

Appendix D: Eagle Creek Monitoring Reports

2009 EAGLE CREEK ANNUAL REPORT

WATERSHED OUTLET MONITORING PROGRAM

(Preliminary Data)



Prepared for:
Lower Minnesota River Watershed District



By:
SCOTT SWCD
7151 190th Street West, Suite 125
Jordan, MN 55352

Introduction

Eagle Creek is a unique stream in the metropolitan area. It is a spring-fed, self-reproducing trout stream that originates at the Boiling Springs (a sacred area for the Mdewakanton Sioux Community) in Savage. To minimize impacts from a rapidly growing suburban area, measures have been taken to prevent degradation including storm water diversion from the stream and establishing a 400-foot native buffer along the creek.

Monitoring Eagle Creek for water quality, stage, flow, precipitation, temperature, and other parameters began in 1999. This study, the Eagle Creek Watershed Outlet Monitoring Program (WOMP), was designed and is currently managed by Metropolitan Council. The Lower Minnesota River Watershed District (LMRWD) funds this project and contracts with the Scott Soil and Water Conservation District (SWCD) to perform monitoring activities.

The monitoring station is located in Savage near Highway 13 and Highway 101, approximately 0.8 miles upstream of the confluence with the Minnesota River. This report summarizes the results of flow, precipitation, and water quality for 2009. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

2009 Results

Many parameters are recorded continuously at the Eagle Creek WOMP station including stage, flow, conductivity, precipitation, and stream temperature. Table 1 displays average monthly flows, total monthly precipitation, and 30-year monthly precipitation average. Figures 1 – 4 illustrate hydrographs detailing when samples were taken, daily average flow or stage, and total daily precipitation. Samples are taken during base-flow conditions and storm events, while flow measurements are taken at various stages to create a stage:discharge relationship useful for determining flow at all stages of the hydrograph.

Monitoring data suggests that Eagle Creek meets state water quality standards and ecoregion means, with the exception of a few parameters. Bacteria, turbidity, and sediment are elevated in winter months, which is characteristic of this stream. Because the stream is spring fed, it does not freeze in the winter. The open water attracts a large number of waterfowl to the stream, which results in higher bacteria, sediment, and turbidity levels than seen in summer months. *Refer to Table 2 for all results.*

Table 1. Average flow and total precipitation at Eagle Creek WOMP station. Eight flow measurements were taken in 2009 to ensure accurate flow was being logged in the datalogger.

Month	Average Monthly Flow (cfs)***	*Precipitation (inches)	30 year precipitation average**
January	7.38	.22	.67
February	7.64	1.14	.72
March	n/a	1.69	1.54
April	7.26	1.53	2.13
May	6.53	.76	3.68
June	6.53	3.16	4.76
July	7.70	1.45	4.09
August	8.71	8.55	4.01
September	8.30	.5	2.67
October	9.48	4.89	1.92
November	8.74	.59	1.17
December	8.22	2.58	.77

*Precipitation data obtained from volunteer rain gauge monitor in Shakopee or rain gauge at WOMP station.

** Data from MN State Climatology Office

***Average monthly flow collected from Eagle Creek datalogger

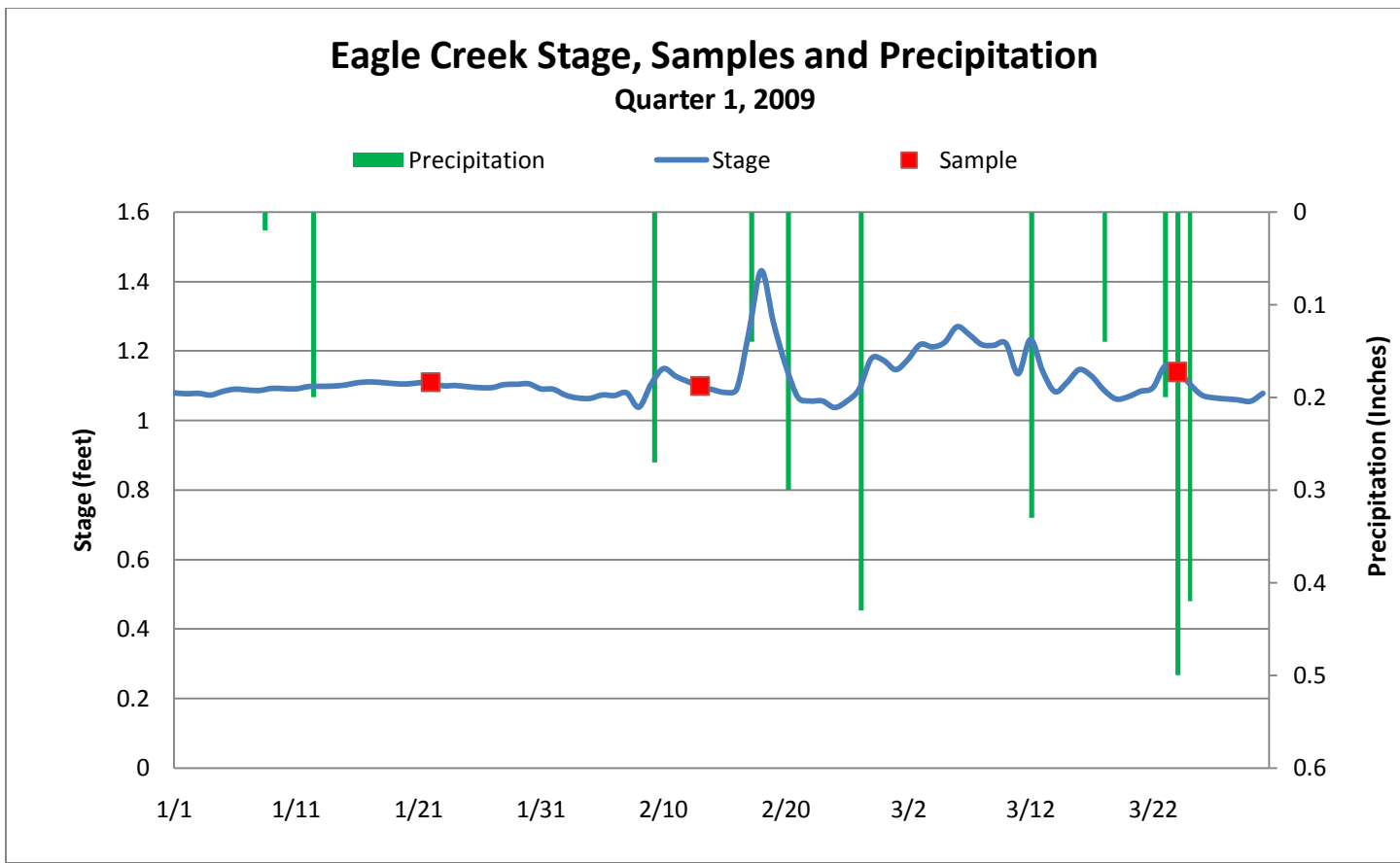


Figure 1. Stage, samples, and precipitation of Quarter 1 (January – March), 2009.

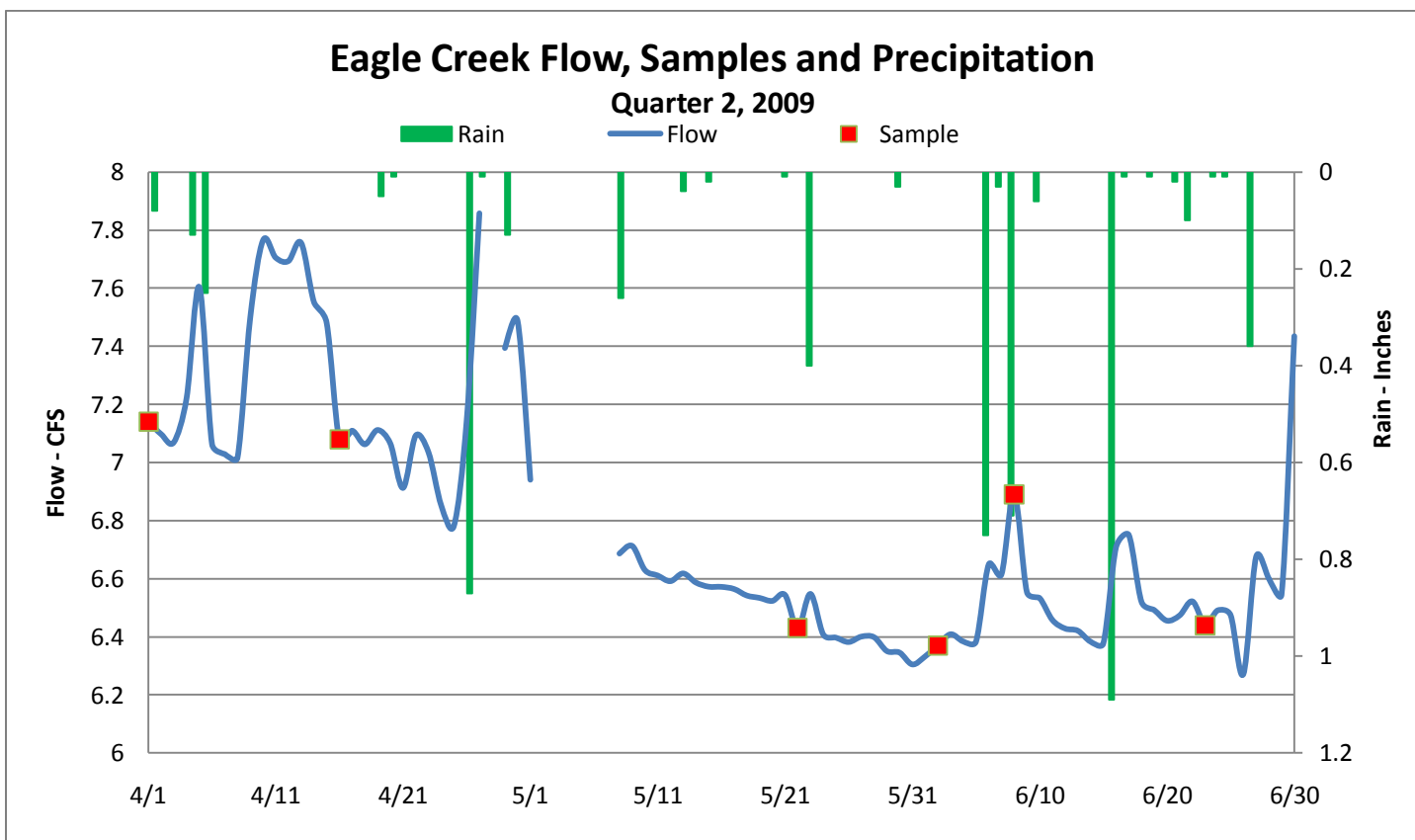


Figure 2. Flow, samples, and precipitation of Quarter 2 (April – June), 2009. Note - some flow data missing due to equipment malfunction.

