Appendix E: Willow Creek Monitoring Reports

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

October – December 2009

Prepared By: Dakota County Soil and Water Conservation District

Prepared For: Lower Minnesota River Watershed District

February 2010

Introduction

The Willow Creek WOMP site, located in Burnsville behind the Menards on Hwy. 13, has been in operation since 1999. The Willow Creek watershed drains more than 5,000 acres of various types of land uses including residential, vacant/agricultural, and commercial properties (Appendix A). This report summarizes the results of flow, precipitation, and water quality for the 4th quarter of 2009. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Flow and Precipitation

Average flow in Willow Creek was 2.37 cubic feet per second (cfs) or 1.53 million gallons per day (mgd) (Table 1). Total precipitation was recorded as 5.37 inches, although the rain gauge was covered for the winter on October 30th, 2009. A graph describing 2009 annual flow and precipitation results is also provided (Figure 2).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station October – December 2009

Period	Average Flow (cfs/mgd)	Precipitation (inches)	*Average Monthly Precipitation, 1999-2008 (inches)
OCTOBER	5.00/3.23	5.37	2.19
NOVEMBER	1.32/0.85	na	1.27
DECEMBER	0.71/0.46	na	0.92
TOTAL QUARTER	2.37/1.53	na	1.50

*Average monthly precipitation data obtained from the National Weather Service station located near the Willow WOMP site.

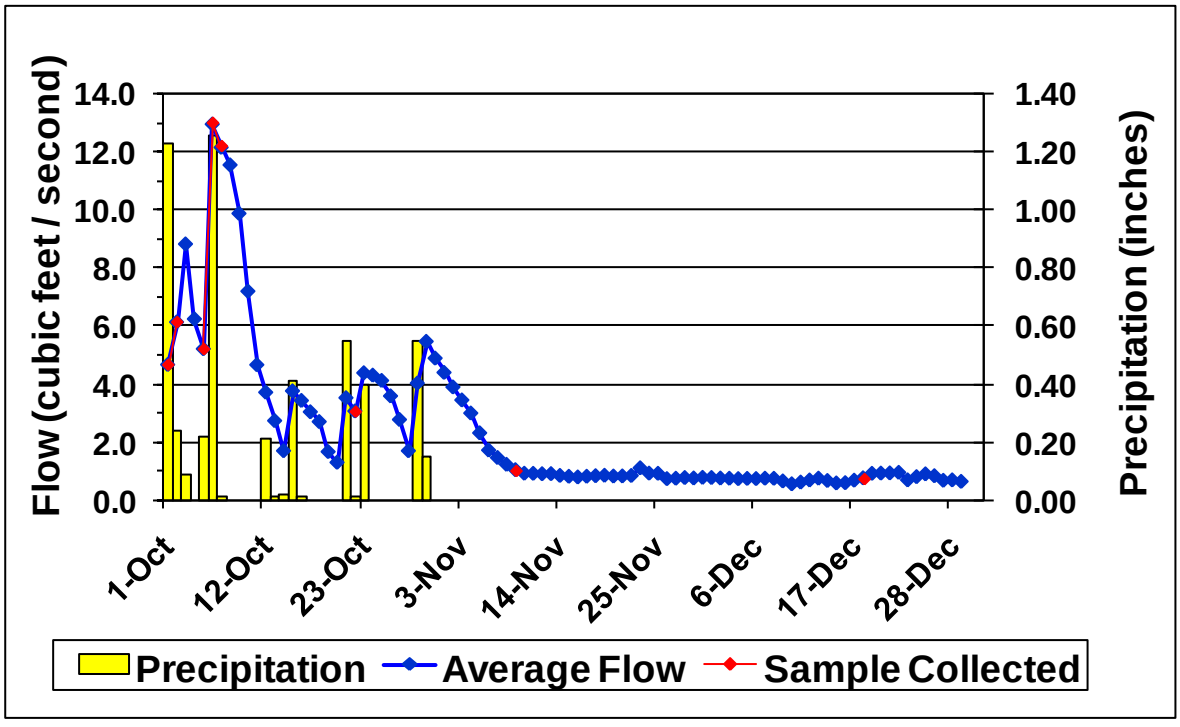


Figure 1. Flow and precipitation at Willow WOMP Station October-December, 2009

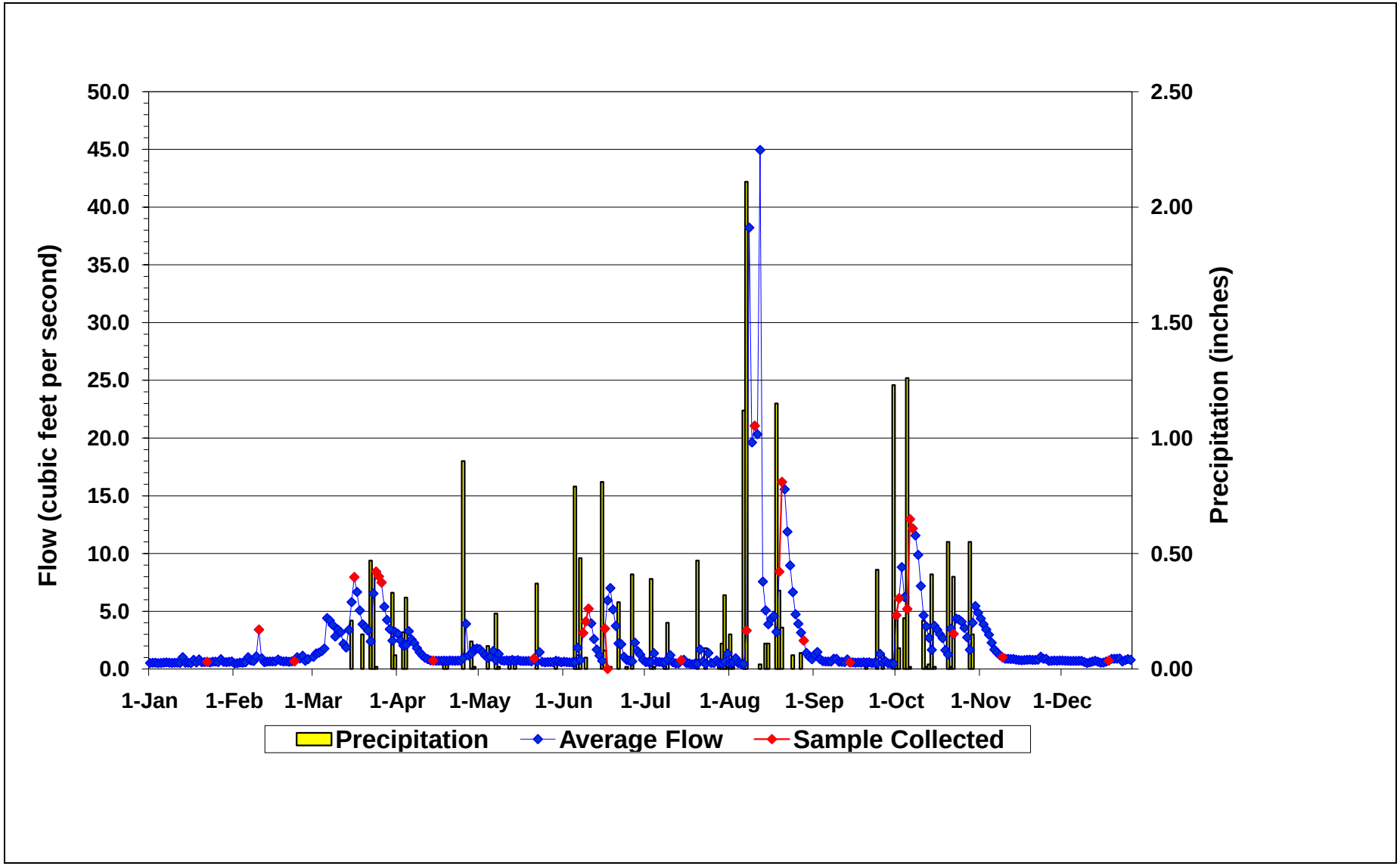


Figure 2. 2009 Willow WOMP Station Flow (January – December 2009) and Precipitation (March 16th – October 30th) Results

Water Quality

4th Quarter Summary:
During the fourth quarter of 2009, two precipitation based event composite samples (10/1/09-10/2/09 and 10/5/09-10/6/09) and three base flow grab samples (10/22/09, 11/9/09 and 12/18/09) were collected at the Willow Creek WOMP station. Overall, fourth quarter water quality in Willow Creek should be considered good, with most parameter concentrations below state standards or minimally impacted stream eco-region means, with the exception of conductivity results and *E. coli* bacteria concentrations (Table 2).

Annual Conductivity Results:
Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, sulfate, sodium, calcium and other solids. Conductivity in streams and rivers is affected by the geology of the area through which the water flows. Streams that run through limestone and clay soils will have higher conductivity values. High conductance readings can also come from industrial pollution or urban runoff. Extended dry periods, low flow conditions, and warmer water temperatures may also contribute to higher specific conductance readings (Source: http://www.epa.gov/volunteer/stream/).

Dakota County Soil and Water Conservation District (SWCD) staff have identified soil types common to the Willow Creek Watershed, in an attempt to explain the source of continually elevated conductivity results. According to the U.S. Department of Agriculture, Soil Survey of Dakota County (1980), soils in this watershed consist primarily of sand, silts, and clays. The high mineral content of these clay soils likely accounts for much of the elevated conductivity results reported throughout the 2009 monitoring season (Table 2).

Annual Bacteria Results:
Bacteria concentrations in fresh water resources continues to be an area of research that is poorly understood. Research has suggested that the sediment of lakes, rivers, and streams can function as a bacterial reservoir, continually releasing bacteria into the water column. Under low flow conditions, sediment release of bacteria may cause elevated bacteria results in water quality samples.

The 2009 4th quarter *E. coli* results (Table 2) describe elevated bacteria concentrations in Willow Creek. Throughout the fall of 2009, SWCD staff observed numerous waterfowl in upstream wetlands while collecting samples, which may account for some portion of these elevated results. However, this problem has been well documented for a number of years, and does not appear to be directly related to the presence or absence of waterfowl. A more chronic source of bacteria in this watershed is likely the cause of this problem and explains high concentrations throughout the year. Elevated bacteria concentrations, especially under lower flow conditions, similar to what was observed in the 4th quarter of 2009, are common in other watersheds elsewhere in Dakota County.

Historical Water Quality Monitoring Results:
When 2009 monitoring results are compared against historical mean concentrations, most parameters are near or below 10-year averages and suggest that water quality has remained relatively stable over the historical monitoring period (Table 2). However, during the 1st quarter of 2009, concentrations for several endpoints (BOD, chloride, conductivity, hardness, lead, nickel, ammonia, nitrate/nitrite) were substantially higher than 10-year averages. This is a consequence of early season runoff event samples which typically carry larger pollutant loads than those events sampled later in the year or base flow samples. This pattern of higher pollutant concentrations during the first quarter has routinely been observed for this station and appears to be the norm for this watershed.

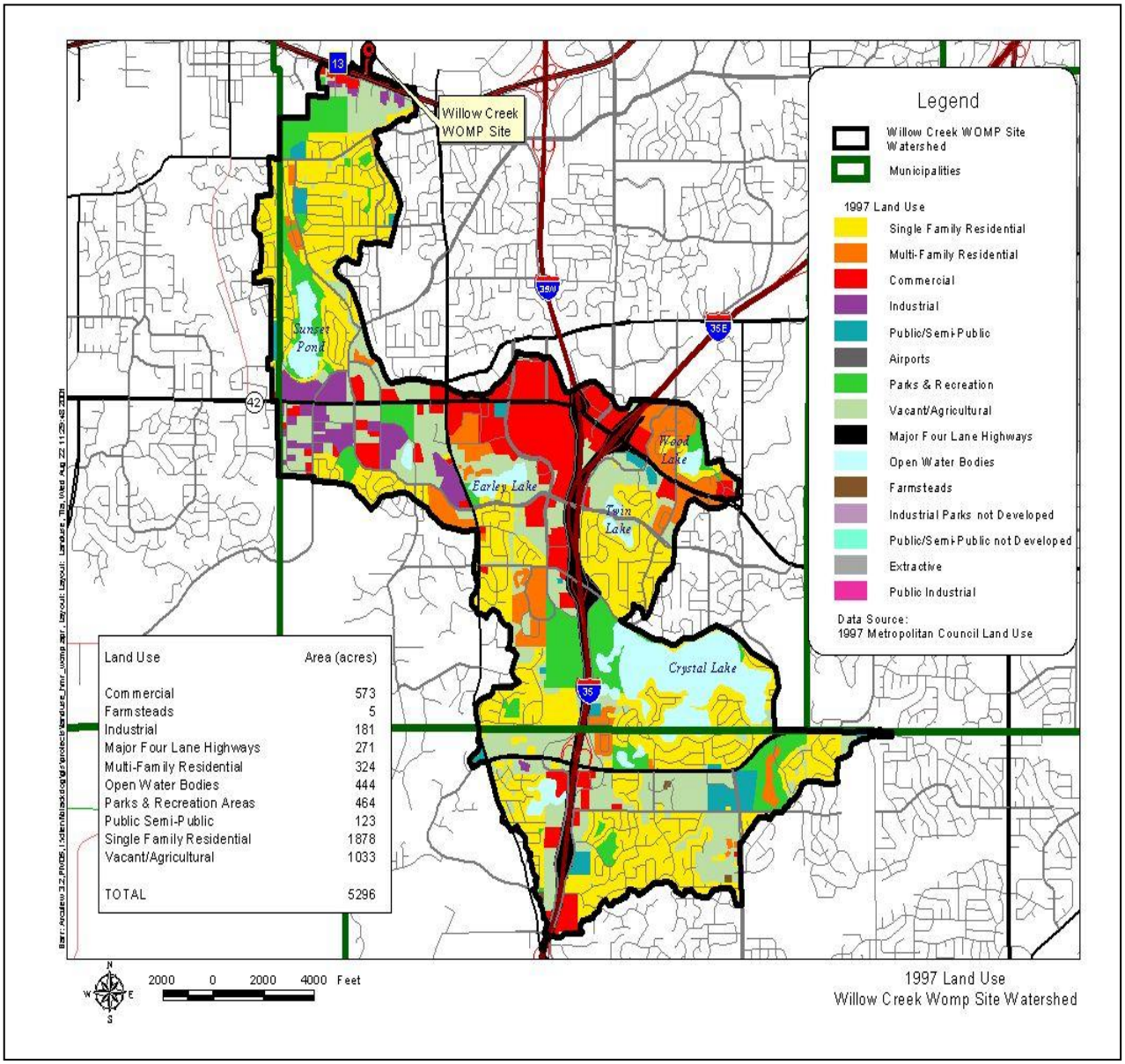
Table 2. Average concentrations at Willow Creek WOMP Station October – December 2009. 1st –3rd quarter results and historical means are included (shaded grey) for comparison purposes. Historical averages also included (shaded dark grey). Results exceeding minimally impacted stream eco-region means or state standards are listed in red font.

Parameter	Historical (1999-2008) Mean Concentration	1st Quarter 2009 Mean Concentration	2nd Quarter 2009 Mean Concentration	3rd Quarter 2009 Mean Concentration	4th Quarter 2009 Mean Concentration	Notes – 4th Quarter Results
Alkalinity	121.1 mg/L $CaCO_3$	228 mg/L $CaCO_3$	220.8 mg/L $CaCO_3$	174.9 mg/L $CaCO_3$	109.4 mg/L $CaCO_3$	Typical for freshwater; higher during lower flow
Biological Oxygen Demand (BOD5)	3.08 mg/L	3.50 mg/L	1.6 mg/L	1.6 mg/L	1.4 mg/L	Below eco-region mean
Cadmium	0.22 ug/L	0.50 ug/L	0.50 ug/L	0.50 ug/L	0.50 ug/L	In compliance with state standard
Chloride	135 mg/L	235 mg/L	145 mg/L	92 mg/L	63 mg/L	In compliance with state standard
Chlorophyll-a	8.0 ug/L	11.9 ug/L	2.8 ug/L	6.5 ug/L	7.2 ug/L	Low level
Chromium	2.87 ug/L	1.2 ug/L	5.7 ug/L	4.2 ug/L	5.0 ug/L	In compliance with state standard
Conductivity	833 mMHOs	1315 mMHOs	1164 mMHOs	665 mMHOs	467 mMHOs	Above eco-region mean, higher during low flow
Copper	5.65 ug/L	4.8 ug/L	2.03 ug/L	1.67 ug/L	1.65 ug/L	In compliance with state standard
Escherichia coli Bacteria (geometric mean)	na	53.5 MPN/100 mL	320 MPN/100mL	384 MPN/100mL	284 MPN/100mL	Exceeds state standard
Hardness	191 mg/L $CaCO_3$	307 mg/L $CaCO_3$	331 mg/L $CaCO_3$	210 mg/L $CaCO_3$	184 mg/L $CaCO_3$	Considered hard water; very hard during low flow
Lead	2.49 ug/L	3.65 ug/L	0.10 ug/L	0.14 ug/L	0.28 ug/L	In compliance with state standard
Nickel	4.8 ug/L	5.9 ug/L	5.6 ug/L	4.72 ug/L	4.43 ug/L	In compliance with state standard
Nitrogen Ammonia	126 ug/L	345 ug/L	58 ug/L	57 ug/L	26 ug/L	In compliance with state standard
Nitrate + Nitrite	0.28 mg/L	0.42 mg/L	0.21 mg/L	0.16 mg/L	0.15 mg/L	Below eco-region mean
Phosphorus, Total	0.149 mg/L	0.146 mg/L	0.048 mg/L	0.086 mg/L	0.035 mg/L	Below eco-region mean
Suspended Solids	57.36 mg/L	7.0 mg/L	3.6 mg/L	24.1 mg/L	9.1 mg/L	Below eco-region mean
Turbidity	23 NTRU	9.5 NTRU	3.6 NTRU	4.3 NTRU	2.8 NTRU	In compliance with state standard
Zinc	20.40 ug/L	7.5 ug/L	4.3 ug/L	6.4 ug/L	6.2 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or microseimens

MPN = most probable number
NTRU = nephelometric turbidity ratio units

Appendix A



Watershed and land use information provided by Metropolitan Council Environmental Services.

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

July – September 2009

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
October 2009

Introduction

The Willow Creek Watershed Outlet Monitoring Program (WOMP) site, located in Burnsville behind the Menards on Highway 13, has been in operation since 1999. The Willow Creek watershed drains more than 5,000 acres of various types of land uses including residential, vacant/agricultural, and commercial properties (Appendix A). This report summarizes the results of flow, precipitation, and water quality for the 3rd quarter of 2009. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Flow and Precipitation

Average flow in Willow Creek was 3.35 cubic feet per second (cfs) or 2.17 million gallons per day (mgd) (Table 1). A graph describing quarterly flow and precipitation results is also provided (Figure 1).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station July-September 2009

Period	Average Flow (cfs/mgd)	Precipitation (inches)	*Average Monthly Precipitation, 1999-2008 (inches)
JULY	0.72/0.47	1.65	3.30
AUGUST	7.53/4.87	5.44	4.35
SEPTEMBER	0.70/0.45	0.50	3.33
TOTAL QUARTER	3.35/2.17	7.59	10.98

*Average monthly precipitation data obtained from the National Weather Service station located near the Willow WOMP site.

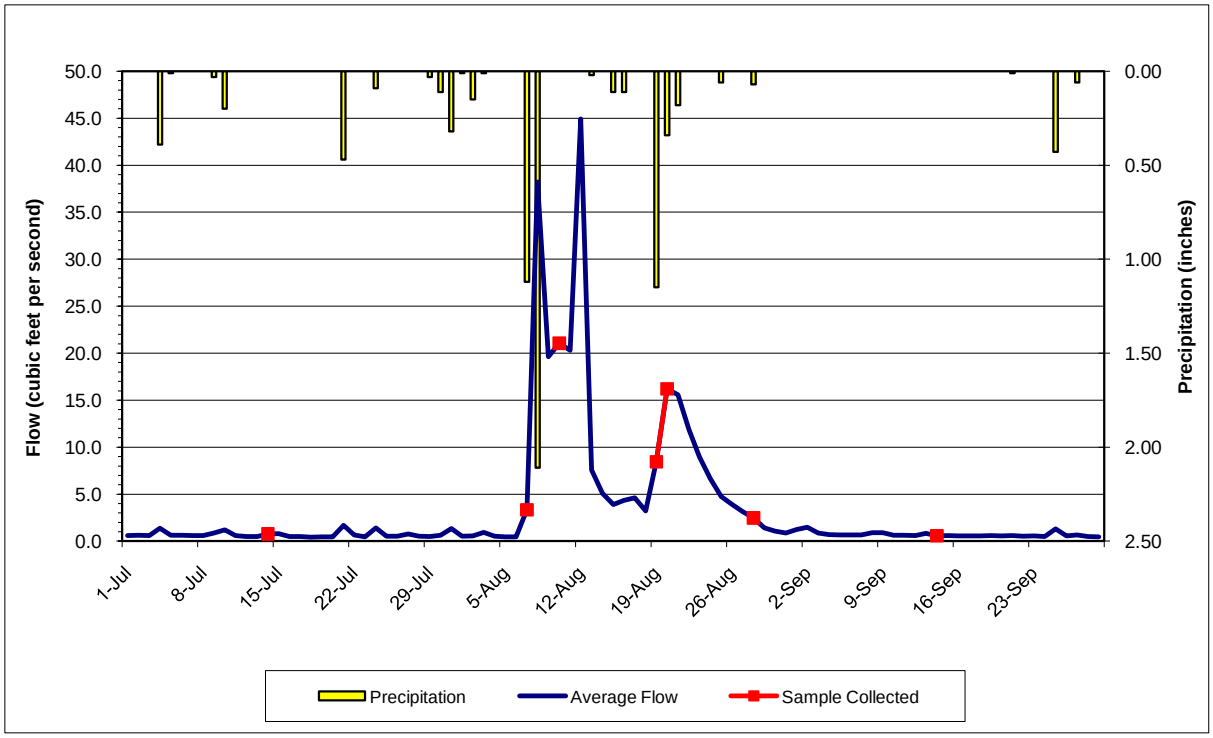


Figure 1. Flow and precipitation data from the Willow WOMP Station July-September 2009

Water Quality

Two event flow composite samples (8/7/09, 8/19/09), and three base flow grab samples (7/14/09, 8/28/09, 9/14/09) were collected from the Willow WOMP Station during the 3rd quarter of 2009.

