2024 Water Quality Monitoring Report

Vermillion River watershed
reflecting life

State of the Watershed

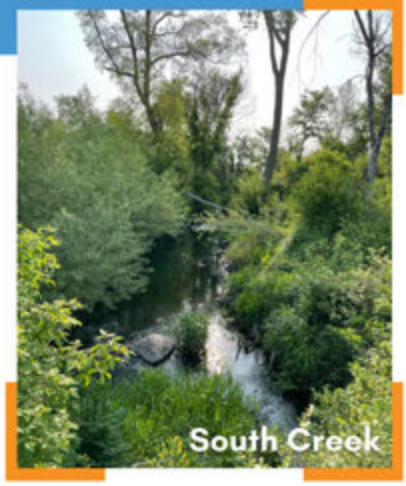
In 2024, water quality in the Vermillion River and its tributaries met many of the state and federal standards, indicating a healthy condition for the watershed. However, there is room for improvement, particularly regarding level and sources of nitrogen, low dissolved oxygen, elevated *E. coli* bacteria, temperature exceedances, and suspended solids concentrations. Continued monitoring of these issues, as well as the planning and implementation of restoration and protection efforts within the eight unique subwatersheds, will help address the various beneficial use impairments (consumption (mercury), life (aluminum, dissolved oxygen, fish, macroinvertebrates, total suspended solids), and recreation (*E. coli*)) found throughout the watershed.

Sampling Summary

- 26 monitoring events with 208 samples collected
- Conducted under Baseflow, Runoff, and Snowmelt conditions

Highlights

- Decreased total suspended solids levels in South Creek Subwatershed
- Habitat conditions along the Vermillion River and major tributaries are stable


South Creek

Climate Conditions

2024 was marked by extreme weather events, with a combination of record-breaking floods, excessive rainfall, some of the warmest temperatures ever recorded across the state, and drought. After experiencing warm, but very dry conditions in the late winter and very early spring months, wetter conditions and warmer temperatures arrived and continued into June. June 2024 was the fourth-wettest June and the fifth-wettest of any month on record in Minnesota. After the return of more "normal" hydroclimatic conditions for July and August, a dry spell took hold during September and much of October resulting in the 10th-driest autumn on record.


South Branch Vermillion River

Vermillion River Watershed

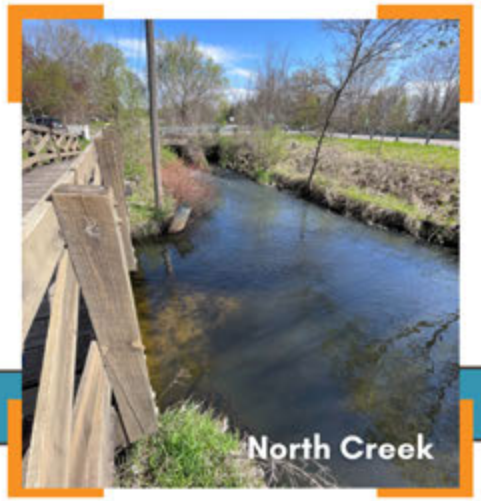
The Vermillion River Watershed (VRW) is the largest watershed in the Twin Cities seven-county metropolitan area. The watershed drains 335 square miles of rural, suburban, and urban landscapes from its headwaters in New Market Township, Scott County and across Dakota County, to its confluences with the Mississippi River at Hastings and Red Wing, Minnesota.

Cities and townships including Apple Valley, Burnsville, Castle Rock Township, Coates, Douglas Township, Elko New Market, Empire, Eureka Township, Farmington, Hampton, Hampton Township, Hastings, Lakeville, Marshan Township, New Market Township, Nininger Township, Ravenna Township, Rosemount, Vermillion, and Vermillion Township make up the watershed.

The Vermillion River main stem travels 35 miles west to east, joined by four major tributaries (North Creek, Middle Creek, South Creek, and South Branch) and many unnamed minor tributaries. The overall topography of the watershed is relatively flat, with low-relief throughout most of the watershed. The watershed's highest elevation is 1,230 feet and lowest elevation is 667 feet. The western part of the watershed has varied topographical features due to glacial moraine deposits. The central and eastern portion flattens out into a relatively level glacial outwash plain. Near the Mississippi River, bedrock bluffs provide more significant relief, but bluff lands make up a small proportion of the overall watershed area.

With its proximity to the Twin Cities Metropolitan Area and a self-sustaining brown trout population, the Vermillion River is a popular place for local anglers and nature enthusiasts. The Vermillion River Watershed protected trout streams includes 32 miles of main stem and 14.4 miles of tributaries and is one of the last trophy trout fisheries in a metropolitan area, according to Trout Unlimited.

The VRW has been, and is continuing to be, threatened by rapid urban development and rural land uses. As the human population in the watershed grows with each passing year, so do concerns for maintaining the ecological integrity of the river and its tributaries.

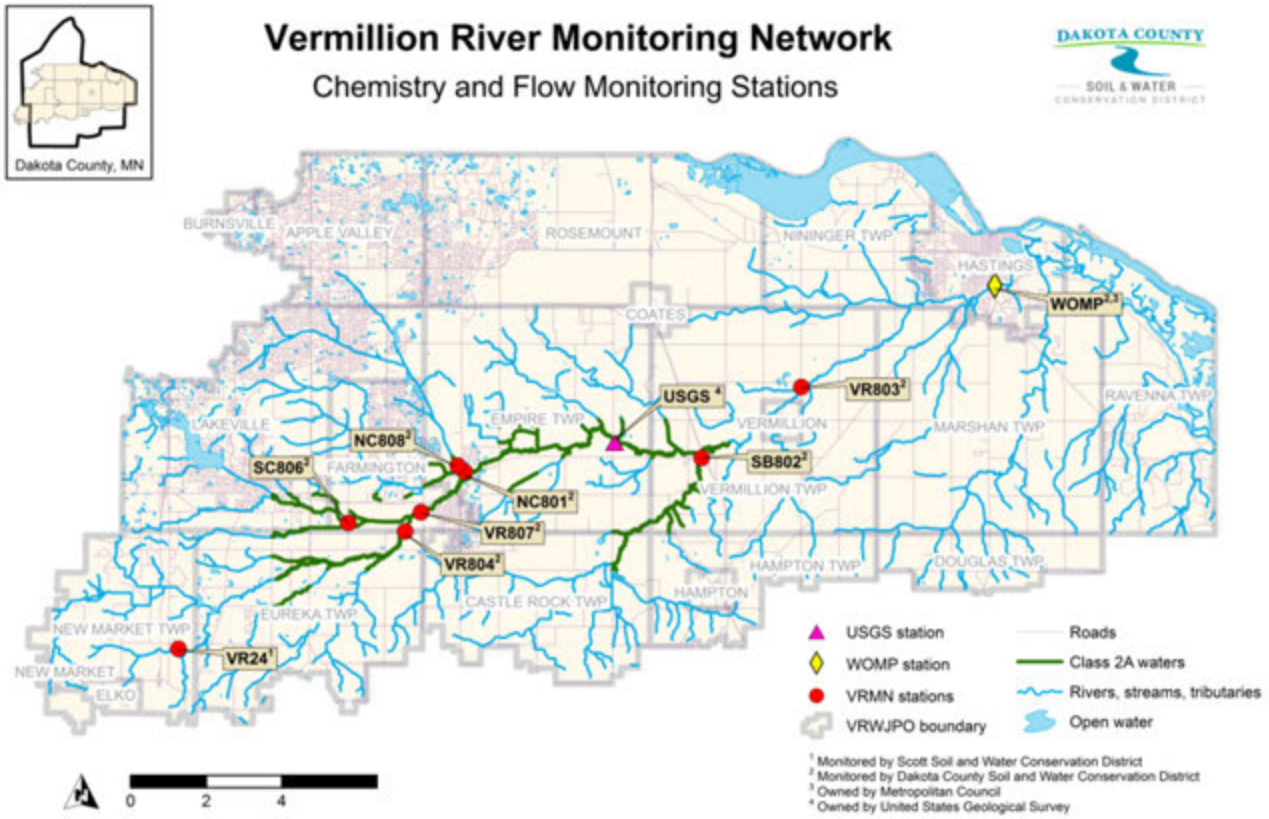

North Creek

Monitoring History and Sampling Parameters

The Vermillion River Monitoring Network (VRMN) was created in the early 2000s to obtain water quality and quantity data for the VRW on behalf of the Vermillion River Watershed Joint Powers Organization (VRWJPO). The VRMN is designed to be spatially extensive and representative of the wide range of flow regimes and land uses encountered in the VRW and its eight unique subwatersheds.