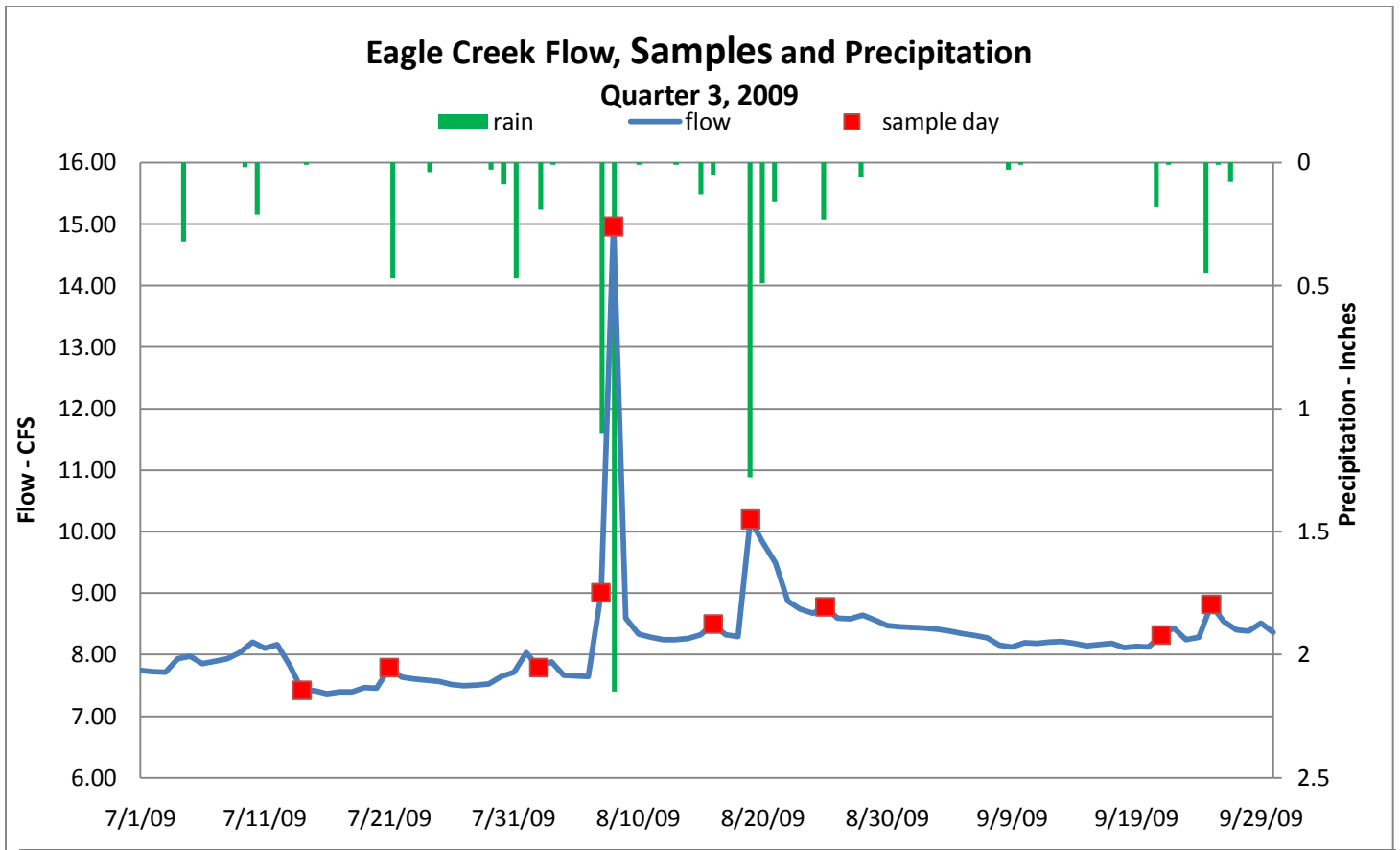


Figure 3. Flow, samples, and precipitation of Quarter 3 (July - September), 2009.

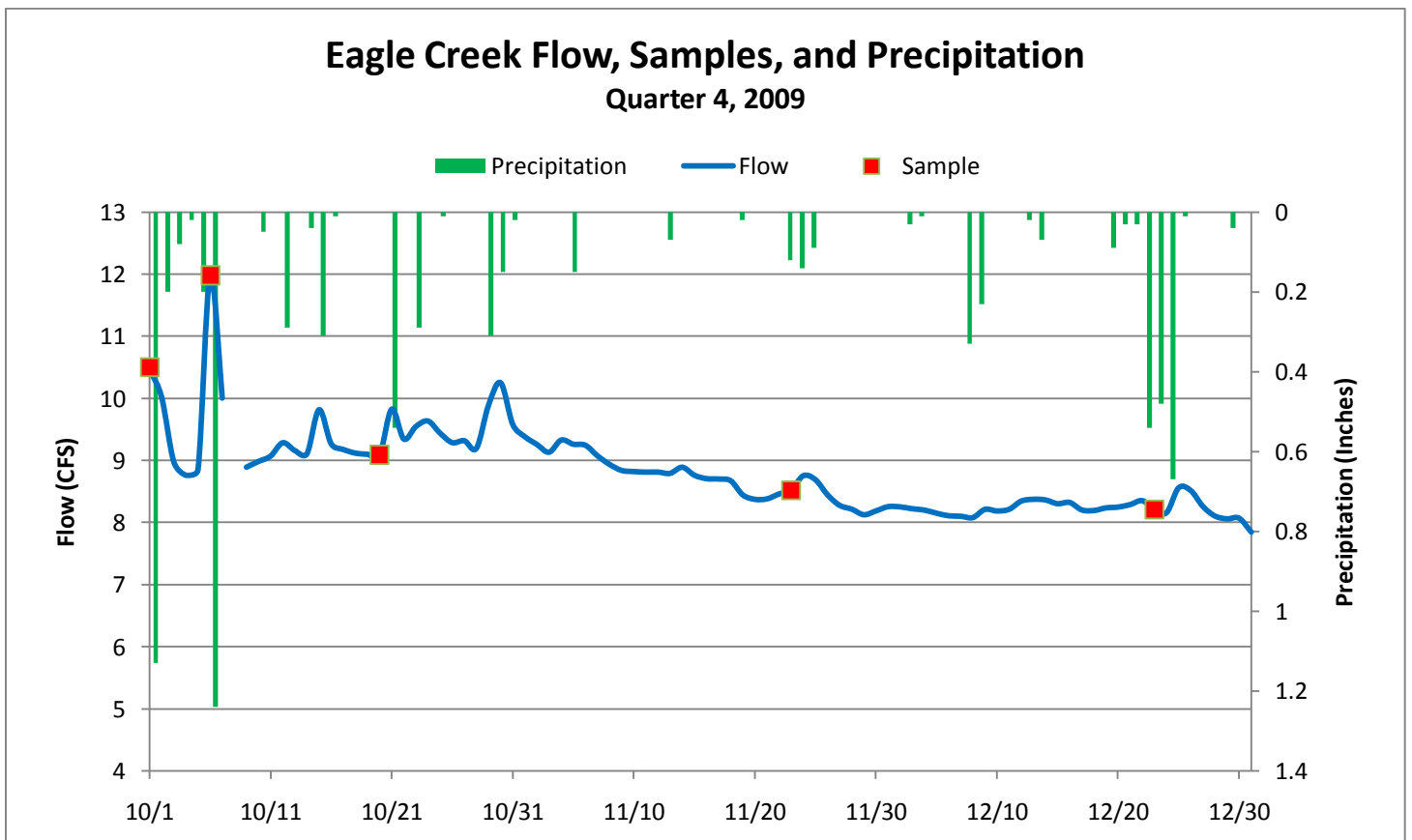


Figure 4. Flow, samples, and precipitation of Quarter 4 (October - December), 2009. Note - some flow data missing due to equipment malfunction.

Table 2. Twelve composite samples, thirteen base flow samples, and one event grab were collected in 2009. Below are the average concentrations at Eagle Creek WOMP Station during each quarter. Red text indicates sample was above state standard or out of ecoregion mean.

Parameter	1 st quarter 2009	2 nd Quarter 2009	3 rd Quarter 2009	4 th Quarter 2009	Unit	Notes
BOD5	1.25	1	1.26	1	mg/L	Ecoregion mean = 2.7 mg/L.
Cadmium	-	.5	.5	-	ug/L	State standard = 2.0 ug/L.
Chloride	28.5	32.7	32.7	31.2	mg/L	State standard = 230 mg/L.
Chlorophyll-a	78.5	72.75	68.5	63.0	ug/L	% Pheo-Corrected Average Of Result
Chromium	-	6	5	-	ug/L	State standard = 365 ug/L.
COD	13.33	8.8	9.36	8.4	mg/L	
Conductivity	580	601	629	608	mMHOs	
Copper		.5	.8	-	ug/L	State standard = 15 ug/L.
Dissolved Oxygen	9.24	8.87	8.03	8.3	mg/L	State standard = 7 mg/L.
<i>Escherichia coli</i> (<i>E Coli</i>)Bacteria	919	94.6	145	137	CFU/100m L	State Standard = 126 organisms/100 ml as a geometric mean of not < 5 samples within any calendar month (Apr 1 – Oct 31)
<i>Fecal Coliform</i> Bacteria	301	77.6	130	108	CFU/100m L	State standard = 200 CFU/100 ml water as geomean of at least 5 samples/month Apr – Oct.
Hardness	314	315	302	306	mg/L	No state standard. Water above 180 mg/L considered very hard water.
Lead	-	.1	.2	-	ug/L	State standard = 7.7 ug/L.
Nickel	-	2.9	2.6	-	ug/L	State standard = 283 ug/L.
Nitrogen Ammonia	.04	.04	.028	.04	mg/L	State standard of unionized Ammonia as N = .016 mg/L. Need to calculate N Ammonia to get unionized Ammonia as N.
Nitrate + Nitrite	.22	.14	.12	.13	mg/L	
pH	8.00	8.02	7.96	7.84	su	State standard = not less than 6.5 nor greater than 8.5.
Phosphorus, Total	.05	.02	.031	.04	mg/L	Ecoregion mean = 0.13 mg/L. EPA recommends less than 0.1 mg/L. These results are the unfiltered average of result.
Suspended Solids	16.7	5.25	5.36	6.20	mg/L	Ecoregion mean = 13.7.
Total Alkalinity	261	263	237	246	mg/L	No state standard. 20 – 200 mg/L typical. Less than 10 mg/L indicate poor buffer.
Total Kjeldahl Nitrogen	.17	.28	.24	0.26	mg/L	
Total Organic Carbon	3.2	2.87	2.94	2.84	mg/L	
Turbidity (NTRU)	13	6	5.1	6.0	NTU	State standard for trout waters = 10 NTU, however lab reports in NTRU. Not quite comparable.
Volatile Suspended Solids	4.7	2.25	2.09	2.00	mg/L	
Zinc	-	1.7	5	-	ug/L	State standard = 191 ug/L

mg/L = milligrams per liter
mMHO = micromhos or micorseimens
NTU = nephelometric turbidity units
su = standard units

ug/L = micrograms per liter
CFU = colony forming units
Highlighted areas indicate areas of concern.
State standard = state standard for Class 2A waters, hardness greater than 200

Watershed Outlet Monitoring Program

Eagle Creek Station

Savage, MN

2008 Annual Report

Preliminary Data



Prepared By:

Scott Soil and Water Conservation District



Introduction

The Eagle Creek Watershed Outlet Monitoring Program (WOMP) site is located in Savage near Hwy 13 and Hwy 101 on 126th Street. Eagle Creek is a designated Class 2A trout stream that has been monitored at this location since 1999.

