured above and below, was better than previous years.

In 2015, a total of 10 aquatic plant species, including a healthy mixture of submerged, floating leaf, and emergent species were observed. Plants were found throughout the entire lake during 2015. The Lake Edina plant community is stable. Plant species observed in 2015 were generally consistent with species observed previously during 2012. However, two additional plant species were present in 2015 – water stargrass and water smartweed. Both are good plants that provide value to the aquatic community.

In 2015, the plant community included three invasive species – purple loosestrife, yellow iris, and curly-leaf pondweed. All three species were observed in Lake Edina previously. During both 2012 and 2015, purple loosestrife and yellow iris were found along the lake perimeter, but were not problematic. Curlyleaf pondweed was

found at one location in the lake at a light density during both 2012 and 2015 and was not problematic.

Nine Mile Creek

Because the primary use of Nine Mile Creek is ecological – a place for fish and aquatic life to live – the focus of the Nine Mile Creek monitoring program is evaluation of the stream's fish and aquatic life community as well as the ecosystem components essential for the survival of fish and aquatic life. The 2015 Nine Mile Creek monitoring program included:

The primary use of Nine Mile Creek is a place for fish and aquatic life to live, such as the shorthead redhorse fish swimming in the Main Stem of Nine Mile Creek at Station ECU-7C, pictured above.

- Annual monitoring of the fish community during summer.
- Annual macroinvertebrate monitoring during October.
- Annual habitat monitoring during summer (i.e., stream substrate type, depth of fine sediment, percent embeddedness, and length of eroded streambank).
- March through October monthly measurements of specific conductance, dissolved oxygen, pH, temperature, turbidity, and flow.

Monitoring locations are shown in Figure 1.

Data collected during 2015 were evaluated to determine whether:

- Specific conductance, dissolved oxygen, pH, temperature, and turbidity levels met Minnesota Pollution Control Agency (MPCA) standards and were consistent with historical values.

- 2015 fish and aquatic life communities were consistent with the stream's ecological use determined from assessments completed in 1997 and 2003.

- The 2015 fish community met the MPCA Fish IBI standard for Nine Mile Creek.

- 2015 macroinvertebrate communities, assessed by biological indices, were consistent with historical data.

Evaluation results follow.

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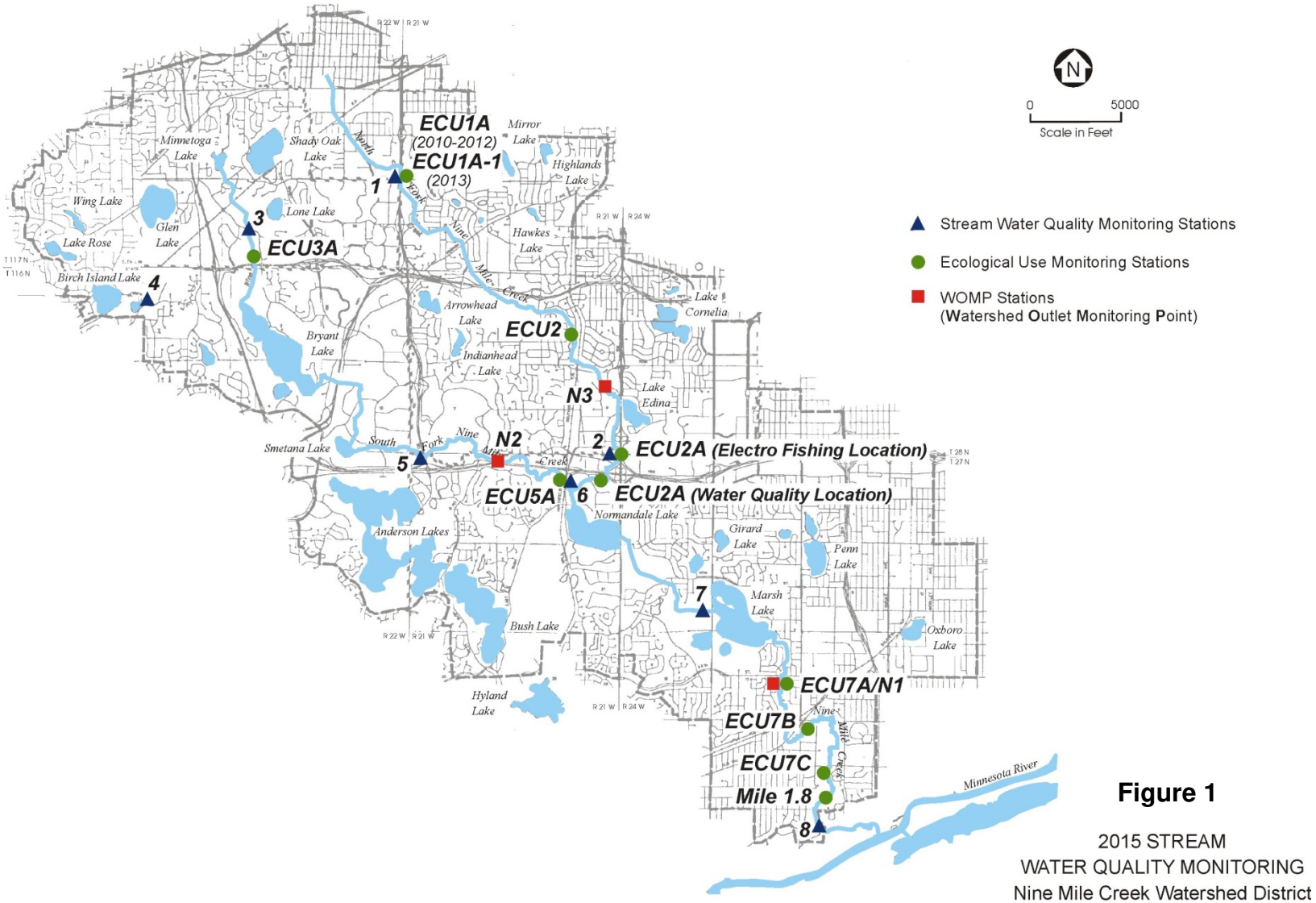

