Water Quality

Current Plan

The 2000-2010 Comprehensive Plan reviewed the effects of geology and soils on water quality noting that studies of the outwash sands of the Anoka Sand Plain have found significant amounts of apatite, a mineral containing phosphorus (Larson 1985). Such apatite levels have the potential to raise the background concentration of phosphorus in water passing through the outwash. These high baseline phosphorus levels must be kept in mind when evaluating water quality data from the sand plain.

In addition, sesquioxides (aluminum and iron oxides) and calcium are fairly abundant in the Anoka Sand Plain peatlands (Larson 1985). Therefore, many water samples analyzed in the following studies exhibited elevated concentrations of aluminum, iron and/or calcium—whether or not the water had come into contact with other sources of the compounds.

The 2000-2010 assessment reviewed the chemical parameters being tested, the tests and studies that have occurred within the watershed and the nature of any exceedences that may have occurred. The information is based wholly on the Water Quality Monitoring efforts conducted by the Anoka Conservation District and reported in their annual Anoka County Water Atlas and in Storet.

Trends in Water Quality

This report includes data from all monitoring years and all sites to provide a broad view of Coon Creek's water quality under a variety of conditions. We focus upon an upstream-to-downstream comparison of water quality, as well as an overall assessment (ACD, 2009).

2000 Impairment Sampling

In August 2000 the MPCA sampled four sites within the watershed.

Site	**Location**
Coon Creek (CD 59)	TH 65
Coon Creek	South of US 10
Sand Creek	TH 65
Pleasure Creek	River Road
Springbrook Creek	River Road

2006 Impairment Listing (303(d))

In 2006 the Minnesota Pollution Control Agency (MPCA) listed Coon Creek, Sand Creek, Pleasure Creek and Springbrook Creek as biologically impaired and listed these resources on the 303d list reported to the U.S. Environmental

Protection Agency as required.

The Impairment is listed as a Category 5C, meaning the water quality standard is not attained due to “suspected” natural conditions. Further, the water is impaired for one or more designated uses by a pollutant(s) and may require development of a Total Maximum Daily Load (TMDL) to bring the pollutant under control. Water Quality Standards for these waters may be re-evaluated due to the presence of natural conditions.

303(d) Listing Information

Reach name	Year Impair List	Affected designated use	Pollutant or stressor	
Coon Creek	2006	Aquatic life	Aquatic macroinvertebrate bioassessments	2C
Pleasure Creek	2006	Aquatic life	Aquatic macroinvertebrate bioassessments	
Sand Creek	2006	Aquatic life	Aquatic macroinvertebrate bioassessments	
Spring Brook Creek (CD 17)	2006	Aquatic life	Aquatic macroinvertebrate bioassessments	

Biomonitoring Trends

Potions of Coon Creek have been monitored for biota every year since 2000 (ACD Water Atlases). The invertebrate community suggests Coon Creek’s health is average compared to other nearby streams. The stream’s habitat is relatively sparse, due mostly to excavations performed to repair and maintain the County Ditch function of most of the drainage system within the watershed.

The biomonitoring suggests that stream health is similar to the average for Anoka County streams, despite the good quality habitat. Family Biotic Index (FBI) has been consistently higher than the county average, but the number of families and number of pollution sensitive families (EPT) has been similar to county averages.

The invertebrate community suggests Coon Creek’s health is average compared to other nearby streams. This is unexpected because habitat at the Egret Street site is much better, including riffles, pools, snags, and forested areas around the stream. At Crosstown Boulevard the creek has been ditched so there are no riffles or pools, there is no rocky habitat, few snags, and adjacent habitat is grassy. One possible explanation is that the biotic community at Egret Street is limited by poorer water quality despite the better habitat. Chemical monitoring has found that Coon Creek's water quality declines from upstream to downstream. This corresponds with an increase in urbanization. Future monitoring will provide insight.

Conductivity, Salinity and Chlorides

Conductivity, chlorides, and salinity are all measures of a broad range of dissolved pollutants. Dissolved pollutant sources include urban road runoff, industrial sources, and others. Metals, hydrocarbons, road salts, and others are often of concern in a suburban environment.

Conductivity is the broadest measure of dissolved pollutants we used. It measures electrical conductivity of the water; pure water with no dissolved constituents has zero conductivity.

Salinity measures dissolved salts as a percent salinity.

Chlorides tests for chloride salts, the most common of which are road de-icing chemicals. Chlorides can also be present in other pollutant types, such as wastewater.

These pollutants are of greatest concern because of the effect they can have on the stream's biological community; however it is noteworthy that Coon Creek is upstream from the drinking water intakes on the Mississippi River for the Twin Cities. Overall, dissolved pollutants in Coon Creek are slightly high.