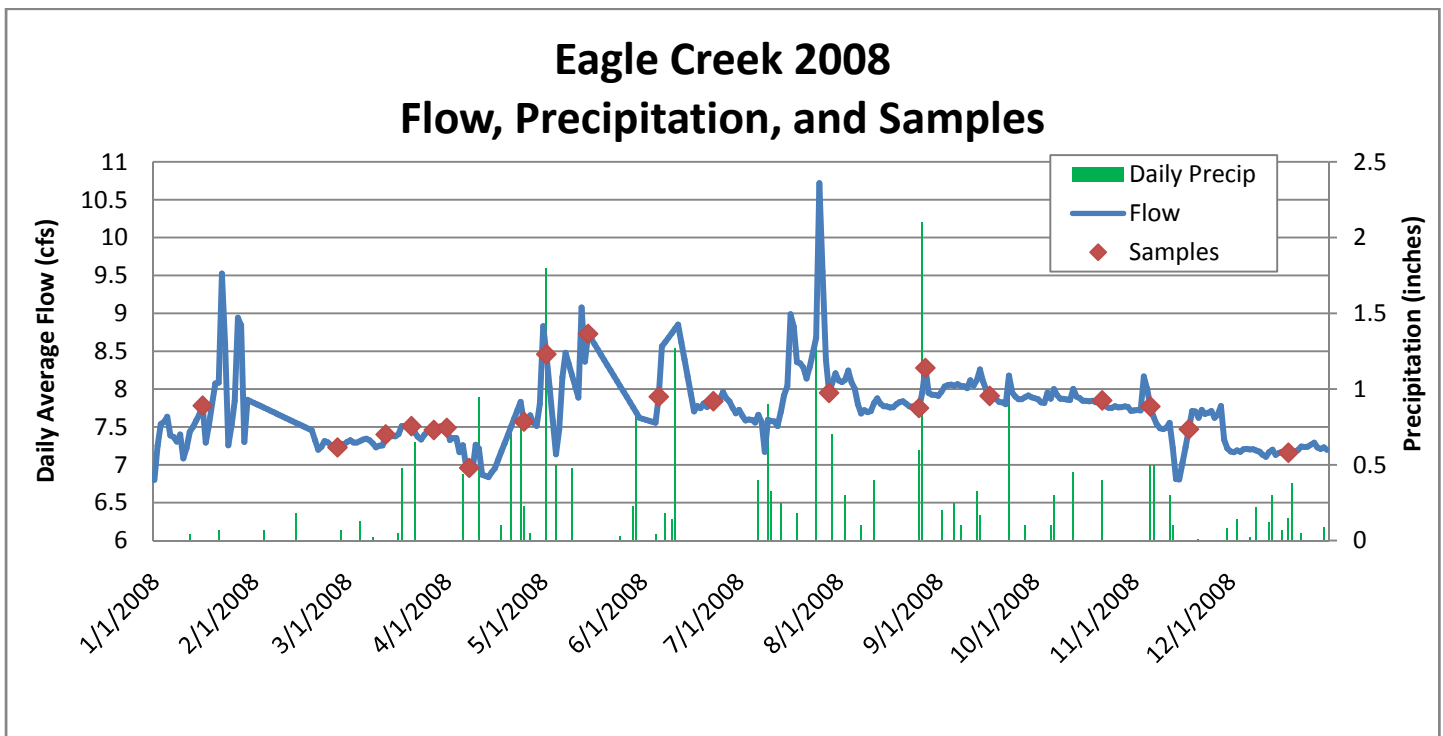
Eagle Creek is unique in many ways. It is one of few naturally reproducing trout streams in the metro area. Also, DNR has managed and revegetated 200 feet of corridor on most of the creek as well as diverted storm water from entering the creek. In a sense, Eagle Creek can be used as a “control” for metro area trout stream’s water quality because of the negligible amount of human impact on the creek. However, because Eagle Creek is spring fed, it does not freeze during winter months. This can lead to poorer water quality conditions possibly due to the high traffic of waterfowl congregating on the open waters. Nevertheless, this is a natural condition that should be considered when analyzing water quality results.

Note: The data presented in this report is preliminary and is subject to change until Metropolitan Council submits the final report for this time period.

Flow, Precipitation, and Sample Frequency

Flow was difficult to monitor during 2008. Beaver dams downstream of the monitoring station affected the rating curve making it unusable for most of the year. Even after the beaver dams were removed in April, the stream bed had changed enough that the rating curve was still ineffectual, possibly because of sediment deposition. A new piece of equipment (Sontek Argonaut) was installed in September to make instantaneous flow measurements. Flow for 2008 was calculated by Metropolitan Council.

Twelve base flow, six composite, and three event grab samples were taken during 2008. Below is a graph showing the daily average flow, precipitation, and sample days. Daily precipitation values were used from a volunteer rain gauge monitor in Shakopee.



Water Quality

2008 was a typical year for Eagle Creek in regards to water quality. As observed from year to year, the creek remains ice-free all winter long. Resident waterfowl have been observed congregating on the stream during winter months. Turbidity and bacteria (*E. Coli* and *F. Coli*) increased substantially during the winter, which could be contributed to waterfowl activity upstream of the monitoring location. During the rest of the year, water quality was generally very good. However, *E Coli* did exceed the state water quality standard during warmer months as well. *E Coli* is a sub specie of *F Coli* bacteria that is specific to fecal matter from warm blooded animals (resource - <http://www.epa.gov/volunteer/stream/vms511.html>). More monitoring will be needed to assess whether a concern persists.

Average concentrations at Eagle Creek WOMP Station. (Numbers in red indicate that the parameter exceeded the state standard or ecoregion mean for that quarter)

Parameter	1 st quarter Avg	2 nd Quarter Avg	3 rd Quarter Avg	4 th Quarter Avg	Unit	Notes
Alkalinity	270	266	227	256	mg/L	No state standard. 20 – 200 mg/L typical. Less than 10 mg/L indicate poor buffer.
BOD5	1.03	1.20	1	1	mg/L	Ecoregion mean = 2.7 mg/L.
Cadmium	.5	.5	.5	.5	ug/L	State standard = 2.0 ug/L.
Chloride	20	22.57	29.5	29.7	mg/L	State standard = 230 mg/L.
Chlorophyll-a	79.5	75.75	54	86	ug/L	% Pheo-Corrected Average Of Result
Chromium	.7	2.3	4	3	ug/L	State standard = 365 ug/L.
COD	8.67	10.57	9.25	6.25	mg/L	
Conductivity	589	579	599	602	mMHOs	
Copper	4	13.4	.5	.5	ug/L	State standard = 15 ug/L.
Dissolved Oxygen	8.73	8.05	8.25	8.55	mg/L	State standard = 7 mg/L.
<i>Escherichia coli</i> (<i>E Coli</i>) Bacteria	200	51	111	350	CFU/100 mL	State Standard = 126 organisms/100 ml as a geometric mean of not < 5 samples within any calendar month (Apr 1 – Oct 31)
<i>Fecal Coliform</i> Bacteria	142	37.75	101	101	CFU/100 mL	State standard = 200 CFU/100 ml water as geomean of at least 5 samples/month Apr – Oct.
Hardness	305	319	267	310	mg/L	No state standard. Water above 180 mg/L considered very hard water.
Lead	.33	0.9	.1	.1	ug/L	State standard = 7.7 ug/L.
Nickel	3.0	2.5	2.5	3.1	ug/L	State standard = 283 ug/L.

Parameter	1 st quarter Avg	2 nd Quarter Avg	3 rd Quarter Avg	4 th Quarter Avg	Unit	Notes
Nitrogen Ammonia Unionized	<.004	<.007	<.004	<.002	mg/L	State standard = .016 mg/L.
Nitrate + Nitrite	.22	.17	.13	.13	mg/L	
pH	7.84	8.07	7.99	7.81	su	State standard = not less than 6.5 nor greater than 8.5.
Phosphorus, Total	.057	.08	.01	.01	mg/L	Ecoregion mean = 0.13 mg/L. EPA recommends less than 0.1 mg/L. These results are the unfiltered average of result.
Suspended Solids	7.83	7.71	3.25	7.5	mg/L	Ecoregion mean = 13.7.
Total Kjeldahl Nitrogen	.28	.59	.20	.19	mg/L	
Total Organic Carbon	2.12	2.60	2.65	2.7	mg/L	
Turbidity	7.70	4.23	4.25	8.75	NTRU	State standard for trout waters = 10 NTU, however lab reports in NTRU. Not quite comparable.
Volatile Suspended Solids	N/A	2.43	1	2.5	mg/L	
Zinc	17.3	.03	1	1	ug/L	State standard = 191 ug/L

mg/L = milligrams per liter

µg/L = micrograms per liter

mMHO = micromhos or micorseimens

CFU = colony forming units

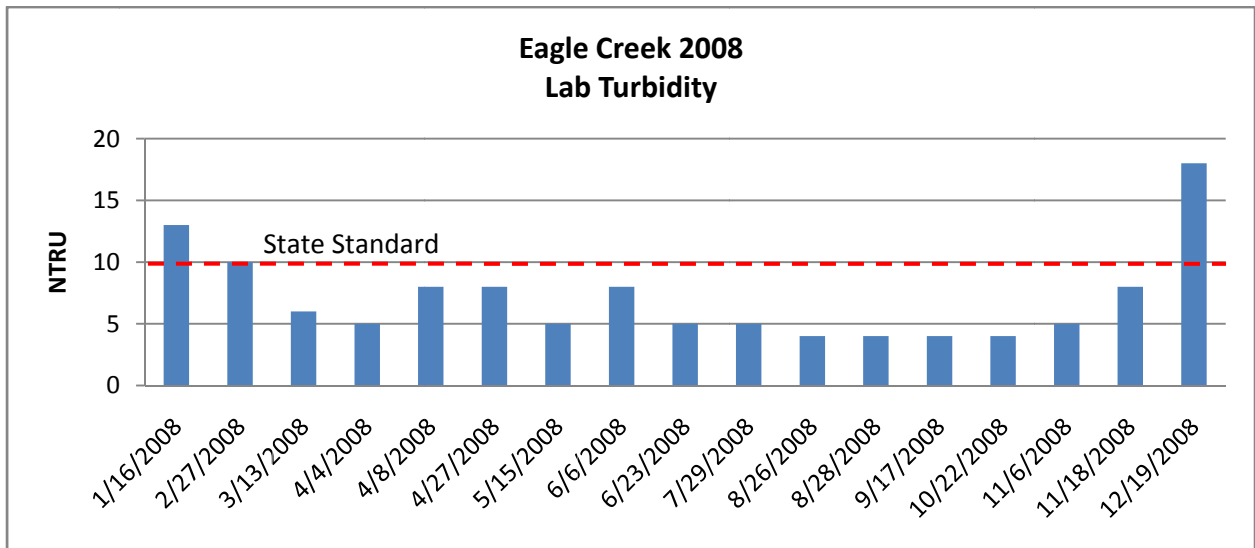
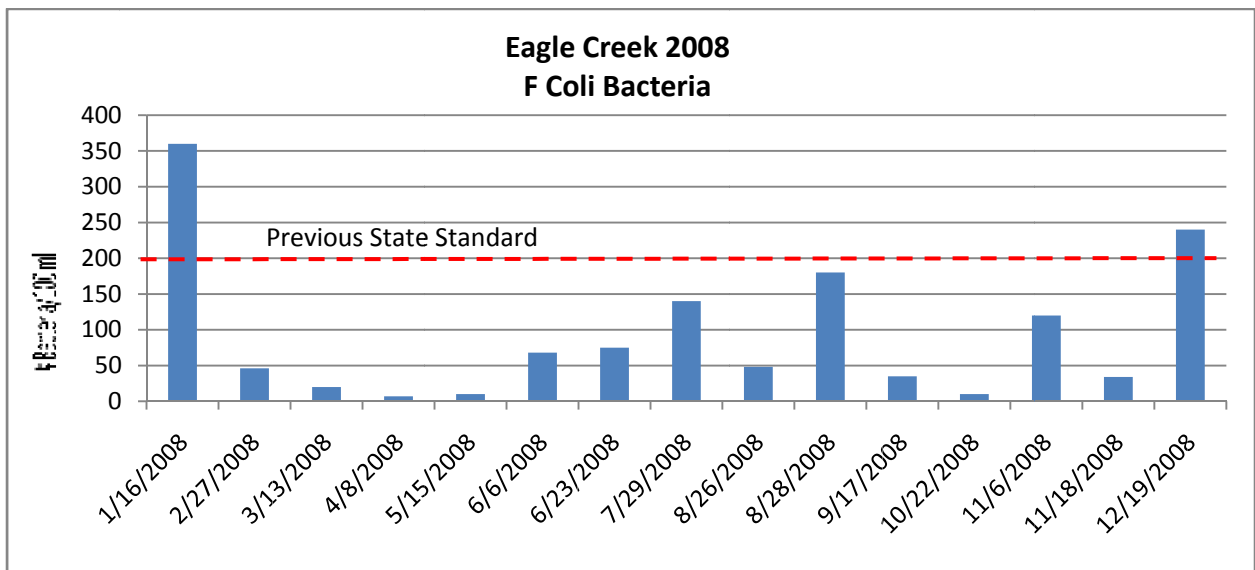
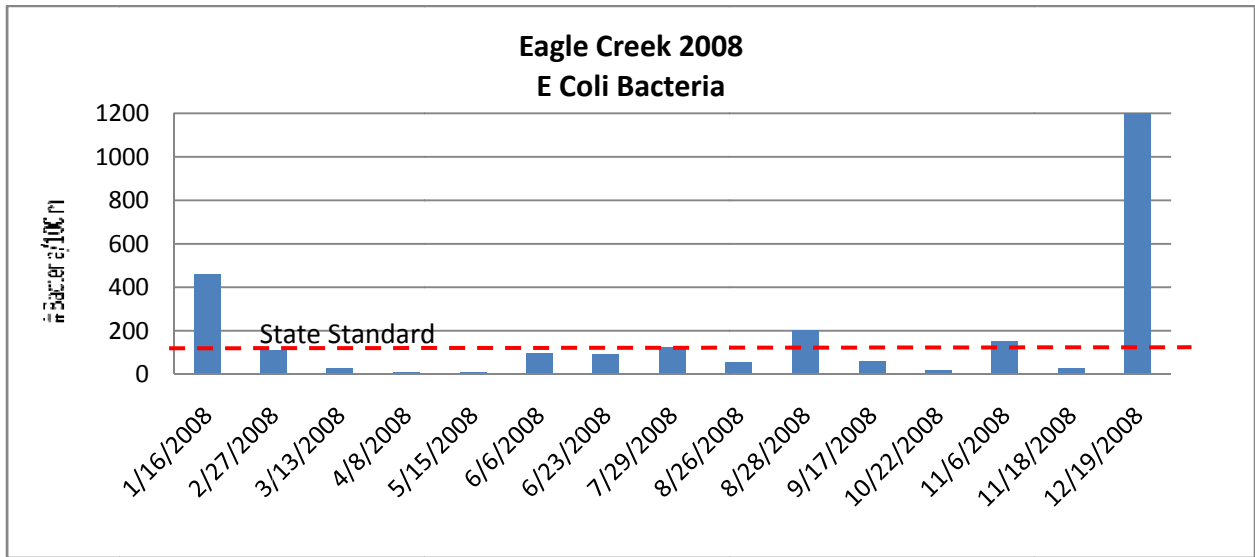
NTRU = nephelometric turbidity ratio units