Figure 1

2015 STREAM
WATER QUALITY MONITORING
Nine Mile Creek Watershed District
(Updated 2016)

2015 Nine Mile Creek specific conductance, dissolved oxygen, pH, temperature, and turbidity levels generally met MPCA criteria. Overall, 85 percent of 2015 values were within MPCA criteria. The South Fork met MPCA criteria most frequently (91 percent) followed by the Main Stem (89 percent) and North Fork (79 percent).

In 2015, North Fork locations, such as ECU-1A pictured above and ECU-2 pictured below, met the MPCA standard for specific conductance less frequently than South Fork and Main Stem locations on Nine Mile Creek.

In 2015, the specific conductance criterion was met less frequently than other MPCA criteria. All temperature, pH, and turbidity measurements, 93 percent of dissolved oxygen measurements, and 50 percent of specific conductance measurements met MPCA criteria. As in previous years, the North Fork locations met the MPCA standard for specific conductance less frequently than other locations. Twenty one percent of North Fork measurements met the MPCA specific conductance standard in 2015 compared with 67 percent of Main Stem and 75 percent of South Fork measurements.

The North Fork of Nine Mile Creek met the dissolved oxygen standard more frequently than the Main Stem and South Fork locations in 2015—97 percent of North Fork dissolved oxygen

measurements met the MPCA standard compared with 88 percent of Main Stem and South Fork measurements.

Water quality data collected from Nine Mile Creek in 2015 indicate the stream's water quality generally remained stable and most values (99 percent) were within the range of historical values.

The 2015 fish data indicate Nine Mile Creek is currently supporting the ecological use determined from assessments completed during 1997 and 2003. Ecological use is a term used to describe the fish community that the stream has the capacity to support per the stream's flow, water quality, and habitat characteristics. The data further indicate the current fish community is generally similar to or better than the stream's average long-term fish community. An exception occurred at ECU-7A/N1, located downstream from Marsh Lake, where the current fish community is poorer than the stream's long term fish community. The fish community at ECU-7A/N1 fluctuates widely from year to year. The 2015 fish community at this location was similar to the 2014 fish community (tolerant forage fish), which is also

In 2015, three locations met the MPCA biological standard for fish, including the most downstream North Fork location, ECU-2A, pictured above, and the most downstream Main Stem location, ECU-7C, pictured below.

the stream's expected fish community per the stream's flow, water quality, and habitat characteristics. However, over the past 40 years, the average fish community at this location has been better than expected (intolerant forage fish), and hence, better than the 2015 fish

community. The data indicate the stream has generally remained stable and confirm that the ecological use designations for Nine Mile Creek are appropriate.