Coon Creek

Overall, dissolved pollutants in Coon Creek are slightly high. Dissolved pollutants, as measured by conductivity, salinity, and chlorides, were slightly elevated in Coon Creek and showed little variability in different flow conditions and little variability from upstream to downstream. Some of these dissolved pollutants are originating from the shallow groundwater which feeds the creek during baseflow (ACD, 2009).

Conductivity and Salinity

Conductivity and salinity in Coon Creek were only slightly higher than typically found in Anoka County streams, but chlorides were significantly higher and of greater concern (see figures below). Median conductivity in Coon Creek (all sites) was 0.491 mS/cm compared to the countywide median of

0.318 mS/cm. Median salinity in Coon Creek (all sites) was 0.02% compared to the countywide median of 0.01%, though salinity is not a very sensitive or useful measure.

Dissolved pollutants were higher in downstream reaches of Coon Creek, where there is more impervious area (see figures below). The increase is slight for conductivity and salinity. It is most pronounced when comparing among baseflow conditions, probably because baseflow sampling conditions were all similar, whereas storm conditions were more variable. Median baseflow conductivity increased modestly from upstream to downstream (0.568, 0.586, and 0.654 mS/cm, respectively).

Conductivity and salinity sources likely included road deicing salts as well as a broad mixture of other chemicals found on roads and other impervious surfaces.

Chlorides

Median chlorides in Coon Creek (all sites), were more than four times higher than the countywide median (49 vs 12 mg/L). Elevated chlorides have been found in most urban and suburban areas of Anoka County and elsewhere due to higher road deicing salt application.

The Minnesota Pollution Control Agency (MPCA) has a water quality standard for only one of the dissolved pollutant parameters, chlorides, but Coon Creek does not exceed this standard. The chronic water quality standard is 230 mg/L. The maximum observed in Coon Creek was 85 mg/L. It is possible that higher levels do occur at other times, such as during snowmelt, but were not captured by the monitoring.

Dissolved pollutants were higher in downstream reaches of Coon Creek, where there is more impervious area (see figures below). The difference from upstream to downstream for chlorides was much more dramatic, especially between the Shadowbrook and Lions Park monitoring sites. Median baseflow chlorides from upstream to downstream were 37, 52, 63 mg/L, respectively.

Sand Creek

Sand Creek dissolved pollutant levels are often double the level typically found in Anoka County streams.

From upstream to downstream there is little change in dissolved pollutants in Sand Creek. While upstream sites seem to have a little more variability with an occasional higher reading, all sites were similar. This suggests dissolved pollutant concentrations in all parts of the watershed are similar.

There was little difference between storm and baseflow conditions. If road runoff was the primary dissolved pollutant source, then readings would be highest during storms. Dissolved pollutants can also easily infiltrate into shallow groundwater that feed streams during baseflow. If this has occurred, dissolved pollutants will be high during baseflow.

Conductivity and Salinity

Considering all sites in all years, median conductivity in Sand Creek is nearly two times greater than the median for all Anoka County streams (0.711 mS/cm compared to 0.318 mS/cm).

Chlorides

Sand Creek median chlorides were 6 times greater than the median of all Anoka County streams (75 mg/L vs 12 mg/L). This is still less than the Minnesota Pollution Control Agency's chronic water quality standard for chloride of 230 mg/L. Salinity is not as sensitive of a test, but salinity in Sand Creek averaged 0.03% compared to 0.01% for the county-wide median. It is possible that higher levels of conductivity, chlorides, and salinity do occur at other times, such as during snowmelt, but were not captured by the monitoring.

For Sand Creek at Xeon Street, the site with the most data and at the bottom of the watershed, measures of dissolved pollutants were similar during storms and baseflow. However, it is notable that baseflow readings were slightly higher overall. The two tributaries (Ditch 39 and 60) had their highest conductivity, chlorides, and salinity during baseflow too, but the difference was greater. For all other sites baseflow and storm readings were indistinguishable.

Effect of Sad Creek on Coon Creek

Sand Creek degrades Coon Creek with dissolved pollutants. Both creeks were monitored just before Sand Creek joins with Coon Creek. Across all years monitored, Sand Creek's median conductivity was 0.689 mS/cm, while Coon Creek's was 0.519. Sand Creek's median chlorides were 22 mg/L higher than Coon Creek. The two streams have similar salinity, but this measure is not very sensitive.

Pleasure Creek

All three parameters of dissolved pollutants were high and increased from upstream to downstream. The increase between the uppermost three monitoring sites (i.e. in the City of Blaine) was small, likely because these sites are in close proximity to each other. Greater increases were observed between the two downstream monitoring sites in the City of Coon Rapids but this is not surprising because these monitoring sites are farther apart and a larger portion of the watershed is between them.