Six of these subwatersheds – Upper Mainstem Vermillion River • South Creek • Middle Mainstem Vermillion River • North Creek • South Branch Vermillion River • Lower Mainstem Vermillion River – are reported here. The two additional subwatersheds – Middle Creek and Lower Vermillion-Mississippi Direct – are not explicitly discussed due to the lack of a representative monitoring station in either subwatershed. While conditions in the Middle Creek Subwatershed are understood as part of the North Creek Subwatershed analysis, due to the Mississippi River's influence on the Lower Vermillion-Mississippi Direct Subwatershed during flood conditions, no independent water quality data have been collected in that subwatershed at this time.

The network consists of eight permanent monitoring stations representing the different subwatersheds and several biological (habitat and macroinvertebrate) monitoring stations. These strategically selected sites provide information about the status of the river and its tributaries, allowing for tracking of long-term trends and more effective management of the water quality and quantity of the VRW.



Sampling parameters include a combination of chemical, physical, and biological parameters and assessments to help identify major sources of pollutants and prioritize areas for management.

Chloride • Chlorophyll a • Dissolved Oxygen • *E. coli* bacteria • Habitat Macroinvertebrates • Nitrate • pH • Specific Conductance • Temperature • Total Phosphorus Total Suspended Solids • Transparency

Water Quality Monitoring

Water quality monitoring of several chemical and physical parameters enables local decision makers and state agencies to evaluate the VRW in order to implement appropriate management strategies to better protect and improve overall stream health.

Transparency of water is affected by both dissolved and suspended materials. The amount of solids (sediment, organic material) suspended in the water has the greatest impact, though dissolved organic material (tea colored water) can also result in low transparency. Elevated sediment levels in a waterbody can reduce the biological productivity of a system by reducing light penetration, increasing water temperature, covering bottom habitat, and diminishing visibility for mobile organisms. Monitoring changes in water transparency is a quick and efficient way to identify when pollutants are present in a given waterbody.

Dissolved Oxygen (DO) is a measure of the oxygen available to aquatic organisms (plant and animal). Reduced DO levels within a stream reach can cause aquatic animals (fish, macroinvertebrates) to leave the area, and under extreme conditions, lack of oxygen can result in death of aquatic organisms. In freshwater systems, such as lakes, rivers, and streams, DO concentrations fluctuate diurnally and will vary by season, location, and water depth. Many factors can influence DO levels in a water body including: water temperature, rate of photosynthesis, light penetration (turbidity and water depth), water turbulence or wave action, and the amount of oxygen used by respiration and decay of organic matter. The state standard for coldwater streams is 7 mg/L as a daily minimum and 5 mg/L as a daily minimum for warm water streams.

Conductivity is a measure of water's ability to transmit an electrical current due to the presence of dissolved chemicals. Chemicals like sodium chloride (salt) dissolve in water and the ions can have physiological effects on plants and animals. Conductivity is fairly constant in most bodies of water, but significant change, due to natural flooding, evaporation or anthropogenic pollution (such as urban and agricultural runoff), can be very detrimental to water quality.

pH is a measure of acidity (less than 7) or alkalinity (greater than 7). A change in pH can alter the behavior of other chemicals (ammonia and some heavy metals) in the water making them toxic . Very low pH can damage gills and membranes, and affect the reproductive success of fish and aquatic macroinvertebrates (bugs), while high pH can ultimately cause death. Human sources of pH fluctuations are usually related to pollution, including stormwater or agricultural runoff, wastewater discharge, or industrial runoff.

Temperature is an important factor to consider when assessing water quality. Water temperature is influenced by both natural (groundwater) and anthropogenic factors (stormwater runoff, eroding soils, and removal of streambank vegetation). Not only can it influence other important monitoring parameters (such as DO and pH), temperature also dictates the types of macroinvertebrates and fish that are able to survive in a given waterbody. Several trout species thrive in cooler waters and studies have shown that temperatures outside their preferred range can affect metabolic rate, as well as behavior, predator-prey responses, and duration of active/rest periods.

South Creek

Phosphorus is required by all living things and occurs in the natural environment (rocks, soil). Phosphorus is generally considered to be the "limiting nutrient" in aquatic ecosystems, meaning that the availability of phosphorus controls the pace at which algae and aquatic plants grow. When too much phosphorus enters a given water body, eutrophication and harmful algal growth can occur. Sources of excess phosphorus are usually associated with human activities: soil erosion, human and animal wastes, septic systems, detergents, runoff from farmland, streets (leaf litter) or lawns. The state standard for all monitoring sites within the VRW is less than or equal to 0.15 mg/L.

Nitrates are a form of nitrogen, which is found in several different forms (ammonia (NH_3), nitrates (NO_3), and nitrites (NO_2)) in terrestrial and aquatic ecosystems. NO_3 are essential plant nutrients, but in excess amounts they can cause significant water quality problems including accelerated eutrophication, which in turn, affects dissolved oxygen, temperature, and other water quality indicators. NO_3 are naturally present in surface and ground waters in low concentrations, but are harmful to humans and livestock and cause aquatic ecosystem degradation in high concentrations. In the lower portion of the VRW, water flows from the stream directly into the underlying groundwater aquifer. Because of this, practices on the landscape can affect the amount of surface water runoff, sediment, and nutrients that are transported to the river. Sources of NO_3 include wastewater treatment plants, runoff from fertilized lawns and cropland, failing on-site septic systems, runoff from animal manure storage areas, and industrial discharges that contain corrosion inhibitors. Coldwater streams are protected as potential drinking water sources and have a less than or equal to 10 mg/L standard.

Total Suspended Solids (TSS) is a measure of all the suspended particles (organic and inorganic material, bacteria, and algae) in the water and is a significant factor when monitoring water clarity. Suspended particles can come from a variety of sources including soil erosion from fields and stream banks, storm water runoff, industrial or wastewater discharges, stirred bottom sediments, decaying vegetation, and algal blooms. Excessive suspended sediment can impair water quality for both aquatic and human life, disrupt feeding behaviors, impede navigation and increase the potential for flooding. The state standard for coldwater streams is less than or equal to 10 mg/L and less than or equal to 30 mg/L for warm water streams.

Escherichia coli (*E. coli*) bacteria are measured as an indicator of the presence of disease-causing pathogens in the water. Originating in the intestines of living creatures (humans and other warm-blooded animals), the presence of *E. coli* in water is a strong indication of recent sewage or animal waste contamination. Potential sources of *E. coli* include land use practices (manure used as fertilizers), animal waste (wild or domestic), and failing septic tanks. *E. coli* contamination is found most commonly in heavily populated or farmed areas. The *E. coli* standard of less than or equal to 126 organisms/100mL as a geometric mean replaced fecal coliform as Minnesota's water quality standard for bacteria in 2008.

Upper Mainstem Vermillion River Subwatershed

2024 Activity Summary

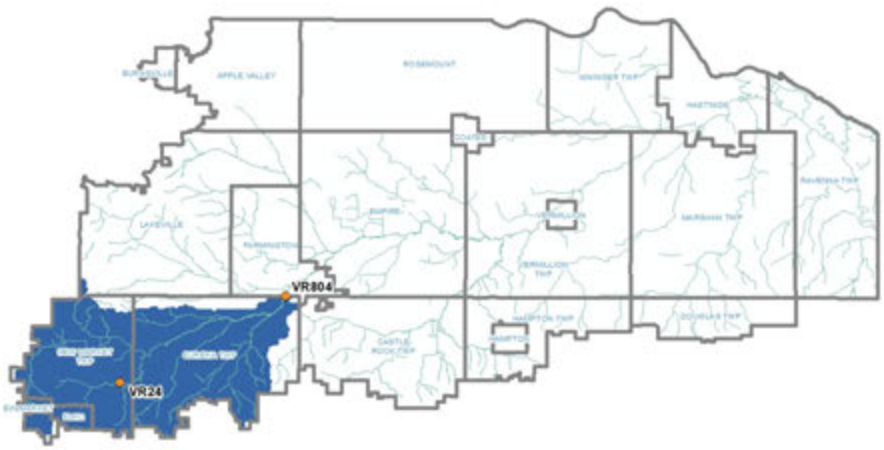
- Water samples were collected monthly from March (snowmelt) through October at VR24 and VR804
- Water level monitoring equipment was installed at VR24 by Scott SWCD staff and at VR804 by the Minnesota DNR
  - Continuous water level and temperature readings are collected at 15 minute intervals

Monitoring Sites

- VR24
  - Vermillion River at Pillsbury Ave
- VR804
  - Vermillion River at 220th St

Topography and Land Use

- Gently rolling
- Predominantly agricultural with residential and commercial lots



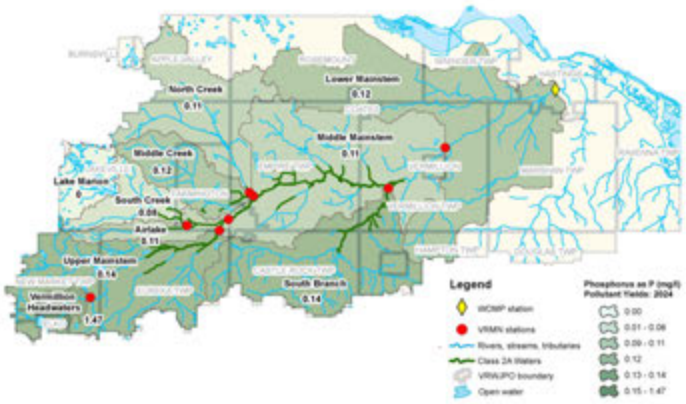
Field Data - Temperature, Dissolved Oxygen, Transparency, Conductivity, pH

Water quality data were collected at VR24 and VR804 during all flow conditions from March to October, 2024. **On most occasions, field parameters fell within the desired ranges**. During runoff sampling events, dissolved oxygen (too low at VR804), transparency (reduced for both sites), and conductivity (exceeded at VR24) issues were identified.