Fish collected from Nine Mile Creek in 2015 were assessed to determine whether the stream met the MPCA biological standard for fish. In Minnesota, biological impairment for fish in streams located within the Minnesota River Basin, including Nine Mile Creek, is defined as failing to meet the Minnesota River Assessment Project (MRAP) Index of Biotic Integrity (IBI) impairment threshold score of 30 or greater out of a possible score of 60. Only streams with a watershed area of at least 5 square miles are obligated to meet the IBI impairment threshold.

The most upstream Main Stem location, ECU-7A, pictured above, and middle Main Stem location, ECU-7B, pictured below, met the MPCA biological standard 54 percent of the time during 2003-2015.

In 2015 three of the six Nine Mile Creek monitoring locations with a watershed area of at least five square miles met the MPCA biological standard for fish—North Fork locations ECU-2 and ECU-2A and Main Stem location ECU-7C (Figure 2). Locations not meeting the MPCA biological standard for fish in 2015 include the downstream South Fork location ECU-5A and the upper and middle Main Stem locations ECU-7A and ECU-7B.

The most downstream location of Nine Mile Creek, ECU-7C, has met the MPCA biological standard for

fish annually during 2003 through 2015. All other locations have met the standard during some years and have failed to meet the standard during other years. However, during 2006 and 2012, all Nine Mile Creek locations met the MPCA biological standard for fish (Figure 2).

During the 13 years of monitoring, 2003 through 2015:

- The most upstream North Fork location, ECU-2, met the standard 54 percent of the time
- The most downstream North Fork location, ECU-2A, met the standard 62 percent of the time
- The most downstream South Fork location, ECU-5A, met the standard 31 percent of the time
- The most upstream Main Stem location, ECU-7A, and the middle Main Stem location, ECU-7B, each met the standard 54 percent of the time
- The most downstream Main Stem location, ECU-7C, met the standard 100 percent of the time.