At the outlet to the Mississippi River dissolved pollutants in Pleasure Creek were among the highest observed in Anoka County, but similar to other streams in urban settings.

Conductivity and Salinity

Median conductivity was 0.945 mS/cm or three times higher than the county-wide median and the third highest among 41 Anoka County streams that have been tested (nearby Springbrook was second highest). Salinity averaged about four times higher than other Anoka County streams.

At the upstream monitoring sites dissolved pollutants were lower, but were still substantially higher than other streams in the county. At the Blaine-Coon Rapids City boundary (96th Lane) conductivity averaged 0.643 mS/cm, or two times higher than the median of other Anoka County streams. At 99th Avenue and Pleasure Creek Parkway West (near the stormwater ponds at the headwaters of Pleasure Creek) median conductivity was 0.509 and 0.643 mS/cm, respectively, compared to the county-wide median of 0.318 mS/cm.

Chlorides

Median chlorides at the outlet to the Mississippi was 159 mg/L, which is the second-highest of any Anoka County stream (Springbrook was highest). Chloride levels occasionally approached the Minnesota Pollution Control Agency's (MPCA) chronic standard for aquatic life of 230 mg/L, and in some cases exceed it (maximum observed was 262 mg/L).

Chlorides at the Blaine-Coon Rapids City boundary (96th Lane) and at 99th Avenue and Pleasure Creek Parkway West (near the stormwater ponds at the headwaters of Pleasure Creek) had medians of 71 and 70 mg/L, respectively, which is more than five times higher than the county-wide median of 12 mg/L.

The fact that other nearby streams, such as Springbrook, have similar dissolved pollutant levels further suggests that urban stormwater is an important source. The low phosphorus in

Pleasure Creek suggests that high dissolved pollutants are likely due to inorganic chemical inputs, not organic nutrient-rich inputs like those found in wastewater (see phosphorus section later in this report).

Total Suspended Solids (TSS) and Turbidity

Total suspended solids (TSS) and turbidity both measure solid particles in the water. TSS measures these particles by weighing materials filtered out of the water. Turbidity measures by defraction of a beam of light sent though the water sample, and is therefore most sensitive to large particles.

In Coon Creek TSS and turbidity are low upstream and during baseflow, but increase dramatically during storms and in downstream reaches (see figures below). The stream appears to exceed state water quality standards for turbidity, though it has not yet been listed as impaired by the MPCA.

In Sand Creek, both TSS and turbidity are low in the upstream reaches but are higher downstream, especially during storms

Suspended solids in Pleasure Creek are low, except in downstream reaches during storms.

Coon Creek During baseflow TSS and turbidity were low. Median turbidity during baseflow from upstream to downstream were 8, 4, and 9 FRNU, respectively. This is lower than the countywide median of 9 FRNU and the MPCA's water quality standard of 25. Median TSS during baseflow from upstream to downstream was 5, 9, and 8 mg/L, respectively. This is lower than the median for streams county-wide of 13.5 mg/L. During storms TSS and turbidity are higher. Median turbidity during storms was 1.6 to 7.9 times higher than during baseflow (comparison is among site medians). Median storm turbidity was 13, 30, and 39 mg/L from upstream to downstream. The greatest increase from baseflow to storms was at the Vale Street monitoring site (farthest downstream). Median TSS during storms was 2.5 to 5.1 times higher than during baseflow. Median storm TSS was 19, 20, and 46 mg/L from upstream to downstream. Both measures were much more variable during storms too.

Exceedences At least three observations and 10% of all observations must exceed the water quality standard of 25 NTU to be considered impaired.

Location (Upstream to Downstream)	Total Number of Samples	Number of Samples Exceeding State Standard	Percent of Samples Exceeding State Standard
Shadowbrook	23	3	13%
Lions Park	25	9	36%
Vale Street	15	40	38%

NOTE Half of all readings are during storms and half during baseflow. All except three exceedences were during storms.

Based on this, the MPCA is likely to list Coon Creek as impaired for high turbidity.

There are some questions regarding the appropriateness of such an impaired listing.
1) Turbidity measurements were taken using units of FNRU, not NTU. It is uncertain how these units differ, but the difference is likely small.
2) Coon Creek exceeded the surrogate standard of 100 mg/L TSS only five times.
3) Only one of five transparency tube measurements exceeded that surrogate standard of 20 cm.

However, given the preference for using turbidity directly, these points are likely irrelevant.

Turbidity and TSS problems are most severe in downstream reaches. Readings in downstream areas are typically two-times higher than those from upstream areas.