Parameter	Desired Range	VR24 Range	VR804 Range
Temperature (°C)	Less than 30	0.25 - 19.99	1.42 - 21.18
Dissolved Oxygen (mg/L)	Warm water - Greater than 5.0 Coldwater - Greater than 7.0	Warm: 6.73 - 14.98	Cold: 5.36 - 12.17
Transparency (cm)	Greater than 25	8 - 100	12 - 100
Conductivity (µS/cm)	Less than 698	502.9 - 1115.6	359.5 - 681
pH (S.U.)	6.5 to 9.0	7.64 - 8.34	7.54 - 8.26

Phosphorus

Total Phosphorus (TP) includes all forms of phosphorus; particulate and dissolved. **The state standard of 0.15 mg/L was exceeded during runoff conditions (> 1" rain in 24 hour period) in the late spring months and in early August.** Large runoff events often lead to phosphorus laden sediment being carried into the river via runoff from streets and agricultural fields. **Samples collected during baseflow conditions in the late summer and fall were below the standard at both sites.**



In 2024, the Vermillion Headwaters subwatershed (located entirely in Scott County; VR24 is the outlet site), showed TP pollutant yields 5-6x higher than all monitoring years from 2016-2023 (see map above). Climactic conditions returned to more "normal" rainfall amounts in 2024 so higher yields could be a result of legacy TP flushing through the system.

Nitrates

The US Environmental Protection Agency set a nitrate (NO3) standard of ⩽10 mg/L for drinking water to protect human health. NO3 in streams is natural, but natural levels are generally around 0.5-2 mg/L. **In 2024, NO3 concentrations did not exceed the drinking water standard at either site, and was in fact significantly lower.** NO3 was highest during baseflow conditions and decreased due to rainwater diluting in-stream concentrations.

Total Suspended Solids

For all water samples collected in 2024, TSS levels were within the state standard of 30 mg/L (VR24 - warm water standard) and 10 mg/L (VR804 - coldwater standard), although the standard may have been exceeded on days when samples were not collected. TSS levels fluctuated throughout the season, but were highest during runoff or snowmelt events in the watershed as that would have resulted in increased sediment flowing into the creek.

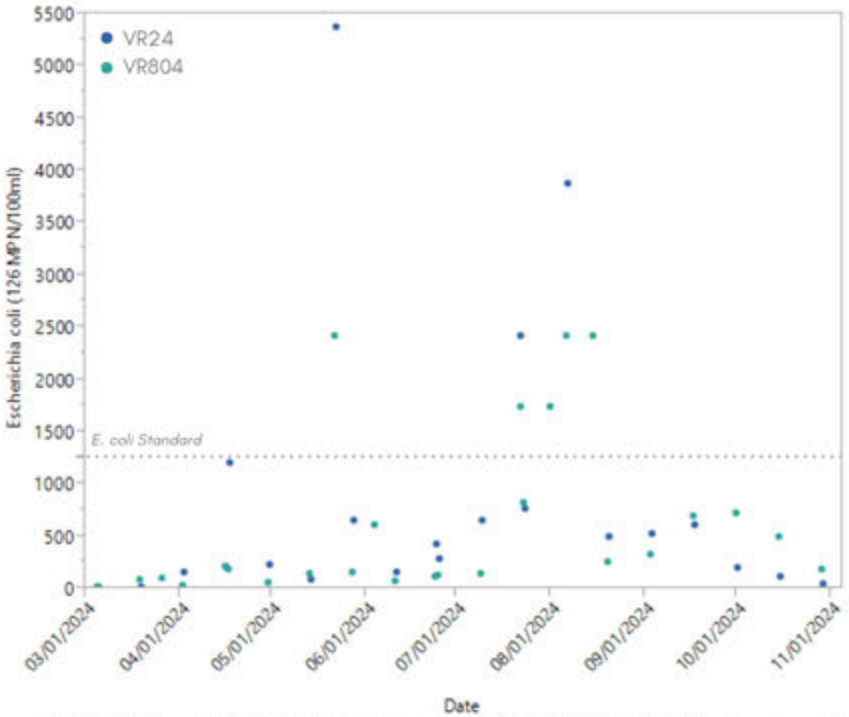
Chlorophyll-a

Chlorophyll-a serves as an indirect indicator of nutrient levels in a river due to the relationship between water quality and algae biomass. **Chlorophyll-a levels were well below the state standard (⩽ 35 ug/L), with increased variability in the spring and early summer months.**

E. coli

VR24 continues to have *E. coli* levels that are considerably higher than other stations in the network, violating the single sample standard (< 1,260 MPN/100mL - see right) in almost a third of samples collected in 2024. The annual *E. coli* geometric mean of 588.11 MPN/100 mL was 2x higher than at all other VRMN sites (VR804 = 267.32 MPN/100 mL). *E. coli* levels at VR804 were more in line with levels seen in the lower portions of the watershed.

From 2016-2023, Scott SWCD staff assessed watercourses upstream of VR24 to determine the source of the elevated *E. coli* levels. Analyses showed sources of human DNA at all sites with septic sources suspected to be the main contributors for higher concentrations. VRWJPO staff are working with Scott County to determine a management strategy.



VR24 Outliers - 11,120 MPN/100 mL on March 26, 10,810 MPN/100 mL on June 4, 30,760 MPN/100 mL on August 1, and 86,640 MPN/100 mL on August 15.

South Creek Subwatershed

2024 Activity Summary

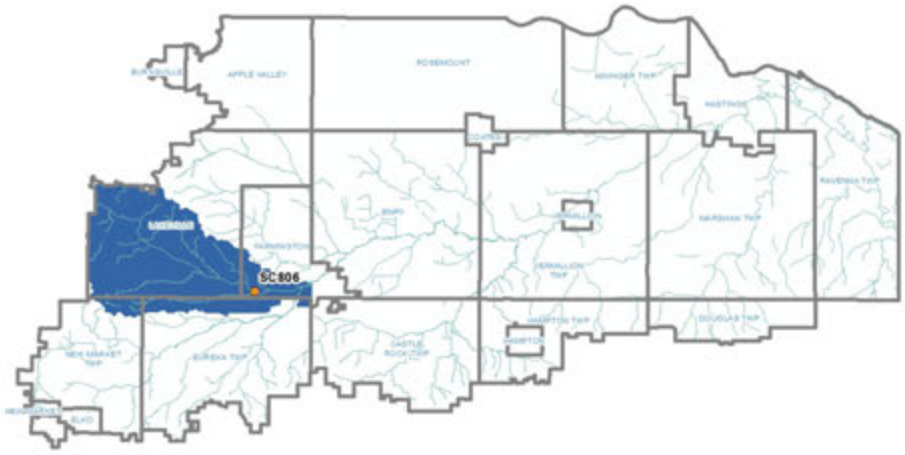
- Water samples were collected monthly from March (snowmelt) through October at SC806
- Water level monitoring equipment was installed at SC806 by the Minnesota DNR
  - Continuous water level and temperature readings are collected at 15 minute intervals

Monitoring Site

- SC806
  - South Creek at Flagstaff Ave

Topography and Land Use

- Gently rolling
- Residential with industrial and agricultural



Field Data - Temperature, Dissolved Oxygen, Transparency, Conductivity, pH

Water quality data were collected at SC806 during all flow conditions from March to October, 2024. **On most occasions, field parameters fell within the desired ranges**. During runoff events, dissolved oxygen (too low), transparency (reduced), and conductivity (exceeds) issues were identified.