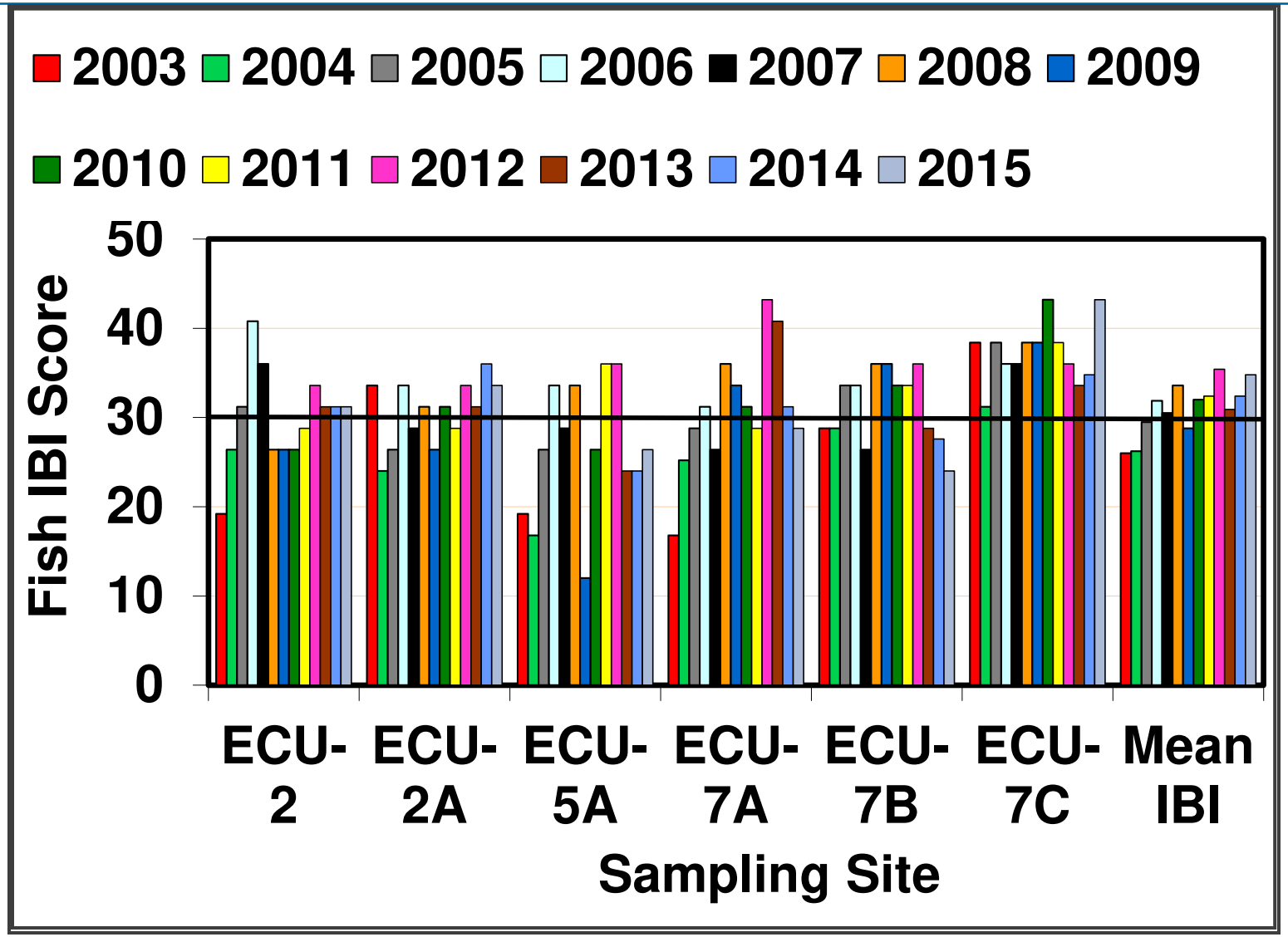

Figure 2 **2003-2015 Nine Mile Creek Fish IBI Scores**

The District's stream stabilization project in the upstream reaches of the North Fork Nine Mile Creek has significantly improved the fish community of ECU-1A. The improved fish community is attributed to improved habitat and water quality improvements resulting from the stream stabilization project. The number of fish collected from the most upstream North Fork location, ECU-1A (upstream of Highway 169), has increased from 55 during 2010 to 369 in 2014 and 231 in 2015 (Figure 3).