Median loadings of turbidity and TSS

Location (Upstream to Downstream)	Median storm turbidity (mg/L)	Median storm TSS (mg/L)
Shadowbrook	13	19
Lions Park	30	20
Vale Street	39	46

Sand Creek

TSS is consistently low at upstream sites, but creeps upward at the farthest downstream sites. Down to and including Sand Creek at University Avenue, median TSS reading (6 mg/L) was less than half the median for Anoka County streams (median 14 mg/L) and no readings exceeded it by more than 3 mg/L. Baseflow and storm readings were similar.

Ditch 39 tributary at University Avenue was similar too, but appeared to have slightly higher TSS during storms; the difference is small and not worrisome.

Farthest downstream at Xeon Street, Sand Creek had the highest TSS, especially during storms. During baseflow it was similar to upstream sites (median 4 compared to 6 mg/L), with the exception of one higher reading of 61 mg/L. But during storms at Xeon Street median TSS was 16 mg/L and readings of 114 mg/L was observed.

The results for turbidity were similar; however the stream more often had turbidity that exceeded the county median.

Down to and including Sand Creek at University Avenue, median turbidity was 8 FRNU compared to the county-wide median of 9. This is lower than the Minnesota Pollution Control Agency's water quality standard of 25 NTU. Storm flows and base flows had similar turbidity.

Ditch 39 had over double the turbidity (20 FRNU), but this was only during storms.

Furthest downstream at Xeon Street, baseflow turbidity was similar to all other sites, but storm turbidity was higher. During storms, turbidity at Xeon Street ranged from 4 to 114 FNRU, with a median of 15.5 FNRU.

Pleasure Creek

Upstream portions of Pleasure Creek have low turbidity and suspended solids.

Total suspended solids (TSS) are nearly always lower than the county-wide average at all monitoring sites except the outlet to the Mississippi River.

At these same sites, turbidity occasionally exceeded the county-wide median, but only 2 of 26 (7.7%) turbidity readings exceeded the state's impairment threshold of 25 NTU.

While turbidity and suspended solids are at good (low) levels throughout the upper reaches of Pleasure Creek, high levels regularly occur in the lower portions of the creek. Suspended solids were high, but only during storms, at the creek's outlet to the Mississippi River. Eight storm events have been monitored at that location. Seven had TSS above the median of Anoka County streams, and ranged from 28 to 81 mg/L. Turbidity was higher too, ranging from 18 to 36

FNRU during the same seven storms. Non-storm suspended solids at this site were acceptably low.

E. coli Bacteria

E. coli, a bacteria found in the feces of warm blooded animals, is unacceptably high in Pleasure Creek. E. coli is an easily testable indicator of all pathogens that are associated with fecal contamination. The Minnesota Pollution Control Agency sets E. coli standards for contact recreation (swimming, etc). A stream is designated as “impaired” if:

1. 10% of measurements in a calendar month are >1260 colony forming units per 100 milliliters of water (cfu/100mL) **or**
2. The geometric mean of five samples taken within 30 days is greater than 126 cfu/100mL.

Pleasure Creek Pleasure Creek exceeds both criteria

The creek has not yet been listed as “impaired” by the State because of confusion about whether the analytical methods used for testing were state-approved, but a water quality problem exists regardless.

Sources of the bacteria likely include:

1. Headwater storm water ponds
2. Storm water runoff from throughout the watershed.

Downstream Enough data is available for the downstream monitoring site (outlet to Mississippi River) to clearly document exceedances of the “impaired” criteria.

Upstream At the upstream site not enough data has been gathered, but the E. coli values observed are similar to the downstream site.

2006 In 2006, five samples taken between 5/24 and 6/21 had a geometric mean of 318 cfu/100mL.

2007 May 2007 At the farthest-downstream monitoring site three of four samples exceeded 1260 cfu/100mL (261, 1986, and two samples exceeded the test limits of 2420 cfu/100mL).

Also in 2007, five samples were taken between 5/24 and 6/20, but calculating their geometric mean is impossible because two of the samples exceed the test’s capacity of 2420 cfu/100mL. If we conservatively replace those readings with 2420 cfu/100mL, then geometric mean is 934 cfu/100mL.

2008 In 2008 monitoring occurred at the Blaine-Coon Rapids Boundary (96th Lane) to determine if the problem originated up or downstream of that point. Average baseflow E. coli was 235 MPN/100mL (n=4) and varied little (standard deviation 135). Average storm E. coli was 1102 MPN/100mL (n=3) and varied widely (standard deviation 1187). This is similar to the outlet to the Mississippi River, so it appears that an important bacteria source is within the City of Blaine. It is likely that urban runoff within Coon Rapids is also contributing E. coli to the stream.