Parameter	Desired Range	SC806 Range
Temperature (°C)	Less than 30	1.74 - 19.81
Dissolved Oxygen (mg/L)	Greater than 7.0	4.25 - 10.76
Transparency (cm)	Greater than 25	19 - 100
Conductivity (µS/cm)	Less than 698	376.2 - 982
pH (S.U.)	6.5 to 9.0	7.49 - 7.98

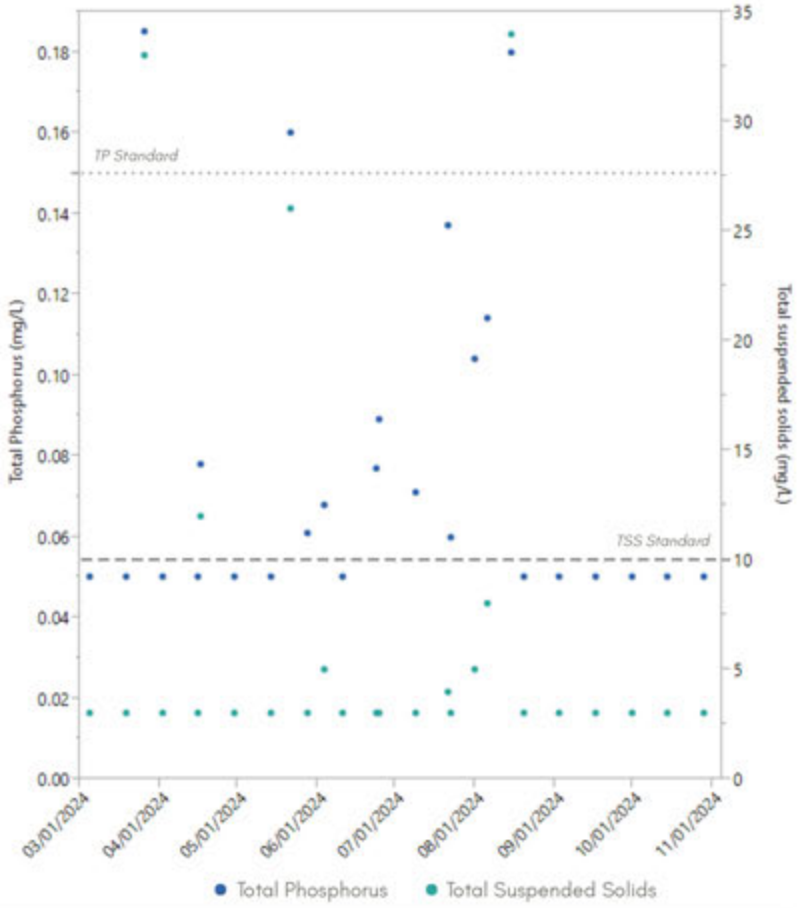
Phosphorus

TP samples collected during baseflow conditions were below the state standard of 0.15 mg/L) throughout the monitoring season. **Major runoff conditions (> 2" rain in 24 hour period) resulted in samples that did exceed the standard** as large runoff events send sediment and other pollutants into the creek via storm runoff from streets, parking lots, and industrial areas in this watershed.

Total Suspended Solids

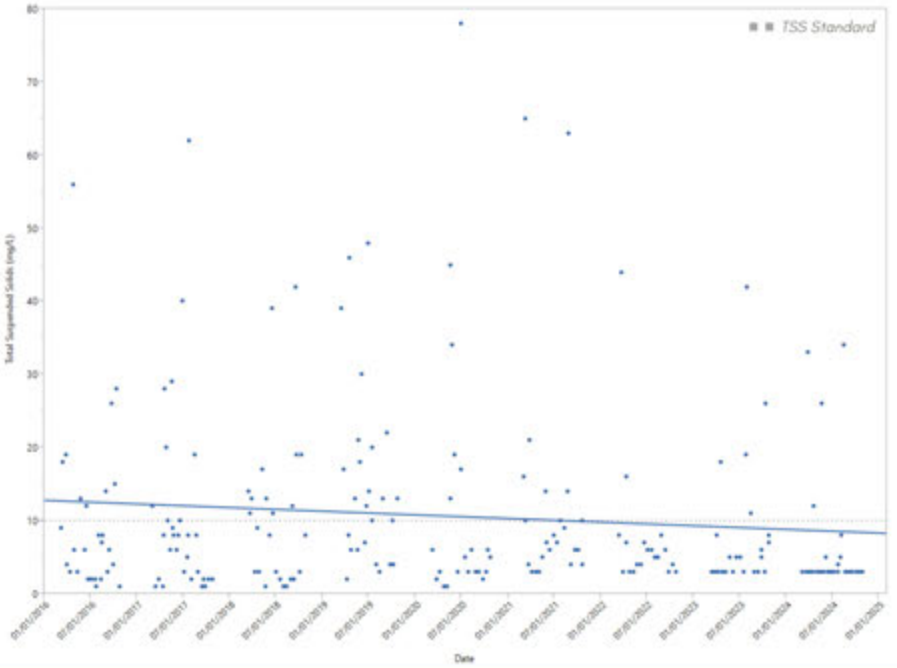
All water samples collected during baseflow conditions met the TSS state coldwater standard of 10 mg/L. The highest TSS levels occurred during the same monitoring events that TP also had exceedances above the standard. TSS showed less variability during the midsummer months when smaller runoff events occurred and during the fall when the stream returned to baseflow conditions.

In recent years, the VRWJPO has implemented several projects in the South Creek Subwatershed focusing on TSS reduction: installation of hydrodynamic separators stormwater treatment device, stream restorations, and bio infiltration. Historical monitoring results since 2016 show a reduction in TSS concentration overtime, as well as increased consistency in sample levels during baseflow conditions.



Chlorophyll-a

Chlorophyll-a serves as an indirect indicator of nutrient levels in a river due to the relationship between water quality and algae biomass. **Chlorophyll-a levels were well below the state standard (⩽ 35 ug/L), with increased variability during runoff events.**



E. coli

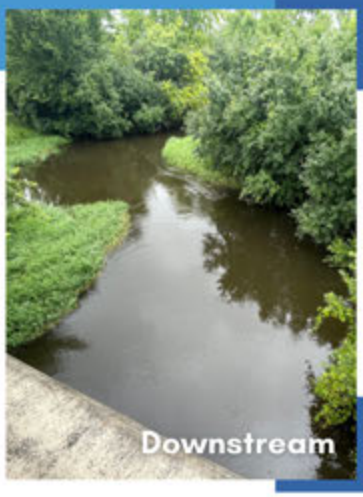
***E. coli* levels are significantly lower in the South Creek Subwatershed than in the Upper Mainstem Vermillion River Subwatershed.** Only five samples exceeded the state single sample standard (< 1,260 MPN/100mL) with three of the samples collected during the extended rainy period in early August.

The annual *E. coli* geometric mean of 207.01 MPN/100 mL was half that of VR24, in line with VR804 and the other VRMN sites downstream.

Nitrates

NO3 concentrations were significantly below the EPA's ⩽ 10 mg/L) drinking water standard regardless of monitoring condition (baseflow vs runoff).

Middle Mainstem Vermillion River Subwatershed



2024 Activity Summary

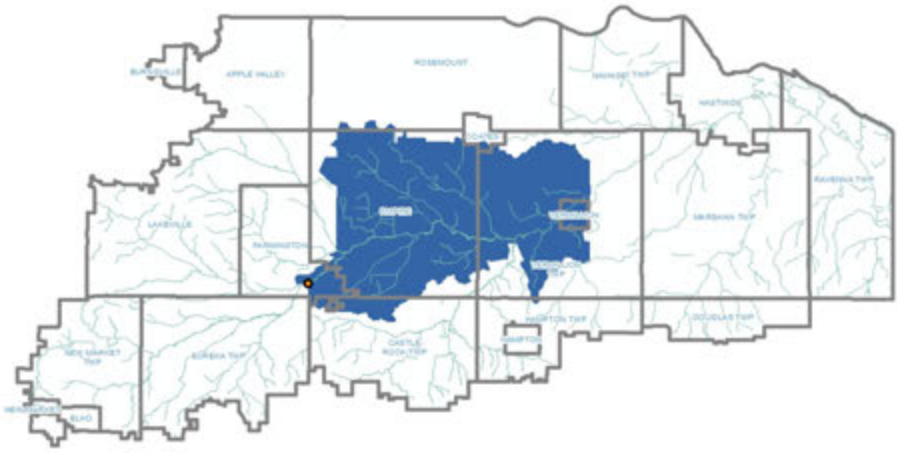
- Water samples were collected monthly from March (snowmelt) through October at VR807
- Water level monitoring equipment was installed at VR807 by the Minnesota DNR
  - Continuous water level and temperature readings are collected at 15 minute intervals

Monitoring Sites

- VR807
  - Vermillion River at Spruce St

Topography and Land Use

- Gently rolling
- Predominantly agricultural with residential and commercial lots



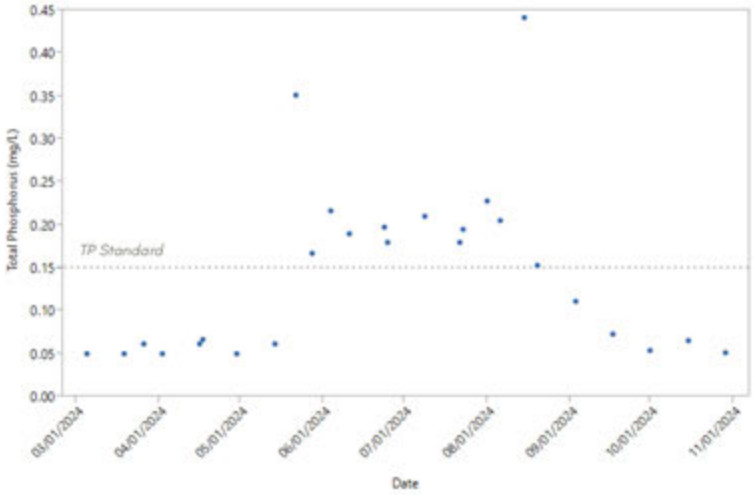
Field Data - Temperature, Dissolved Oxygen, Transparency, Conductivity, pH

Water quality data were collected at VR807 during all flow conditions from March to October, 2024. **On most occasions, field parameters fell within the desired ranges**. Baseflow conditions met expectations, while during runoff events, dissolved oxygen (too low), transparency (reduced), and conductivity (exceeds) issues were identified.