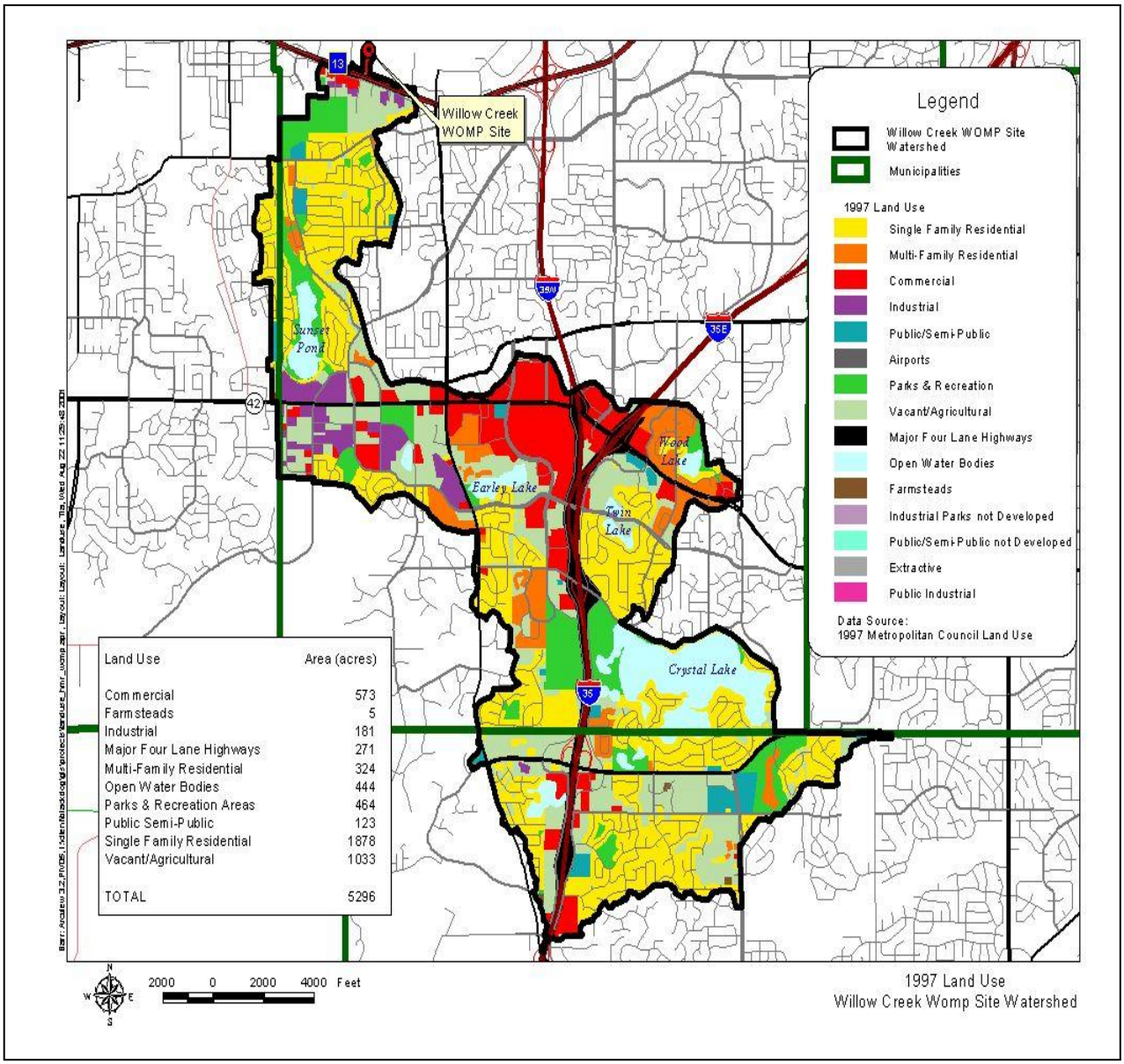
Overall, water quality during the third quarter was good with most parameters below the state standard (in compliance with standards) or near ecoregion means (Table 2). However, conductivity and *E. coli* results continue to exceed ecoregion means or state standards (highlighted red). These exceedances are likely an artifact of soil types and the highly urbanized nature of the Willow Creek watershed.

Table 2. Average concentrations at Willow Creek WOMP Station April-June 2009 (for comparison purposes) and July-September 2009.

Parameter	2nd Quarter 2009 Mean Concentration	3rd Quarter 2009 Mean Concentration	Notes – 3rd quarter results
Alkalinity	220.8 mg/L $CaCO_3$	174.9 mg/L $CaCO_3$	Typical for freshwater; higher during low flow
Biological Oxygen Demand (2.7 mg/L)	1.6 mg/L	1.6 mg/L	Below ecoregion mean
Cadmium	0.50 ug/L	0.50 ug/L	In compliance with state standard
Chloride (230 mg/L)	145 mg/L	92 mg/L	In compliance with state standard
Chlorophyll-a	2.8 ug/L	6.5 ug/L	Low level
Chromium	5.7 ug/L	4.2 ug/L	In compliance with state standard
Conductivity (297.7 umMHOs)	1164 mMHOs	665 mMHOs	Above ecoregion mean, higher during low flow
Copper	2.03 ug/L	1.67 ug/L	In compliance with state standard
E. coli (126 MPN/100mL)	320 MPN/100mL	384 MPN/100mL	Exceeds state standard
Hardness	331 mg/L $CaCO_3$	210 mg/L $CaCO_3$	Considered hard water; very hard during low flow
Lead	0.10 ug/L	0.14 ug/L	In compliance with state standard
Nickel	5.6 ug/L	4.72 ug/L	In compliance with state standard
Nitrogen Ammonia (200 ug/L)	58 ug/L	57 ug/L	Below ecoregion mean
Nitrate + Nitrite (0.16 mg/L)	0.21 mg/L	0.16 mg/L	At ecoregion mean
Phosphorus, Total (0.13 mg/L)	0.048 mg/L	0.086 mg/L	Below ecoregion mean
Suspended Solids (13.7 mg/L)	3.6 mg/L	24.1 mg/L	Above ecoregion mean, due to elevated storm samples
Turbidity (25 NTU)	3.6 NTU	4.3 NTU	In compliance with state standard
Zinc	4.3 ug/L	6.4 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or micorseimens
CFU = colony forming units
NTU = nephelometric turbidity units

Appendix A



Watershed and land use information provided by Metropolitan Council Environmental Services.

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

April – June 2009

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
July 2009

Introduction

The Willow Creek Watershed Outlet Monitoring Program (WOMP) site, located in Burnsville behind the Menards on Highway 13, has been in operation since 1999. The Willow Creek watershed drains more than 5,000 acres of various types of land uses including residential, vacant/agricultural, and commercial properties (Appendix A). This report summarizes the results of flow, precipitation, and water quality for the 2nd quarter of 2009. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Flow and Precipitation

Average flow in Willow Creek was 1.52 cubic feet per second (cfs) or 0.98 million gallons per day (mgd) (Table 1). A graph describing quarterly flow and precipitation results is also provided (Figure 1).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station April-June 2009

Period	Average Flow (cfs/mgd)	Precipitation (inches)	*Average Monthly Precipitation, 1999-2008 (inches)
APRIL	1.46/0.94	1.64	3.16
MAY	0.87/0.56	0.81	4.00
JUNE	2.24/1.45	2.99	4.24
TOTAL QUARTER	1.52/0.98	5.44	11.40

*Average monthly precipitation data obtained from the National Weather Service station located near the Willow WOMP site.

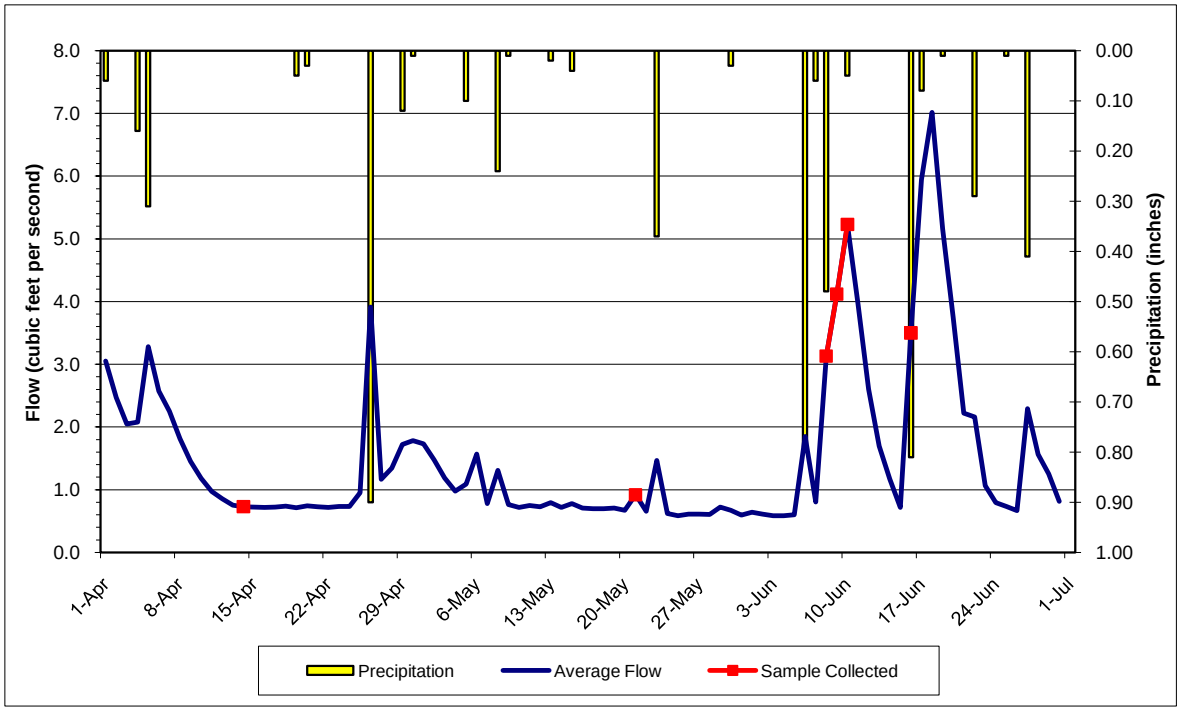


Figure 1. Flow and precipitation data from the Willow WOMP Station April-June 2009

Water Quality

One event flow composite sample (6/8/09), and three base flow grab samples (4/14/09, 5/21/09, 6/16/09) were collected from the Willow WOMP Station during the 2nd quarter of 2009.

Overall, water quality was good with most parameters below the state standard (in compliance with standards) or near ecoregion means (Table 2). However, conductivity, *E. coli*, and nitrate/nitrite levels continue to exceed ecoregion means (highlighted red). These exceedances are likely an artifact of soil types and the highly urbanized nature of the Willow Creek watershed.

Table 2. Average concentrations at Willow Creek WOMP Station January-March 2009 (for comparison purposes) and April-June 2009.

Parameter	1st Quarter 2009 Mean Concentration	2nd Quarter 2009 Mean Concentration	Notes – 2nd quarter results
Alkalinity	146.9 mg/L $CaCO_3$	220.8 mg/L $CaCO_3$	Typical for freshwater; higher during low flow
Biological Oxygen Demand (2.7 mg/L)	6.8 mg/L	1.6 mg/L	Below ecoregion mean
Cadmium	0.50 ug/L	0.50 ug/L	In compliance with state standard
Chloride (230 mg/L)	171 mg/L	145 mg/L	In compliance with state standard
Chlorophyll-a	21.4 ug/L	2.8 ug/L	Low level
Chromium	5.6 ug/L	5.7 ug/L	In compliance with state standard
Conductivity (297.7 umMHOs)	1083 umMHOs	1164 mMHOs	Above ecoregion mean, higher during low flow
Copper	4.5 ug/L	2.03 ug/L	In compliance with state standard
E. coli (126 MPN/100mL)	387 MPN/100mL	320 MPN/100mL	Exceeds state standard
Hardness	332 mg/L $CaCO_3$	331 mg/L $CaCO_3$	Considered hard water; very hard during low flow
Lead	0.10 ug/L	0.10 ug/L	In compliance with state standard
Nickel	5.3 ug/L	5.6 ug/L	In compliance with state standard
Nitrogen Ammonia (200 ug/L)	362 ug/L	58 ug/L	Below ecoregion mean
Nitrate + Nitrite (0.16 mg/L)	0.28 mg/L	0.21 mg/L	Above ecoregion mean
Phosphorus, Total (0.13 mg/L)	0.20 mg/L	0.048 mg/L	Below ecoregion mean
Suspended Solids (13.7 mg/L)	15.4 mg/L	3.6 mg/L	Below ecoregion mean
Turbidity (25 NTU)	13 NTRU	3.6 NTU	In compliance with state standard
Zinc	12.0 ug/L	4.3 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or micorseimens
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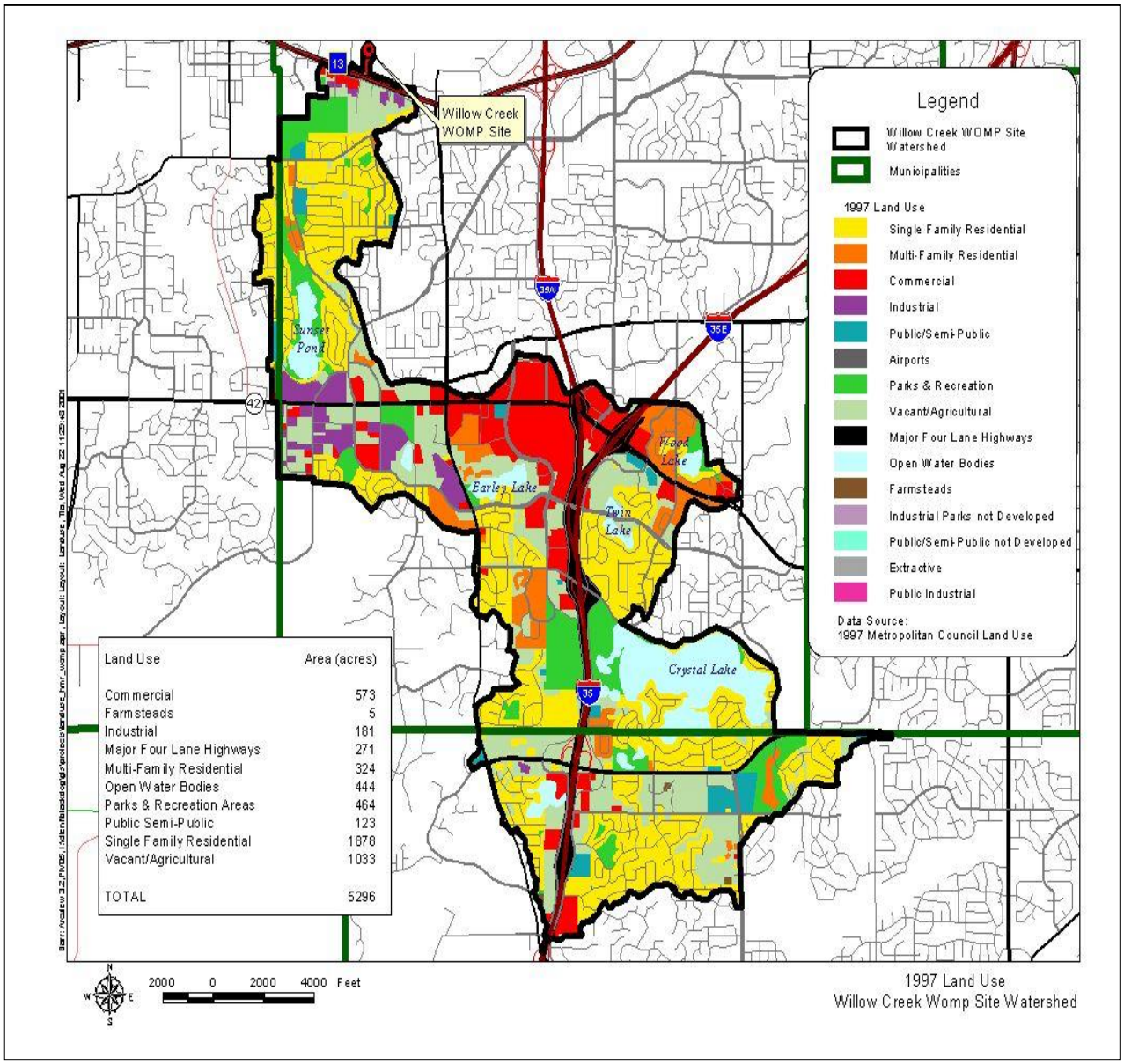

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Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

January – March 2009

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
June 2009

Introduction

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Flow and Precipitation

Average flow in Willow Creek was 1.86 cubic feet per second (cfs) or 1.20 million gallons per day (mgd) (Table 1). A graph describing quarterly flow and precipitation results is also provided (Figure 1).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station January – March 2009

Period	Average Flow (cfs/mgd)	Precipitation (inches)	*Average Monthly Precipitation, 1999-2008 (inches)
JANUARY	0.62/0.40	na**	0.81
FEBRUARY	0.84/0.54	na**	0.79
MARCH	4.02/2.60	1.60**	1.80
TOTAL QUARTER	1.86/1.20	1.60**	1.13

*Average monthly precipitation data obtained from the National Weather Service station located near the Willow WOMP site.
**Rain gauge was not activated until 3/16/09.

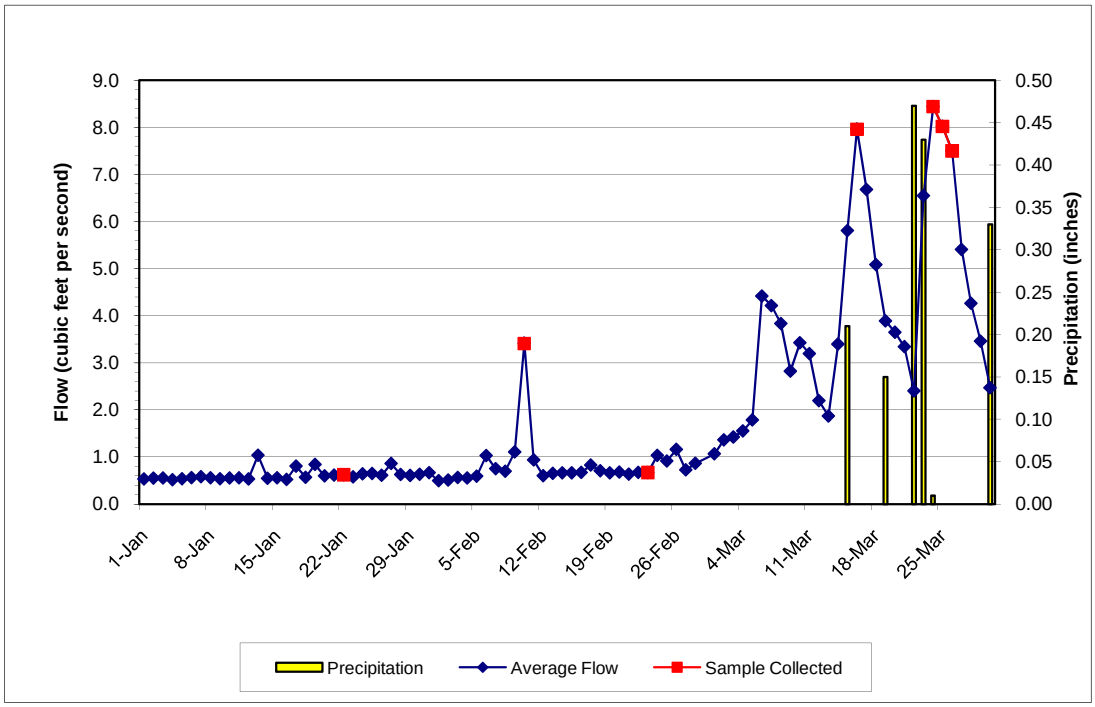

Figure 1. Flow and precipitation at Willow WOMP Station January-March 2009

Water Quality

Three event flow grab samples (2/10/09, 3/16/09, 3/24/09), one storm event composite sample (3/24-3/26/09), and two base flow grab samples (1/22/09, 2/23/09) were collected from the Willow WOMP Station during the 1st quarter of 2009.

Overall, water quality was good with most parameters below the state standard (in compliance with standards) or near the ecoregion mean (Table 2). However, several endpoints exceeded standards or ecoregion means (highlighted red). These results are primarily due to elevated sample concentrations common in early spring runoff samples. Concentrations will likely moderate as the year progresses.

Table 2. Average concentrations at Willow Creek WOMP Station October 2008-December 2008 (for comparison purposes) and January-March 2009.

Parameter (standard/ecoregion mean)	4th Quarter 2008 Mean Concentration	1st Quarter 2009 Mean Concentration	Notes – 1st quarter results
Alkalinity	188.2 mg/L $CaCO_3$	146.9 mg/L $CaCO_3$	Typical for freshwater; higher during low flow
Biological Oxygen Demand (2.7 mg/L)	1.0 mg/L	6.8 mg/L	Above ecoregion mean
Cadmium	0.50 ug/L	0.50 ug/L	In compliance with state standard
Chloride (230 mg/L)	101 mg/L	171 mg/L	In compliance with state standard
Chlorophyll-a	3.8 mg/L	21.4 mg/L	Fair level
Chromium	3.0 ug/L	5.6 ug/L	In compliance with state standard
Conductivity (297.7 umMHOs)	853 umMHOs	1083 umMHOs	Above ecoregion mean, higher during low flow
Copper	1.6 ug/L	4.5 ug/L	In compliance with state standard
E. coli (126 MPN/100mL)	401 MPN/100mL	387 MPN/100mL	Exceeds state standard
Hardness	308 mg/L $CaCO_3$	332 mg/L $CaCO_3$	Considered hard water; sometimes very hard during low flow
Lead	0.10 ug/L	0.10 ug/L	In compliance with state standard
Nickel	5.5 ug/L	5.3 ug/L	In compliance with state standard
Nitrogen Ammonia	24 ug/L	362 ug/L	Above ecoregion mean
Nitrate + Nitrite (0.16 mg/L)	0.22 mg/L	0.28 mg/L	Above ecoregion mean
Phosphorus, Total (0.13 mg/L)	0.056 mg/L	0.20 mg/L	Above ecoregion mean
Suspended Solids (13.7 mg/L)	2.25 mg/L	15.4 mg/L	Above ecoregion mean
Turbidity (25 NTU)	5 NTRU	13 NTRU	In compliance with state standard
Zinc	2.3 ug/L	12.0 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or micorseimens
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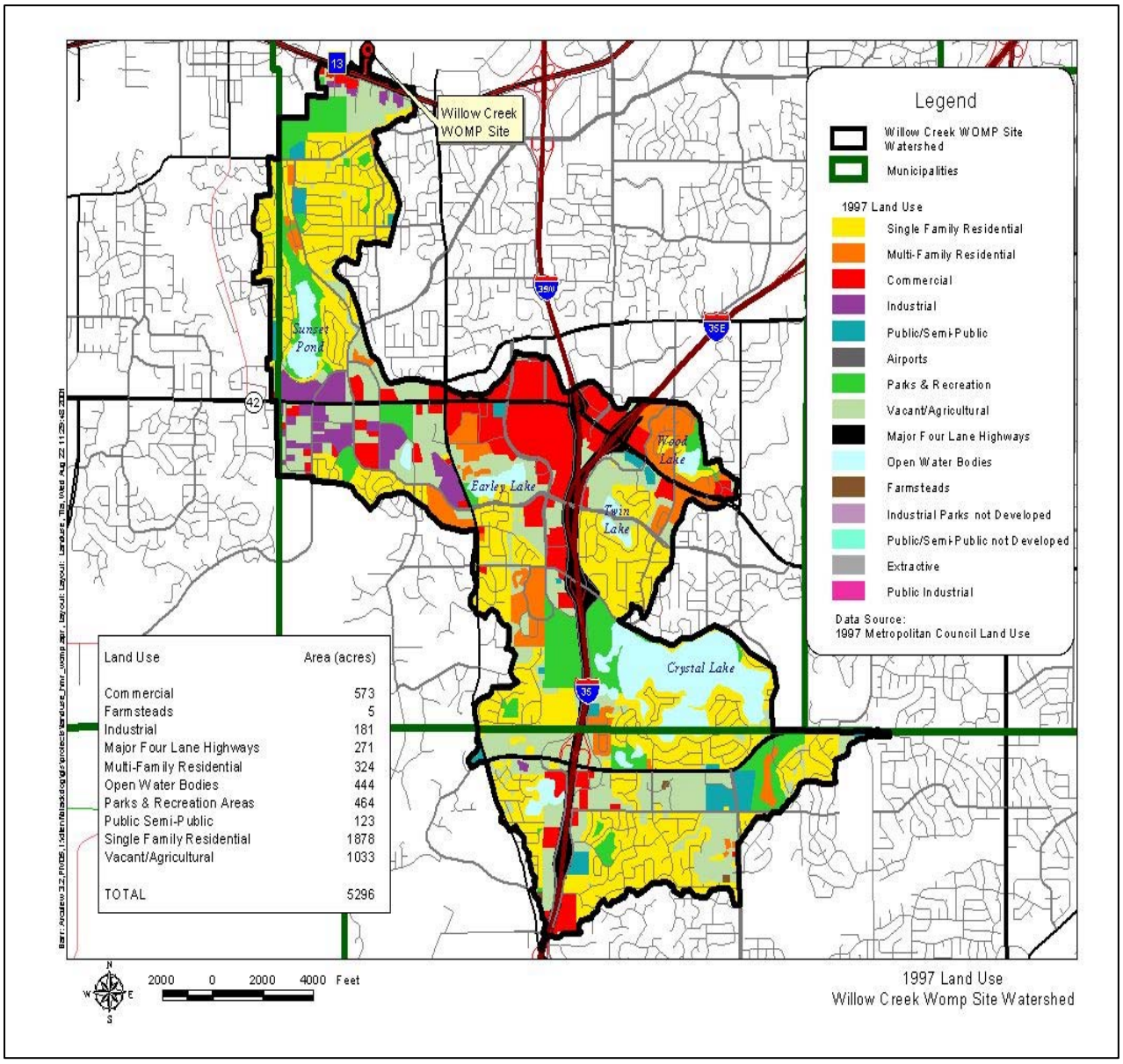

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Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

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Flow and Precipitation

Average flow in Willow Creek was 1.05 cubic feet per second (cfs) or 0.68 million gallons per day (mgd) (Table 1). Total precipitation was recorded as 2.90 inches, although the rain gauge was covered for the winter on November 10th, 2008. A graph describing annual flow and precipitation results is also provided (Figure 2).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station October – December 2008

Period	Average Flow (cfs/mgd)	Precipitation (inches)	*Average Monthly Precipitation, 1998-2007 (inches)
OCTOBER	1.57/1.01	1.68	2.21
NOVEMBER	1.02/0.66	1.22	1.29
DECEMBER	0.56/0.36	na	0.86
TOTAL QUARTER	1.05/0.68	na	1.46

*Average monthly precipitation data obtained from the National Weather Service station located near the Willow WOMP site.