2009 In 2009 monitoring moved further upstream to diagnose the bacteria source. The portions of the watershed above the 2008 monitoring site are a network of stormwater ponds in the City of Blaine. 2009 monitoring was designed to determine which drainage areas to these ponds are bacteria sources or if the ponds themselves might be the source. One monitoring site split was mid-way through the pond network (Pleasure Cr Parkway W), while the other was at the outlet of the last pond (99th Avenue, see monitoring sites map above). Most monitoring (6 of 8 occasions) was during storms because the highest bacteria levels were found during storms in previous years. The results suggest that the ponds themselves are a source of E. coli, while additional bacteria may come from the neighborhoods around the ponds.

Effect of Storms E. coli levels were highest and most variable at the outlet to the Mississippi River during storms. Average baseflow E. coli was 257 MPN/100mL (n=8; units MPN/100mL are comparable to cfu/100mL and differ in analytical method) and varied little (standard deviation 179).

During storms average E. coli jumped to 935 MPN/100mL (n=9) and varied widely (standard deviation 1046). A large part of this variability might be explained by the intensity of the storm, phenology of the storm, and when during the storm the sampling was done. E. coli during storms is higher because storms flush bacteria from impermeable surfaces throughout the watershed, and because higher flows suspend and transport E. coli that were already present in the creek.

Effect of Location The monitoring site mid-way through the pond network (Pleasure Cr Parkway W) did have elevated E. coli during baseflow and storms, which suggests that the small drainage area upstream of this site contributes E. coli to the creek. Only two baseflow samples were taken and little flow was moving; E. coli levels were 307 and 770 MPN/100mL, which is moderately high. This would seem to suggest that bacteria levels my have a regular, non-storm related presence in the ponds (i.e. the ponds are a bacteria source). During storms, six samples had widely different E. coli levels. On the low end, one storm had only 34 MPN/100mL and another had only 122 MPN/100mL. These readings are below the state water quality standard. Two other storms had moderate E. coli levels of 307 and 387 MPN/100mL. But during the other two storms E. coli levels were so high they exceeded the laboratory's maximum test result of 2420 MPN/100mL. E. coli levels were not correlated with precipitation totals or stream water level.

The monitoring site at the bottom of the pond network (99th Avenue) had low E. coli during baseflow. Only two samples were taken during baseflow, and the E. coli levels were low (55 and 58 MPN/100mL). While two samples are too few for a confident assessment, it suggests that few bacteria exit the last stormwater pond during baseflow. The last ponds are the largest and deepest, and therefore least likely to harbor bacteria and most likely to remove them during baseflow. While the smaller, shallower upper ponds may harbor E. coli, the larger, deeper lower ponds remove them during baseflow. However, higher flows during storms can allow bacteria to pass through all of the ponds.

E. coli levels during storms at 99th Avenue were much more variable, similar to what was found in the ponds. While one storm sample had desirably low E. coli (104 MPN/100mL), others were high (248, 435, 727, 727, and 1986 MPN/100mL). Again, E. coli levels were not correlated with precipitation totals or stream water level.

There is some evidence that E. coli is not associated with nutrient-rich sources such as wastewater. Phosphorus in Pleasure Creek is low, especially for an urban stream (see 2009 ACD report). If wastewater or other nutrient rich sources were significant, phosphorus would be higher.

Fecal coliform and fecal streptococcus bacteria testing was done at 99th Avenue to determine if the bacteria source was human sewage. The feces of different animals have different ratios of these two bacteria types.

Admittedly, this is an imperfect test for several reasons.

First, pollution from multiple sources can alter the ratio. Second, bacterial ratios will change over time because of different die-off rates; fecal streptococci die-off faster thereby increasing the ratio and possibly resulting in incorrect determinations that the bacterial source is human.

Research has found that these bacteria types can survive and reproduce outside of the digestive tracts of warm-blooded animals. The population dynamics of these "free-living" bacteria could affect the ratio. These limitations are important to recognize when interpreting the data.

Coon Creek In 2011 the MPCA informed the CCWD that the Creek was exceeding State standards for bacteria at the Vale Street, Coon Rapids site.

No detailed data have been provided at the time this report was prepared.

Dissolved Oxygen

Coon Creek Dissolved oxygen was similar at all sites, only once dropping below 5 mg/L at which point some aquatic life becomes stressed.

Sand Creek Dissolved oxygen in Sand Creek was within the acceptable level on 95% of the site visits. On four occasions it dropped below 5 mg/L. These four readings occurred at three different sites; two during storms and two during baseflow. Three occurred in 2009, which was a severe drought year. Stagnant conditions are probably responsible for these low oxygen conditions, and are likely natural.