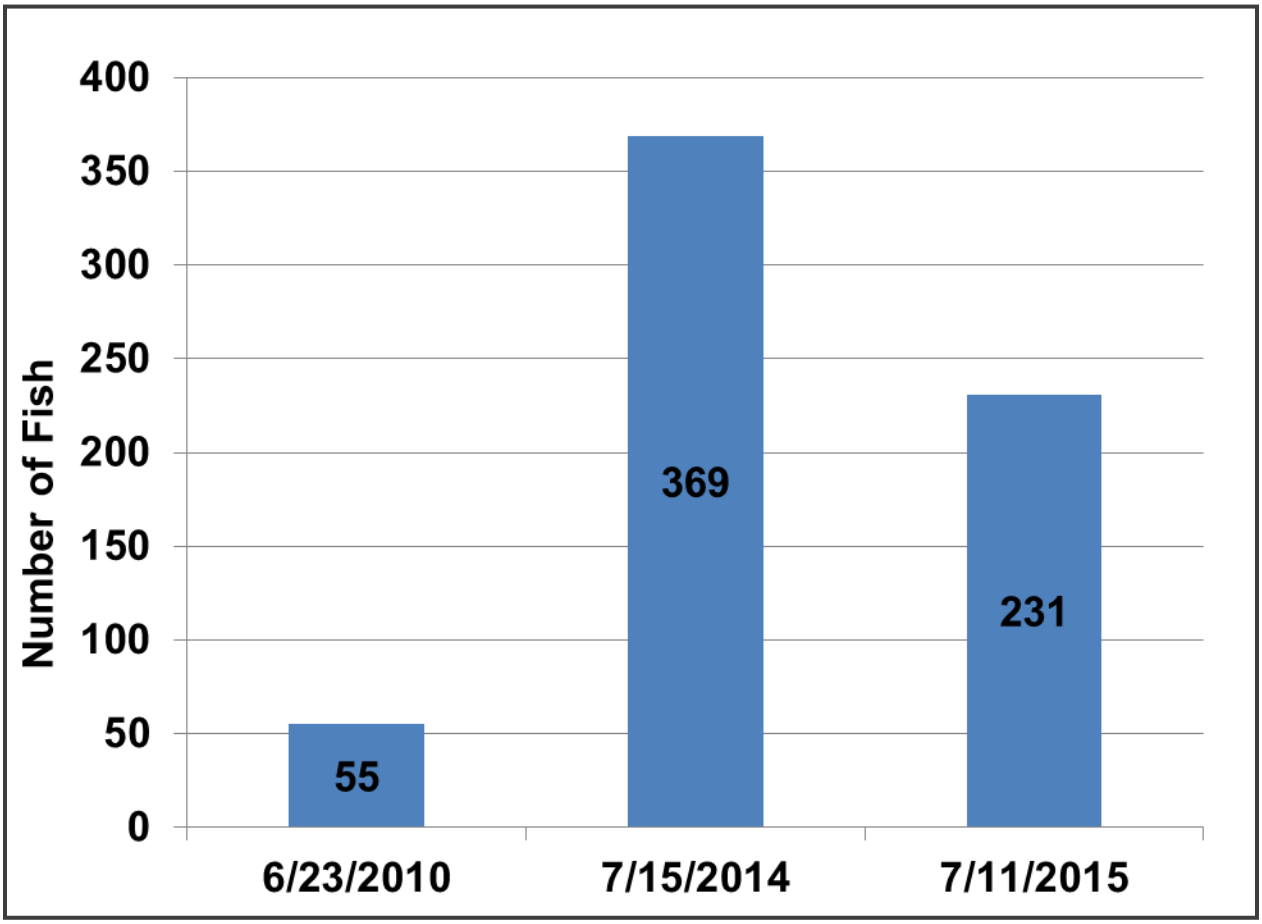

Figure 3 Number of Fish in Nine Mile Creek at Station ECU-1A (Upstream of Highway 169) During 2010, 2014, and 2015

Habitat and water quality improvements from the North Fork stream stabilization project have not only increased the numbers of fish in the stream, but have also improved the quality of the fish community. Warm water sport fish (e.g., green sunfish) were not observed in 2010, but were

present during both 2014 (3 fish) and 2015 (2 fish) (Figure 4). The number of pollution intolerant forage fish increased from 11 in 2010 to 76 in 2014 and 17 in 2015 (Figure 4).