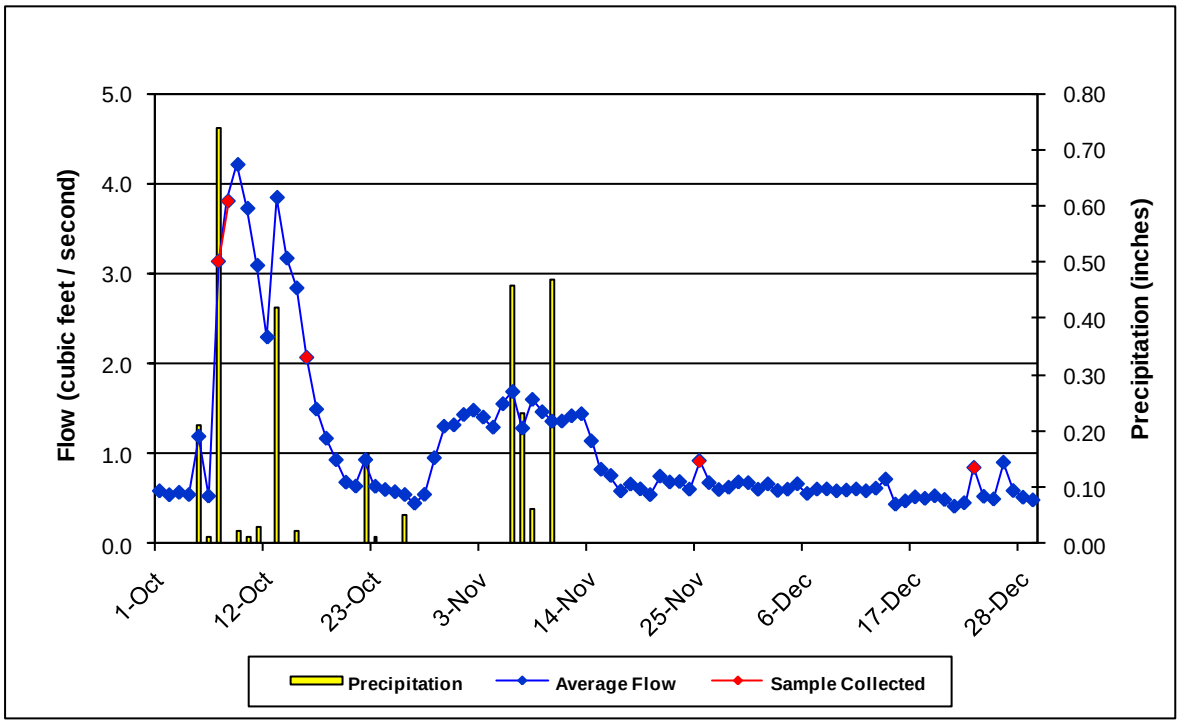


Figure 1. Flow and precipitation at Willow WOMP Station October-December, 2008

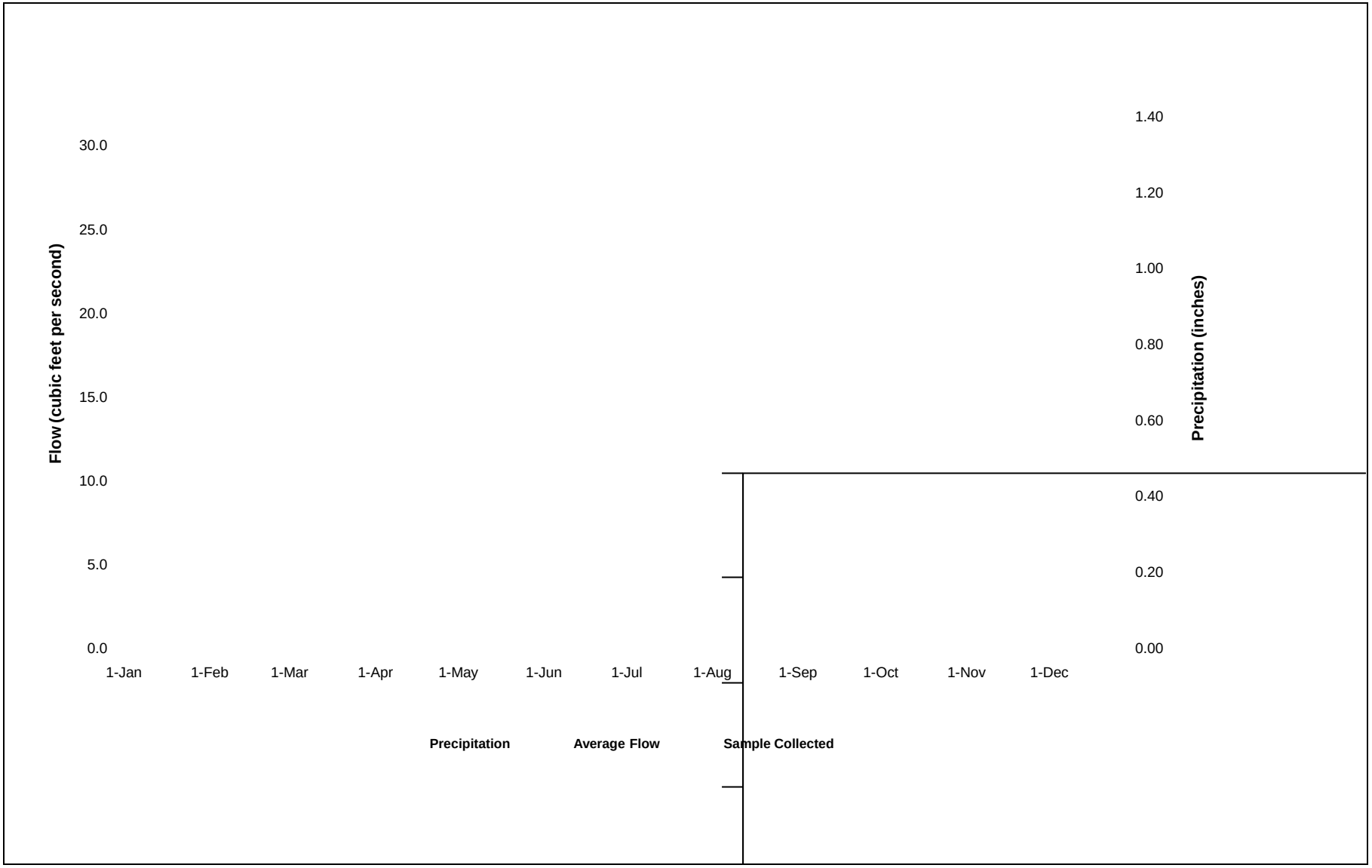


Figure 2. 2008 Flow (January – December 2008) and Precipitation (March 14th – November 10th) Results

Water Quality

Summary:
During the fourth quarter of 2008, one precipitation based event composite sample (10/7/08-10/8/08) and three base flow grab samples (10/16/08, 11/25/08 and 12/23/08) were collected at the Willow Creek WOMP station. Overall, water quality in Willow Creek should be considered good, with most parameters below state standards or minimally impacted stream eco-region means, with the exception of conductivity results, *E. coli* bacteria concentrations, and nitrate/nitrite levels.

Conductivity Results:
Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, sulfate, sodium, calcium and other solids. Conductivity in streams and rivers is affected by the geology of the area through which the water flows. Streams that run through limestone and clay soils will have higher conductivity values. High conductance readings can also come from industrial pollution or urban runoff. Extended dry periods, low flow conditions, and warmer water temperatures may also contribute to higher specific conductance readings (Source: http://www.epa.gov/volunteer/stream/).

Dakota County Soil and Water Conservation District (SWCD) staff have identified soil types common to the Willow Creek Watershed, in an attempt to explain the source of continually elevated conductivity results. According to the U.S. Department of Agriculture, Soil Survey of Dakota County (1980), soils in this watershed consist primarily of sand, silts, and clays. The high mineral content of these clay soils likely accounts for much of the elevated conductivity results reported throughout all 2008 monitoring data (Table 2).

Bacteria Results:
Bacteria concentrations in fresh water resources continues to be an area of research that is poorly understood. Some research has suggested that the sediment of lakes, rivers, and streams can function as a bacterial reservoir, continually releasing bacteria into the water column. Under low flow conditions, sediment release of bacteria may cause elevated bacteria results in water quality samples.

The 4th quarter *E. coli* results (Table 2) indicate elevated bacteria concentrations in Willow Creek. SWCD staff did not observe any waterfowl in upstream wetlands while collecting samples in the 4th quarter of 2008, so waterfowl may not be the source elevated results, as suggested in other quarterly reports. Due to very low flow conditions observed in this quarter, the sediment of Willow Creek, acting as a bacterial reservoir, may be a source of bacteria in these samples. Elevated bacteria concentrations, especially under low flow conditions similar to what was observed in the 4th quarter of 2008, are common in other watersheds elsewhere in Dakota County. SWCD staff will continue to monitor waterfowl populations in upstream wetlands to assist in identifying potential sources of elevated *E. coli* results.

Nitrate/Nitrite Results:
Nitrate/nitrite concentrations in the 4th quarter of 2008 were slightly higher than the minimally impacted stream eco-region mean (0.16 mg/L). Although somewhat elevated at 0.22 mg/L, nitrate/nitrite results of less than 1.0 mg/L are generally considered low. Slightly higher concentrations are to be expected in urbanized areas like the Willow Creek Watershed (Appendix A). Common sources of nitrates/nitrites include lawn fertilizer, failing septic systems, and industrial runoff.

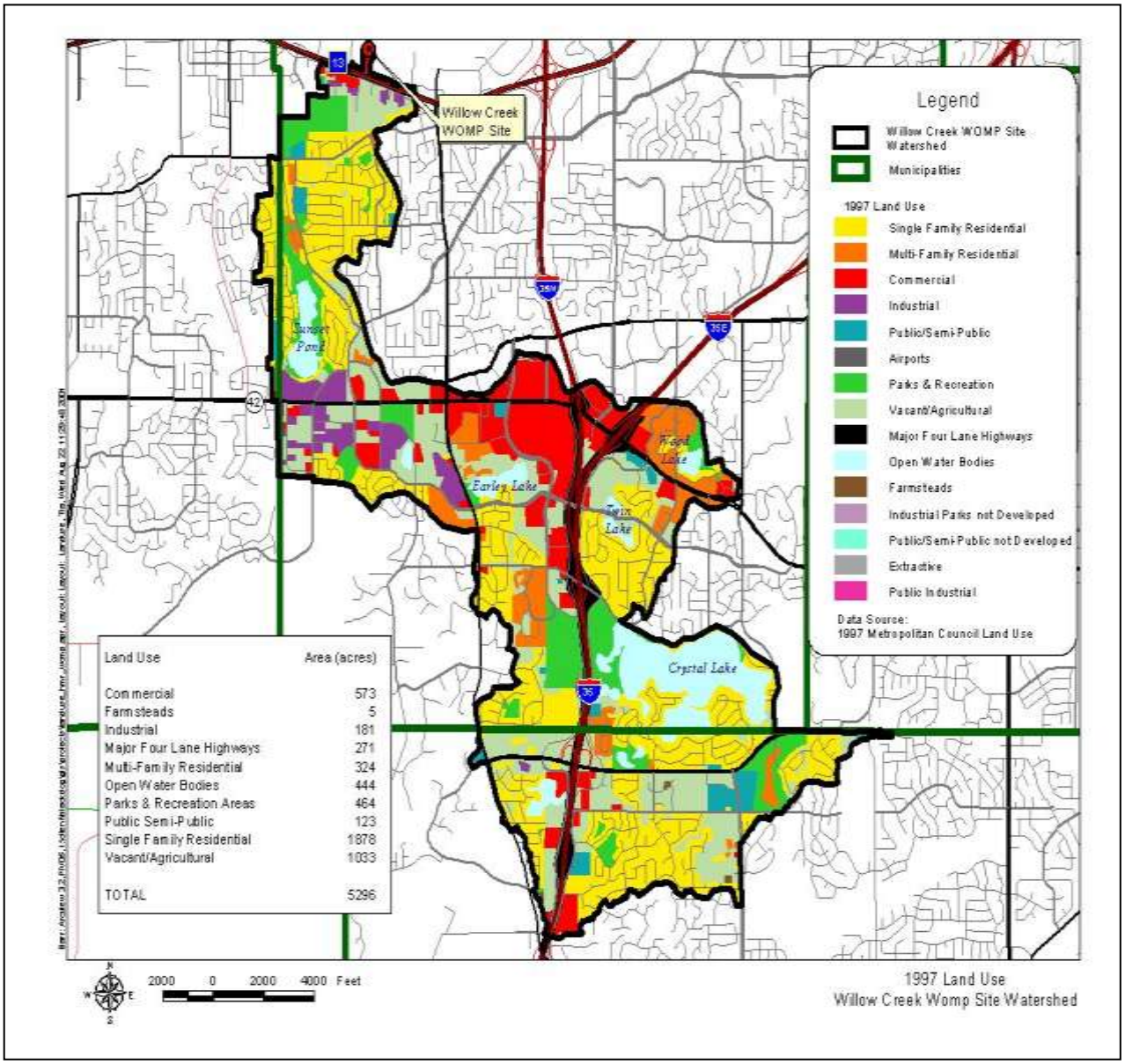
Table 2. Average concentrations at Willow Creek WOMP Station October – December 2008. 1st –3rd quarter results are included (shaded grey) for comparison purposes (results exceeding minimally impacted stream eco-region means or state standards are listed in red font).

Parameter	1st Quarter 2008 Mean Concentration	2nd Quarter 2008 Mean Concentration	3rd Quarter 2008 Mean Concentration	4th Quarter 2008 Mean Concentration	Notes – 4th Quarter Results
Alkalinity	228 mg/L $CaCO_3$	83.4 mg/L $CaCO_3$	208.8 mg/L $CaCO_3$	188.2 mg/L $CaCO_3$	Typical for freshwater; higher during lower flow
Biological Oxygen Demand (BOD5)	3.50 mg/L	1.84 mg/L	1.0 mg/L	1.0 mg/L	Below eco-region mean
Cadmium	0.50 ug/L	0.50 ug/L	0.50 ug/L	0.50 ug/L	In compliance with state standard
Chloride	235 mg/L	201 mg/L	132 mg/L	101 mg/L	In compliance with state standard
Chlorophyll-a	11.9 ug/L	11.7 ug/L	2.8 ug/L	3.8 ug/L	Low level
Chromium	1.2 ug/L	3.6 ug/L	3.3 ug/L	3.0 ug/L	In compliance with state standard
Conductivity	1315 mMHOs	832 mMHOs	1072 mMHOs	853 mMHOs	Above eco-region mean, higher during low flow
Copper	4.8 ug/L	2.6 ug/L	1.8 ug/L	1.6 ug/L	In compliance with state standard
Escherichia coli Bacteria (geometric mean)	53.5 MPN/100mL	20.6 MPN/100mL	88.7 MPN/100mL	401.0 MPN/100mL	Exceeds state standard
Hardness	307 mg/L $CaCO_3$	144 mg/L $CaCO_3$	350 mg/L $CaCO_3$	308 mg/L $CaCO_3$	Considered hard water; very hard during low flow
Lead	3.65 ug/L	0.40 ug/L	0.10 ug/L	0.10 ug/L	In compliance with state standard
Nickel	5.9 ug/L	1.7 ug/L	6.2 ug/L	5.5 ug/L	In compliance with state standard
Nitrogen Ammonia	345 ug/L	76 ug/L	28 ug/L	24 ug/L	In compliance with state standard
Nitrate + Nitrite	0.42 mg/L	0.28 mg/L	0.39 mg/L	0.22 mg/L	Above eco-region mean
Phosphorus, Total	0.146 mg/L	0.065 mg/L	0.045 mg/L	0.056 mg/L	Below eco-region mean
Suspended Solids	7.0 mg/L	13.3	9.8 mg/L	2.25 mg/L	Below eco-region mean
Turbidity	9.5 NTRU	6.6 NTRU	4.8 NTRU	5 NTRU	In compliance with state standard
Zinc	7.5 ug/L	4.1 ug/L	2.6 ug/L	2.3 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or microseimens

MPN = most probable number
NTRU = nephelometric turbidity ratio units

Appendix A



Watershed and land use information provided by Metropolitan Council Environmental Services.

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

July – September 2008

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
October 2008

Introduction

The Willow Creek WOMP (Watershed Outlet Monitoring Program) site, located in Burnsville behind the Menards on Hwy. 13, has been in operation since 1999. The Willow Creek watershed drains more than 5,000 acres of various types of land uses including residential, vacant/agricultural, and commercial properties (Appendix A). This report summarizes the results of flow, precipitation, and water quality for the 3rd quarter of 2008. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Flow and Precipitation

Average flow in Willow Creek was 1.11 cubic feet per second (cfs) or 0.72 million gallons per day (mgd) (Table 1). A graph describing quarterly flow and precipitation results is also provided (Figure 1).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station July-September 2008

Period	Average Flow (cfs/mgd)	Precipitation (inches)	*Average Monthly Precipitation, 1998-2007 (inches)
JULY	1.57/1.01	2.86	3.35
AUGUST	0.94/0.61	2.17	4.62
SEPTEMBER	0.80/0.52	1.07	3.28
TOTAL QUARTER	1.11/0.72	6.10	11.25

*Average monthly precipitation data obtained from the National Weather Service station located near the Willow WOMP site.

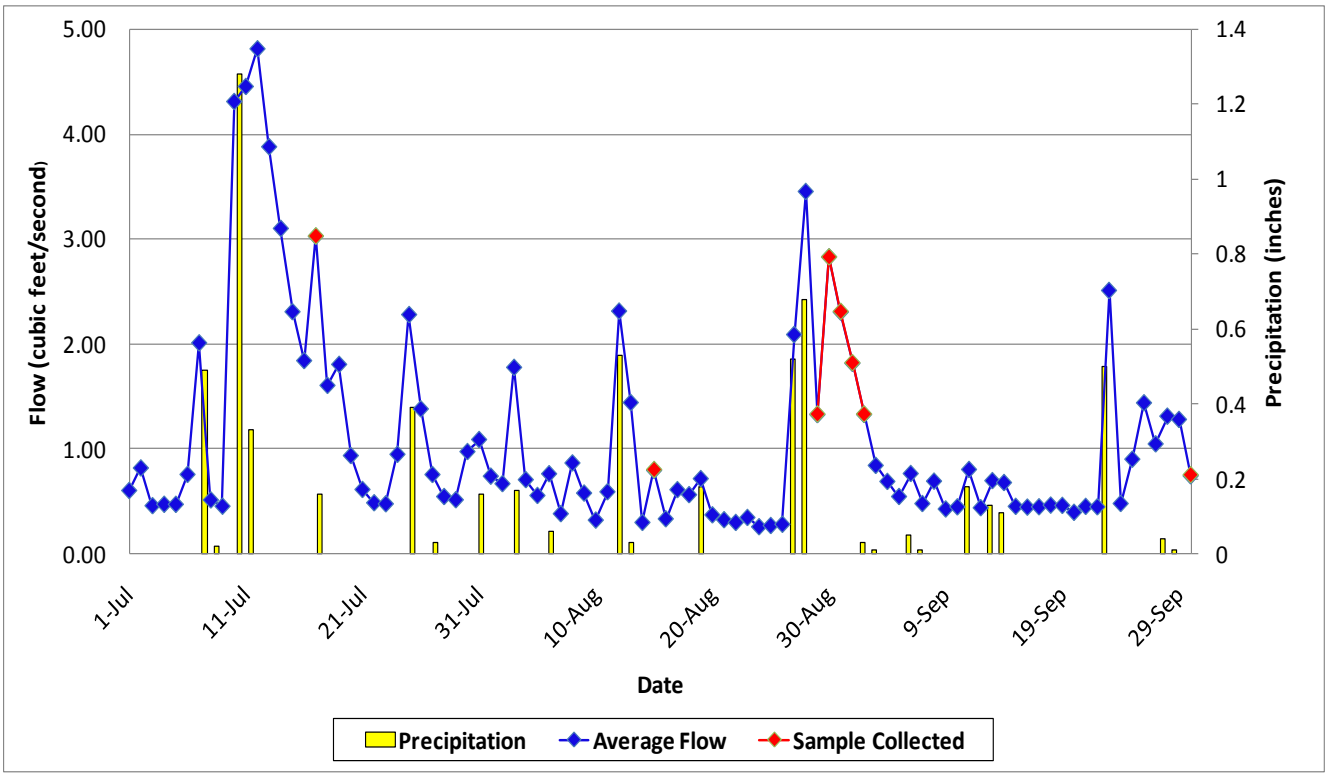


Figure 1. Flow and precipitation at Willow WOMP Station July-September 2008

Water Quality

One event flow composite sample (8/28/08), and three base flow grab samples (7/17/08, 8/15/08, 9/30/08) were collected from the Willow WOMP Station during the 3rd quarter of 2008.

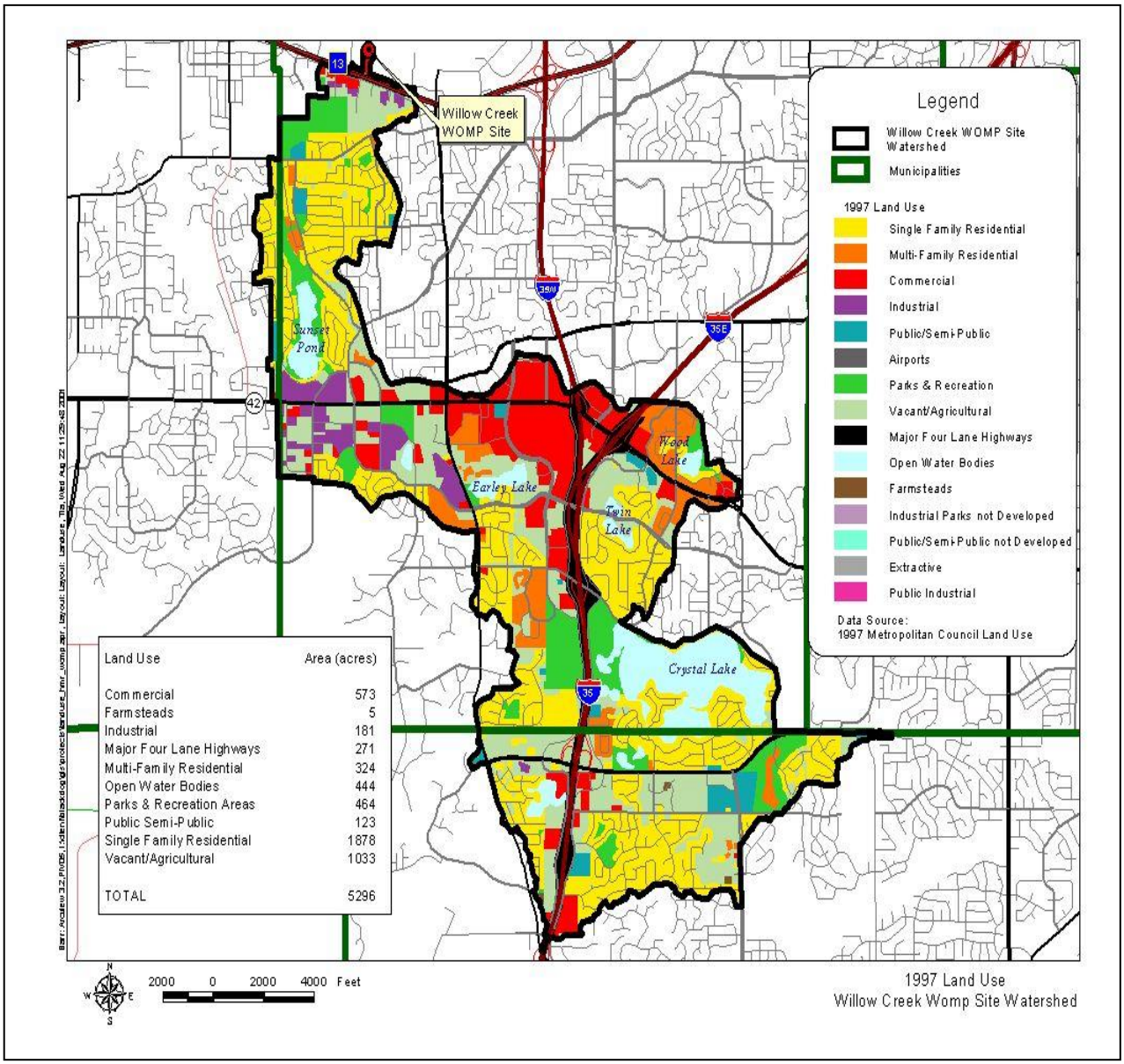
Overall, water quality was good with most parameters below the state standard (in compliance with standards) or near ecoregion means (Table 2). However, conductivity and nitrate/nitrite levels continue to exceed ecoregion means (highlighted red). These exceedances are likely an artifact of soil types and the highly urbanized nature of the Willow Creek watershed.