Pleasure Creek Dissolved oxygen was at acceptable levels commonly found in the area

Total Phosphorus

Total phosphorus (TP) is a common nutrient pollutant. It is limiting for most algae growth.

Coon Creek Total phosphorus (TP) in Coon Creek was consistently low during baseflow conditions, but more than doubled during storms.

<u>During baseflow</u> the three monitoring sites had median TP of 70, 76, 77 ug/L, respectively, from upstream to downstream. This is much lower than the countywide median for streams of

126 ug/L. There was little variability among baseflow samples, with only three samples exceeding 126 ug/L. The maximum was 179 ug/L.

During storms TP was higher, and sometimes much higher. Median TP during storms was 2.5 times the median for baseflow at each site. Storms also had much greater variability. The standard deviation for storm readings were 99 mg/L at Shadowbrook, 102 at Lions Park, and 159 at Vale Street. By contrast, the standard deviations during baseflow were 22, 34, and 33 mg/L, respectively. Variation in the timing, magnitude, and intensity of the storm is likely responsible for the greater variability in TP during storms compared to baseflow.
TP increased in an upstream to downstream direction during storms. While median storm TP was similar at the three sites (174, 194, and 192 ug/L, respectively, upstream to downstream), the Vale Street site had the highest individual readings and much more variability. At Vale Street there were six readings over 300 ug/L, while there were three such instances at Lions Park and only one at Shadowbrook. More sampling events at Vale Street could partially explain this.

Sand Creek Total Phosphorus is generally low in Sand Creek. Median Sand Creek TP for all sites in all years during baseflow (0.063 mg/L) and storms (0.094 mg/L) were below the median for Anoka County streams (0.126 mg/L) and below the published value for minimally impacted streams in this ecoregion (0.130 mg/L). While TP is slightly higher at most sites during storms compared to baseflow, this difference is minor. No apparent TP increase occurs from upstream to downstream; all sites are similar, including the tributary ditches.

These low phosphorus levels, even during storms, are surprising in a suburban setting. The fact that the watershed is mostly residential probably helps to keep phosphorus inputs relatively low. Additionally, storm flushing into Sand Creek is light; the hydrograph is relatively flat, even in response to moderate storms.

Pleasure Creek Phosphorus in Pleasure Creek is low. In Pleasure Creek total phosphorus was consistently lower than the median for Anoka County streams at both the upstream and downstream monitoring sites. It was highest at Pleasure Creek Parkway West, but this is not surprising given that this site is within a network of stormwater ponds designed to capture these pollutants. At the downstream end of the stormwater ponds phosphorus was lower. This is evidence that the ponds are effectively removing that pollutant.

pH

Coon Creek pH was within the expected range at all sites, with one exception. pH is expected to be between 6.5 and 8.5 according to MPCA water quality standards. While occasional readings outside of this range did occur, they were not large departures that generate concerns. pH was notably lower during all storm events, but this is not surprising because rainfall has a lower pH and the creek serves as a stormwater conveyance for four cities. One unusually low pH reading of 6.24 occurred on July 20, 2009. The reason for this low reading is unknown, but it appears to be isolated.

Sand Creek Sand Creek pH was within the expected range at all sites and during all conditions, ranging from 7.05 to 8.71. The median was 7.65. The Minnesota Pollution Control Agency water quality standards set an expectation for pH between 6.5 and 8.5. At the farthest downstream sites (Ditch 39 at University Ave and Sand Cr at Xeon), storm pH was noticeably lower than baseflow, but this is likely because of higher percentage by volume of rain downstream. Rainwater has a lower pH.

Pleasure Creek pH was at acceptable levels commonly found in the area

Maintenance Regime	Reach	2008	2009	2010
Unmaintained	D58 x 165th	ACD	ACD	ACD
	D58 x Andover Bld		ACD	ACD
	Sand Creek x Olive		ACD	ACD
	Coon Creek x Egret[1]	ACD	ACD	ACD
Maintained	D59-4 x Bunker Lake Bld	ACD		ACD
	D41 x TH65	ACD	ACD	ACD
	Coon Creek x TH65[1]	ACD	ACD	ACD
	Coon Creek x 131st	ACD	ACD	ACD
[1]Locations of MPCA 2000 Samples				

Implications of Changes in Water Quality

Pleasure and Coon Creeks Exceeds State Standards for E. Coli and Could be Impaired

On all accounts, Pleasure Creek at the outlet to the Mississippi River exceeds the State of Minnesota E.coli standard for contact with the water.