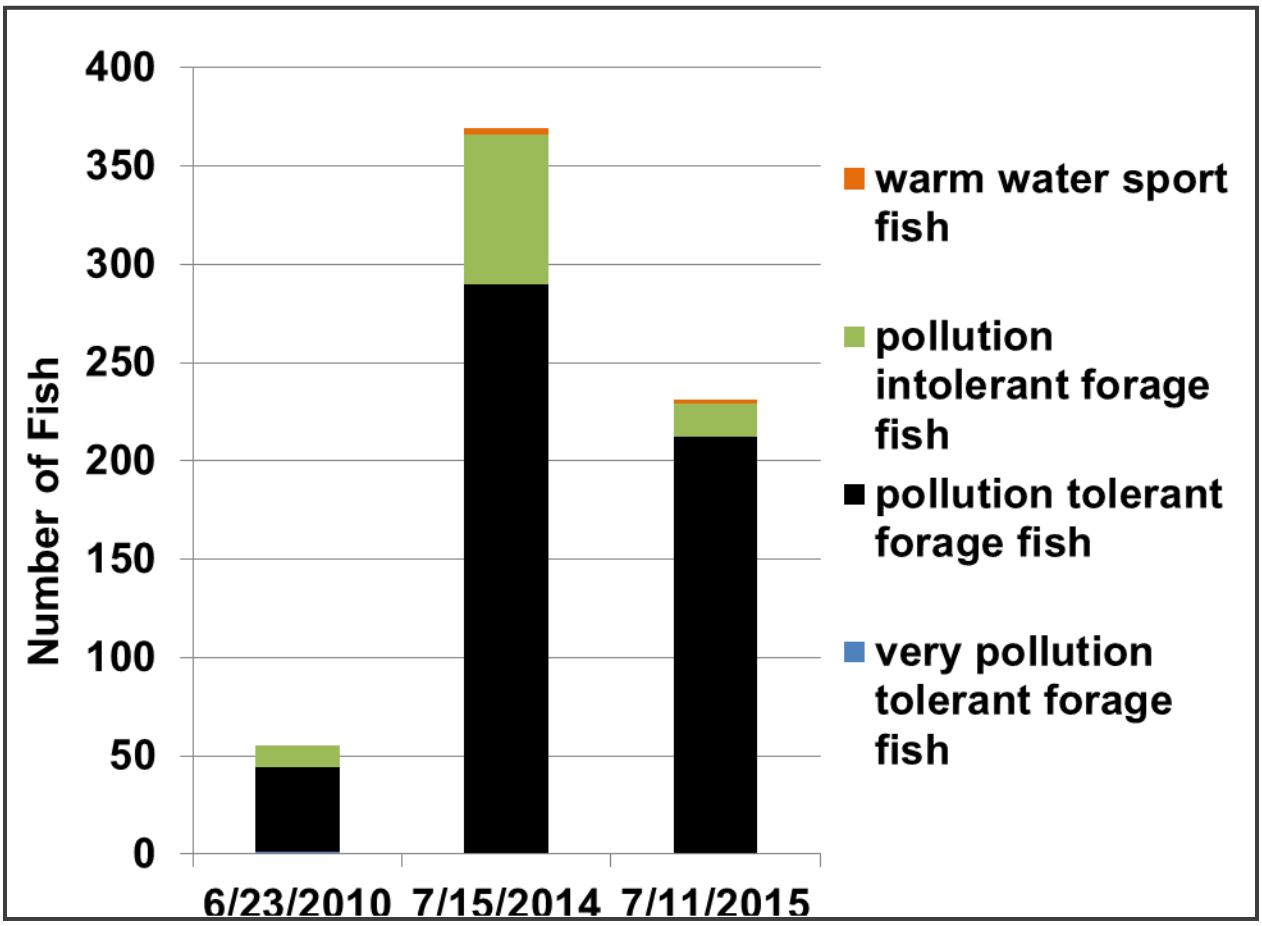

Figure 4 Number of Fish by Ecological Use in Nine Mile Creek at Station ECU-1A (Upstream of Highway 169) During 2010, 2014, and 2015

Habitat and water quality improvements from the North Fork stream stabilization project have improved fish IBI scores at North Fork location ECU-1A. Stream reaches with a watershed area of less than 5 square miles, including ECU-1A, are not obligated to meet the MPCA biological standard for fish, which is a Fish IBI score of at least 30 (Figure 5). The pre-project Fish IBI score from ECU-1A was 26.4, which did not meet the MPCA standard. Following completion of the North Fork stream stabilization project, Fish IBI scores from ECU-1A have consistently

improved – from 33.6 in 2014 to 36.0 in 2015 (Figure 5). Hence, Fish IBI scores at ECU-1A have consistently met the MPCA Standard since completion of the North Fork stream stabilization project.