Table 2. Average endpoint concentrations at Willow Creek WOMP Station April 2008-June 2008 (2nd quarter-for comparison purposes) and July-September 2008 (3rd quarter).

Parameter	2nd Quarter 2008 Mean Concentration	3rd Quarter 2008 Mean Concentration	Notes – 3rd quarter results
Alkalinity	83.4 mg/L $CaCO_3$	208.8 mg/L $CaCO_3$	Typical for freshwater; higher during low flow
Biological Oxygen Demand	1.84 mg/L	1.0 mg/L	Below ecoregion mean
Cadmium	0.50 ug/L	0.50 ug/L	In compliance with state standard
Chloride	201 mg/L	132 mg/L	In compliance with state standard
Chlorophyll-a	11.7 ug/L	2.8 ug/L	Fair level
Chromium	3.6 ug/L	3.3 ug/L	In compliance with state standard
Conductivity	832 mMHOs	1072 mMHOs	Above ecoregion mean, higher during low flow
Copper	2.6 ug/L	1.8 ug/L	In compliance with state standard
E. coli	20.6 CFU/100mL	88.7 CFU/100mL	In compliance with state standard
Hardness	144 mg/L $CaCO_3$	350 mg/L $CaCO_3$	Considered hard water; very hard during low flow
Lead	0.40 ug/L	0.10 ug/L	In compliance with state standard
Nickel	1.7 ug/L	6.2 ug/L	In compliance with state standard
Nitrogen Ammonia	76 ug/L	28 ug/L	Below ecoregion mean
Nitrate + Nitrite	0.28 mg/L	0.39 mg/L	Above ecoregion mean
Phosphorus, Total	0.065 mg/L	0.045 mg/L	Below ecoregion mean
Suspended Solids	13.3 mg/L	9.8 mg/L	Below ecoregion mean
Turbidity	6.6 NTU	4.8 NTU	In compliance with state standard
Zinc	4.1 ug/L	2.6 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or micorseimens
CFU = colony forming units
NTU = nephelometric turbidity units

Appendix A



Watershed and land use information provided by Metropolitan Council Environmental Services.

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

April – June 2008

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
July 2008

Introduction

The Willow Creek WOMP site, located in Burnsville behind the Menards on Hwy. 13, has been in operation since 1999. The Willow Creek watershed drains more than 5,000 acres of various types of land uses including residential, vacant/agricultural, and commercial properties (Appendix A). This report summarizes the results of flow, precipitation, and water quality for the 2nd quarter of 2008. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Flow and Precipitation

Average flow in Willow Creek was 7.76 cubic feet per second (cfs) or 5.02 million gallons per day (mgd) (Table 1). A graph describing quarterly flow and precipitation results is also provided (Figure 1).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station April-June 2008

Period	Average Flow (cfs/mgd)	Precipitation (inches)	*Average Monthly Precipitation, 1998-2007 (inches)
APRIL	9.69/6.26	3.75	3.01
MAY	6.11/3.95	3.07	4.18
JUNE	7.52/4.86	2.87	4.62
TOTAL QUARTER	7.76/5.02	9.69	11.81

*Average monthly precipitation data obtained from the National Weather Service station located near the Willow WOMP site.

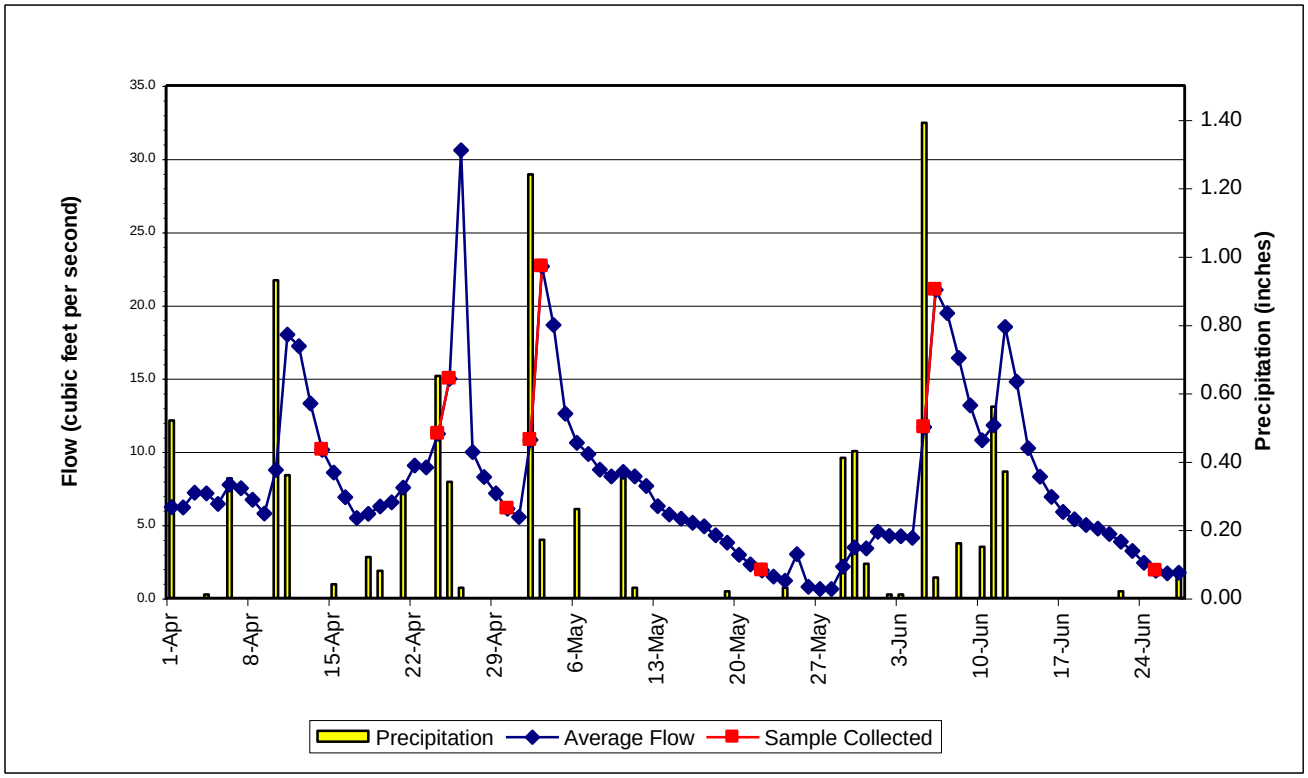


Figure 1. Flow and precipitation at Willow WOMP Station April-June 2008

Water Quality

Three event flow composite samples (4/24/08, 5/2/08, 6/5/08), one event grab sample (4/14/08), and three base flow grab samples (4/30/08, 5/22/08, 6/25/08) were collected from the Willow WOMP Station during the 2nd quarter of 2008.

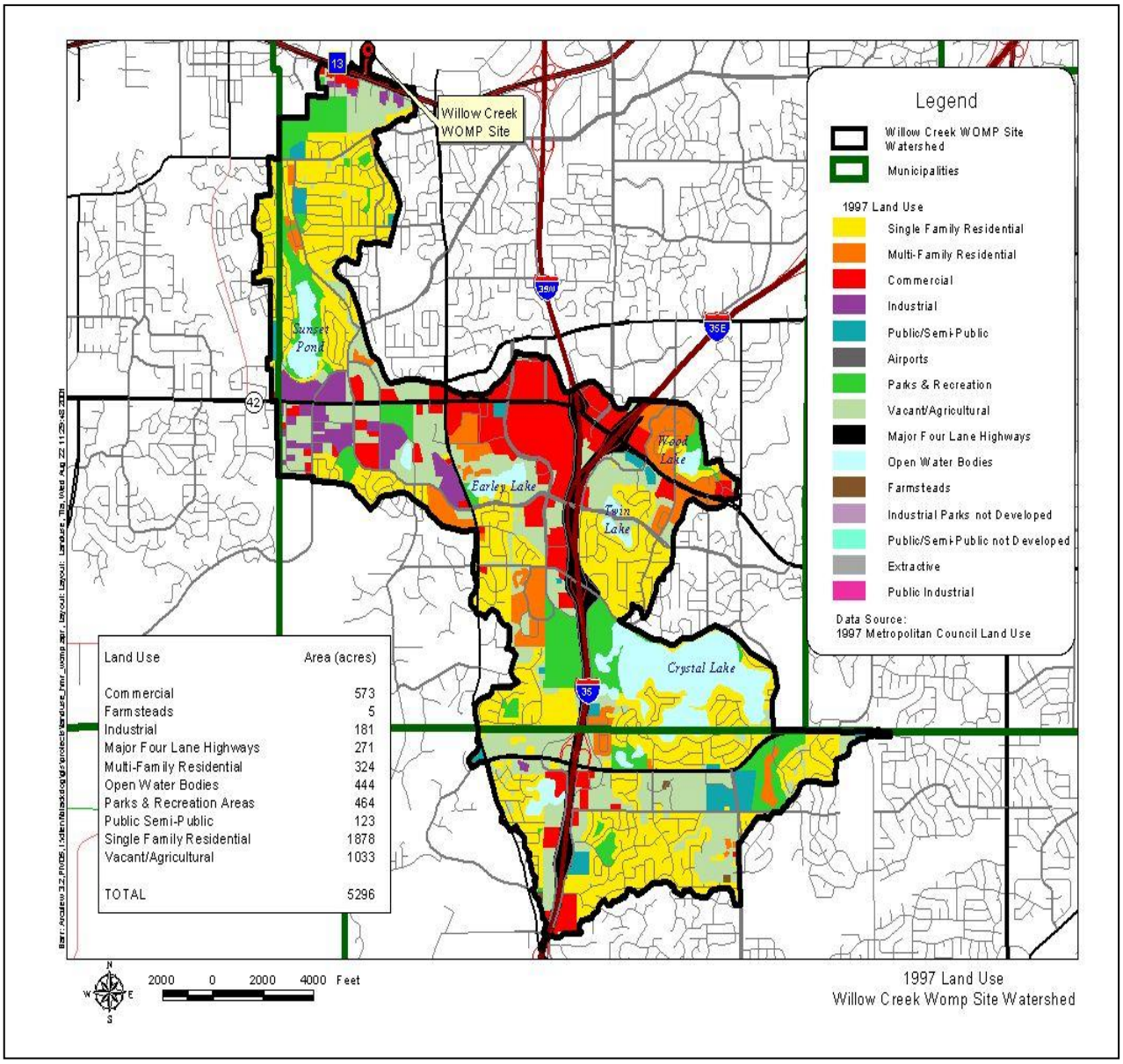
Overall, water quality was good with most parameters below the state standard (in compliance with standards) or near the ecoregion mean (Table 2). However, two endpoints exceeded standards or ecoregion means (highlighted red). These exceedances are likely artifacts of the soils and the highly urbanized nature of the Willow Creek watershed.

Table 2. Average concentrations at Willow Creek WOMP Station January 2008-March 2008 (for comparison purposes) and April-June 2008.

Parameter	1st Quarter 2008 Mean Concentration	2nd Quarter 2008 Mean Concentration	Notes – 2nd quarter results
Alkalinity	228 mg/L $CaCO_3$	83.4 mg/L $CaCO_3$	Typical for freshwater; higher during low flow
Biological Oxygen Demand	3.50 mg/L	1.84 mg/L	Below ecoregion mean
Cadmium	0.50 ug/L	0.50 ug/L	In compliance with state standard
Chloride	235 mg/L	201 mg/L	In compliance with state standard
Chlorophyll-a	11.9 ug/L	11.7 ug/L	Fair level
Chromium	1.2 ug/L	3.6 ug/L	In compliance with state standard
Conductivity	1315 mMHOs	832 mMHOs	Above ecoregion mean, higher during low flow
Copper	4.8 ug/L	2.6 ug/L	In compliance with state standard
E. coli	53.5 CFU/100 mL	20.6 CFU/100mL	In compliance with state standard
Hardness	307 mg/L $CaCO_3$	144 mg/L $CaCO_3$	Considered hard water; sometimes very hard during low flow
Lead	3.65 ug/L	0.40 ug/L	In compliance with state standard
Nickel	5.9 ug/L	1.7 ug/L	In compliance with state standard
Nitrogen Ammonia	345 ug/L	76 ug/L	Below ecoregion mean
Nitrate + Nitrite	0.42 mg/L	0.28 mg/L	Slightly above ecoregion mean
Phosphorus, Total	0.146 mg/L	0.065 mg/L	Below ecoregion mean
Suspended Solids	7.0 mg/L	13.3	Below ecoregion mean
Turbidity	9.5 NTU	6.6 NTU	In compliance with state standard
Zinc	7.5 ug/L	4.1 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or micorseimens
CFU = colony forming units
NTU = nephelometric turbidity units

Appendix A



Watershed and land use information provided by Metropolitan Council Environmental Services.

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

January – March 2008

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
May 2008

Introduction

The Willow Creek WOMP site, located in Burnsville behind the Menards on Hwy. 13, has been in operation since 1999. The Willow Creek watershed drains more than 5,000 acres of various types of land uses including residential, vacant/agricultural, and commercial properties (Appendix A). This report summarizes the results of flow, precipitation, and water quality for the 1st quarter of 2008. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Flow and Precipitation

Average flow in Willow Creek was 1.21 cubic feet per second (cfs) or 0.78 million gallons per day (mgd) (Table 1). A graph describing quarterly flow and precipitation results is also provided (Figure 1).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station January – March 2008

Period	Average Flow (cfs/mgd)	Precipitation (inches)	*Average Monthly Precipitation, 1998-2007 (inches)
JANUARY	0.46/0.30	na**	0.96
FEBRUARY	0.44/0.28	na**	0.83
MARCH	2.68/1.73	1.29**	2.06
TOTAL QUARTER	1.21/0.78	1.29**	3.85

*Average monthly precipitation data obtained from the National Weather Service station located near the Willow WOMP site.
**Rain gauge was not activated until 3/14/08.

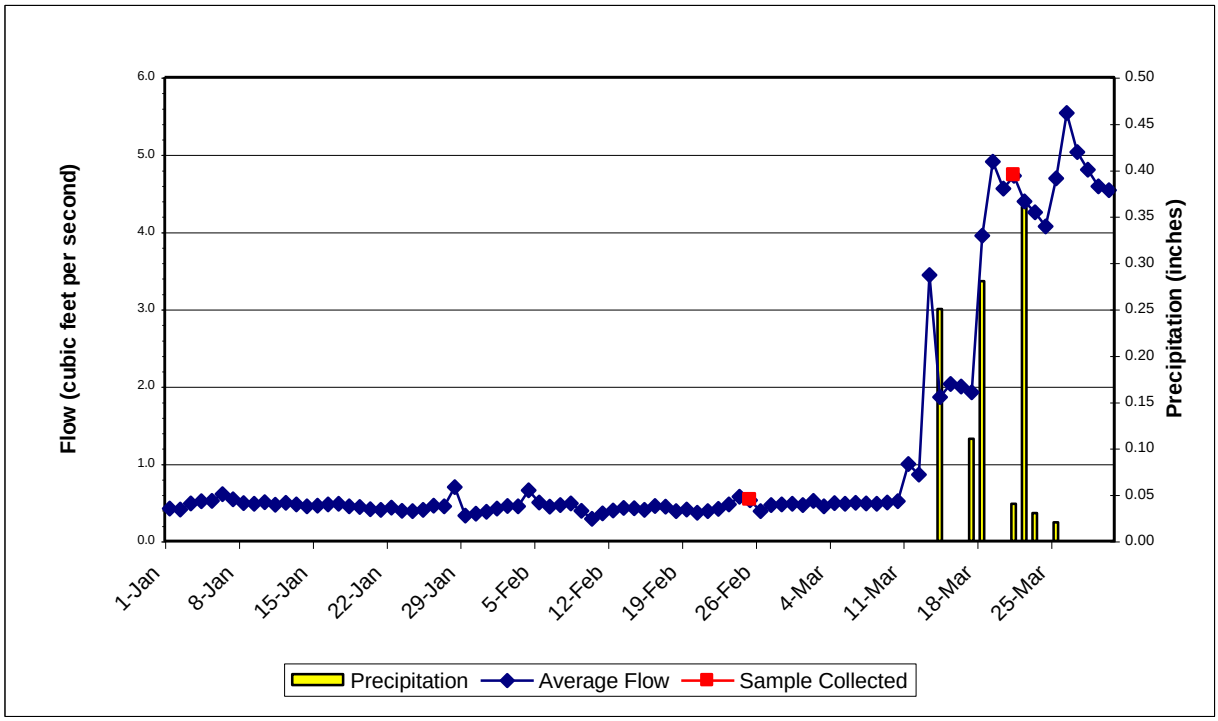


Figure 1. Flow and precipitation at Willow WOMP Station January-March 2008

Water Quality

One event flow grab sample (3/21/08) and one base flow grab sample (2/26/08) were collected from the Willow WOMP Station during the 1st quarter of 2008. Weather conditions over this period were especially harsh, preventing samples from being taken (manhole cover frozen).

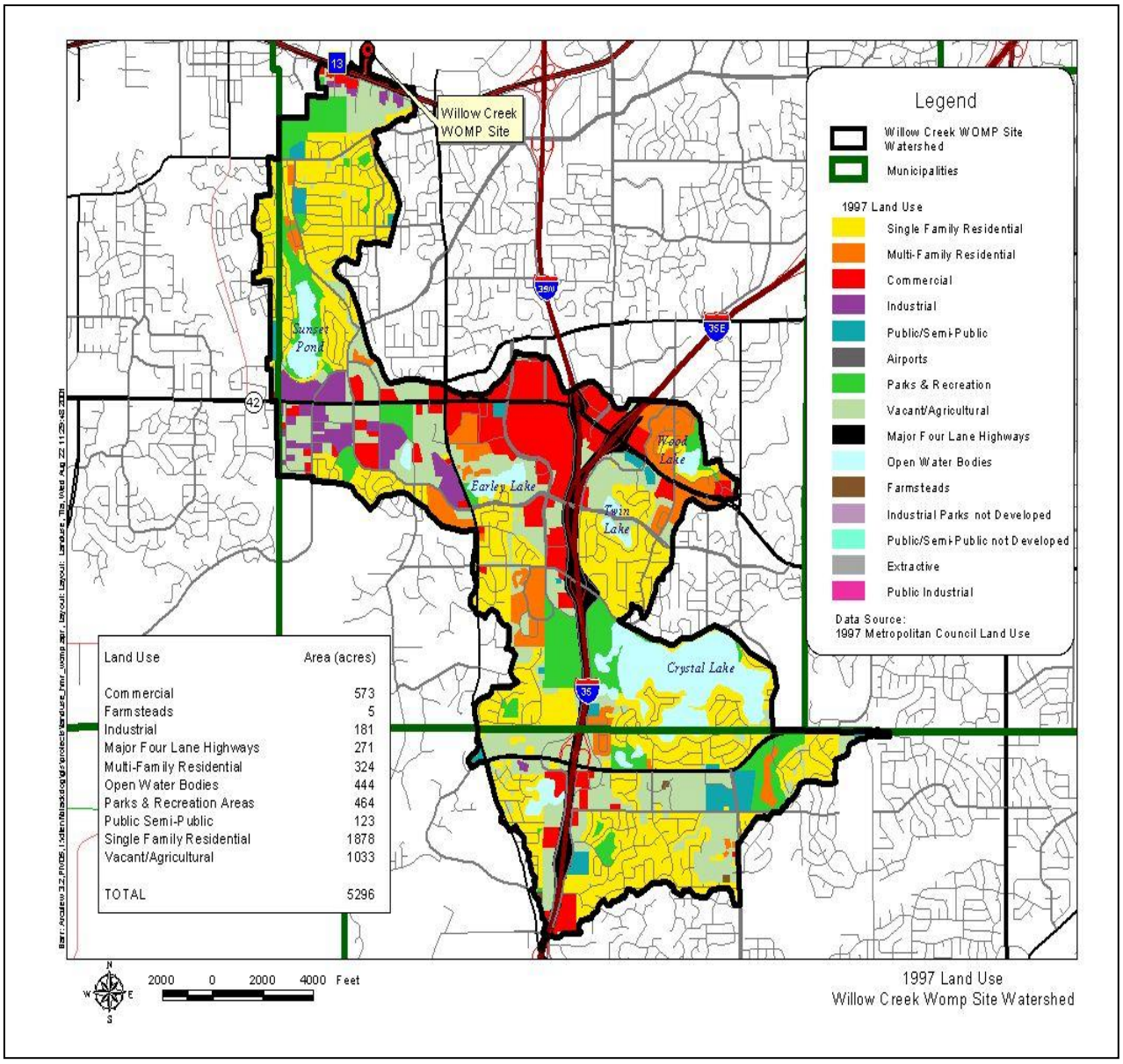
Overall, water quality was good with most parameters below the state standard (in compliance with standards) or near the ecoregion mean (Table 2). However, several endpoints exceeded standards or ecoregion means (highlighted red). These results are primarily due to elevated sample concentrations detected in a single sample, which was collected during a large spring snowmelt event (3/21/08).

Table 2. Average concentrations at Willow Creek WOMP Station October 2007-December 2007 (for comparison purposes) and January-March 2008.

Parameter	4th Quarter 2007 Mean Concentration	1st Quarter 2008 Mean Concentration	Notes – 1st quarter results
Alkalinity	274 mg/L $CaCO_3$	228 mg/L $CaCO_3$	Typical for freshwater; higher during low flow
Biological Oxygen Demand	1.13 mg/L	3.50	Above ecoregion mean
Cadmium	0.50 ug/L	0.50 ug/L	In compliance with state standard
Chloride	95 mg/L	235 mg/L	Slightly exceeding state standard due to single elevated sample
Chlorophyll-a	5.3 ug/L	11.9 ug/L	Fair level
Chromium	0.5 ug/L	1.2 ug/L	In compliance with state standard
Conductivity	1015 mMHOs	1315 mMHOs	Above ecoregion mean, higher during low flow
Copper	1.6 ug/L	4.8 ug/L	In compliance with state standard
E. coli	na	53.5 CFU/100 ML	In compliance with state standard
Hardness	416 mg/L $CaCO_3$	307 mg/L $CaCO_3$	Considered hard water; sometimes very hard during low flow
Lead	0.1 ug/L	3.65 ug/L	In compliance with state standard
Nickel	9.3 ug/L	5.9 ug/L	In compliance with state standard
Nitrogen Ammonia	33.3 ug/L	345 ug/L	Exceeds state standard due to single elevated sample
Nitrate + Nitrite	0.39 mg/L	0.42 mg/L	Above ecoregion mean
Phosphorus, Total	0.103 mg/L	0.146 mg/L	Below ecoregion mean
Suspended Solids	2.0 mg/L	7.0 mg/L	Below ecoregion mean
Turbidity	2.0 NTU	9.5 NTU	In compliance with state standard
Zinc	2.0 ug/L	7.5 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or micorseimens
CFU = colony forming units
NTU = nephelometric turbidity units

Appendix A



Watershed and land use information provided by Metropolitan Council Environmental Services.