Parameter	Desired Range	VR807 Range
Temperature (°C)	Less than 30	2.57 - 20.84
Dissolved Oxygen (mg/L)	Coldwater - Greater than 7.0	5.29 - 12.15
Transparency (cm)	Greater than 25	18 - 100
Conductivity (µS/cm)	Less than 698	333 - 756
pH (S.U.)	6.5 to 9.0	7.44 - 8.24

Phosphorus

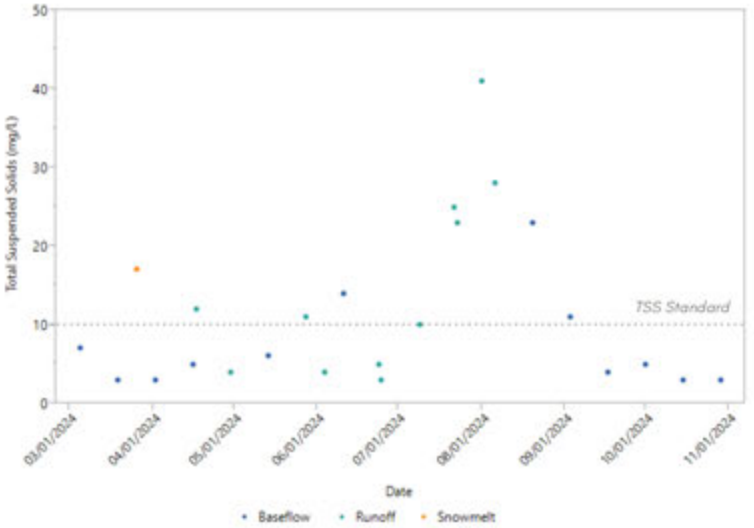
The TP state standard of 0.15 mg/L was exceeded during runoff conditions (> 1" rain in 24 hour period) starting in late May and staying high through the summer. Samples collected during baseflow conditions in the late summer and fall were below the standard. Large runoff events often lead to sediment and other pollutants being carried into the creek via storm runoff from streets, parking lots, and agricultural fields.



Total Suspended Solids

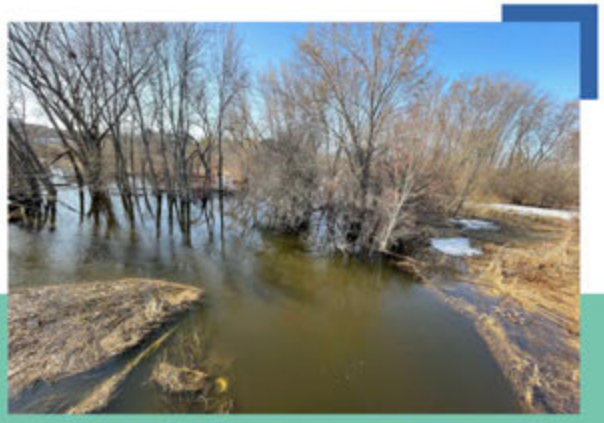
TSS levels exceeded the state's coldwater standard of 10 mg/L several times throughout the monitoring season. TSS levels were highest during runoff and snowmelt events in the watershed. During these conditions, TSS levels would be higher due to increased sediment flowing into the creek. Post-runoff baseflow sampling events also had elevated TSS levels as water levels were slowly returning to baseflow levels.

Two TSS outliers are not shown on the graph - 81 mg/L on May 22 (> 2" rain in 48 hours) and 122 mg/L on August 15 (> 3" two weeks prior and water levels still high).



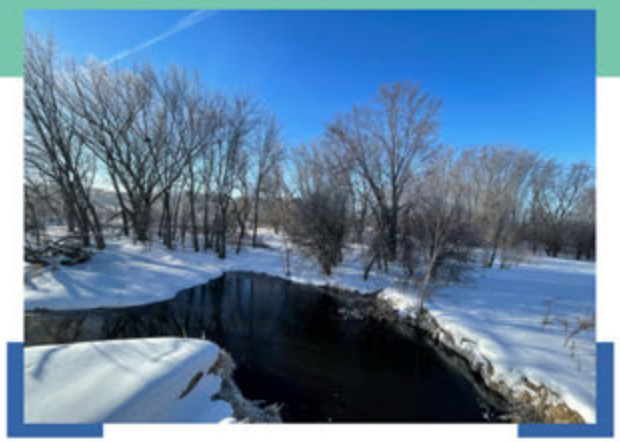
Nitrates

NO3 concentrations did not exceed the EPA's ⩽ 10 mg/L drinking water standard during the monitoring season at both sites. NO3 was highest (4.5 mg/L) during baseflow conditions and decreased to 1.3 mg/L due to rainwater dilution of in-stream nitrate concentrations.



Chlorophyll-a

Chlorophyll-a levels were below the state standard (⩽ 35 ug/L), with increased variability in the spring months.



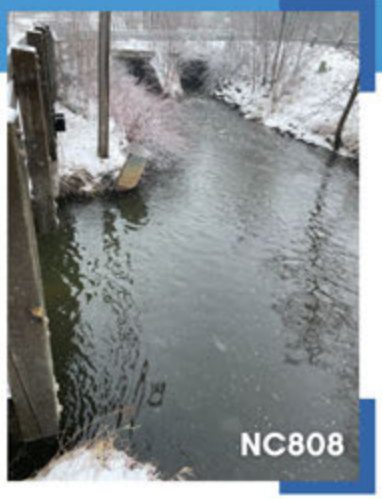
E. coli

E. coli levels are again much lower in the Middle Mainstem Vermillion River Subwatershed than what was found in the Upper Mainstem Vermillion River (specifically VR24). **Only five samples exceeded the state single sample standard (< 1,260 MPN/100mL) with three of the samples collected during the extended rainy period in early August.**

The annual *E. coli* geometric mean of 283.54 MPN/100 mL in line with other VRMN sites in the watershed.

Middle Mainstem Vermillion River

North Creek Subwatershed



2024 Activity Summary

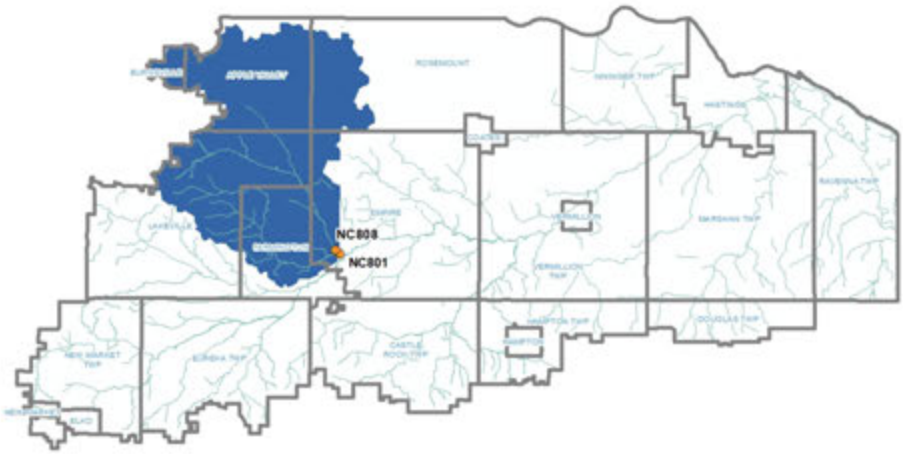
- Water samples were collected monthly from March (snowmelt) through October at NC801 and NC808
- Water level monitoring equipment was installed at NC801 and NC808 by Dakota SWCD staff
  - Continuous water level and temperature readings are collected at 15 minute intervals

Monitoring Sites

- NC801
  - North Creek at Hwy 3 (DS)
- NC808
  - North Creek at Hwy 3 (US)

Topography and Land Use

- Relatively flat to gently rolling
- Residential with some agriculture, commercial, and industrial



Field Data - Temperature, Dissolved Oxygen, Transparency, Conductivity, pH

Water quality data were collected at NC801 and NC808 during all flow conditions from March to October, 2024. **On most occasions, field parameters fell within the desired ranges**. Dissolved oxygen (too low at both sites), transparency (reduced for both sites), and conductivity (exceeded at both) were issues identified during runoff events.