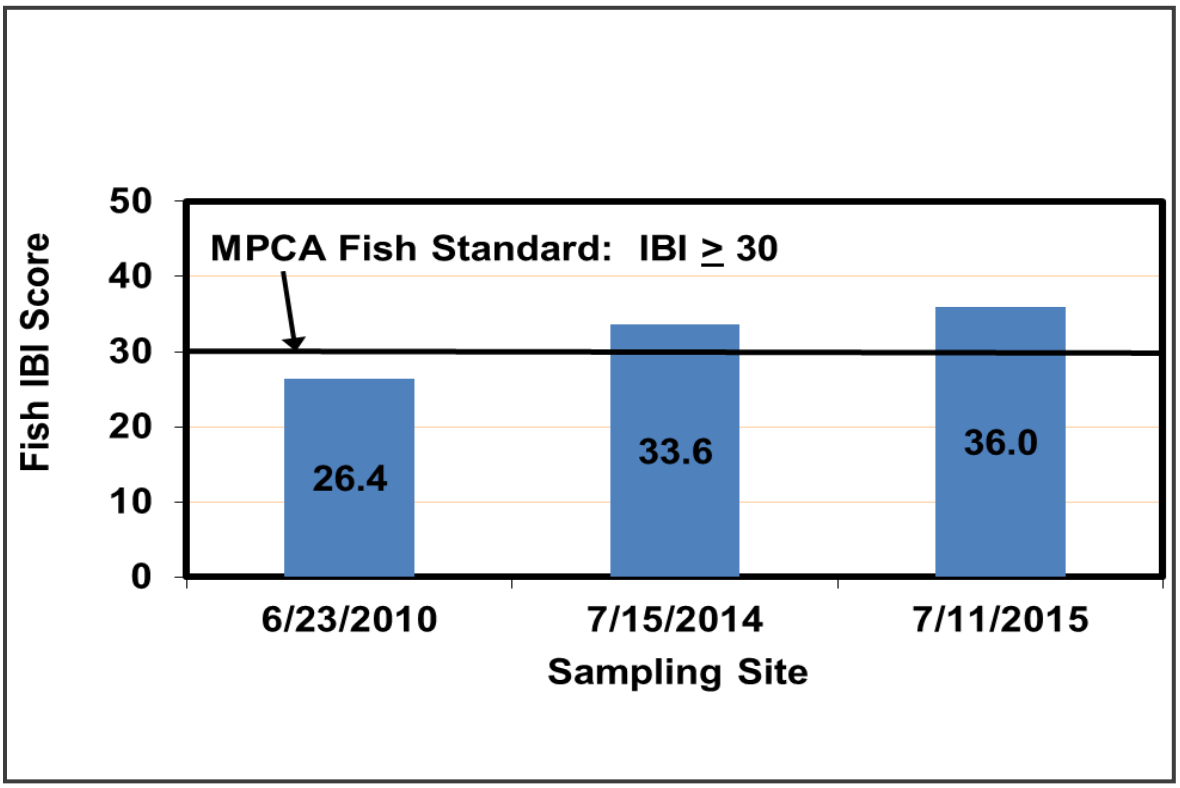

Figure 5 Fish IBI Scores for Nine Mile Creek Station ECU-1A (Upstream of Highway 169) During 2010, 2014, and 2015

The North Fork Nine Mile Creek stream stabilization project significantly improved the fish community at ECU-1A, pictured to the left, including increased numbers of fish, improved quality of the fish community, and increased Fish IBI scores such that the stream currently meets the MPCA Standard.

Nine Mile Creek macroinvertebrates (bugs that can be seen with the naked eye) were assessed using two biotic indices to evaluate the water quality of Nine Mile Creek. The Hilsenhoff Biotic Index (HBI) was used to assess the long-term oxygen content of the stream. HBI assesses stream oxygen by determining the average tolerance of the macroinvertebrate community to low oxygen conditions. A second index, the Invertebrate Community Index, provides a broader view of the stream's water quality than the HBI, determining the average tolerance of the macroinvertebrate community to a wide range of pollutants.

In 2015, the HBI and ICI values from the Main Stem of Nine Mile Creek (ECU-7A, ECU-7B, and ECU-7C), the most upstream North Fork location (ECU-1A), and most downstream South Fork location (ECU-5A) were similar to past values, indicating stream water quality, including oxygen conditions, have remained stable.

In 2015, North Fork locations ECU-2, pictured above, and ECU-2A, pictured below continued a trend toward improving water quality and oxygen conditions that began in 2013.

In 2015, North Fork locations ECU-2 and ECU-2A continued a trend toward improving water quality and oxygen conditions that began in 2013 following a rapid worsening of both HBI and ICI values. A rapid decline in caddisflies at ECU-2 and ECU-2A in 2013 resulted in the poorest biological index (i.e., Hilsenhoff Biotic Index and Invertebrate Community Index) values since monitoring began. ICI values during 1997 through 2015 are shown in Figure 6.

Although the number of caddisflies observed at ECU-2 and ECU-2A were lower in 2015 than years prior to 2013, numbers have increased since 2014. In 2014, caddisflies remained absent from the downstream North Fork location (ECU-2A) and low numbers were observed at the upstream North Fork location (ECU-2). In 2015, caddisflies were present at both locations and higher numbers were observed at the upstream location (ECU-2) than the downstream location

(ECU-2A). The trend toward increasing numbers of caddisflies indicates water quality conditions in the stream are improving.