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

October – December 2007

Prepared By: Dakota County Soil and Water Conservation District

Prepared For: Lower Minnesota River Watershed District

January 2008

Introduction

The Willow Creek WOMP site, located in Burnsville behind the Menards on Hwy. 13, has been in operation since 1999. The Willow Creek watershed drains more than 5,000 acres of various types of land uses including residential, vacant/agricultural, and commercial properties (Appendix A). This report summarizes the results of flow, precipitation, and water quality for the 4th quarter of 2007. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Flow and Precipitation

Average flow in Willow Creek was 3.40 cubic feet per second (cfs) or 2.20 million gallons per day (mgd) (Table 1). Total precipitation was recorded as 4.04 inches, although the rain gauge was covered for the winter on November 1st. A graph describing annual flow and precipitation results is also provided (Figure 2).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station October – December 2007

Period	Average Flow (cfs/mgd)	Precipitation (inches)	*Average Monthly Precipitation, 1997-2006 (inches)
OCTOBER	8.56/5.53	4.04	2.05
NOVEMBER	1.05/0.68	na	1.35
DECEMBER	0.52/0.34	na	0.74
TOTAL QUARTER	3.40/2.20	na	4.14

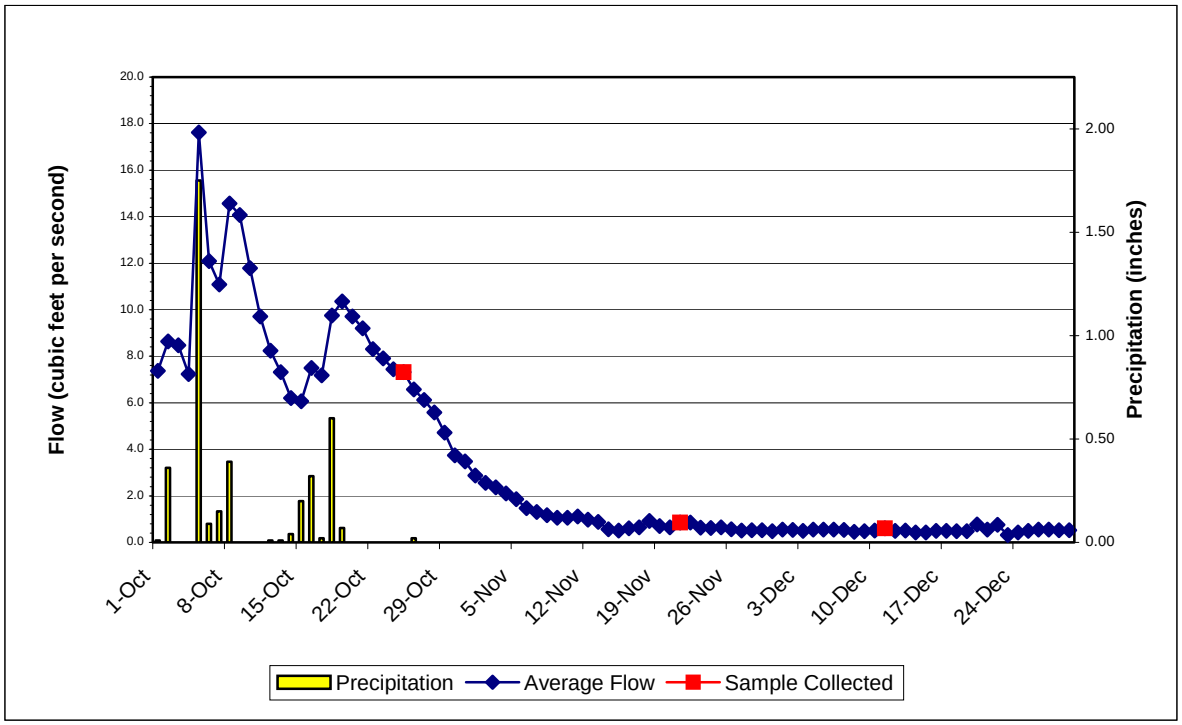


Figure 1. Flow and precipitation at Willow WOMP Station October-December, 2007

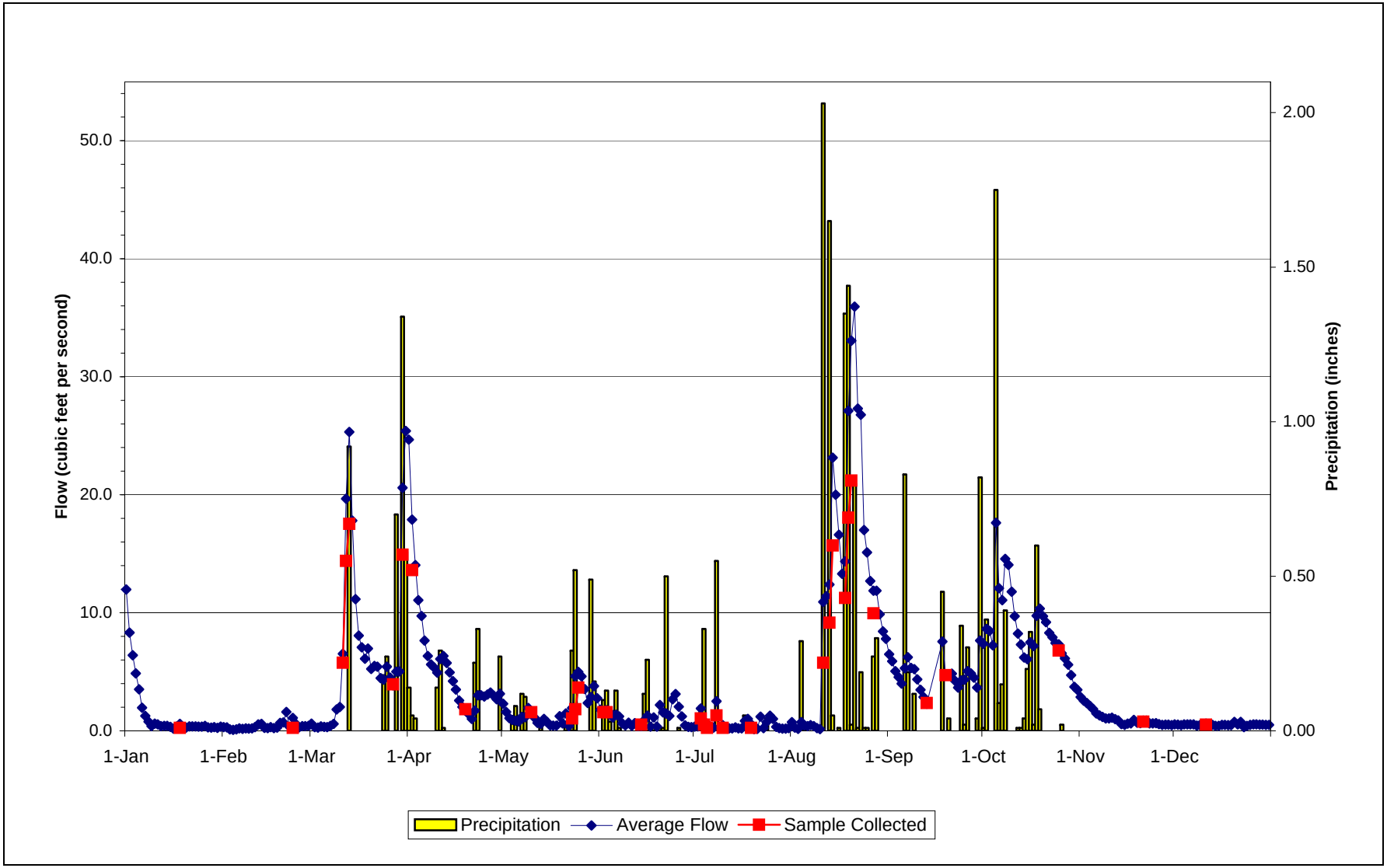


Figure 2. Flow January – December 2007 and Precipitation March 13 – November 1, 2007

Water Quality

Throughout 2007, the long established Willow Creek WOMP monitoring schedule was followed and samples were collected during runoff events and base flows, giving us a good representation of water quality conditions. It should be mentioned that the equipment used to measure stage failed in mid-September. Metropolitan Council staff promptly replaced the faulty equipment within four days of the equipment failure.

During the fourth quarter of 2007, three base flow grab samples (10/25/07, 11/21/07 and 12/11/07) were collected at the Willow WOMP Station. Overall, water quality was excellent with most parameters below/near the state standard or the minimally impacted stream ecoregion mean, with the exception of conductivity and nitrates/nitrites.

Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, sulfate, sodium, calcium and others. Conductivity in streams and rivers is affected by the geology of the area through which the water flows. Streams that run through granite bedrock will have lower conductivity, and those that flow through limestone and clay soils will have higher conductivity values. High conductance readings can also come from industrial pollution or urban runoff. Extended dry periods, low flow conditions, and warmer water temperatures may also contribute to higher specific conductance readings (Source: http://www.epa.gov/volunteer/stream/).

As suggested in the 2006 4th Quarter Willow Creek Monitoring Report, Dakota County Soil and Water Conservation District (SWCD) staff identified soil types common to the Willow Creek Watershed in an attempt to describe the source of the continually elevated conductivity results. According to the U.S. Department of Agriculture, Soil Survey of Dakota County (1980), soils in this watershed consist primarily of sand, silts, and clays. The high mineral content of the clay soils may account for much of the elevated conductivity results.

Nitrate/nitrate concentrations over the 4th quarter of 2007 were also higher than the minimally impacted stream ecoregion mean. Although somewhat elevated at 0.39 mg/L, nitrate/nitrite results of less than 1.0 mg/L are generally considered low. Slightly higher concentrations are to be expected in urbanized areas like the Willow Creek Watershed. Common sources of nitrates/nitrites include lawn fertilizer, failing septic systems, and industrial runoff.

In 2006, elevated fecal coliform concentrations were often reported at the Willow Creek WOMP station. Dakota County SWCD staff agreed to monitor waterfowl populations that may be inhabiting the wetland system immediately upstream from the Willow Creek monitoring station. Staff routinely surveyed this wetland following sample collections. On many occasions large populations (50+) of geese and ducks were observed in these wetlands. In addition, local residents have confirmed that a large nuisance population of geese live on or near these waterways. Therefore, we assume that a likely source of the elevated bacteria concentrations may be waterfowl living in the area. Moderately elevated fecal coliform results are relatively common in other urban streams within Dakota County.

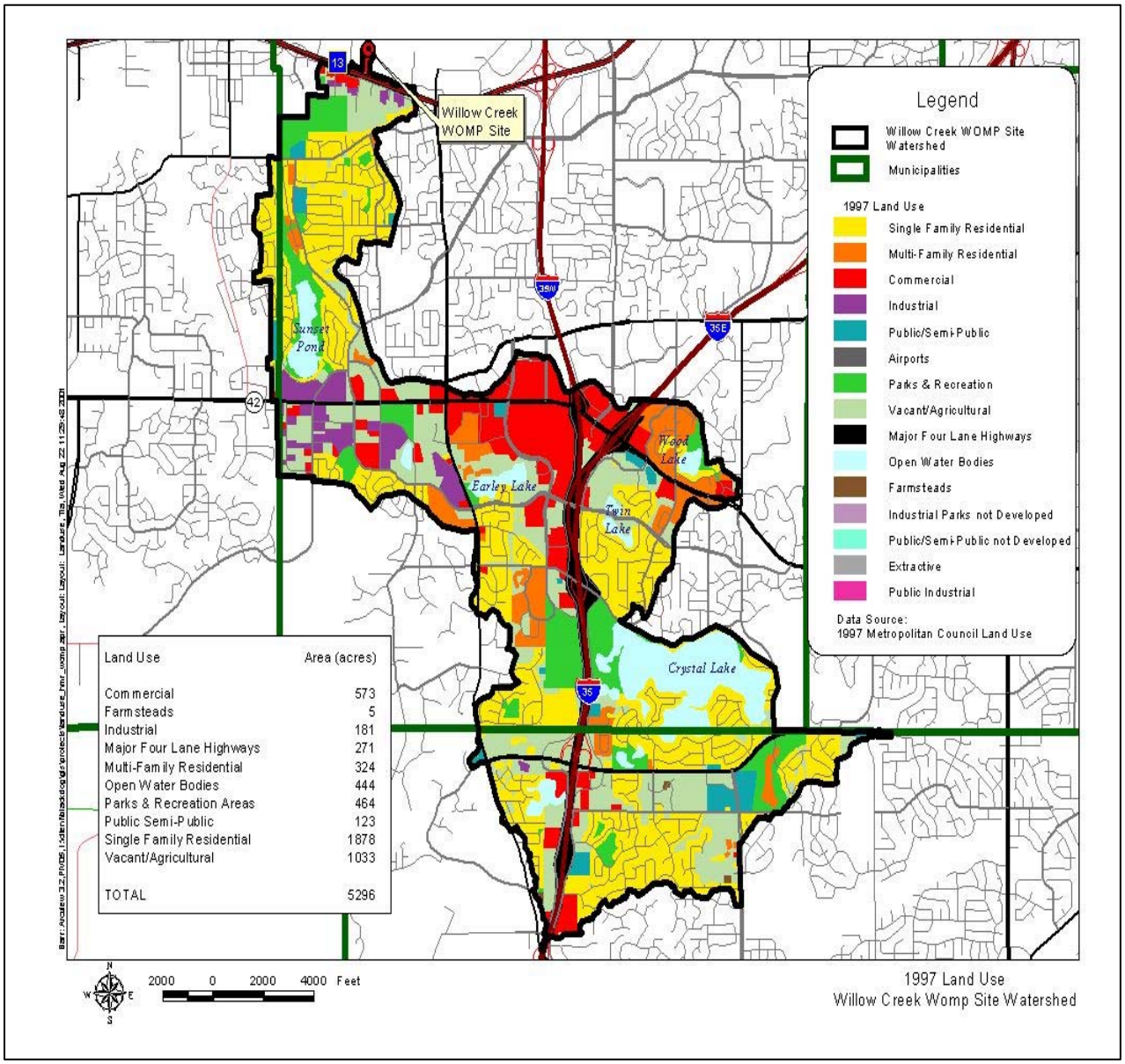
Table 2. Average concentrations at Willow Creek WOMP Station October – December 2007. 1st –3rd quarter results are included (shaded grey) for comparison purposes.

Parameter	1st Quarter 2007 Mean Concentration	2nd Quarter 2007 Mean Concentration	3rd Quarter 2007 Mean Concentration	4th Quarter 2007 Mean Concentration	Notes – 4th Quarter Results
Alkalinity	197 mg/L $CaCO_3$	175 mg/L $CaCO_3$	91 mg/L $CaCO_3$	274 mg/L $CaCO_3$	Typical for freshwater; higher during lower flow
Biological Oxygen Demand (BOD5)	1.5 mg/L	1.37 mg/L	2.93 mg/L	1.13 mg/L	Below ecoregion mean
Cadmium	0.04 ug/L	0.04 ug/L	0.29 ug/L	0.50 ug/L	In compliance with state standard
Chloride	158 mg/L	126 mg/L	47 mg/L	95 mg/L	In compliance with state standard
Chlorophyll-a	3.7 ug/L	4.2 ug/L	9.9 ug/L	5.3 ug/L	Low level
Chromium	3.3 ug/L	10.9 ug/L	4.5 ug/L	0.5 ug/L	In compliance with state standard
Conductivity	1057 mMHOs	937 mMHOs	454 mMHOs	1015 mMHOs	Above ecoregion mean, higher during low flow
Copper	2.75 ug/L	5.4 ug/L	7.6 ug/L	1.6 ug/L	In compliance with state standard
Fecal Coliform Bacteria (geometric mean)	45 CFU/100mL	240 CFU/100mL	81 CFU/100mL	15 CFU/100mL	In compliance with state standard
Hardness	321 mg/L $CaCO_3$	258 mg/L $CaCO_3$	129 mg/L $CaCO_3$	416 mg/L $CaCO_3$	Considered hard water; very hard during low flow
Lead	0.6 ug/L	1.8 ug/L	5.0 ug/L	0.1 ug/L	In compliance with state standard
Nickel	9.6 ug/L	6.6 ug/L	7.7 ug/L	9.3 ug/L	In compliance with state standard
Nitrogen Ammonia	107.5 ug/L	48.0 ug/L	168.6 ug/L	33.3 ug/L	In compliance with state standard
Nitrate + Nitrite	0.30 mg/L	2.21 mg/L	0.30 mg/L	0.39 mg/L	Above ecoregion mean
Phosphorus, Total	0.0938 mg/L	0.1136 mg/L	0.1718 mg/L	0.103 mg/L	Below ecoregion mean
Suspended Solids	11.75 mg/L	50.2 mg/L	104.1 mg/L	2.0 mg/L	Below ecoregion mean
Turbidity	6.75 NTU	22.6 NTU	20.8 NTU	2.0 NTU	In compliance with state standard
Zinc	7.7 ug/L	17.2 ug/L	56.0 ug/L	2.0 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or microseimens

CFU = colony forming units
NTU = nephelometric turbidity units

Appendix A



Watershed and land use information provided by Metropolitan Council Environmental Services.

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

July – September 2007

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
October 2007

Introduction

The Willow Creek WOMP site, located in Burnsville behind the Menards on Hwy. 13, has been in operation since 1999. The Willow Creek watershed drains more than 5,000 acres of various types of land uses including residential, vacant/agricultural, and commercial properties (Appendix A). This report summarizes the results of flow, precipitation, and water quality for the 3rd quarter of 2007. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Flow and Precipitation

Average flow in Willow Creek was 5.84 cubic feet per second (cfs) or 3.77 million gallons per day (mgd) (Table 1). A graph describing quarterly flow and precipitation results is also provided (Figure 1). It should be noted that the stage monitoring equipment was replaced in mid-September, which corresponds with a temporary decrease in stage observed in Figure 1.

Table 1. Average flow and total precipitation at Willow Creek WOMP Station July – September 2007

Period	Average Flow (cfs/mgd)	Precipitation (inches)	*Average Monthly Precipitation, 1997-2006 (inches)
JULY	0.55/0.36	1.05	4.28
AUGUST	11.97/7.74	8.41	4.29
SEPTEMBER	4.82/3.12	3.12	3.00
TOTAL QUARTER	5.84/3.77	12.58	11.57

*Average monthly precipitation data obtained from the National Weather Service station located near the Willow WOMP site.

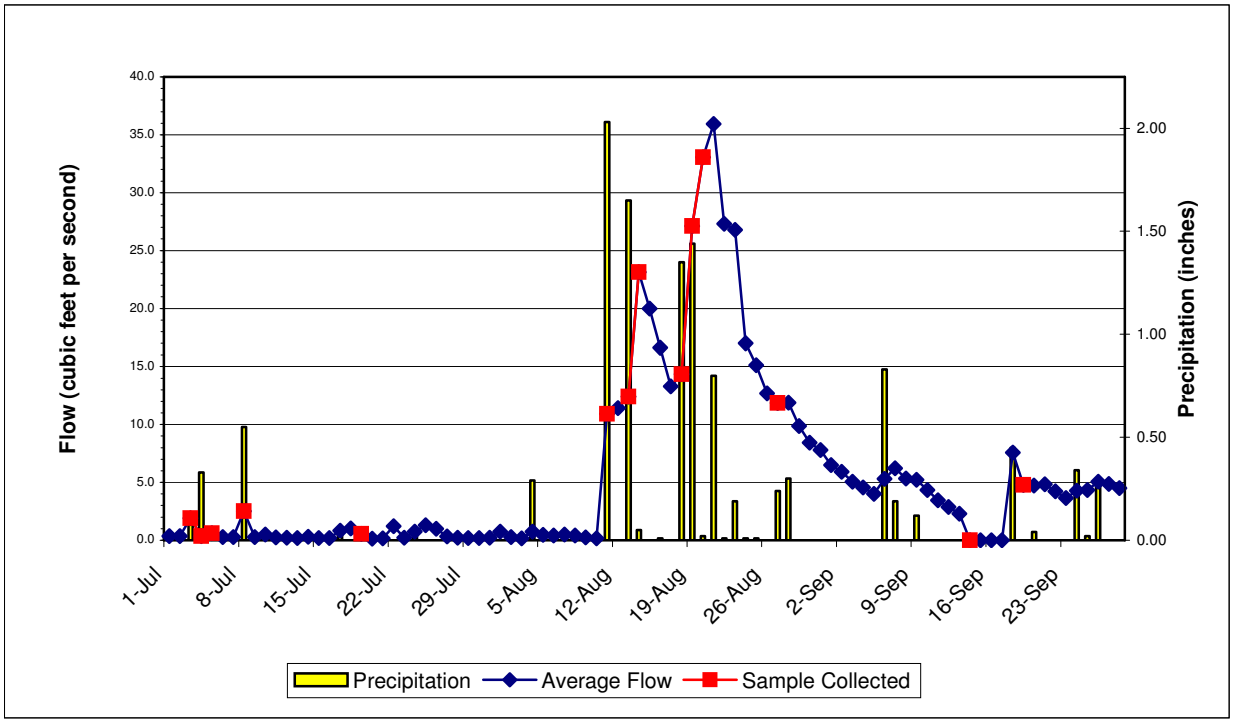


Figure 1. Flow and precipitation at Willow WOMP Station July-September 2007

Water Quality

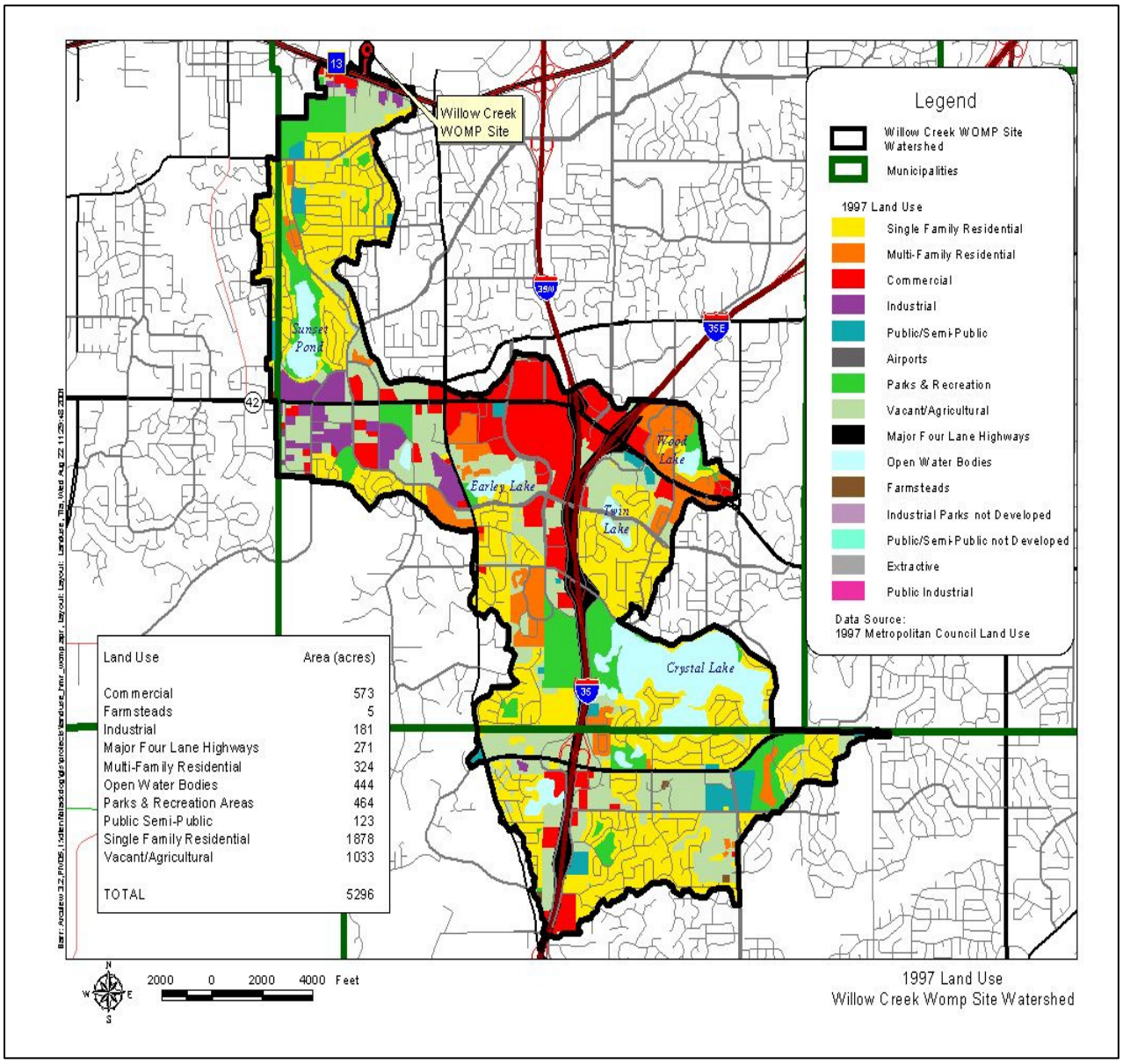
Five event composite samples (7/3/07, 7/8/07, 8/11/07, 8/13/07, 8/18/07), one event grab sample (9/19/07-due to equipment failure), and three low flow grab samples were collected at the Willow WOMP Station during the 3rd quarter of 2007. Overall, water quality was good with most parameters below the state standard (in compliance with standards) or near the ecoregion mean (Table 2). However, several endpoints showed unusually elevated results (highlighted red). These results are likely due to the large number of August rain events and a reflection of the pollutant load present in the initial flush of storm water runoff.