Pleasure Creek E. coli levels are not Waste Water Related

The lack of nutrient inputs despite high levels of other dissolved pollutants and E. coli lends some insight into the source of the pollutants.

High dissolved pollutants are likely due to inorganic chemical inputs, not organic nutrient-rich inputs like those found in wastewater. Likewise, it indicates that the source of E. coli is not likely to be active inputs of wastewater.

The Biological Impairment Listing of Coon, Sand and Pleasure Creeks is Inappropriate

The biomonitoring results point to a number of problems with the current system of identifying biological impairments and correcting them.

First, MPCA's use of single samples to determine impaired conditions does not take into account the variability in natural environments and is therefore prone to erroneous results. In the case of Coon Creek, it appears that they may have overestimated long-term stream health.

Secondly, there are questions about the appropriateness of state biological standards for streams being applied to ditches. The MPCA has recognized this and begun developing tiered biotic standards for different types of waterways, but until those are completed the current "impaired" designations have not been rescinded. The fact that Coon Creek's biota is typical among the Anoka County streams monitored provides some evidence that either many streams are biologically impaired or the standards are inappropriate.

Third, a single biotic impairment designation for all of Coon Creek is inappropriate because of the great variability throughout this watershed. Two sampling sites are not sufficient to understand the entire creek length, especially in such a diverse watershed; the MPCA plans to monitor more sites in 2010. Any total maximum daily load study for Coon Creek will likely identify different stressors in different areas. In upstream areas, which have experienced greater disturbance through ditching, habitat is likely most limiting to stream life. Farther downstream, habitat is better but water quality is poorer. Many of the stressors will be related to factors that are difficult to change, such as the effect of 100 years of ditching activity or urban development. More realistic protocols are needed that allow managers to focus on realistic ways to improve stream health.

A final concern is the use of biological stream standards in the total maximum daily load (TMDL) framework. This framework originated from the Federal Clean Water Act and was used to address industrial, point source pollutants. The process is based upon determining the maximum amount of pollutant that can be discharged while still meeting water quality standards. Biological standards do not fit this approach. Biota are not a stressor or pollutant. A TMDL for impaired biota begins with a stressor identification process. This process focuses on water quality. In many waterways, but most obviously ditches, habitat may be the problem, not water quality. In other cases, the stressors identified (usually TSS or DO) may only be partial or intermittent factors. Efforts to address any one factor may be beneficial, but not result in the biotic community outcomes that are sought.

Sand, Pleasure and Springbrook Creeks are Approaching Chronic Chloride Problems

Sand, Pleasure and Springbrook Creeks have water quality problems that affect aquatic life, recreation, and pose a health threat to humans that contact the water.

Urban stormwater is likely the most important source of dissolved pollution. No one neighborhood or city seems to contribute disproportionately to the problem; the source is diffuse. Urban storm water is known to generally carry high levels of dissolved pollutants. The Pleasure Creek watershed is densely populated and has a high percentage of impervious surfaces. In the older areas, the stormwater treatment measures in place are much less than would be required of a similar development built today. While up-to-date stormwater treatment such as settling ponds, street sweeping and catch basins do exist in part of the watershed, these practices are designed to remove particulate pollutants, and do not effectively remove dissolved pollutants.

Given that dissolved pollutant concentrations are similar during baseflow and stormflow, urban stormwater is not likely the only contributor. Dissolved pollutants during baseflow are from one or more of the following:

- Conductivity and salinity sources likely include road deicing salts as well as a broad mixture of other chemicals found on roads and other impervious surfaces.

- Dissolved pollutants that have permeated into the shallow groundwater that feeds the stream during baseflow.
- Continuous discharges to the creek, such as industrial wastes or illicit discharges through the stormwater conveyance system.
- Storm water ponds upstream which may retain pollutants from storms and release them to the creek continuously.

In any case, there are multiple sources of dissolved pollutants to these creeks. There was little difference between storm and baseflow conditions. If road runoff was the primary dissolved pollutant source, then readings would be highest during storms. Dissolved pollutants can also easily infiltrate into shallow groundwater that feed streams during baseflow. If this has occurred, dissolved pollutants will be high during baseflow.

Coon, Pleasure and Sand Creeks Regularly Exceed State Turbidity Standard

There is likely enough data for the MPCA to consider Coon, pleasure and Sand Creeks "impaired" due to violations of turbidity water quality standards.

Whenever possible, MPCA prefers to use turbidity for these determinations rather than use TSS and transparency tube as surrogates. A minimum of 20 readings are required. At least three observations and 10% of all observations must exceed the water quality standard of 25 NTU to be considered impaired.