Red text indicates areas of concern.

su = standard units

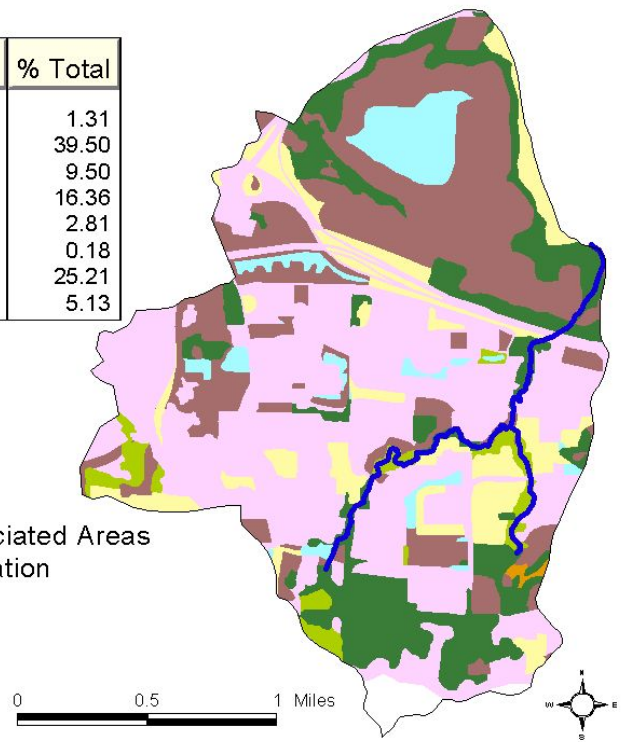
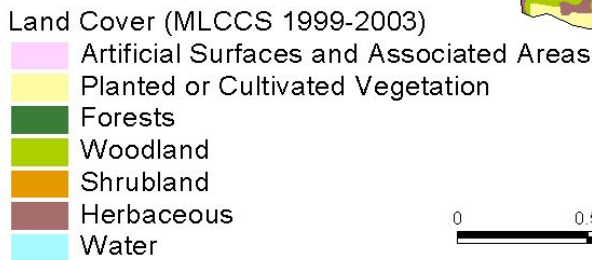
State standard = state standard for Class 2A waters, hardness greater than 200

The graphs on this page show the trends of bacteria and turbidity worsening during winter months, possibly due to the waterfowl congregating on the ice-free Eagle Creek.



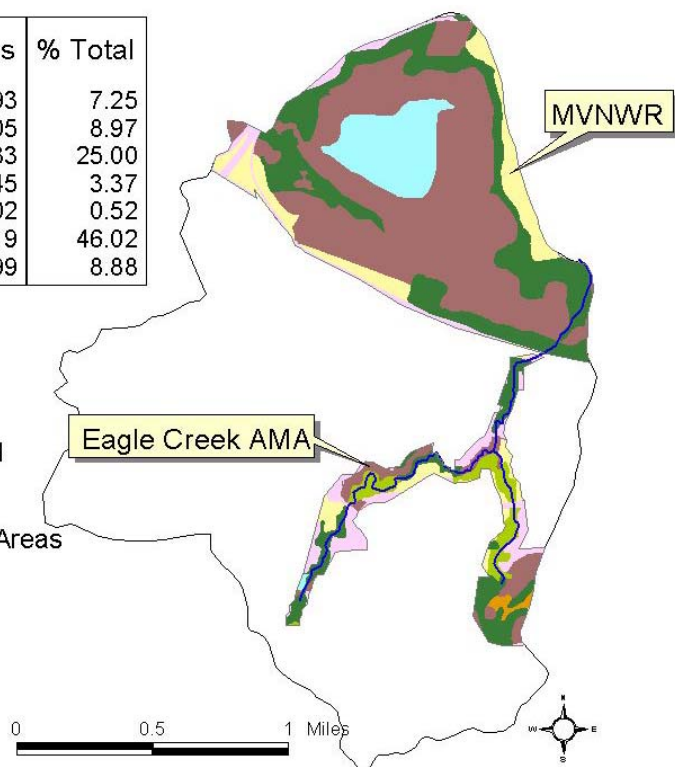
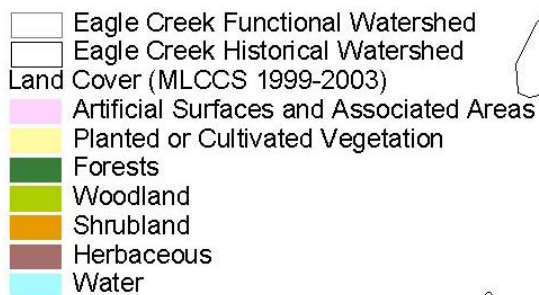
Estimated land cover, Eagle Creek *historical* watershed (Resource: MN DNR, Division of Fish and Wildlife, Section of Fisheries "Stream Survey Report, Eagle Creek 2005.")

Land Cover	Sum Acres	% Total
Unclassified	28.3497	1.31
Artificial Surfaces	852.1656	39.50
Planted or Cultivated Veg	204.9884	9.50
Forests	352.8935	16.36
Woodland	60.5463	2.81
Shrubland	3.9502	0.18
Herbaceous	543.9638	25.21
Water	110.7137	5.13



Estimated land cover, Eagle Creek *current* watershed (Resource: MN DNR, Division of Fish and Wildlife, Section of Fisheries "Stream Survey Report, Eagle Creek 2005.")

Land Cover	Sum Acres	% Total
Artificial Surfaces	54.8893	7.25
Planted or Cultivated Veg	67.9305	8.97
Forests	189.2233	25.00
Woodland	25.4945	3.37
Shrubland	3.9502	0.52
Herbaceous	348.3519	46.02
Water	67.1899	8.88



Watershed Outlet Monitoring Program

Eagle Creek Station Savage, MN

Quarterly Report *Preliminary Data* January – March 2007



Prepared By:
Jaime Rockney
Water Quality Technician
Scott Soil and Water Conservation District
Prepared For:
Lower Minnesota River Watershed District
July 2007



Introduction

The Eagle Creek WOMP site, located in Savage near Hwy. 13 and Hwy 101. This report summarizes the results of flow, precipitation, and water quality for the 1st 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

Table 1. Average flow and total precipitation at Eagle Creek WOMP Station January – March 2007

Period	Average Flow (cfs)	*Precipitation (inches)	Average precipitation for Shakopee obtained from weather.com
JANUARY	8.18	.35	.93
FEBRUARY	7.56	1.20	.62
MARCH	9.17	4.11	1.77
TOTAL QUARTER	8.30	5.66	3.32

*Precipitation data obtained from volunteer rain gauge monitor in Shakopee

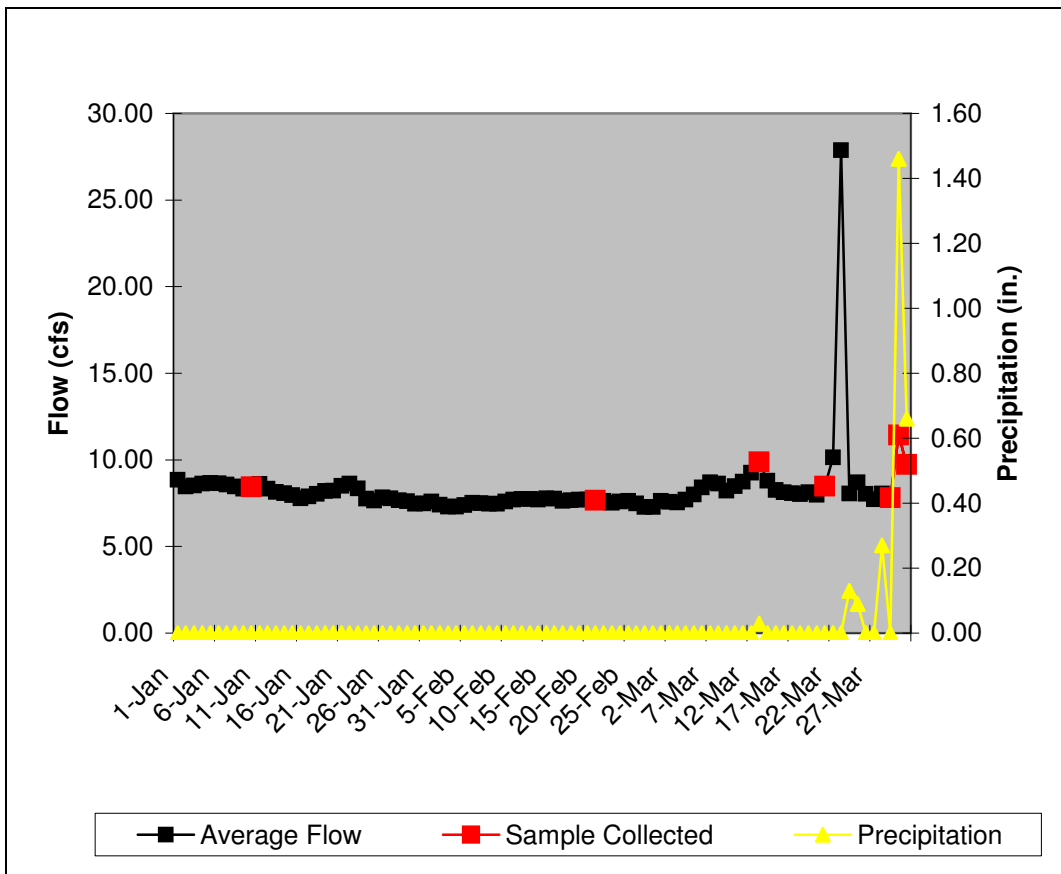


Figure 1. Flow and precipitation at Eagle Creek WOMP Station January – March 2007. The rain gauge was uncovered on March 13.

Water Quality

One event composite sample, one event grab, and three low flow grab samples were collected at the Eagle Creek WOMP Station during the 1st quarter 2007. Overall, water quality was good with nearly all parameters in compliance with state standards or near the ecoregion mean (Table 2). From observations in the past, as well as this year, ducks have congregated on Eagle Creek during the winter months because of the lack of ice. This has caused some elevated water quality results.