Table 2. Average concentrations at Willow Creek WOMP Station January – June 2007 (for comparison purposes) and July-September 2007.

Parameter	1st quarter 2007 Ave. Concentration	2nd Quarter 2007 Ave. Concentration	3rd Quarter 2007 Ave. Concentration	Notes – 3rd quarter results
Alkalinity	197 mg/L $CaCO_3$	175 mg/L $CaCO_3$	91 mg/L $CaCO_3$	Typical for freshwater; higher during low flow
Biological Oxygen Demand	1.5 mg/L	1.37	2.93	Slightly above ecoregion mean due to a single elevated sample
Cadmium	0.04 ug/L	0.04 ug/L	0.29 ug/L	In compliance with state standard
Chloride	158 mg/L	126 mg/L	47 mg/L	In compliance with state standard
Chlorophyll-a	3.7 ug/L	4.2 ug/L	9.9 ug/L	Fair level
Chromium	3.3 ug/L	10.9 ug/L	4.5 ug/L	In compliance with state standard
Conductivity	1057 mMHOs	937 mMHOs	454 mMHOs	Above ecoregion mean, higher during low flow
Copper	2.75 ug/L	5.4 ug/L	7.6 ug/L	In compliance with state standard
Fecal Coliform Bacteria	45 CFU/100mL	240 CFU/100mL	81 CFU/100mL	In compliance with state standard
Hardness	321 mg/L $CaCO_3$	258 mg/L $CaCO_3$	129 mg/L $CaCO_3$	Considered hard water; sometimes very hard during low flow
Lead	0.6 ug/L	1.8 ug/L	5.0 ug/L	Exceeds state standard
Nickel	9.6 ug/L	6.6 ug/L	7.7 ug/L	In compliance with state standard
Nitrogen Ammonia	107.5 ug/L	48.0 ug/L	168.6 ug/L	Exceeds state standard
Nitrate + Nitrite	0.30 mg/L	2.21 mg/L	0.30 mg/L	Above ecoregion mean
Phosphorus, Total	0.0938 mg/L	0.1136 mg/L	0.1718 mg/L	Slightly above ecoregion mean
Suspended Solids	11.75 mg/L	50.2 mg/L	104.1 mg/L	Above ecoregion mean
Turbidity	6.75 NTU	22.6 NTU	20.8 NTU	In compliance with state standard
Zinc	7.7 ug/L	17.2 ug/L	56.0 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or microseimens
CFU = colony forming units
NTU = nephelometric turbidity units

Appendix A



Watershed and land use information provided by Metropolitan Council Environmental Services.

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

October – December 2006

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
January 2007

The Willow Creek WOMP site, located in Burnsville behind the Menards on Hwy. 13, has been in operation since 1999. This report summarizes the results of flow, precipitation, and water quality for the 4th quarter of 2006. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Flow and Precipitation

Average flow in Willow Creek was 0.57 cubic feet per second (cfs) or 0.37 million gallons per day (mgd) (Table 1). Total precipitation was recorded as 0.41 inches, although the rain gauge was covered on November 3rd. A graph describing annual flow and precipitation results is also provided (Figure 2).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station October – December 2006

Period	Average Flow (cfs/mgd)	Precipitation (inches)
OCTOBER	0.53 / 0.34	0.31
NOVEMBER	0.52 / 0.34	0.10
DECEMBER	0.66 / 0.43	NA
TOTAL QUARTER	0.57 / 0.37	0.41

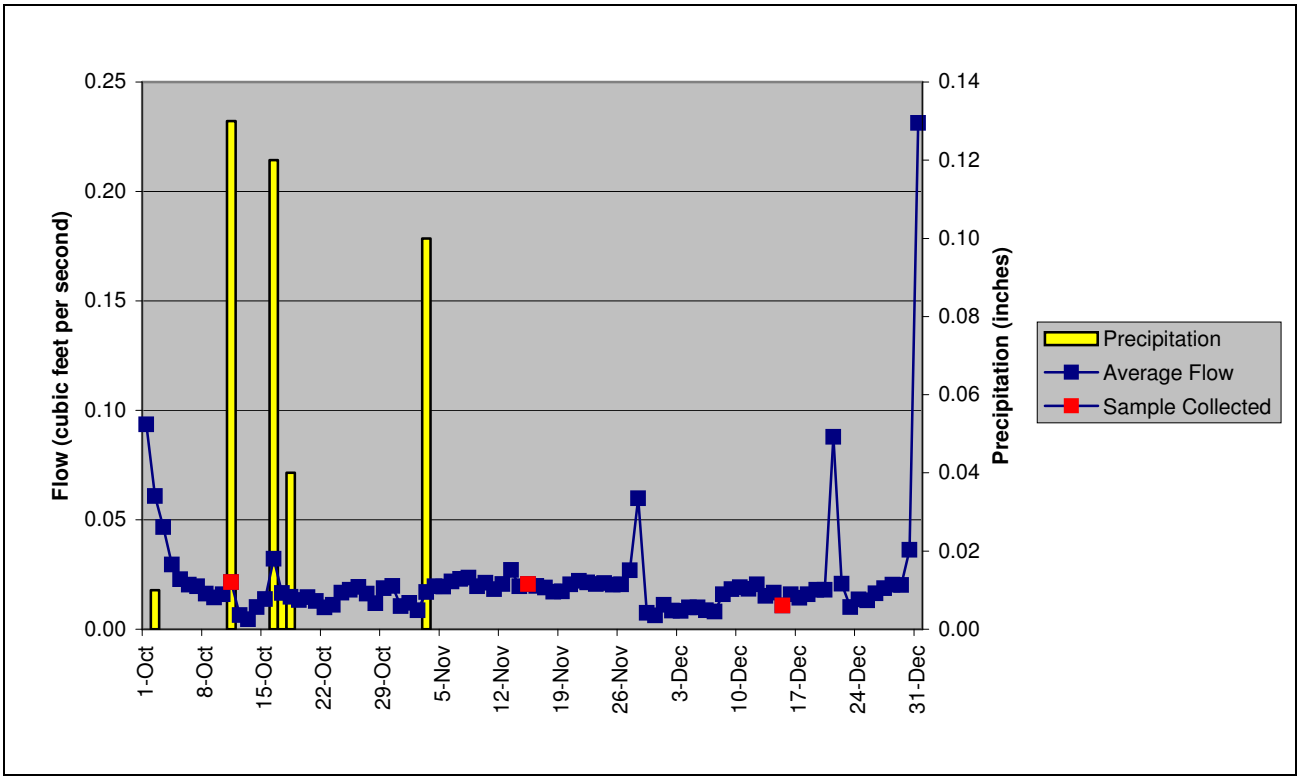


Figure 1. Flow and precipitation at Willow WOMP Station October-December, 2006

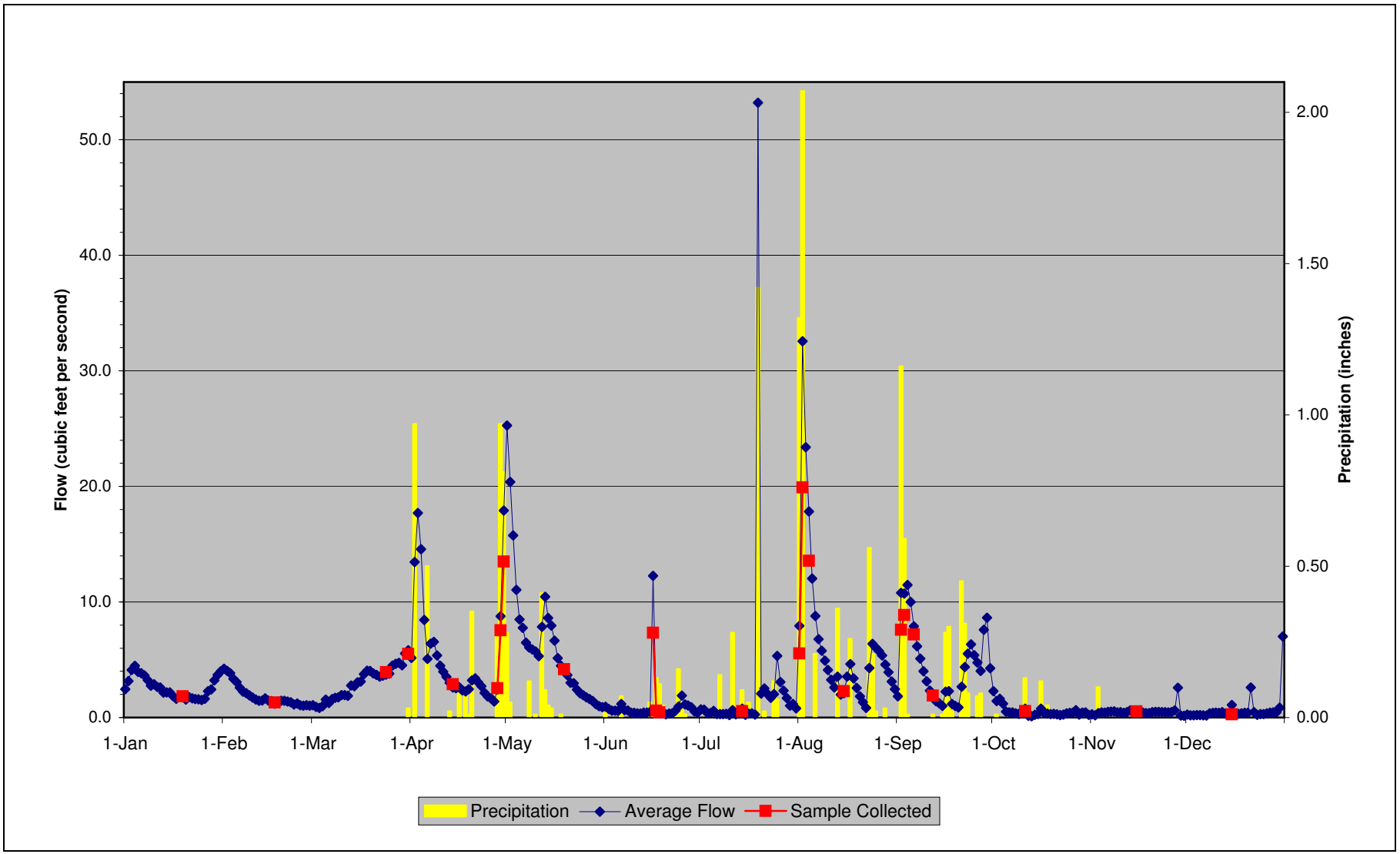


Figure 2. Flow January – December 2006 and Precipitation March 31 – November 3, 2006

Water Quality

During the fourth quarter of 2006, three low flow grab samples were collected at the Willow WOMP Station. Overall, water quality was good with most parameters below the state standard or near the minimally impacted stream ecoregion mean, with the exception of fecal coliform bacteria concentrations (Table 2). The source of the elevated fecal coliform results is unknown, although later concentrations had fallen below the state standard.

Table 2. Average concentrations at Willow Creek WOMP Station October – December 2006. 1st –3rd quarter results are included (shaded grey) for comparison purposes.

Parameter	1st Quarter 2006 Mean Concentration	2nd Quarter 2006 Mean Concentration	3rd Quarter 2006 Mean Concentration	4th Quarter 2006 Mean Concentration	Notes – 3rd Quarter Results
Alkalinity	148 mg/L $CaCO_3$	90 mg/L $CaCO_3$	126 mg/L $CaCO_3$	273 mg/L $CaCO_3$	Typical for freshwater; higher during lower flow
Biological Oxygen Demand (BOD5)	1.7 mg/L	1.5 mg/L	1.3 mg/L	7.7 mg/L	Slightly above ecoregion mean
Cadmium	0.04 ug/L	0.04 ug/L	0.04 ug/L	0.04 ug/L	In compliance with state standard
Chloride	237 mg/L	202 mg/L	101 mg/L	123 mg/L	In compliance with state standard
Chlorophyll-a	12 ug/L	5.9 ug/L	1.2 ug/L	2.2 ug/L	Low level
Chromium	0.6 ug/L	10.5 ug/L	1.2 ug/L	1.6 ug/L	In compliance with state standard
Conductivity	1219 mMHOs	996 mMHOs	733 mMHOs	1251 mMHOs	Above ecoregion mean, higher during low flow
Copper	2.0 ug/L	5.3 ug/L	1.5 ug/L	8.7 ug/L	In compliance with state standard
Fecal Coliform Bacteria	26 CFU/100mL	96 CFU/100mL	415 CFU/100mL	498 CFU/100mL	Exceeds state standard due to a single elevated sample.
Hardness	198 mg/L $CaCO_3$	166 mg/L $CaCO_3$	207 mg/L $CaCO_3$	483 mg/L $CaCO_3$	Considered hard water; very hard during low flow
Lead	0.2 ug/L	2.0 ug/L	0.3 ug/L	0.6 ug/L	In compliance with state standard
Nickel	3.9 ug/L	8.6 ug/L	3.0 ug/L	8.2 ug/L	In compliance with state standard
Nitrogen Ammonia	32.5 ug/L	187.5 ug/L	58.3 ug/L	123.3 ug/L	Exceeds state standard due to a single elevated sample.

Nitrate + Nitrite	0.43 mg/L	0.50 mg/L	0.28 mg/L	0.76 mg/L	Above ecoregion mean
Phosphorus, Total	0.0552 mg/L	0.4848 mg/L	0.0924 mg/L	0.2550	Slightly above ecoregion mean
Suspended Solids	2.25 mg/L	459 mg/L	6.0 mg/L	9.3 mg/L	Below ecoregion mean
Turbidity	3.25 NTU	268.33 NTU	6.71 NTU	4.33 NTU	In compliance with state standard
Zinc	4.3 ug/L	20.9 ug/L	5.1 ug/L	26.0 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or microseimens
CFU = colony forming units
NTU = nephelometric turbidity units

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

July – September 2006

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
November 2006

The Willow Creek WOMP site, located in Burnsville behind the Menards on Hwy. 13, has been in operation since 1999. This report summarizes the results of flow, precipitation, and water quality for the 3rd quarter of 2006. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

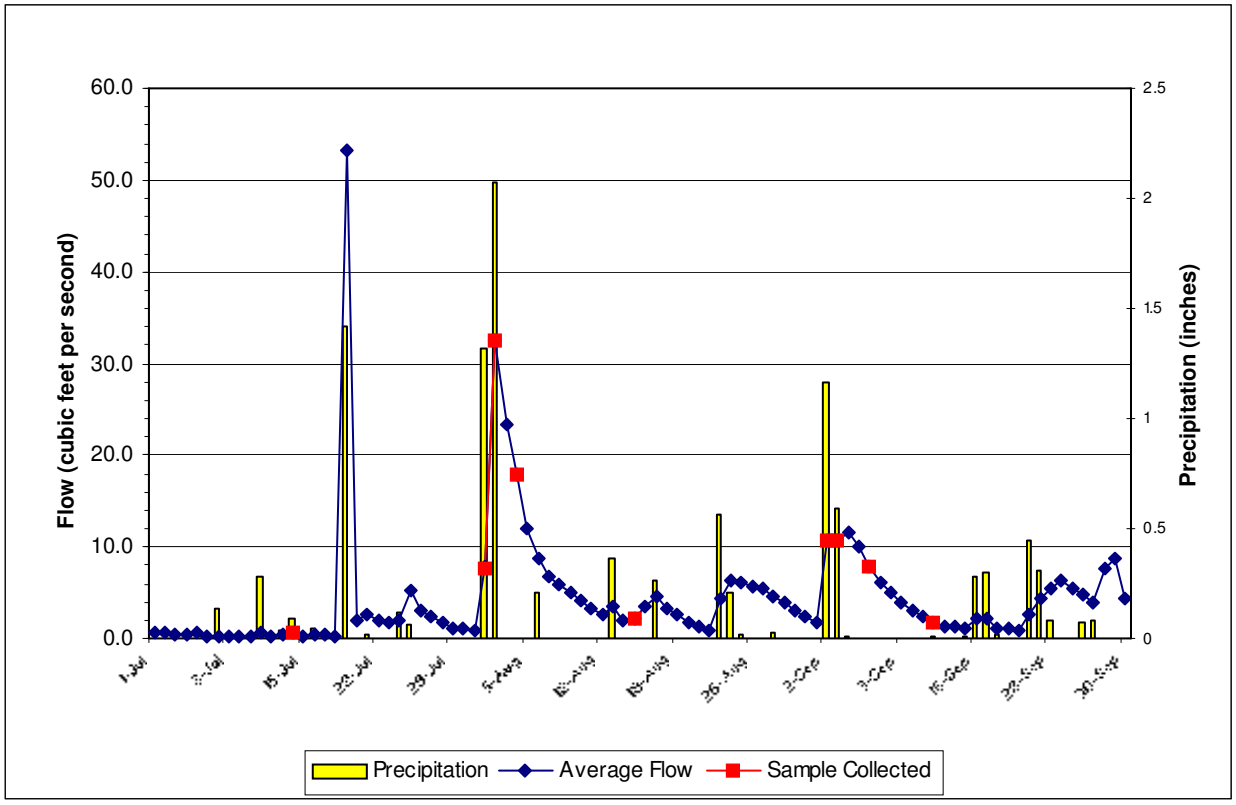
Flow and Precipitation

Average flow in Willow Creek was 4.94 cubic feet per second (cfs) or 3.19 million gallons per day (mgd). Total precipitation was recorded as 10.63 inches.

Table 1. Average flow and total precipitation at Willow Creek WOMP Station July – September 2006

Period	Average Flow (cfs/mgd)	Precipitation (inches)
JULY	3.41 / 2.20	2.22
AUGUST	6.71 / 4.34	5.04
SEPTEMBER	4.71 / 3.04	3.37
TOTAL QUARTER	4.94 / 3.19	10.63

Figure 1. Flow and precipitation at Willow WOMP Station July-September, 2006



Water Quality

Two event composite samples (8/1/06, 9/2/06) and three low flow grab samples were taken at the Willow WOMP Station during the 3rd quarter of 2006. Overall, water quality was good with most parameters below the state standard or near the ecoregion mean, with the exception of fecal coliform bacteria concentrations (Table 2). The source of the elevated fecal coliform results is unknown.

Table 2. Average concentrations at Willow Creek WOMP Station July – September 2006. 1st and 2nd quarter results are included (shaded grey) for comparison purposes.

Parameter	1st Quarter 2006 Ave. Concentration	2nd Quarter 2006 Ave. Concentration	3rd Quarter 2006 Ave. Concentration	Notes – 3rd Quarter Results
Alkalinity	148 mg/L $CaCO_3$	90 mg/L $CaCO_3$	126 mg/L $CaCO_3$	Typical for freshwater
Biological Oxygen Demand (BOD5)	1.7 mg/L	1.5 mg/L	1.3 mg/L	Below ecoregion mean
Cadmium	0.04 ug/L	0.04 ug/L	.04 ug/L	In compliance with state standard
Chloride	237 mg/L	202 mg/L	101 mg/L	In compliance with state standard
Chlorophyll-a	12 ug/L	5.9 ug/L	1.2 ug/L	Fair level
Chromium	0.6 ug/L	10.5 ug/L	1.2 ug/L	In compliance with state standard
Conductivity	1219 mMHOs	996 mMHOs	733 mMHOs	Higher than average for metro streams
Copper	2.0 ug/L	5.3 ug/L	1.5 ug/L	In compliance with state standard
Fecal Coliform Bacteria	26 CFU/100mL	96 CFU/100mL	415 CFU/100mL	Exceeds ecoregion mean
Hardness	198 mg/L $CaCO_3$	166 mg/L $CaCO_3$	207 mg/L $CaCO_3$	Considered hard water; very hard during low flow
Lead	0.2 ug/L	2.0 ug/L	0.335 ug/L	In compliance with state standard
Nickel	3.9 ug/L	8.6 ug/L	3.0 ug/L	In compliance with state standard
Nitrogen Ammonia	32.5 ug/L	187.5 ug/L	58.3 ug/L	In compliance with state standard
Nitrate + Nitrite	0.43 mg/L	0.50 mg/L	0.28 mg/L	Slightly below ecoregion mean
Phosphorus, Total	0.0552 mg/L	0.4848 mg/L	0.0924 mg/L	Below ecoregion mean
Suspended Solids	2.25 mg/L	459 mg/L	6.0 mg/L	Below ecoregion mean
Turbidity	3.25 NTU	268.33 NTU	6.71 NTU	In compliance with state standard
Zinc	4.3 ug/L	20.9 ug/L	5.1 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or micorseimens
CFU = colony forming units
NTU = nephelometric turbidity units

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

April – June 2006

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
July 2006

The Willow Creek WOMP site, located in Burnsville behind the Menards on Hwy. 13, has been in operation since 1999. This report summarizes the results of flow, precipitation, and water quality for the 2nd quarter of 2006. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

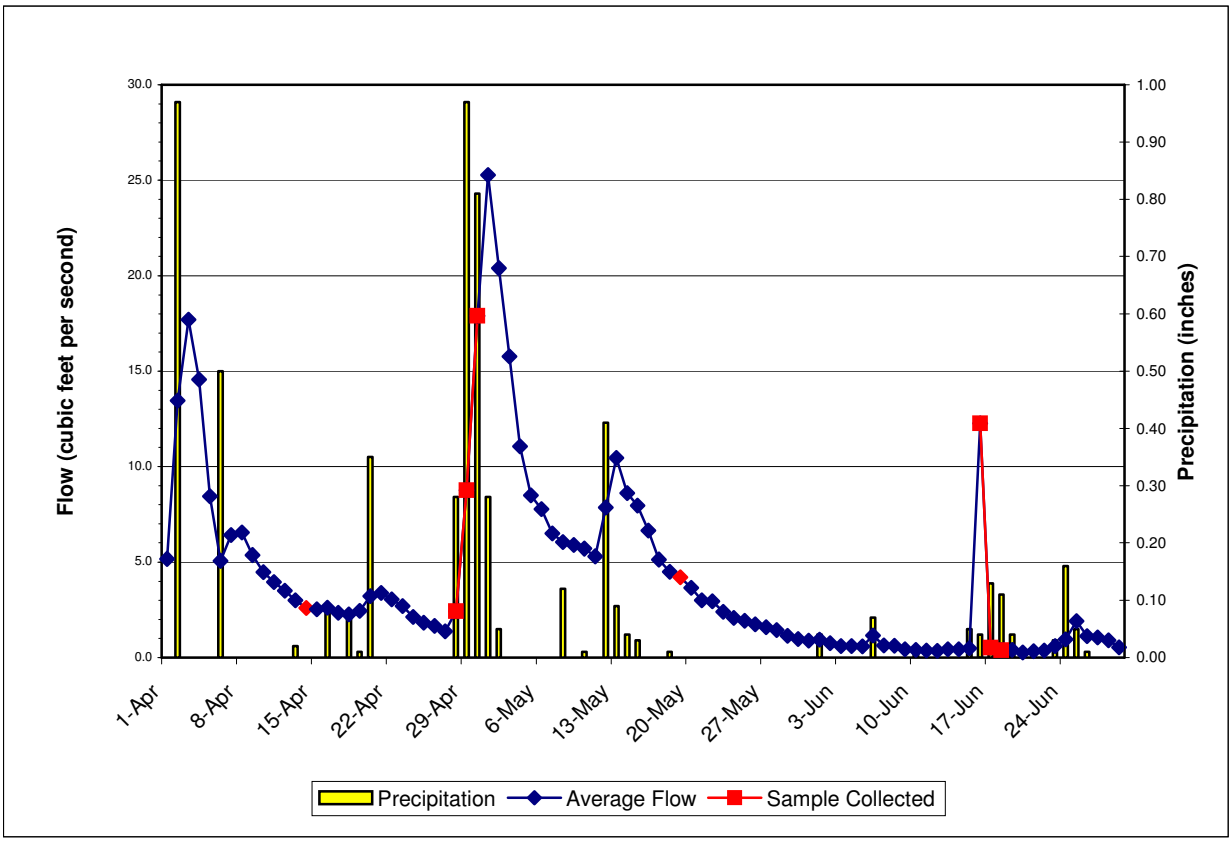
Flow and Precipitation

Average flow in Willow Creek was 4.28 cubic feet per second (cfs) or 2.77 million gallons per day (mgd). Total precipitation was recorded as 5.87 inches. However rain gauge information may be suspect, as the gauge was plugged for much of June.