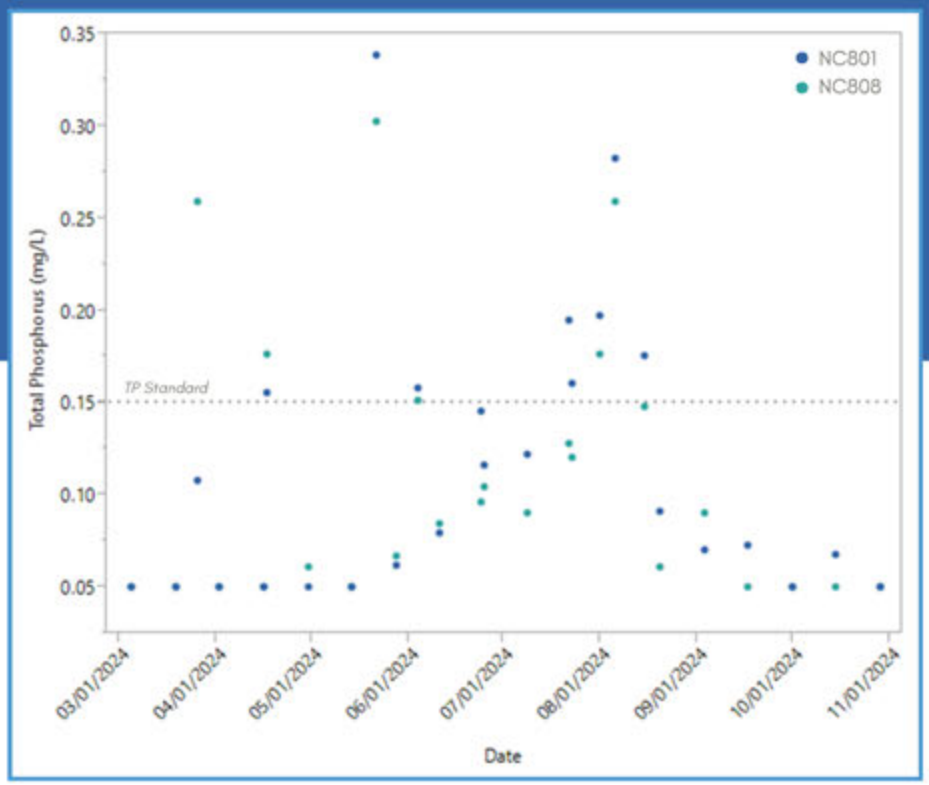
Parameter	Desired Range	NC801 Range	NC808 Range
Temperature (°C)	Less than 30	1.84 - 20.81	1.84 - 20.99
Dissolved Oxygen (mg/L)	Coldwater - Greater than 7.0	4.41 - 12.39	4.42 - 12.53
Transparency (cm)	Greater than 25	23 - 100	23 - 100
Conductivity (µS/cm)	Less than 698	394.7 - 829	275.1 - 852
pH (S.U.)	6.5 to 9.0	7.33 - 8.2	7.21 - 8.23

Chlorophyll-a

Chlorophyll-a serves as an indirect indicator of nutrient levels in a river due to the relationship between water quality and algae biomass. **Chlorophyll-a levels were well below the state standard (⩽ 35 ug/L), with variability throughout the monitoring season.**

Phosphorus

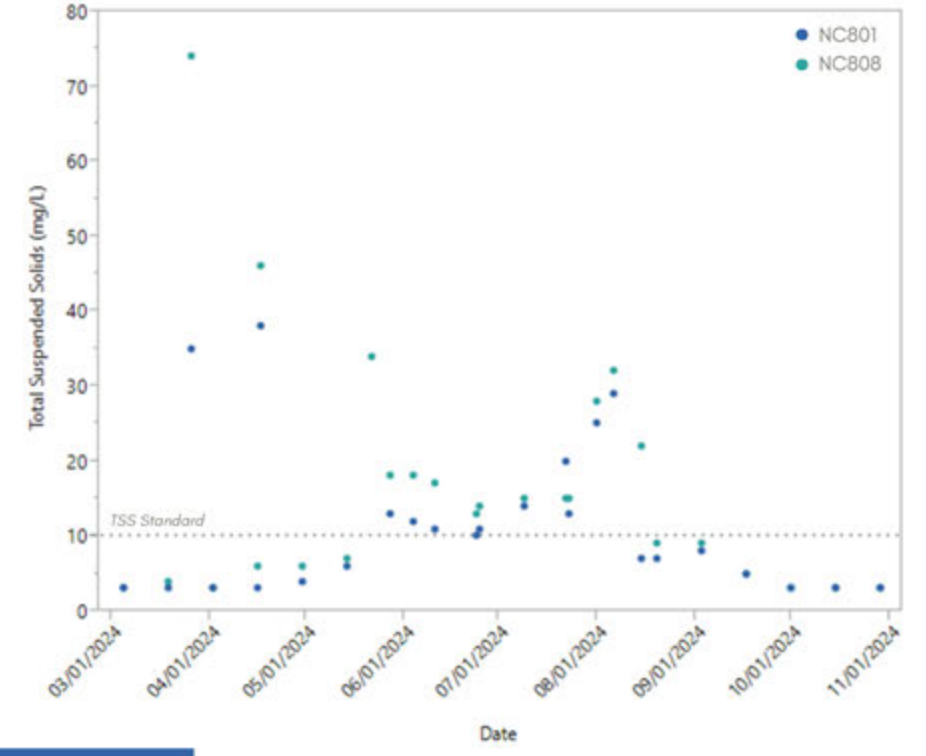
The TP state standard of 0.15 mg/L was exceeded during runoff conditions (> 1" rain in 24 hour period) in the late spring months through early August. Samples collected during baseflow conditions in the summer and fall were below the standard at both sites. Throughout the season, TP levels at NC801 were consistently higher than NC808, though TP levels at NC808 exceeded occasionally.



Total Suspended Solids

TSS levels were within the state's coldwater standard of 10 mg/L during much of the spring and throughout the fall months. **TSS levels fluctuated with individual rain events in the early spring before being consistently above the standard from late May through early July.** The highest value in 2024 was seen at NC801 on May 22nd was 131 mg/L (outlier not shown on graph to right).

Unlike with TP, NC808 (upstream site in North Creek watershed) TSS levels were consistently above levels at NC801.



E. coli

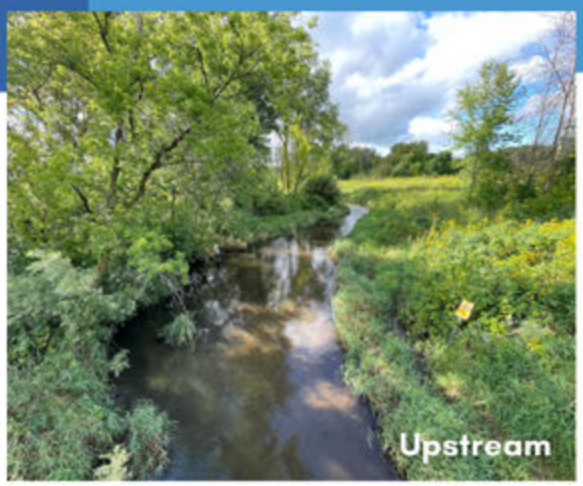
***E. coli* levels in the North Creek Subwatershed are in line with levels seen elsewhere in the VRW.** Five samples at NC801 and six samples at NC808 exceeded the state single sample standard (< 1,260 MPN/100mL) with the majority of samples collected during the extended rainy period in late July and early August.

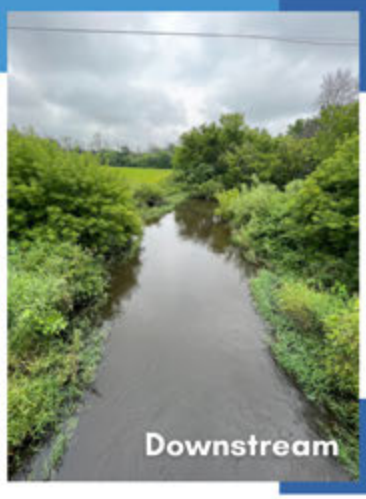
The annual *E. coli* geometric mean at NC801 of 262.11 MPN/100 mL and 230.10 MPN/100 mL at NC808 were middle of the road for the watershed.

Nitrates

NO3 concentrations did not exceed the EPA's ⩽ 10 mg/L drinking water standard during the monitoring season at either site. Concentrations were in fact considerably lower than the standard, much like in other parts of the VRW. NO3 was highest during baseflow conditions and decreased due to rainwater diluting in-stream concentrations.