Table 2. Average concentrations at Eagle Creek WOMP Station

Parameter	1 st quarter 2007 Ave. Concentration	Unit	Notes – 1 st quarter results
Alkalinity	253	mg/L	No state standard. 20 – 200 mg/L typical. Less than 10 mg/L indicate poor buffer.
Biological Oxygen Demand (BOD5)	1.05	mg/L	Ecoregion mean = 2.7 mg/L.
Cadmium	.04	ug/L	State standard = 2.0 ug/L.
Chloride	23.2	mg/L	State standard = 230 mg/L.
Chlorophyll-a	83.5	ug/L	
Chromium	.4	ug/L	State standard = 365 ug/L.
COD	13.8	mg/L	
Conductivity	569	mMHOs	
Copper	.5	ug/L	State standard = 15 ug/L.
Dissolved Oxygen	8.89	mg/L	State standard = 7 mg/L.
Fecal Coliform Bacteria	102	CFU/100mL	State standard = 200 CFU/100 ml water as geomean of at least 5 samples per month Apr – Oct. Samples were much higher in January and February.
Hardness	286	mg/L	No state standard. Water above 180 mg/L considered very hard water.
Lead	.3	ug/L	State standard = 7.7 ug/L.
Nickel	3	ug/L	State standard = 283 ug/L.
Nitrogen Ammonia	.05	ug/L	State standard = 16 ug/L.
Nitrate + Nitrite	.32	mg/L	Ecoregion mean = .16 mg/L. Could be elevated due to large number of ducks in stream.
pH	7.75	su	State standard = not less than 6.5 nor greater than 8.5.
Phosphorus, Total	.01	mg/L	Ecoregion mean = .13 mg/L. EPA recommends less than 0.1 mg/L.
Suspended Solids	11	mg/L	Ecoregion mean = 13.7. Eagle is usually lower in the non-winter months. Again, it is most likely due to the ducks.
TKN (Total Kjeldahl Nitrogen)	.34	mg/L	
Total Organic Carbon	2.84	mg/L	
Turbidity	10.11	NTU	State standard = 10 NTU Could be elevated due to large number of ducks in stream.
Volatile Suspended Solids	3.4	mg/L	
Zinc	.9	ug/L	State standard = 191 ug/L

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

ug/L = micrograms per liter or parts per billion (ppb)

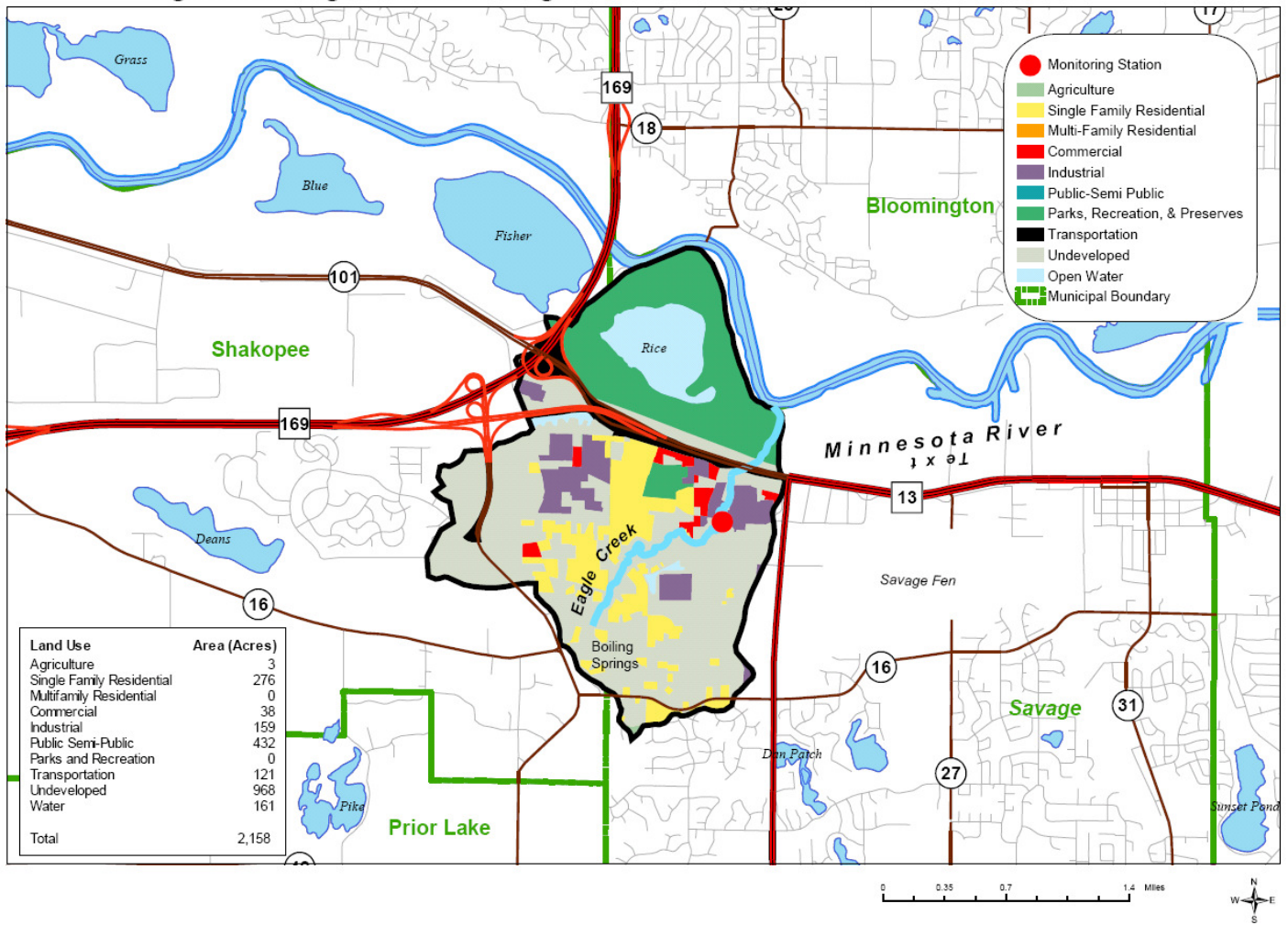
mMHO = micromhos or micorseimens

CFU = colony forming units

NTU = nephelometric turbidity units

State standard = state standard for Class 2A waters with a hardness greater than 200

Figure 1.EA. Eagle Creek Monitoring Station Location and Watershed Characteristics



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

Watershed Outlet Monitoring Program

Eagle Creek Station Savage, MN

Quarterly Report *Preliminary Data* April - June 2007



Prepared By:
Jaime Rockney
Water Quality Technician
Scott Soil and Water Conservation District
Prepared For:
Lower Minnesota River Watershed District
August 2007



Introduction

The Eagle Creek WOMP site, located in Savage near Hwy. 13 and Hwy 101. This report summarizes the results of flow, precipitation, and water quality for the 2nd quarter of 2007. This data is preliminary and is subject to change until the Metropolitan Council submits the final report for this period.

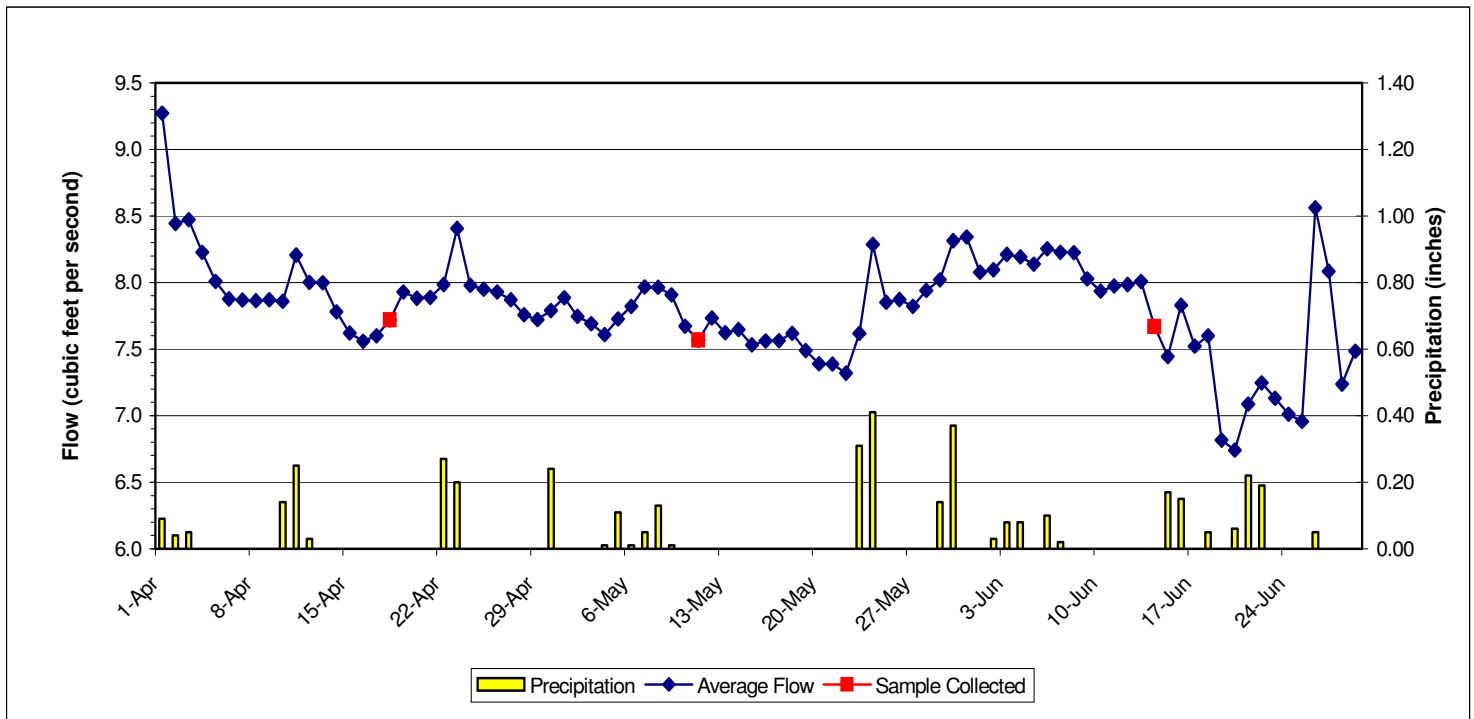
Flow and Precipitation

Table 1. Average flow and total precipitation at Eagle Creek WOMP Station April - June 2007

Period	Average Flow (cfs)	*Precipitation (inches)	30 year precipitation average from state climatology office
April	7.97	2.01	2.13
May	7.78	2.40	3.68
June	7.71	1.56	4.76
TOTAL QUARTER	7.82	5.97	10.57

*Precipitation data obtained from volunteer rain gauge monitor in Shakopee

Figure 1. Flow and precipitation at Eagle Creek WOMP Station, April - June 2007. Beaver dam removed upstream on June 26 to cause spike in flow.



Water Quality

Three low flow grab samples were collected at the Eagle Creek WOMP Station during the 2nd quarter in 2007. There were no significant rain events so no composites were taken. Overall, water quality was excellent with all parameters in compliance with state standards or near the ecoregion mean (Table 2). The results of 2nd quarter seem to support the idea that ducks were influencing the water quality results of 1st quarter; Fecal Coliform, Solids, Nitrate/Nitrite's, and Turbidity are all lower this quarter.