Table 1. Average flow and total precipitation at Willow Creek WOMP Station April – June 2006

Period	Average Flow (cfs/mgd)	Precipitation (inches)
APRIL	5.49 / 3.55	4.07
MAY	6.38 / 4.12	1.04
JUNE	1.15 / 0.74	0.76
TOTAL QUARTER	4.28 / 2.77	5.87

Figure 1. Flow and precipitation at Willow WOMP Station April-June 2006



Water Quality

Two event composite samples (4/28/06, 6/16/06) and two low flow grab samples were taken at the Willow WOMP Station during the 2nd quarter 2006. Overall, the water quality was fair to good, with several parameters slightly exceeding the state standard or slightly above the ecoregion mean (Table 2). It should be noted that values exceeding state standards occurred only as a consequence of a single event sample (4/28/06), which heavily influenced mean results.

Table 2. Average concentrations at Willow Creek WOMP Station January – March 2006 (for comparison purposes) and April – June 2006.

Parameter	1st Quarter 2006 Ave. Concentration	2nd Quarter 2006 Ave. Concentration	Notes – 2nd Quarter results
Alkalinity	148 mg/L $CaCO_3$	90 mg/L $CaCO_3$	Typical for freshwater
Biological Oxygen Demand (BOD5)	1.7 mg/L	1.5 mg/L	Below ecoregion mean
Cadmium	0.04 ug/L	0.04 ug/L	In compliance with state standard
Chloride	237 mg/L	202 mg/L	In compliance with state standard
Chlorophyll-a	12 ug/L	5.9 ug/L	Fair level
Chromium	0.6 ug/L	10.5 ug/L	In compliance with state standard
Conductivity	1219 mMHOs	996 mMHOs	Higher than average for metro streams, and for ecoregion mean
Copper	2.0 ug/L	5.3 ug/L	In compliance with state standard
Fecal Coliform Bacteria	26 CFU	96 CFU	In compliance with state standard
Hardness	198 mg/L $CaCO_3$	166 mg/L $CaCO_3$	Considered hard water; sometimes very hard during low flow
Lead	0.2 ug/L	2.0 ug/L	In compliance with state standard
Nickel	3.9 ug/L	8.6 ug/L	In compliance with state standard
Nitrogen Ammonia	32.5 ug/L	187.5 ug/L	In compliance with state standard
Nitrate + Nitrite	0.43 mg/L	0.50 mg/L	Slightly above ecoregion mean
Phosphorus, Total	0.0552 mg/L	0.4848 mg/L	Above ecoregion mean; Heavily influenced by a single event sample
Suspended Solids	2.25 mg/L	459 mg/L	Above ecoregion mean; Heavily influenced by a single event sample
Turbidity	3.25 NTU	268.33 NTU	Exceeds state standard; Heavily influenced by a single event sample
Zinc	4.3 ug/L	20.9 ug/L	In compliance with state standard

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Burnsville, MN

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April – June 2006

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
July 2006

The Willow Creek WOMP site, located in Burnsville behind the Menards on Hwy. 13, has been in operation since 1999. This report summarizes the results of flow, precipitation, and water quality for the 2nd quarter of 2006. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Flow and Precipitation

Average flow in Willow Creek was 4.28 cubic feet per second (cfs) or 2.77 million gallons per day (mgd). Total precipitation was recorded as 5.87 inches. However rain gauge information may be suspect, as the gauge was plugged for much of June.

Table 1. Average flow and total precipitation at Willow Creek WOMP Station April – June 2006

Period	Average Flow (cfs/mgd)	Precipitation (inches)
APRIL	5.49 / 3.55	4.07
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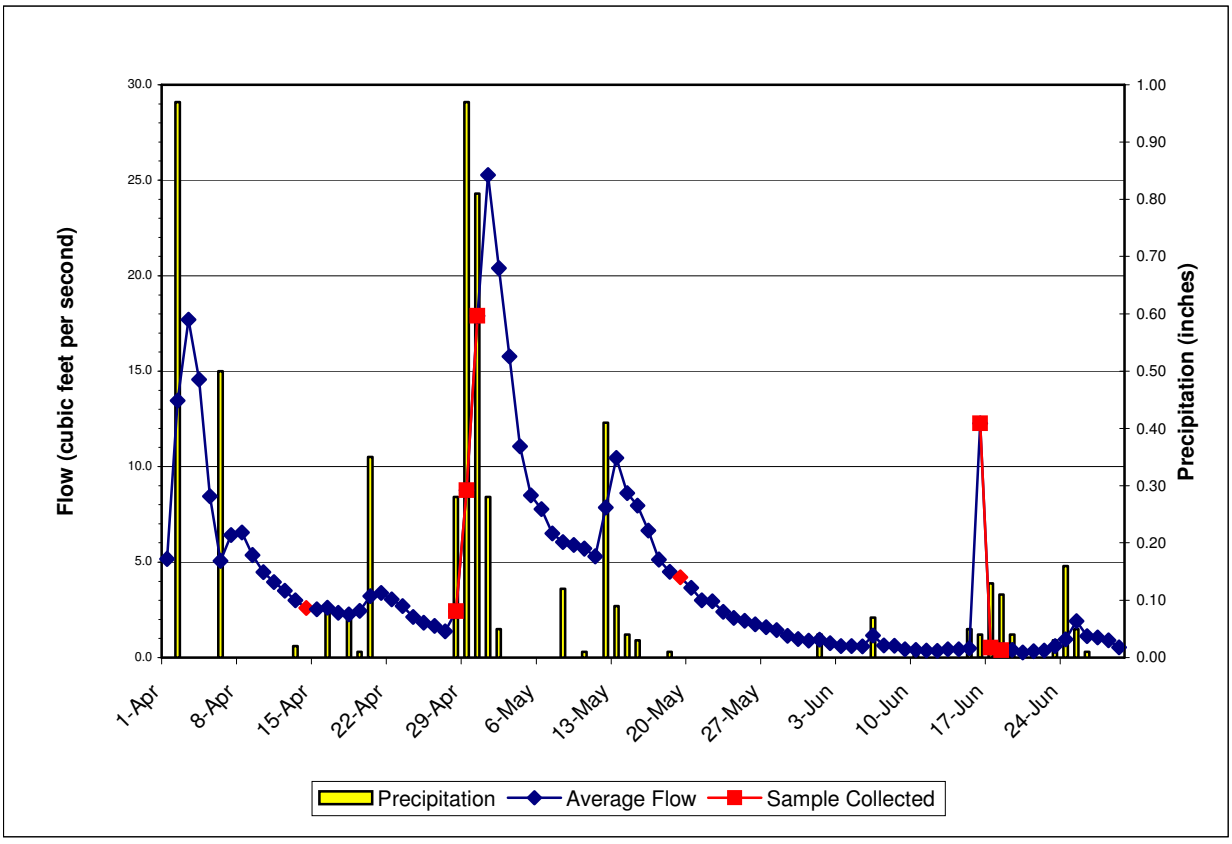

Water Quality

Two event composite samples (4/28/06, 6/16/06) and two low flow grab samples were taken at the Willow WOMP Station during the 2nd quarter 2006. Overall, the water quality was fair to good, with several parameters slightly exceeding the state standard or slightly above the ecoregion mean (Table 2). It should be noted that values exceeding state standards occurred only as a consequence of a single event sample (4/28/06), which heavily influenced mean results.

Table 2. Average concentrations at Willow Creek WOMP Station January – March 2006 (for comparison purposes) and April – June 2006.

Parameter	1st Quarter 2006 Ave. Concentration	2nd Quarter 2006 Ave. Concentration	Notes – 2nd Quarter results
Alkalinity	148 mg/L $CaCO_3$	90 mg/L $CaCO_3$	Typical for freshwater
Biological Oxygen Demand (BOD5)	1.7 mg/L	1.5 mg/L	Below ecoregion mean
Cadmium	0.04 ug/L	0.04 ug/L	In compliance with state standard
Chloride	237 mg/L	202 mg/L	In compliance with state standard
Chlorophyll-a	12 ug/L	5.9 ug/L	Fair level
Chromium	0.6 ug/L	10.5 ug/L	In compliance with state standard
Conductivity	1219 mMHOs	996 mMHOs	Higher than average for metro streams, and for ecoregion mean
Copper	2.0 ug/L	5.3 ug/L	In compliance with state standard
Fecal Coliform Bacteria	26 CFU	96 CFU	In compliance with state standard
Hardness	198 mg/L $CaCO_3$	166 mg/L $CaCO_3$	Considered hard water; sometimes very hard during low flow
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Nitrate + Nitrite	0.43 mg/L	0.50 mg/L	Slightly above ecoregion mean
Phosphorus, Total	0.0552 mg/L	0.4848 mg/L	Above ecoregion mean; Heavily influenced by a single event sample
Suspended Solids	2.25 mg/L	459 mg/L	Above ecoregion mean; Heavily influenced by a single event sample
Turbidity	3.25 NTU	268.33 NTU	Exceeds state standard; Heavily influenced by a single event sample
Zinc	4.3 ug/L	20.9 ug/L	In compliance with state standard

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Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

January – March 2006

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
April 2006

The Willow Creek WOMP site, located in Burnsville behind the Cub Foods Store on Hwy. 13, has been in operation since 1999. This report summarizes the results of flow, precipitation, and water quality for the 1st quarter of 2006. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

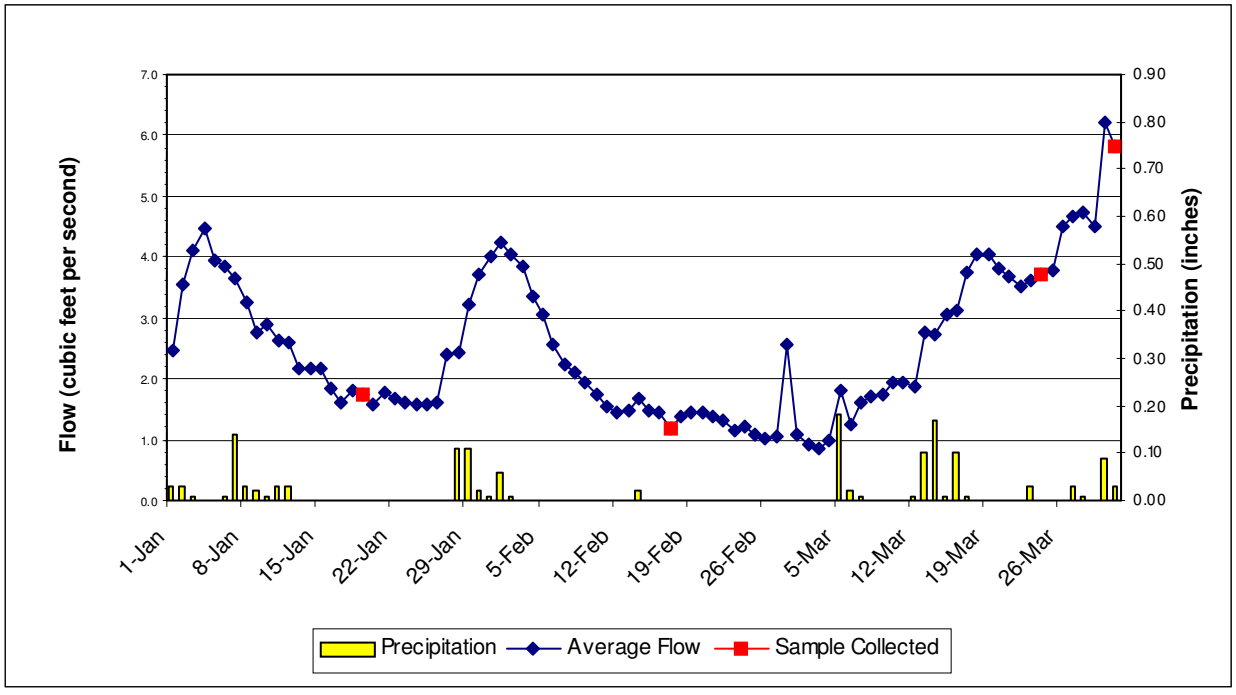
Flow and Precipitation

Average flow in Willow Creek was 2.54 cubic feet per second (cfs) or 1.64 million gallons per day (mgd). The rain gauge was not activated until 3/31/06.

Table 1. Average flow and total precipitation at Willow Creek WOMP Station January – March 2006

Period	Average Flow (cfs/mgd)	Precipitation (inches)
JANUARY	2.61 / 1.69	NA
FEBRUARY	1.94 / 1.25	NA
MARCH	3.02/ 1.95	NA
TOTAL QUARTER	2.54 / 1.64	NA

Figure 1. Flow and precipitation at Willow WOMP Station January – March 2006



Water Quality

Two event grab samples (3/24/06, 3/31/06) and two low flow grab samples were taken at the Willow WOMP Station during the 1st quarter 2006. Overall, the water quality was fair to good with most parameters below the state standard (in compliance with standards) or near the ecoregion mean (Table 2).

Table 2. Average concentrations at Willow Creek WOMP Station October – December 2005 (for comparison purposes) and January – March 2006.

Parameter	4th quarter 2005 Ave. Concentration	1st quarter 2006 Ave. Concentration	Notes – 1st quarter results
Alkalinity	103 mg/L $CaCO_3$	148 mg/L $CaCO_3$	Typical for freshwater; higher during low flow
Biological Oxygen Demand (BOD5)	1.6 mg/L	1.7 mg/L	Fair level; higher during runoff events
Cadmium	NA	0.04 ug/L	In compliance with state standard
Chloride	57 mg/L	237 mg/L	Average exceeding state standard; all samples elevated
Chlorophyll-a	20 ug/L	12 ug/L	Fair level
Chromium	NA	0.6 ug/L	In compliance with state standard
Conductivity	602 mMHOs	1219 mMHOs	Higher than average for metro streams, and for ecoregion mean
Copper	NA	2.0 ug/L	In compliance with state standard
Fecal Coliform Bacteria	52 CFU	26 CFU	In compliance with state standard
Hardness	139 mg/L $CaCO_3$	198 mg/L $CaCO_3$	Considered hard water; sometimes very hard during low flow
Lead	NA	0.2 ug/L	In compliance with state standard
Nickel	NA	3.9 ug/L	In compliance with state standard
Nitrogen Ammonia	50 ug/L	32.5 ug/L	In compliance with state standard
Nitrate + Nitrite	0.32 mg/L	0.43 mg/L	Above ecoregion mean
Phosphorus, Total	0.18 mg/L	0.0552 mg/L	Below ecoregion mean
Suspended Solids	56 mg/L	2.25 mg/L	Below ecoregion mean; higher during some runoff events
Turbidity	12.4 NTU	3.25 NTU	In compliance with state standard
Zinc	NA	4.3 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or micorseimens
CFU = colony forming units
NTU = nephelometric turbidity units

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

October - December 2005

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
February 2006

The Willow Creek WOMP site, located in Burnsville just southeast of Menards on Hwy. 13, has been in operation since 1999. This report summarizes the results of flow, precipitation, and water quality for the 4th quarter of 2005. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

Flow and Precipitation

Average flow in Willow Creek was 9.01 cubic feet per second (cfs) or 5.82 million gallons per day (mgd). Total precipitation for the period October 1 – November 18 was 5.88 inches, most of which fell on October 4th (Table 1, Figure 1). The rain gauge was covered for the winter season on November 18th. Also included is a graph showing flow, precipitation and samples collected for the entire year (Figure 2).

Table 1. Average flow October - December 2005 and total precipitation October 1 – November 18, 2005

Period	Average Flow (cfs/mgd)	Precipitation (inches)
OCTOBER	21.90/14.15	5.39
NOVEMBER	2.50/1.61	0.49 (thru 18th)
DECEMBER	2.43/1.57	NA
TOTAL QUARTER	9.01/5.82	5.88

Figure 1. Flow October - December 2005 and precipitation October 1 – November 18, 2005

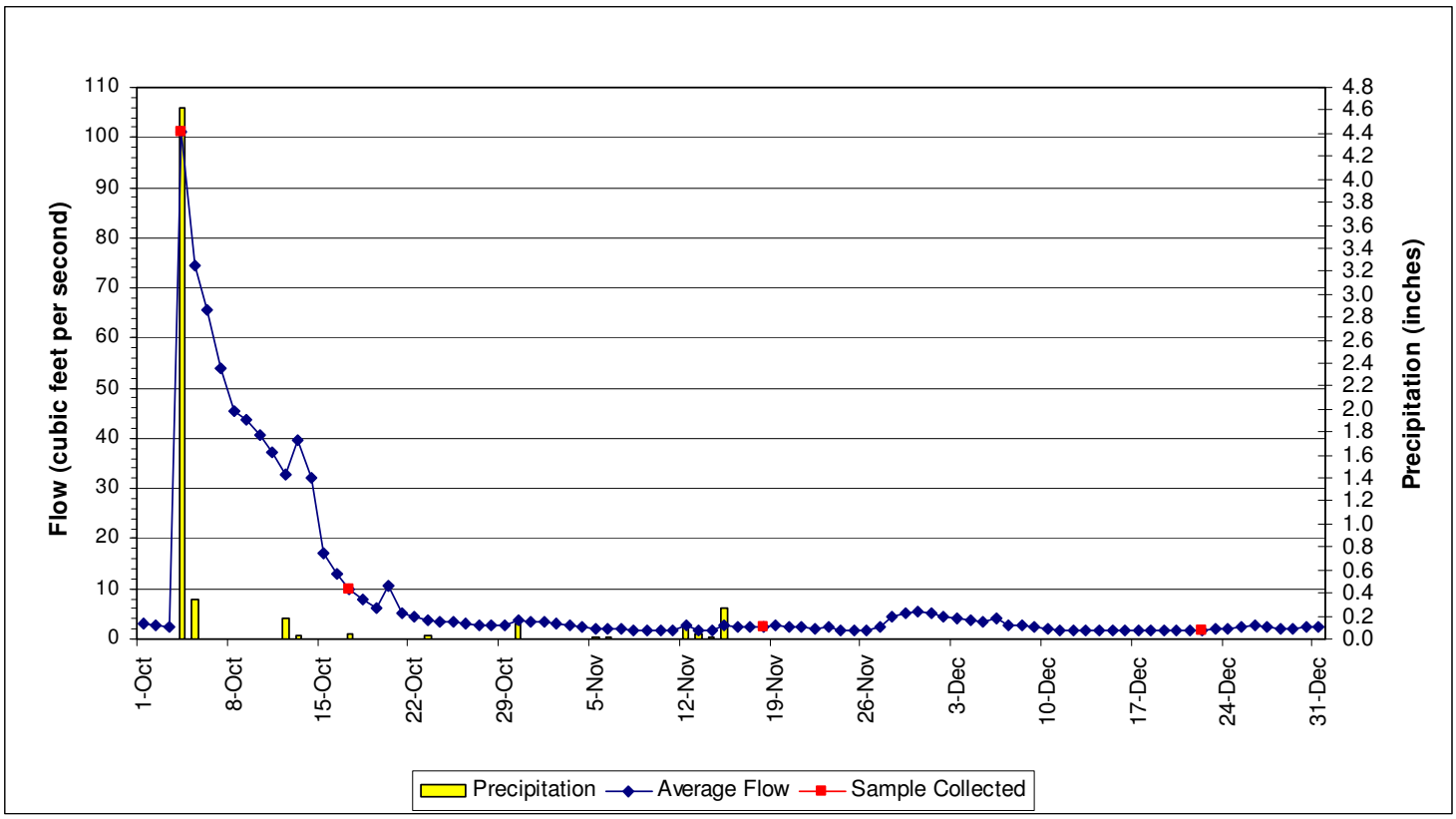
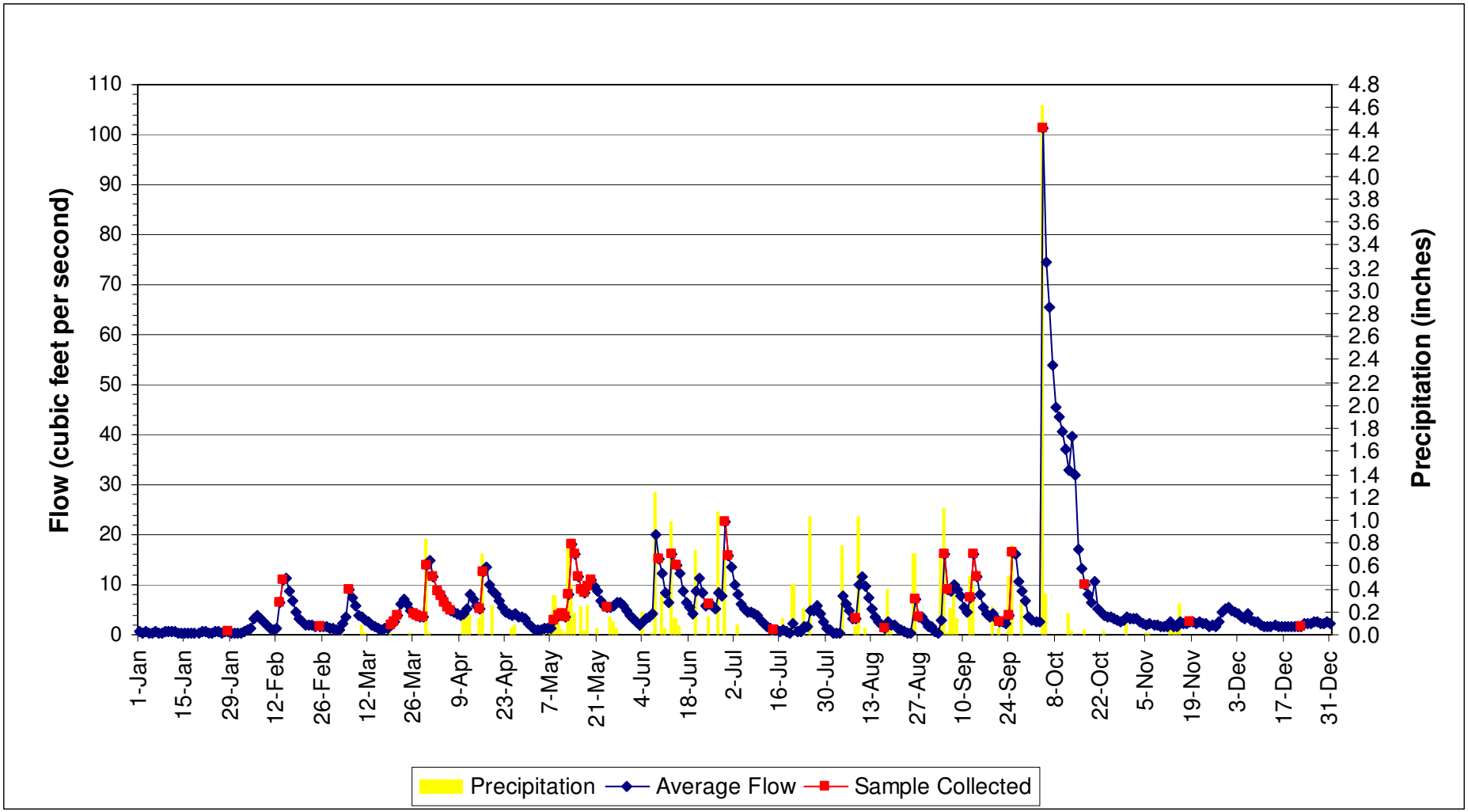


Figure 2. Flow January – December 2005 and Precipitation March 4 – November 18, 2005



Water Quality

One composite sample was taken during a major event in October, and three grab samples were taken during low flow at the Willow WOMP Station during the 4ht quarter 2005. Overall, the water quality was fair to good with most parameters below the state standard (in compliance with standards) or near the ecoregion mean (Table 2).