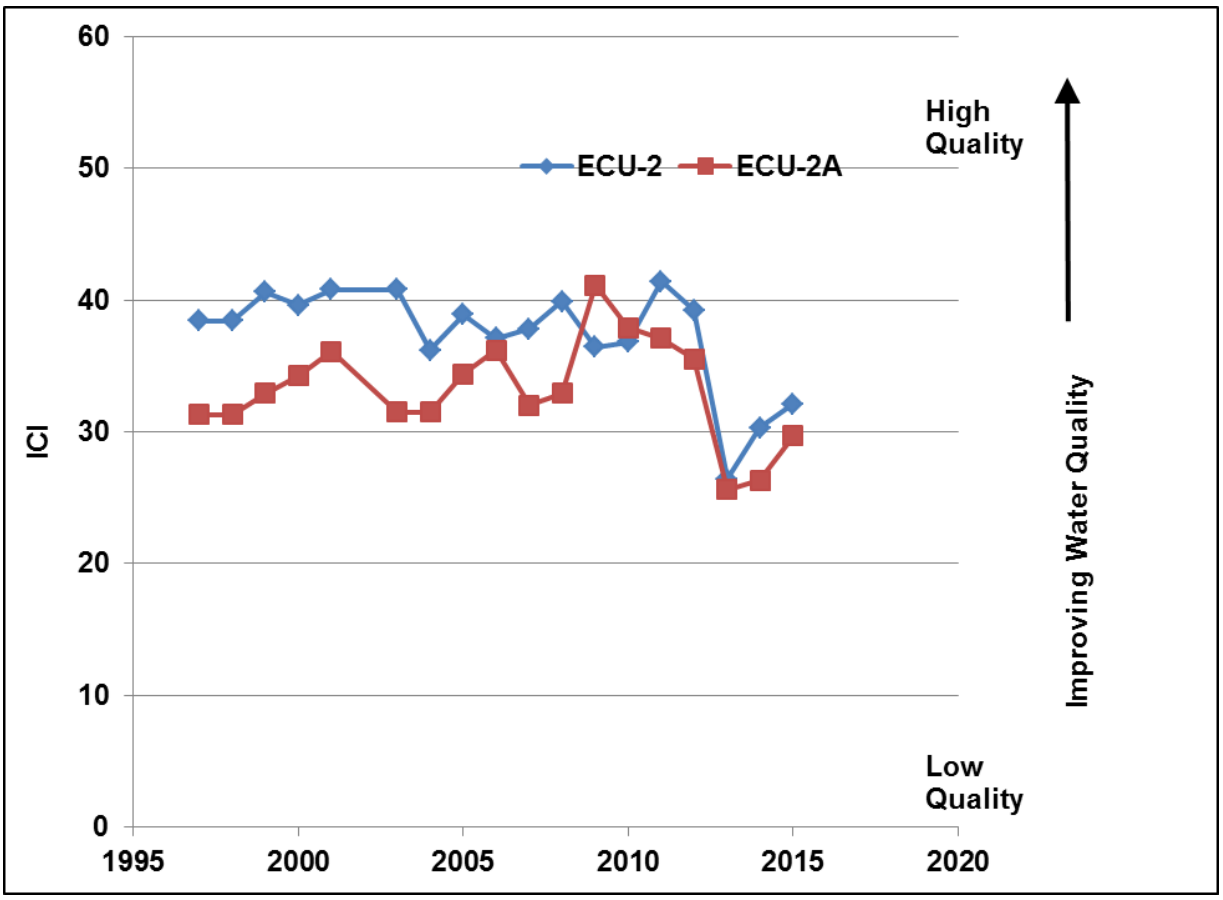

Figure 6 1997-2015 Nine Mile Creek ICI: North Fork Stations ECU-2 and ECU-2A

In 2015, the upstream location on the South Fork (ECU-3A) observed worsening HBI and ICI scores, compared with previous years. However, the worsening HBI and ICI scores coincided with increased numbers of fish and an improved quality of the fish community. The number of fish collected from this location has increased annually since 2012 – from 58 in 2012 to 75 in 2013 to 131 in 2014 to 315 in 2015. Because the watershed tributary to ECU-3A is less than 5 square miles, this location is not obligated to meet the MPCA biological standard for fish, which is a Fish IBI score of at least 30. However, this location has met the State standard annually since 2012 and the Fish IBI scores have consistently improved – from 31.2 in 2012 to 36.0 in 2013 to 40.8 in 2014 to 55.2 in 2015. The consistently improving fish community over the past few years indicates water quality conditions at this location are good. It is hypothesized that the changes in the macroinvertebrate community reflected by the worsening HBI and ICI scores in 2015 are due to fish predation which reduced the number of macroinvertebrates at this location. The number of macroinvertebrates collected in 2015 (394) was about 40 percent less than the number collected in 2014 (656).

During 2012 through 2015, the fish community at the upstream South Fork location, ECU-3A, pictured above, consistently improved and Fish IBI scores annually met the MPCA standard. However, increased numbers of fish reduced macroinvertebrate numbers due to fish predation.

The 2015 water quality, fish, and macroinvertebrate data indicate that despite urbanization impacts, water quality conditions in Nine Mile Creek during 1968 through 2015 have generally remained relatively stable over time. Monitoring will continue at the annual monitoring stations to maintain this long-term record of water quality and biota in Nine Mile Creek and to assess the biological community to determine changes in stream habitat or water quality that warrant further investigation or management measures.