South Branch Vermillion River Subwatershed





2024 Activity Summary

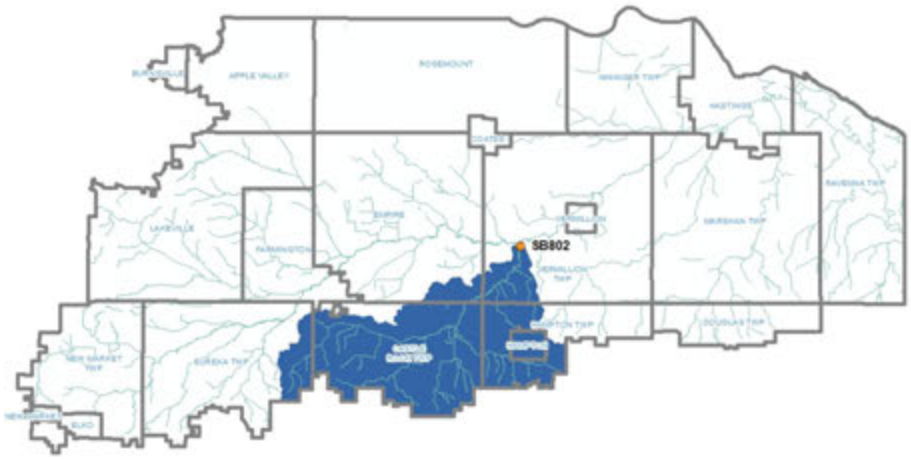
- Water samples were collected monthly from March (snowmelt) through October at SB802
- Water level monitoring equipment was installed at SB802 by the Minnesota DNR
  - Continuous water level and temperature readings are collected at 15 minute intervals

Monitoring Sites

- SB802
  - South Branch Vermillion River at 200th St E

Topography and Land Use

- Flat with hills in southern portion
- Predominately agricultural land use



Field Data - Temperature, Dissolved Oxygen, Transparency, Conductivity, pH

Water quality data were collected at SB802 during all flow conditions from March to October, 2024. **On most occasions, field parameters fell within the desired ranges**. Dissolved oxygen (too low) and transparency (reduced) issues were identified in the watershed during runoff and snowmelt conditions.

Parameter	Desired Range	SB802 Range
Temperature (°C)	Less than 30	3.17 - 19.65
Dissolved Oxygen (mg/L)	Greater than 7.0	5.55 - 12.51
Transparency (cm)	Greater than 25	17 - 100
Conductivity (µS/cm)	Less than 698	395.6 - 595
pH (S.U.)	6.5 to 9.0	7.62 - 8.24

Phosphorus

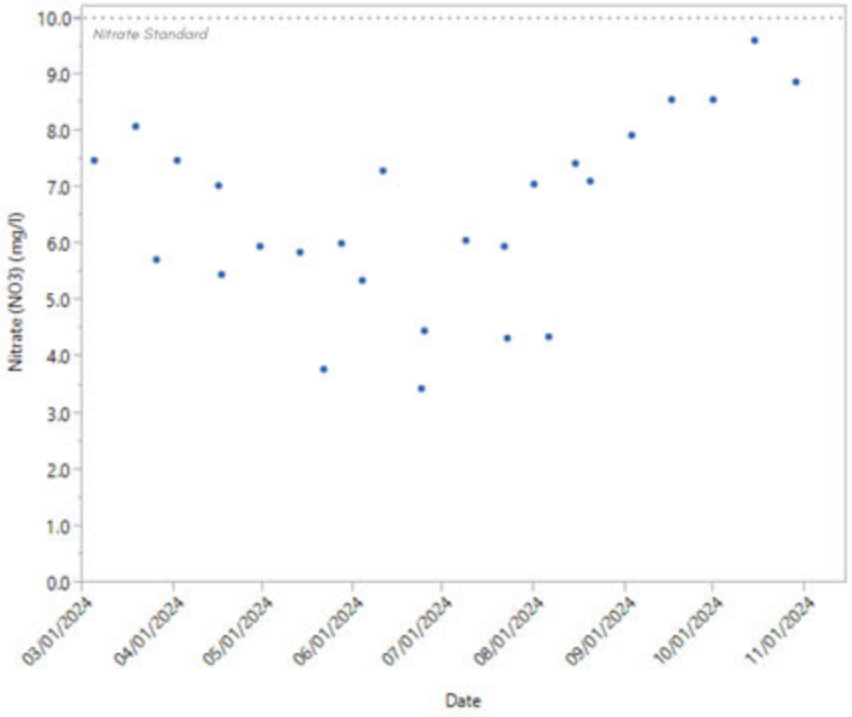
The TP state standard of 0.15 mg/L was exceeded during runoff conditions (> 1" rain in 24 hour period) in late May/early June and late July/early August. Samples collected during baseflow conditions were below the standard at both sites. Large runoff events often lead to sediment and other pollutants being carried into the creek via storm runoff from streets and agricultural fields.

Total Suspended Solids

For the majority of water samples collected in 2024, the TSS levels were within the state's coldwater standard of 10 mg/L, although the standard may have been exceeded on days when samples were not collected. TSS levels fluctuated throughout the season, but were highest during runoff or snowmelt events in the watershed as that would have resulted in increased sediment flowing into the creek.

Nitrates

NO3 concentrations did not exceed the EPA's ⩽ 10 mg/L drinking water standard during the monitoring season, though levels are much higher in this subwatershed than in others in the VRW. NO3 was highest during baseflow conditions and decreased due to rainwater diluting in-stream concentrations.



The baseflow NO3 values measured at SB802 continues to increase. The subwatershed is predominately agricultural land use, has course-textured soils, and a high-water table. The increasing NO3 in the watershed may be the result of one of the following factors - 1) an increase in the amount of drain tile installed; 2) the turnover of marginal land not in production (or lands in conservation programs) to lands in production with concurrent nitrogen applications; 3) poor nutrient management resulting in the improper rate, source, time or placement of nitrogen fertilizers; or 4) an increase in the total acreage of agricultural land in the watershed, which in turn results in greater application of fertilizer to said land. All these factors can result in elevated NO3 levels in the soil, from which available NO3 can leach into shallow groundwater or be directly discharged to a nearby stream or ditch through drain tile.

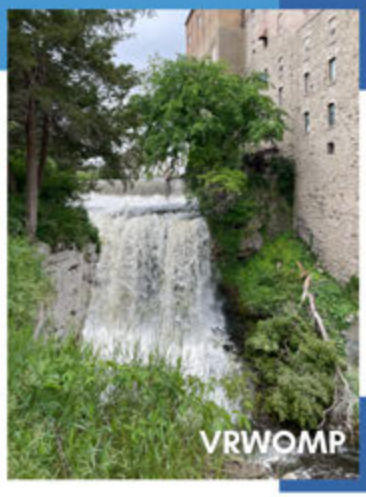
E. coli

***E. coli* levels are lower in the South Branch Vermillion River Watershed than elsewhere.** Only six samples exceeded the state single sample standard (< 1,260 MPN/100mL) with five of the samples collected during the extended rainy period in late July and early August. **The annual *E. coli* geometric mean of 183.89 MPN/100 mL was lowest in the whole watershed.**

Chlorophyll-a

Chlorophyll-a levels were well below the state standard (⩽ 35 ug/L), with variability in the spring months and during runoff events.

Lower Mainstem Vermillion River Subwatershed



2024 Activity Summary

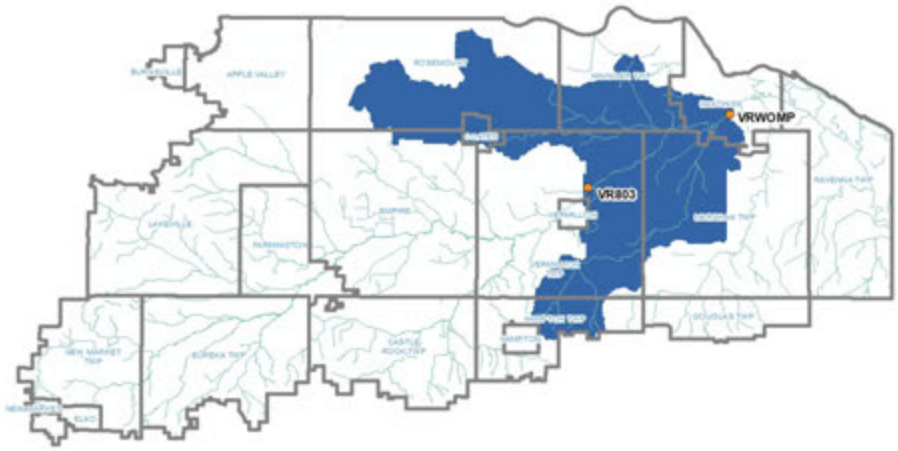
- Water samples were collected monthly from March (snowmelt) through October at VR803 and VRWOMP
- Water level monitoring equipment was installed at VR803 by by the Minnesota DNR and at VRWOMP by the Metropolitan Council
  - Continuous water level and temperature readings are collected at 15 minute intervals

Monitoring Sites

- VR803
  - Vermillion River at Goodwin Ave
- VRWOMP
  - Vermillion River at Vermillion Falls Park (Great River Rd)

Topography and Land Use

- Steeper slopes transitioning to flat
- Predominately agricultural land use



Field Data - Temperature, Dissolved Oxygen, Transparency, Conductivity, pH

Water quality data were collected at VR803 and VRWOMP during all flow conditions from March to October, 2024. **On most occasions, field parameters fell within the desired ranges**. Transparency (reduced at VRWOMP) and conductivity (exceeded at VR803) measurements were both out of range, but to a lesser extent extent unlike at other sites.