Table 2. Average concentrations at Willow Creek WOMP Station October - December 2005 plus 1st - 3rd quarters 2005 for comparison purposes.

Parameter	1st quarter Average Concentration	2nd quarter Average Concentration	3rd quarter Average Concentration	4th quarter Average Concentration	Notes – 4th Quarter
Alkalinity	120 mg/L $CaCO_3$	76 mg/L $CaCO_3$	82 mg/L $CaCO_3$	103 mg/L $CaCO_3$	Typical for freshwater; higher during low flow
Biological Oxygen Demand (BOD5)	2.92 mg/L	3.14 mg/L	1.4 mg/L	1.6 mg/L	Good level; usually higher during runoff events
Cadmium	0.04 ug/L	NA	0.156 ug/L *	NA	No cadmium samples collected
Chloride	198 mg/L	121.5 mg/L	47.4 mg/L	57 mg/L	In compliance with state standard
Chlorophyll-a	13.3 ug/L	NA	14.6 ug/L *	20 ug/L	This is half of the level usually associated with algal blooms
Chromium	0.2 ug/L	3.2 ug/L	1.87 ug/L	NA	No chromium samples collected
Conductivity	1623 mMHOs	805 mMHOs	685 mMHOs	602 mMHOs	Higher than average for metro streams, higher during low flow
Copper	1.8 ug/L	3.9 ug/L	3.1 ug/L	NA	No copper samples collected
Fecal Coliform Bacteria	63.0 CFU	31.8 CFU	35 CFU	52 CFU	In compliance with state standard – although rose to 2,200 during October event; 10 x the state standard of 200 CFU
Hardness	147 mg/L $CaCO_3$	95 mg/L $CaCO_3$	111 mg/L	139 mg/L $CaCO_3$	Considered hard water
Lead	0.2 ug/L	2.0 ug/L	1.4 ug/L	NA	No lead samples collected
Nickel	7.5 ug/L	3.5 ug/L	3.7 ug/L	NA	No nickel samples collected
Nitrogen Ammonia	32.6 ug/L	98 ug/L	64.5 ug/L	50 ug/L	In compliance with state standard
Nitrate + Nitrite	0.455 mg/L	0.21 mg/L	.31 mg/L	0.32 mg/L	Slightly above ecoregion mean

Table 2. Continued . . . . .

Phosphorus, Total	0.3165 mg/L	0.1004 mg/L	0.0779 mg/L	0.18 mg/L	Slightly above ecoregion mean and EPA recommendation; higher during runoff events
Suspended Solids	54.5 mg/L	17.0 mg/L	31.4 mg/L	56 mg/L	Above ecoregion mean; higher during runoff events
Turbidity	11.0 NTU	7.3 NTU	4.4 NTU	12.4 NTU	In compliance with state standard, higher during runoff events although barely exceeds state standard even then
Zinc	4.4 ug/L	14.7 ug/L	14.8 ug/L	NA	No zinc samples collected

* Average of 2nd and 3rd quarter
mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or micorseimens
CFU = colony forming units
NTU = nephelometric turbidity units

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

July - September 2005

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
October 2005

The Willow Creek WOMP site, located in Burnsville just southeast of Menards on Hwy. 13, has been in operation since 1999. This report summarizes the results of flow, precipitation, and water quality for the 3rd quarter of 2005. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

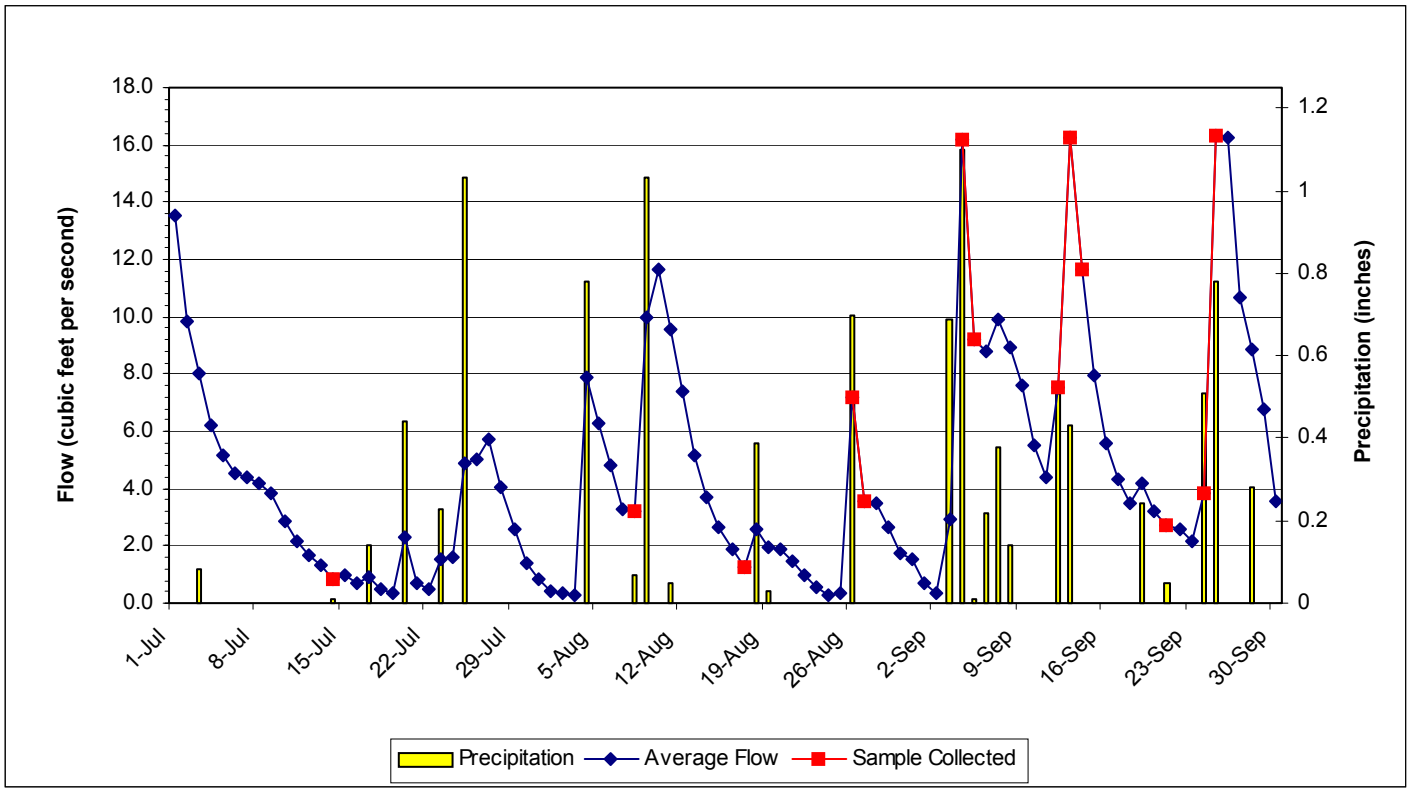
Flow and Precipitation

Average flow in Willow Creek was 4.62 cubic feet per second (cfs) or 2.98 million gallons per day (mgd). Total precipitation for the quarter was 10.32 inches, half of which fell in September (Table 1, Figure 1).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station July - September 2005

Period	Average Flow (cfs/mgd)	Precipitation (inches)
JULY	3.33 / 2.15	1.93
AUGUST	3.54 / 2.29	3.05
SEPTEMBER	7.08 / 4.57	5.34
TOTAL QUARTER	4.62 / 2.98	10.32

Figure 1. Flow and precipitation at Willow WOMP Station July - September 2005



Water Quality

Five composite samples and two grab sample were taken during runoff events and three grab samples were taken during low flow at the Willow WOMP Station during the 3rd quarter 2005. Overall, the water quality was fair to good with most parameters below the state standard (in compliance with standards) or near the ecoregion mean (Table 2).

Table 2. Average concentrations at Willow Creek WOMP Station July – September 2005 plus 1st and 2nd quarters 2005 for comparison purposes.

Parameter	1st quarter Average Concentration	2nd quarter Average Concentration	3rd quarter Average Concentration	Notes – 3nd quarter results
Alkalinity	120 mg/L $CaCO_3$	76 mg/L $CaCO_3$	82 mg/L $CaCO_3$	Typical for freshwater; usually higher during low flow
Biological Oxygen Demand (BOD5)	2.92 mg/L	3.14 mg/L	1.4 mg/L	Good level; usually higher during runoff events
Cadmium	0.04 ug/L	NA	0.156 ug/L *	In compliance with state standard
Chloride	198 mg/L	121.5 mg/L	47.4 mg/L	In compliance with state standard
Chlorophyll-a	13.3 ug/L	NA	14.6 ug/L *	Fair level
Chromium	0.2 ug/L	3.2 ug/L	1.87 ug/L	In compliance with state standard
Conductivity	1623 mMHOs	805 mMHOs	685 mMHOs	Higher than average for metro streams, higher during low flow
Copper	1.8 ug/L	3.9 ug/L	3.1 ug/L	In compliance with state standard
Fecal Coliform Bacteria	63.0 CFU	31.8 CFU	35 CFU	In compliance with state standard
Hardness	147 mg/L $CaCO_3$	95 mg/L $CaCO_3$	111 mg/L	Considered moderately hard water
Lead	0.2 ug/L	2.0 ug/L	1.4 ug/L	In compliance with state standard
Nickel	7.5 ug/L	3.5 ug/L	3.7 ug/L	In compliance with state standard
Nitrogen Ammonia	32.6 ug/L	98 ug/L	64.5 ug/L	In compliance with state standard
Nitrate + Nitrite	0.455 mg/L	0.21 mg/L	.31 mg/L	Slightly above ecoregion mean
Phosphorus, Total	0.3165 mg/L	0.1004 mg/L	0.0779 mg/L	Below ecoregion mean; below EPA recommendation; higher during runoff events
Suspended Solids	54.5 mg/L	17.0 mg/L	31.4 mg/L	Above ecoregion mean; higher during runoff events
Turbidity	11.0 NTU	7.3 NTU	4.4 NTU	In compliance with state standard, higher during runoff events although barely exceeds state standard
Zinc	4.4 ug/L	14.7 ug/L	14.8 ug/L	In compliance with state standard

* Average of 2nd and 3rd quarter
mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or micorseimens
CFU = colony forming units
NTU = nephelometric turbidity units

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

April - June 2005

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
August 2005

The Willow Creek WOMP site, located in Burnsville behind the Cub Foods Store on Hwy. 13, has been in operation since 1999. This report summarizes the results of flow, precipitation, and water quality for the 2nd quarter of 2005. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

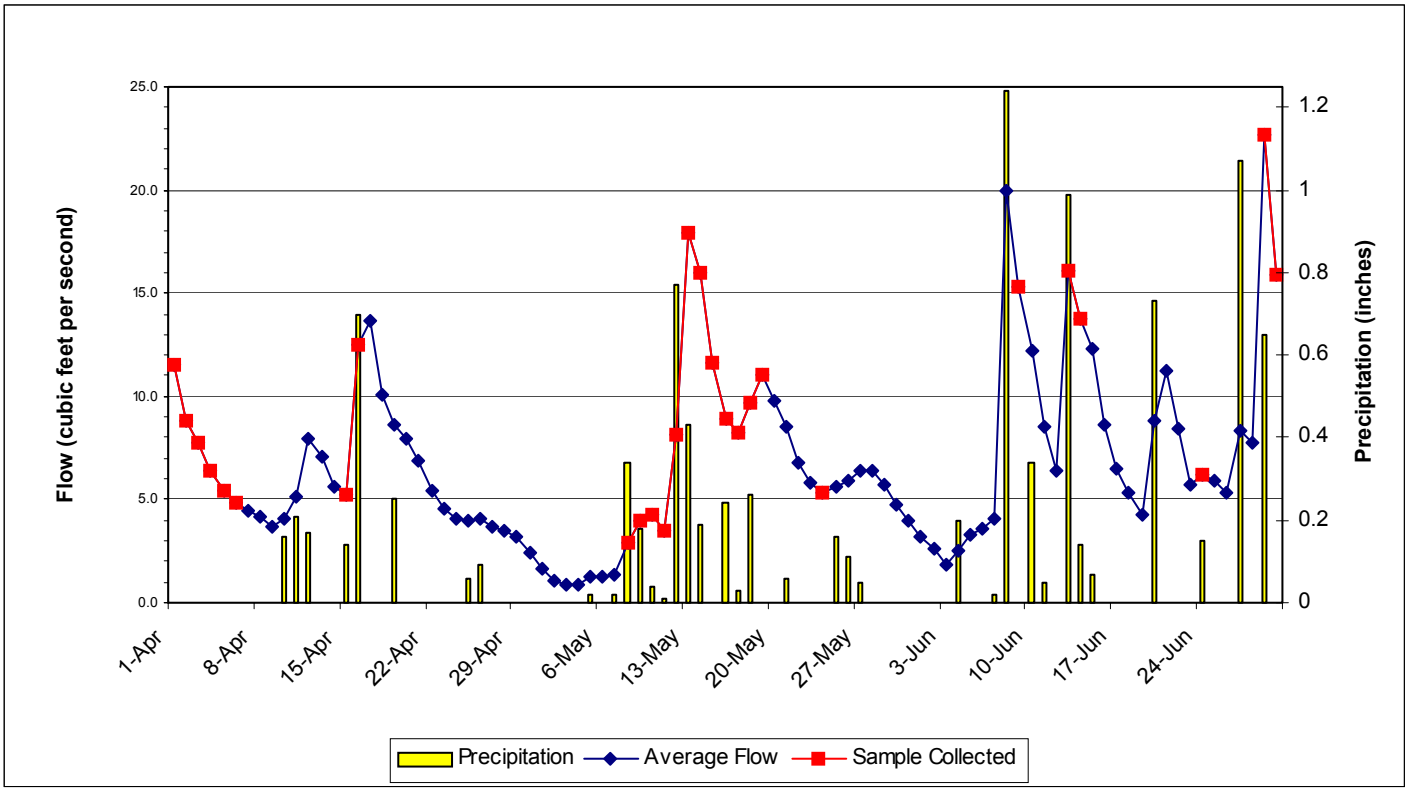
Flow and Precipitation

Average flow in Willow Creek was almost 7 cubic feet per second (cfs) or 4.5 million gallons per day (mgd). Total precipitation for the quarter was 10.34 inches, most of which fell in June (Table 1, Figure 1).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station April - June 2005

Period	Average Flow (cfs/mgd)	Precipitation (inches)
APRIL	6.23 / 4.03	1.78
MAY	6.27 / 4.05	2.91
JUNE	8.57 / 5.54	5.65
TOTAL QUARTER	6.96 / 4.50	10.34

Figure 1. Flow and precipitation at Willow WOMP Station April - June 2005



Water Quality

Six composite samples and one grab sample were taken during runoff events and three grab samples were taken during low flow at the Willow WOMP Station during the 2nd quarter 2005. Overall, the water quality was fair to good with most parameters below the state standard (in compliance with standards) or near the ecoregion mean (Table 2).

Table 2. Average concentrations at Willow Creek WOMP Station January - March 2005 (for comparison purposes) and April - June 2005.

Parameter	1st quarter 2005 Ave. Concentration	2nd quarter 2005 Ave. Concentration	Notes – 2nd quarter results
Alkalinity	120 mg/L $CaCO_3$	76 mg/L $CaCO_3$	Typical for freshwater; usually higher during low flow
Biological Oxygen Demand (BOD5)	2.92 mg/L	3.14 mg/L	Fair level; higher during runoff events
Cadmium	0.04 ug/L	NA	Data unavailable
Chloride	198 mg/L	121.5 mg/L	In compliance with state standard
Chlorophyll-a	13.3 ug/L	NA	Data unavailable
Chromium	0.2 ug/L	3.2 ug/L	In compliance with state standard
Conductivity	1623 mMHOs	805 mMHOs	Higher than average for metro streams, higher during low flow
Copper	1.8 ug/L	3.9 ug/L	In compliance with state standard
Fecal Coliform Bacteria	63.0 CFU	31.8 CFU	In compliance with state standard
Hardness	147 mg/L $CaCO_3$	95 mg/L $CaCO_3$	Considered moderately hard water
Lead	0.2 ug/L	2.0 ug/L	In compliance with state standard
Nickel	7.5 ug/L	3.5 ug/L	In compliance with state standard
Nitrogen Ammonia	32.6 ug/L	98 ug/L	In compliance with state standard
Nitrate + Nitrite	0.455 mg/L	0.21 mg/L	Slightly below ecoregion mean
Phosphorus, Total	0.3165 mg/L	0.1004 mg/L	Slightly below ecoregion mean; slightly above EPA recommendation; higher during runoff events
Suspended Solids	54.5 mg/L	17.0 mg/L	Slightly above ecoregion mean; higher during some runoff events
Turbidity	11.0 NTU	7.3 NTU	In compliance with state standard
Zinc	4.4 ug/L	14.7 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
ug/L = micrograms per liter or parts per billion (ppb)
mMHO = micromhos or micorseimens
CFU = colony forming units
NTU = nephelometric turbidity units

Watershed Outlet Monitoring Program

Willow Creek Station

Burnsville, MN

Quarterly Report

Preliminary Data

January – March 2005

Prepared By: Dakota County Soil and Water Conservation District
Prepared For: Lower Minnesota River Watershed District
June 2005

The Willow Creek WOMP site, located in Burnsville behind the Cub Foods Store on Hwy. 13, has been in operation since 1999. This report summarizes the results of flow, precipitation, and water quality for the 1st quarter of 2005. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

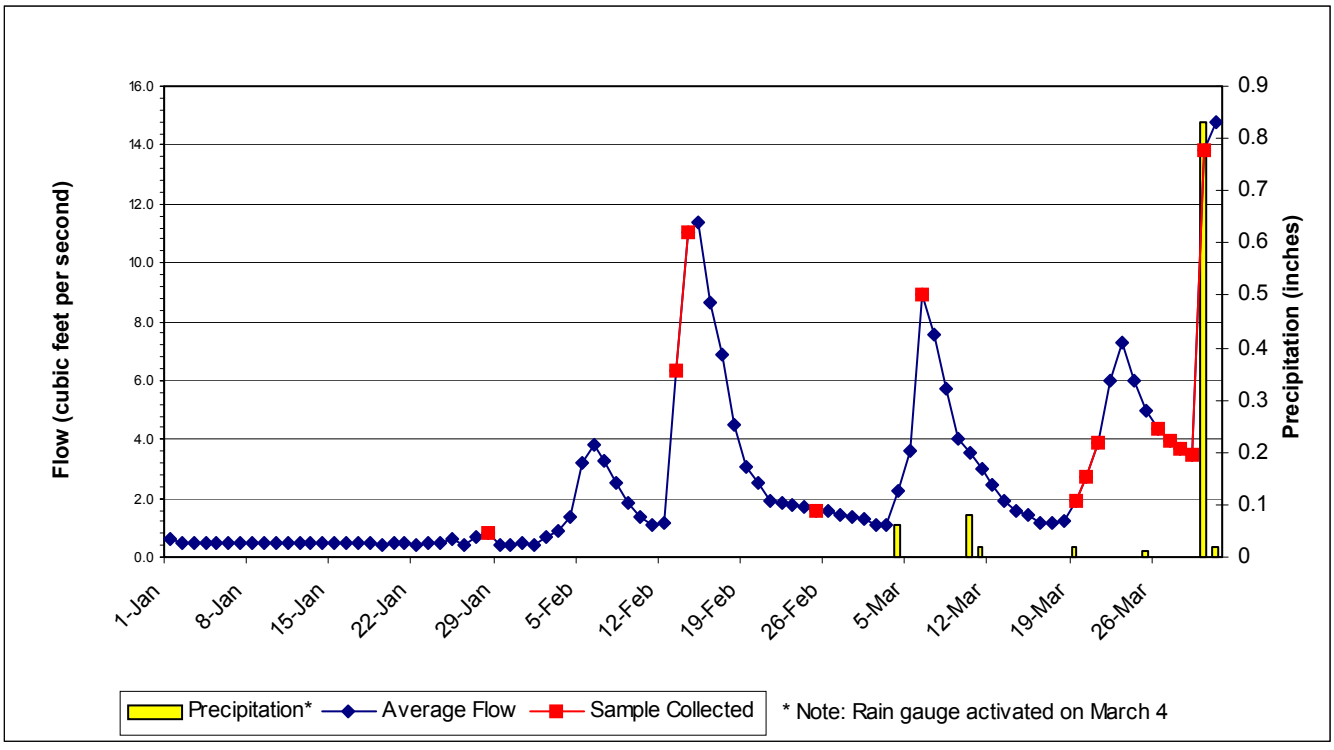
Flow and Precipitation

Average flow in Willow Creek was 2.60 cubic feet per second (cfs) or 1.68 million gallons per day (mgd). Total precipitation for the quarter is unknown as the rain gauge was activated on March 4. March precipitation was 1.04 inches (Table 1, Figure 1).

Table 1. Average flow and total precipitation at Willow Creek WOMP Station January – March 2005

Period	Average Flow (cfs/mgd)	Precipitation (inches)
JANUARY	0.49 / 0.317	na
FEBRUARY	3.27 / 2.11	na
MARCH	4.37 / 2.82	1.04
TOTAL QUARTER	2.60 / 1.68	na

Figure 1. Flow and precipitation at Willow WOMP Station January – March 2005



Water Quality

Six composite samples during runoff events and three low flow grab samples were taken at the Willow WOMP Station during the 1st quarter 2005. Overall, the water quality was fair to good with most parameters below the state standard (in compliance with standards) or near the ecoregion mean (Table 2).

Table 2. Average concentrations at Willow Creek WOMP Station October – December 2004 (for comparison purposes) and January – March 2005.

Parameter	4th quarter 2004 Ave. Concentration	1st quarter 2005 Ave. Concentration	Notes – 1st quarter results
Alkalinity	192 mg/L $CaCO_3$	120 mg/L $CaCO_3$	Typical for freshwater; higher during low flow
Biological Oxygen Demand (BOD5)	2.23 mg/L	2.92 mg/L	Fair level; higher during runoff events
Cadmium	0.08 ug/L	0.04 ug/L	In compliance with state standard
Chloride	68.5 mg/L	198 mg/L	Barely in compliance with state standard; higher during low flow
Chlorophyll-a	1.3 ug/L	13.3 ug/L	Fair level
Chromium	1.05 ug/L	0.2 ug/L	In compliance with state standard
Conductivity	1090 mMHOs	1623 mMHOs	Higher than average for metro streams, higher during low flow
Copper	3.3 ug/L	1.8 ug/L	In compliance with state standard
Fecal Coliform Bacteria	3.0 CFU	63.0 CFU	In compliance with state standard
Hardness	331 mg/L $CaCO_3$	147 mg/L $CaCO_3$	Considered hard water; sometimes very hard during low flow
Lead	0.7 ug/L	0.2 ug/L	In compliance with state standard
Nickel	5.35 ug/L	7.5 ug/L	In compliance with state standard
Nitrogen Ammonia	32.5 ug/L	32.6 ug/L	In compliance with state standard
Nitrate + Nitrite	0.535 mg/L	0.455 mg/L	Slightly above ecoregion mean
Phosphorus, Total	0.1545 mg/L	0.3165 mg/L	Slightly above ecoregion mean; slightly above EPA recommendation; higher during runoff events
Suspended Solids	29.75 mg/L	54.5 mg/L	Above ecoregion mean; higher during some runoff events
Turbidity	1.75 NTU	11.0 NTU	In compliance with state standard
Zinc	13.8 ug/L	4.4 ug/L	In compliance with state standard

mg/L = milligrams per liter or parts per million (ppm)
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