Table 2. Average concentrations at Eagle Creek WOMP Station

Parameter	1 st quarter Ave. Concentration	2 nd Quarter Ave Concentration	Unit	Notes – 2 nd Quarter Results
Alkalinity	253	259	mg/L	No state standard. 20 – 200 mg/L typical. Less than 10 mg/L indicate poor buffer.
Biological Oxygen Demand (BOD5)	1.05	1.0	mg/L	Ecoregion mean = 2.7 mg/L.
Cadmium	.04	.04	ug/L	State standard = 2.0 ug/L.
Chloride	23.2	25.5	mg/L	State standard = 230 mg/L.
Chlorophyll-a	83.5	67.3	ug/L	
Chromium	.4	.2	ug/L	State standard = 365 ug/L.
COD	13.8	8.7	mg/L	
Conductivity	569	588	mMHOs	
Copper	.5	.5	ug/L	State standard = 15 ug/L.
Dissolved Oxygen	8.89	8.3	mg/L	State standard = 7 mg/L.
Fecal Coliform Bacteria	102	43.7	CFU/100mL	State standard = 200 CFU/100 ml water as geomean of at least 5 samples per month Apr – Oct.
Hardness	286	291	mg/L	No state standard. Water above 180 mg/L considered very hard water.
Lead	.3	.1	ug/L	State standard = 7.7 ug/L.
Nickel	3	2.7	ug/L	State standard = 283 ug/L.
Nitrogen Ammonia	.05	.05	mg/L	State standard = .016 mg/L.
Nitrate + Nitrite	32	.12	mg/L	Ecoregion mean = .16 mg/L.
pH	7.75	7.61	su	State standard = not less than 6.5 nor greater than 8.5.
Phosphorus, Total	.08	.04	mg/L	Ecoregion mean = 0.13 mg/L. EPA recommends less than 0.1 mg/L. These results are the unfiltered average of result.
Suspended Solids	11	4	mg/L	Ecoregion mean = 13.7.
Total Kjeldahl Nitrogen	.34	.32	mg/L	
Total Organic Carbon	2.84	2.8	mg/L	
Turbidity	10.11	4.02	NTU	State standard = 10 NTU
Volatile Suspended Solids	3.4	1.6	mg/L	
Zinc	.9	3.0	ug/L	State standard = 191 ug/L

mg/L = milligrams per liter

mMHO = micromhos or micorseimens

NTU = nephelometric turbidity units

su = standard units

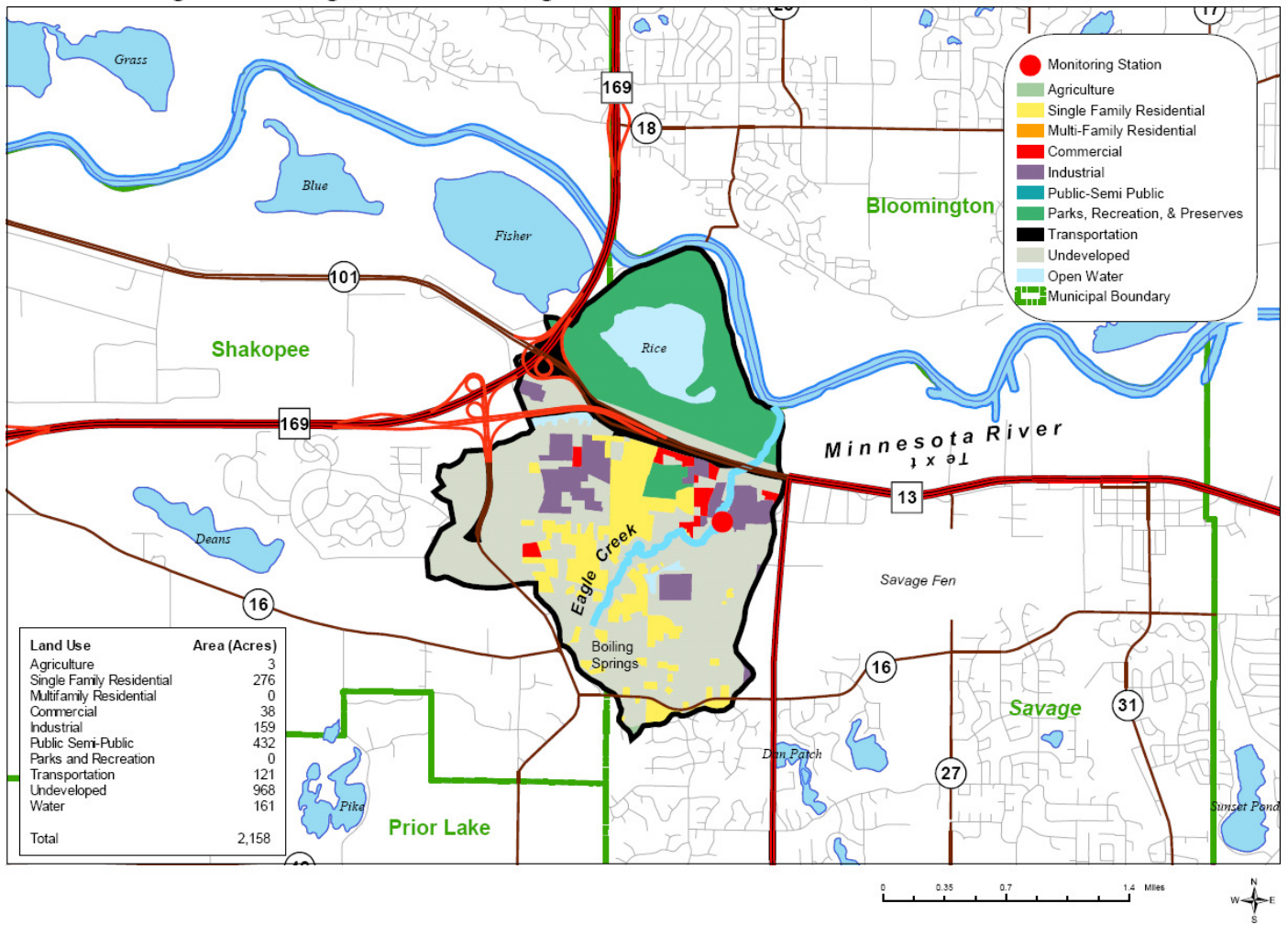
State standard = state standard for Class 2A waters with a hardness greater than 200

ug/L = micrograms per liter

CFU = colony forming units

Highlighted areas indicate areas of concern.

Figure 1.EA. Eagle Creek Monitoring Station Location and Watershed Characteristics



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

Watershed Outlet Monitoring Program

Eagle Creek Station Savage, MN

Quarterly Report *Preliminary Data* July-September 2007



Prepared By:
Jaime Rockney
Water Quality Technician
Scott Soil and Water Conservation District
Prepared For:
Lower Minnesota River Watershed District
October 2007



Introduction

The Eagle Creek WOMP site is located in Savage near Hwy 13 and Hwy 101. 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.

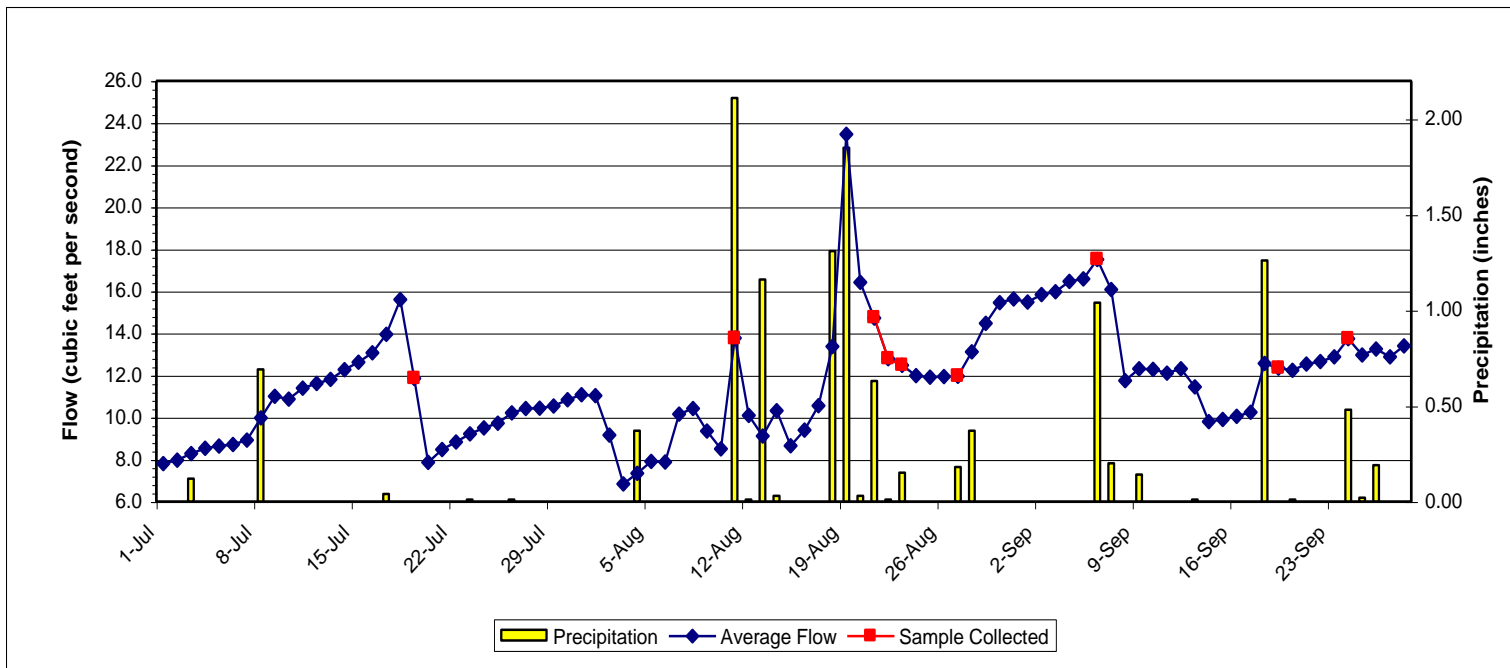
Flow and Precipitation

Table 1. Average flow and total precipitation at Eagle Creek WOMP station.

Period	Average Flow (cfs)	*Precipitation (inches)	30 year precipitation average from state climatology office
July	10.38	.87	4.09
August	11.62	8.21	4.01
September	13.29	4.17	2.67
TOTAL QUARTER		13.25	10.77

*Precipitation data obtained from WOMP station rain gauge

Figure 1. Flow, precipitation, and sample collection at Eagle Creek WOMP Station.*



*Beaver dams downstream of the station are affecting flow and stage values. The flow is actually lower than represented in this graph because the beaver dams are backing up the water, making stage and flow appear higher than normal. The dams will be removed in spring by DNR to return the stream back to normal conditions. By waiting until spring to remove the dams, it will avoid the negative effect sedimentation and debris cause to the trout eggs nested on the stream bed.

Water Quality - Three composite samples and five grab samples were collected at the Eagle Creek WOMP Station during the 3rd quarter in 2007. Overall, water quality was excellent with all parameters in compliance with state standards or near the ecoregion mean (Table 2).

Table 2. Average concentrations at Eagle Creek WOMP Station

Parameter	1 st quarter Ave. Concentration	2 nd Quarter Ave Concentration	3 rd Quarter Ave. Concentration	Unit	Notes – 2 nd Quarter Results
Alkalinity	253	259	244	mg/L	No state standard. 20 – 200 mg/L typical. Less than 10 mg/L indicate poor buffer.
Biological Oxygen Demand (BOD5)	1.05	1.0	1.0	mg/L	Ecoregion mean = 2.7 mg/L.
Cadmium	.04	.04	.05	ug/L	State standard = 2.0 ug/L.
Chloride	23.2	25.5	27	mg/L	State standard = 230 mg/L.
Chlorophyll-a	83.5	67.3	64	ug/L	
Chromium	.4	.2	.5	ug/L	State standard = 365 ug/L.
COD	13.8	8.7	13.1	mg/L	
Conductivity	569	588	581	mMHOS	
Copper	.5	.5	.7	ug/L	State standard = 15 ug/L.
Dissolved Oxygen	8.89	8.3	7.67	mg/L	State standard = 7 mg/L.
Fecal Coliform Bacteria	102	43.7	151.5	CFU/100mL	State standard = 200 CFU/100 ml water as geomean of at least 5 samples per month Apr – Oct.
Hardness	286	291	285	mg/L	No state standard. Water above 180 mg/L considered very hard water.
Lead	.3	.1	.1	ug/L	State standard = 7.7 ug/L.
Nickel	3	2.7	2.8	ug/L	State standard = 283 ug/L.
Nitrogen Ammonia	.05	.05	.043	mg/L	State standard = .016 mg/L.
Nitrate + Nitrite	.32	.12	.15	mg/L	Ecoregion mean = .16 mg/L.
pH	7.75	7.61		su	State standard = not less than 6.5 nor greater than 8.5.
Phosphorus, Total	.08	.04	.06	mg/L	Ecoregion mean = 0.13 mg/L. EPA recommends less than 0.1 mg/L. These results are the unfiltered average of result.
Suspended Solids	11	4	9.9	mg/L	Ecoregion mean = 13.7.
Total Kjeldahl Nitrogen	.34	.32	.30	mg/L	
Total Organic Carbon	2.84	2.8	3.23	mg/L	
Turbidity	10.11	4.02	5.2	NTU	State standard = 10 NTU
Volatile Suspended Solids	3.4	1.6	3.1	mg/L	
Zinc	.9	3.0	3.4	ug/L	State standard = 191 ug/L

mg/L = milligrams per liter

mMHO = micromhos or micorseimens

NTU = nephelometric turbidity units

su = standard units

State standard = state standard for Class 2A waters with a hardness greater than 200

ug/L = micrograms per liter

CFU = colony forming units

Highlighted areas indicate areas of concern.