Parameter	Desired Range	VR803 Range	VRWOMP Range
Temperature (°C)	Less than 30	3.20 - 21.59	1.42 - 21.18
Dissolved Oxygen (mg/L)	Warm water - Greater than 5.0	6.73 - 12.9	5.36 - 12.17
Transparency (cm)	Greater than 25	27 - 100	12 - 100
Conductivity (µS/cm)	Less than 698	421.6 - 690	359.5 - 681
pH (S.U.)	6.5 to 9.0	7.72 - 8.42	7.54 - 8.26

Phosphorus

The TP state standard of 0.15 mg/L was exceeded during runoff conditions (> 1" rain in 24 hour period) from the middle of May through early August. Samples collected during baseflow conditions in the early spring and fall were below the standard at, and consistent between, both sites. Large runoff events often lead to sediment and other phosphorus-laden pollutants being carried into the river via storm runoff from streets, parking lots, and agricultural fields.

Total Suspended Solids

The TSS levels were within the state's warm water standard of 30 mg/L during baseflow conditions. Exceedances were most often seen when monitoring occurred during or immediately after a rain event. TSS levels were pretty consistent between the two sites for much of the monitoring season. Increased variability was seen in the subwatershed from late May through early August as water levels remained high during that time period.

E. coli

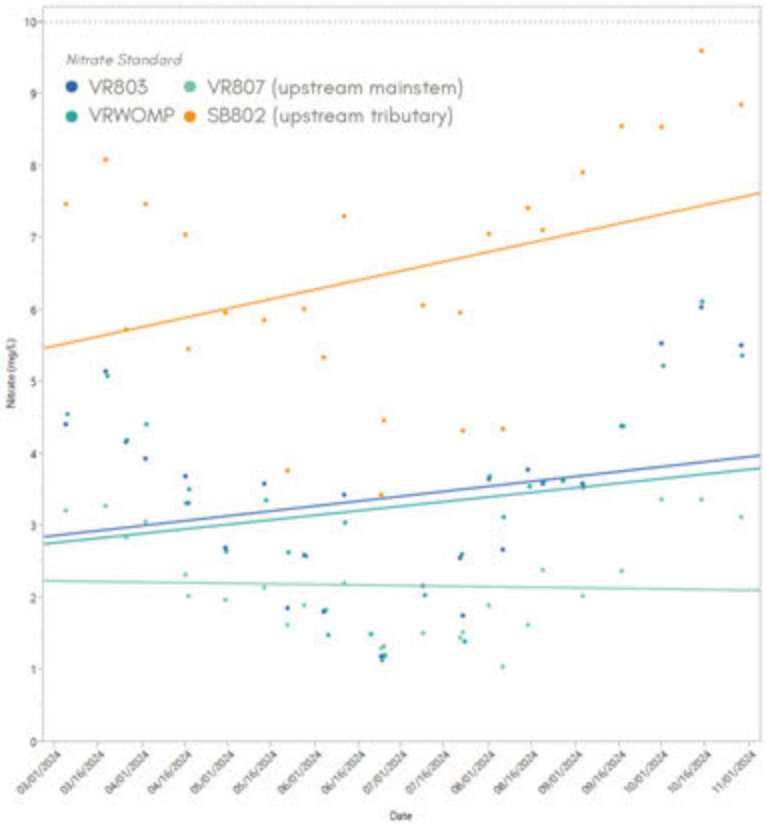
***E. coli* levels in the lowest part of the watershed are in line with levels seen elsewhere within the greater watershed.** Three samples at VR803 and five samples at VRWOMP exceeded the state single sample standard (< 1,260 MPN/100mL) with the majority of samples collected during the extended rainy period in late July and early August. The annual *E. coli* geometric mean at VR803 of 203.88 MPN/100 mL was second lowest and 262.06 MPN/100 mL at VRWOMP was middle of the road for the watershed.

Chlorophyll-a

Chlorophyll-a levels were well below the state standard (⩽ 35 ug/L), with higher levels and increased variability in the spring and early summer months.

Nitrates

NO3 concentrations at VR803 and VRWOMP did not exceed the drinking water standard during the monitoring season, though they are higher than what is found in the middle watershed (VR807) due to influence from the South Branch Vermillion River (SB802). The soils and underlying geology near VR803 allow for the water in the Vermillion River to recharge underlying groundwater aquifers. Nitrogen leaching from agricultural production in this area has led to groundwater contamination in private drinking water wells and the city of Hastings drinking water supply. NO3 levels were highest during baseflow conditions in the spring and fall and decreased mid-season due to rainwater causing a dilution of in-stream nitrate concentrations.



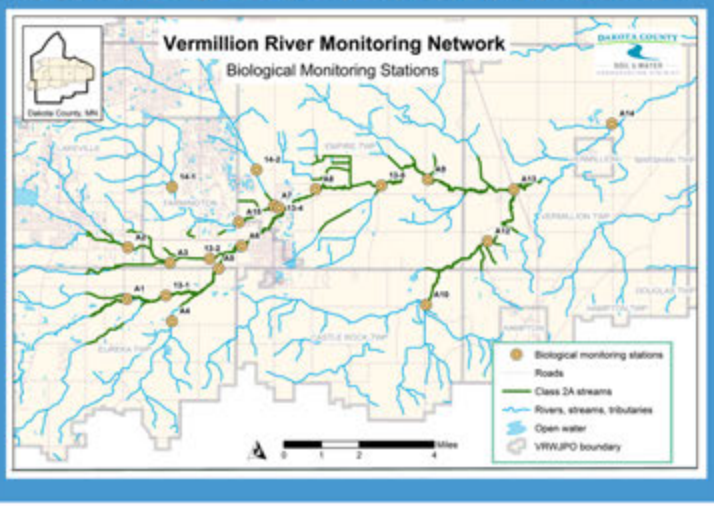
Lower Mainstem Vermillion River

Habitat and Macroinvertebrates

Monitoring biological communities is a widely accepted method for assessing the health of an aquatic environment. It is believed that biological monitoring is more sensitive in identifying the cumulative effects of numerous, simultaneous stressors as opposed to chemical and physical parameters which only provide a snapshot of the abiotic factors throughout the monitoring season.

Habitat assessments are completed at biological monitoring stations on the main stem Vermillion River and its tributaries to better understand possible stressors to the biotic community. Five sites were monitored in 2024 with three sites categorized as "fair" and two as "good". In-stream habitat benefited from the higher water levels following the August rain events.

Macroinvertebrate samples were collected at the same five sites. Data will be posted to the website when available.



Temperature

Temperature is an important factor in growth and reproduction rates of macroinvertebrates and fish, particularly brown trout.

In 2024, temperature maximums were measured above 20°C (resistance range: prolonged exposure leads to a high mortality rate) at all coldwater stream sites during the summer months. The highest median water temperatures were observed in July at all sites.

The three sites with the lowest temperatures (SC806, VR807, and SB802) may be attributed to cool groundwater influence during low flow conditions, either naturally from springs and seeps or artificially from tile drainage. The greatest temperature-induced stress on fish likely occurs in July during which the mean temperature is highest. Annual fish surveys have identified the reach at VR804 to likely have the least desirable temperature structure for coldwater fish as few, if any, coldwater fish were caught during sampling surveys.

Conclusion

The VRMN is valuable as it allows staff to make informed management decisions based on the VRW's physical, chemical, and biological characteristics. Improvement is possible even in the face of observed pollutant challenges. Water quantity and flow patterns impact aquatic communities, with too much or too little causing stress. Restoring in-stream and riparian habitat, reducing nutrients and suspended materials in the stream, minimizing temperature peaks, and identifying *E. coli* sources, among other possible conservation strategies, will have a cascading positive effect on the overall health of the river and its tributaries. An effective management strategy that focuses on both the water quality and quantity aspects of the VRW.

Recommendations

- Study conductivity and DO issues in North Creek and South Creek subwatersheds
- Implement projects to help address increasing NO3 levels in the South Branch Vermillion River subwatershed
- Undertake habitat improvement projects to improve fish cover, sinuosity, and channel substrate
- Network with local landowners to initiate dialogue of available restoration opportunities
- Work with partners to install strategically placed water storage and retention features in prioritized areas to minimize fluctuations in flow and temperature
- Continue monitoring to assess progress toward reaching water quality goals

Prepared for the Vermillion River Watershed Joint Powers Organization by the Dakota County Soil and Water Conservation District, June 2025