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

Figure 1.EA. Eagle Creek Monitoring Station Location and Watershed Characteristics

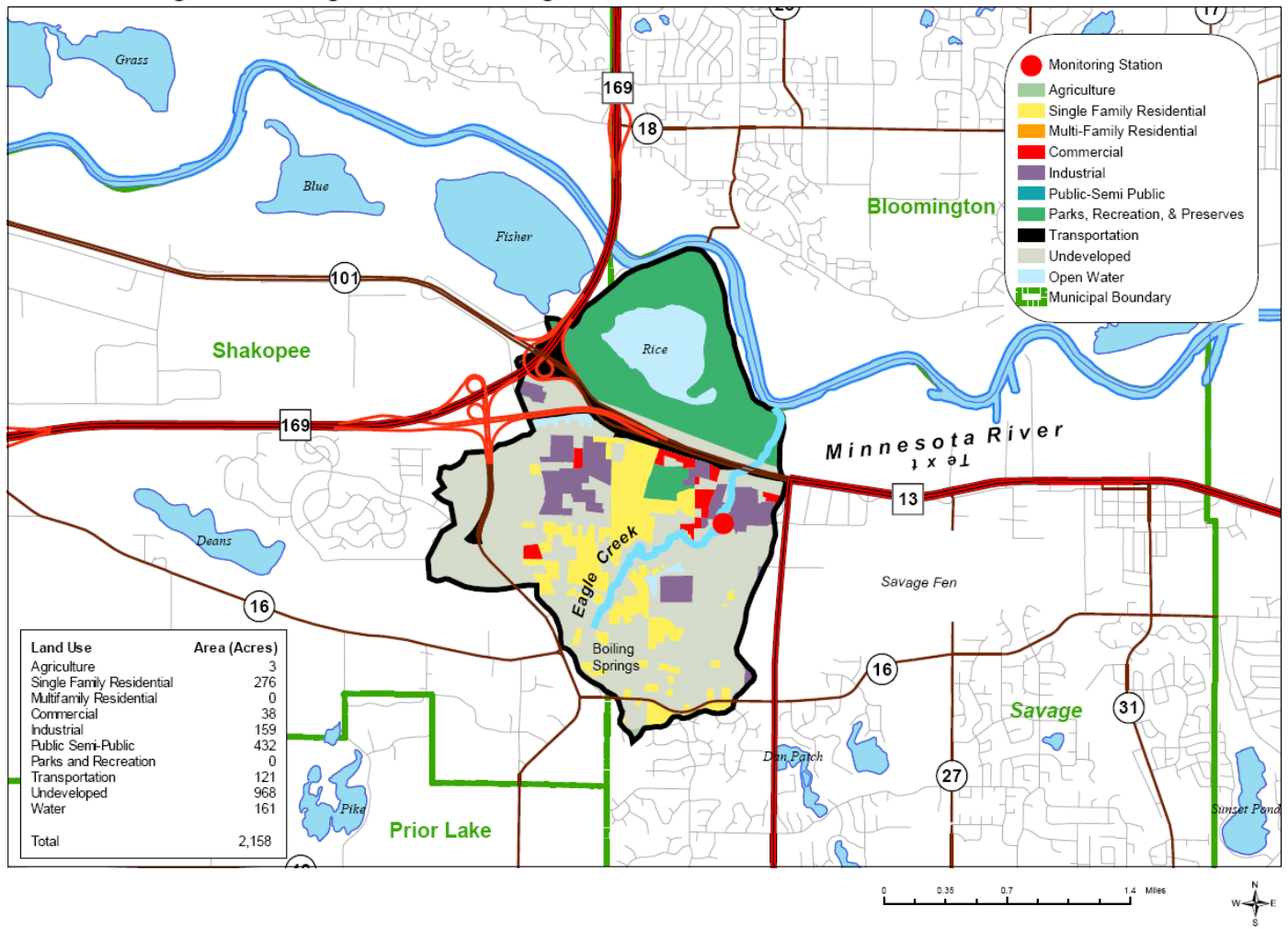


Figure 3 and 4 below taken from the MN DNR, Division of Fish and Wildlife, Section of Fisheries “Stream Survey Report, Eagle Creek 2005.”

Figure 3. Eagle Creek, Scott County, Minnesota - Historic Watershed (Land Cover data source: MLCCS 1999-2003).

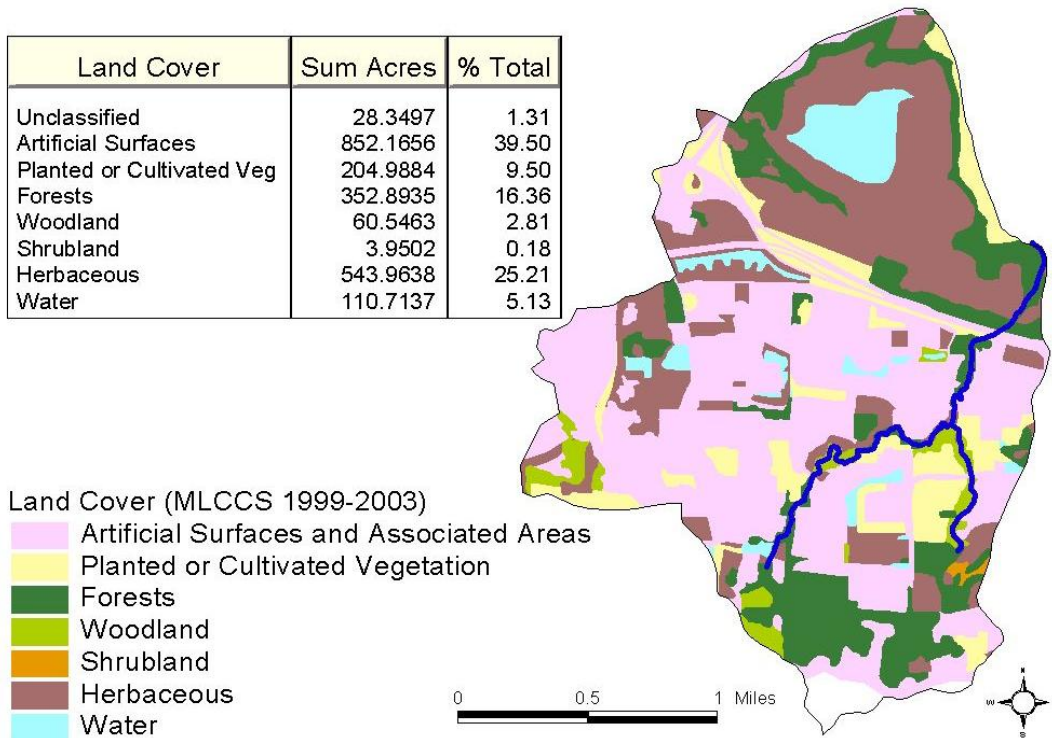
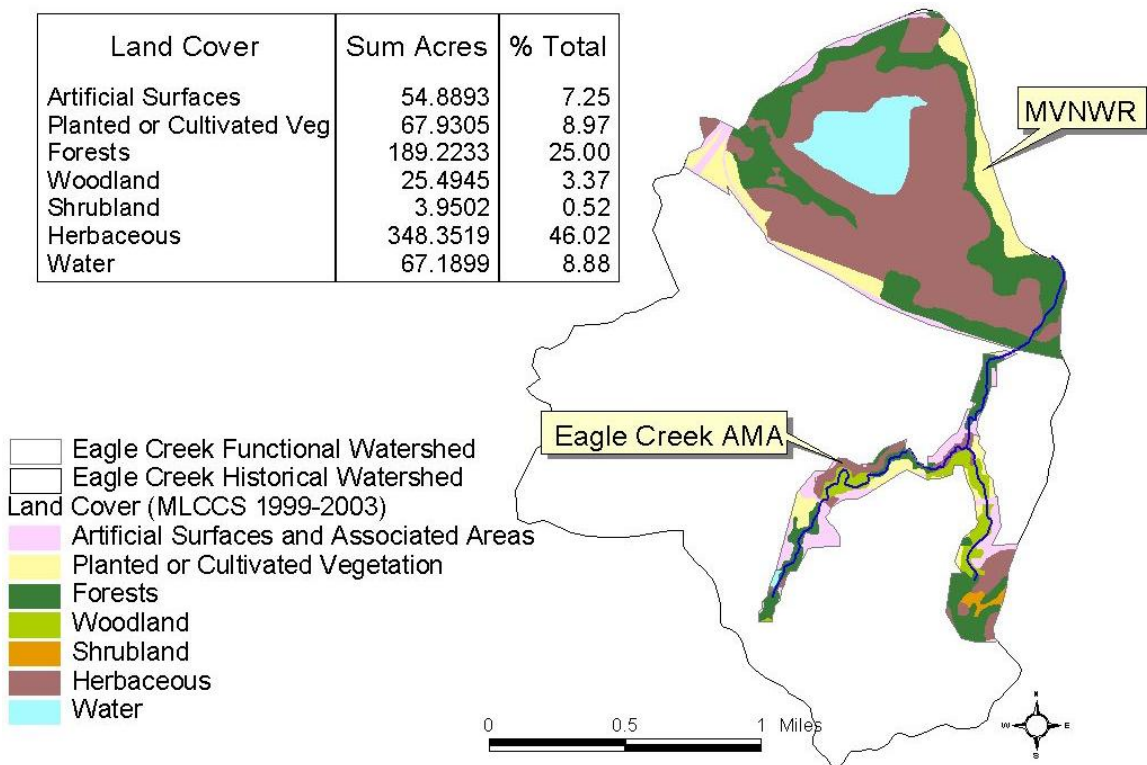


Figure 4. Estimated land cover, Eagle Creek functional watershed (Land Cover data source: MLCCS 1999-2003).



Watershed Outlet Monitoring Program

Eagle Creek Station Savage, MN

Quarterly Report *Preliminary Data* October - December 2007



Prepared By:
Jaime Rockney
Water Quality Technician
Scott Soil and Water Conservation District
Prepared For:
Lower Minnesota River Watershed District
January 2008



Introduction

The Eagle Creek WOMP site is located in Savage near Hwy 13 and Hwy 101. 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.

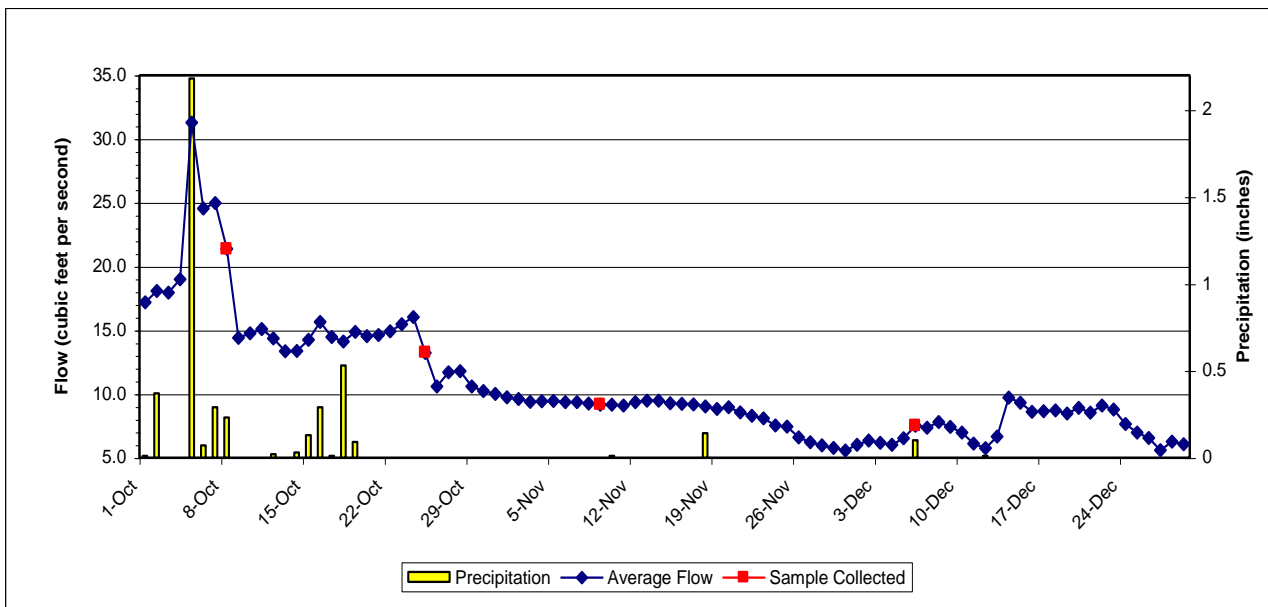
Flow and Precipitation

Table 1. Average flow and total precipitation at Eagle Creek WOMP station.

Period	Average Flow (cfs)	*Precipitation (inches)	30 year precipitation average from state climatology office
October	15.69	4.75	1.92
November	8.58	.17	1.17
December	7.30	1.43	.77
TOTAL	10.57	6.35	3.86

*Precipitation data was obtained from volunteer rain gauge monitor

Figure 1. Flow, precipitation, and sample collection at Eagle Creek WOMP Station.



4th Quarter Notes:

The bubbler was not tracking stage (depth of water) very well. This year it has been drifting so much that nearly every time we visited the station, we had to calibrate the bubbler to match the actual stage. Metropolitan Council replaced the bubbler with a new one on December 13. After a few more visits to the station, we will be able to see how well it has been tracking.

Metropolitan Council is also considering installing an in-situ flow meter in Eagle Creek to reduce the impacts beaver dams are having on the stage/flow relationship (rating curve) that has been developed. The new device would measure flow and stage to give instantaneous flow measurements, rather than relying on the rating curve that has been skewed by the dams. The way it is now, the bubbler measures stage and then computes what the flow would be based on equations we have in the program. The equations are based on numerous flow measurements that have been collected over many years of monitoring. The new flow meter would be measuring actual flow every 15 minutes.

Water Quality – One event grab and three base grab samples were collected at the Eagle Creek WOMP Station during the 4th quarter in 2007. Overall, water quality was excellent with all parameters in compliance with state standards or near the ecoregion mean (Table 2). No metals were sampled this quarter.

Table 2. Average concentrations at Eagle Creek WOMP Station

Parameter	1 st quarter Avg Conc.	2 nd Quarter Avg Conc.	3 rd Quarter Avg. Conc.	4 th Quarter Avg. Conc.	Unit	Notes – 2 nd Quarter Results
Alkalinity	253	259	244	259	mg/L	No state standard. 20 – 200 mg/L typical. Less than 10 mg/L indicate poor buffer.
Biological Oxygen Demand (BOD5)	1.05	1.0	1.0	1	mg/L	Ecoregion mean = 2.7 mg/L.
Cadmium	.04	.04	.05		ug/L	State standard = 2.0 ug/L.
Chloride	23.2	25.5	27	27	mg/L	State standard = 230 mg/L.
Chlorophyll-a	83.5	67.3	64	62	ug/L	
Chromium	.4	.2	.5		ug/L	State standard = 365 ug/L.
COD	13.8	8.7	13.1	8.3	mg/L	
Conductivity	569	588	581	603	mMHOs	
Copper	.5	.5	.7		ug/L	State standard = 15 ug/L.
Dissolved Oxygen	8.89	8.3	7.67	8.18	mg/L	State standard = 7 mg/L.
Fecal Coliform Bacteria	102	43.7	151.5	71.3	CFU/100 mL	State standard = 200 CFU/100 ml water as geomean of at least 5 samples per month Apr – Oct.
Hardness	286	291	285	278	mg/L	No state standard. Water above 180 mg/L considered very hard water.
Lead	.3	.1	.1		ug/L	State standard = 7.7 ug/L.
Nickel	3	2.7	2.8		ug/L	State standard = 283 ug/L.
Nitrogen Ammonia	.05	.05	.043	.03	mg/L	State standard = .016 mg/L.
Nitrate + Nitrite	32	.12	.15	.16	mg/L	Ecoregion mean = .16 mg/L.
pH	7.75	7.61		7.73	su	State standard = not less than 6.5 nor greater than 8.5.
Phosphorus, Total	.08	.04	.06	.04	mg/L	Ecoregion mean = 0.13 mg/L. EPA recommends less than 0.1 mg/L. These results are the unfiltered average of result.
Suspended Solids	11	4	9.9	9	mg/L	Ecoregion mean = 13.7.
Total Kjeldahl Nitrogen	.34	.32	.30	.33	mg/L	
Total Organic Carbon	2.84	2.8	3.23	2.8	mg/L	
Turbidity	10.11	4.02	5.2	7.7	NTU	State standard = 10 NTU
Volatile Suspended Solids	3.4	1.6	3.1		mg/L	
Zinc	.9	3.0	3.4		ug/L	State standard = 191 ug/L

mg/L = milligrams per liter
 mMHO = micromhos or micorseimens
 NTU = nephelometric turbidity units
 su = standard units

ug/L = micrograms per liter
 CFU = colony forming units
 Highlighted areas indicate areas of concern.

State standard = state standard for Class 2A waters with a hardness greater than 200

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

Figure 1.EA. Eagle Creek Monitoring Station Location and Watershed Characteristics

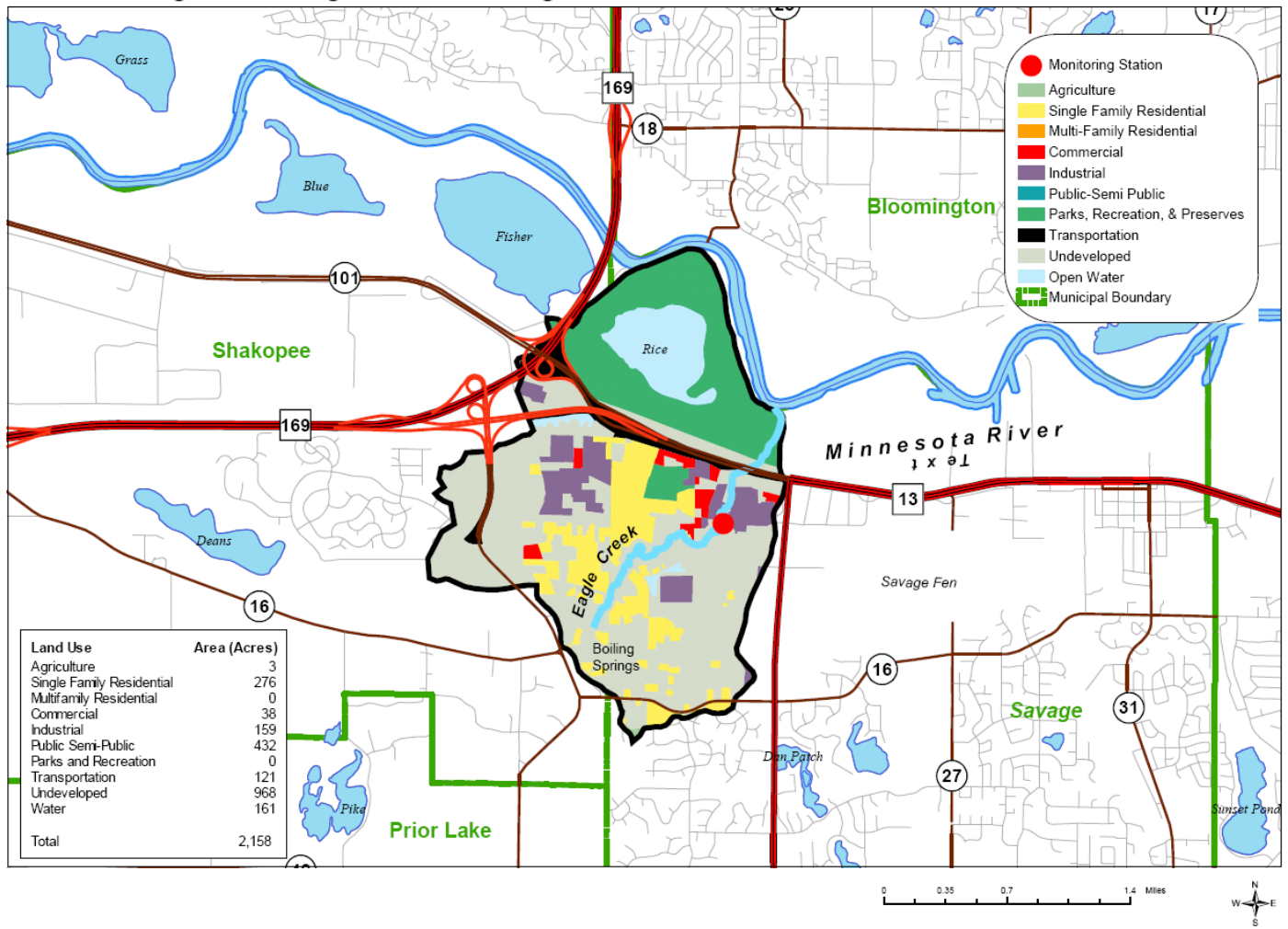


Figure 3 and 4 below taken from the MN DNR, Division of Fish and Wildlife, Section of Fisheries “Stream Survey Report, Eagle Creek 2005.”

Figure 3. Eagle Creek, Scott County, Minnesota - Historic Watershed (Land Cover data source: MLCCS 1999-2003).

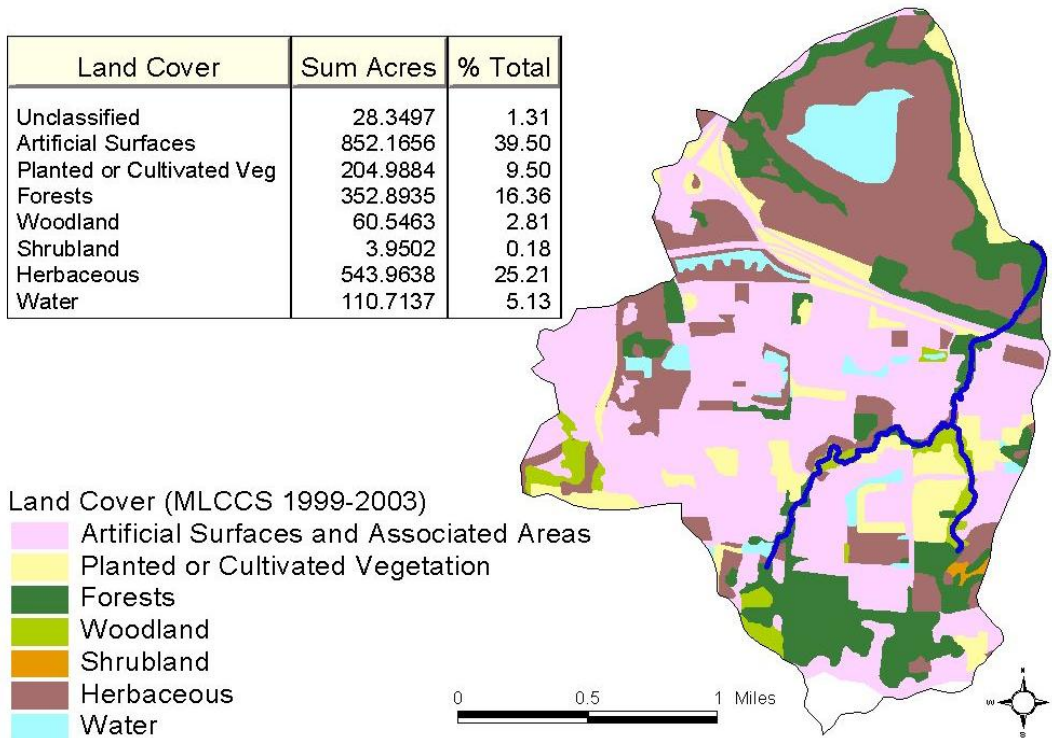


Figure 4. Estimated land cover, Eagle Creek functional watershed (Land Cover data source: MLCCS 1999-2003).