Higher flows in downstream areas probably contribute to greater bedload transport of sediment. Greater impervious area in downstream portions of the watershed results more urban stormwater runoff, which is often high in suspended materials. The lower portions of the Coon Creek watershed were mostly developed before rigorous stormwater treatment regulations were enacted.

In the case of Pleasure Creek, because of the positioning of monitoring sites, we can confidently say that high suspended solids during storms originate within the City of Coon Rapids. This is the oldest developed portion of the watershed and has fewer stormwater treatment facilities. The source of suspended solids is likely materials swept into the creek through storm water conveyances, but may also include spot erosion of the stream bank.

Based on the monitored data, the MPCA is likely to list Coon Pleasure and Sand Creeks as impaired for high turbidity.

There are some questions regarding the appropriateness of such an impaired listing.

1. Turbidity measurements were taken using units of FNRU, not NTU. It is uncertain how these units differ, but the difference is likely small.
2. Coon Creek exceeded the surrogate standard of 100 mg/L TSS only five times.
3. Only one of five transparency tube measurements exceeded that surrogate standard of 20 cm.

However, given the preference for using turbidity directly, these points are likely irrelevant.

Insufficient Water Quality Data Exists for Springbrook Creek

In 2003 the Anoka Conservation District with the support of the Six Cities Watershed Management Organization and the City of Fridley along with the MPCA made a good faith effort to address the water quality and hydrology concerns on Springbrook Creek. Equipment failures, data corruption and the complexity of the watershed made accurate assessment and diagnosis of problems and the hydrodynamics in play with those problems impossible and confounded further continuous monitoring of Springbrook Creek

Management Needs

Continue Water Quality Monitoring

Water quality monitoring needs to continue on Coon Creek and the principle tributaries and watersheds including Springbrook Creek

Cooperate on the Upper Mississippi River bacteria (E. coli) TMDL study

Join the Upper Mississippi Bacteria TMDL Study. The Minnesota Pollution Control Agency will begin this study in 2010. They are seeking partners for monitoring, and will at least partially fund it. Their monitoring will be more intense, but less diagnostic. More may be learned through this monitoring, but the more substantial benefit of joining this project would be access to funds for correcting the problem after the study is done.

Clean stormwater ponds frequently to Address E. Coli

The network of stormwater ponds that the creek flows through in Blaine should receive regular removal of accumulated sediments and trash. The shallower, smaller ponds should be of highest priority for more frequent cleaning. The goal should be to remove organic materials and sediment that provide a substrate for bacterial growth. While the ponds are effectively removing suspended solids and phosphorus, maintaining the ponds will improve their effectiveness.

Catch basin testing, increased cleaning to Assess E. coli levels

By testing water and sediment from catch basins during dry weather conditions it can be determined if they are acting as reservoirs for bacterial survival. If E. coli concentrations are high, more frequent cleaning should be considered. This activity should be targeted in the Blaine neighborhoods draining to stormwater ponds first because of the known issues in that area. If problems are found there, similar work in Coon Rapids should occur.

Targeted public education on Dissolved pollutants, E. coli, and suspended solids

Given that the likelihood of contact with water is low, especially during storms when E. coli is highest but flows are most hazardous, the focus of public education need not be water contact advisories. Instead, a blended public education messages that states the risks and problems but focuses on changing behaviors that will alleviate the problem should be undertaken.

Subwatershed Plans or Retrofit Assessments Should be Conducted for Springbrook, Pleasure, Lower Coon and Middle Coon Creeks

A comprehensive assessment of the watershed for opportunities to improve stormwater treatment and ranking of those opportunities by cost-effectiveness should be undertaken. A focus should be practices that most effectively address bacteria, dissolved pollutants, and reducing storm flow rate and volume. Project and practices identified through this process should be installed. The Anoka Conservation District has staff specialized in this process and can assist.

From a management perspective, water quality improvement projects should focus upon treating stormwater, especially in the lower half of the watershed. Retrofitting the existing stormwater conveyance and treatment system will be necessary in many instances. Where redevelopment occurs, improved stormwater practices should be installed. In some areas, stabilization of the creek itself is needed; several areas of significant streambank erosion exist. This is not surprising given that upper reaches of the creek have been ditched.

In addition to the data presented above, some transparency tube data and photos are available from the Anoka Conservation District. Transparency tube readings were not included in this report because they were taken only in 2009 and because in many instances water clarity was greater than the tube's length, resulting in a reading of >100cm.

Corrective actions should include:

- Heightened best management practices that keep suspended materials from reaching stormwater conveyances, such as street sweeping, settling ponds, swales, and others.
- Reduction of storm flow velocities in the creek by improving storm water detention or infiltration throughout the watershed. This will reduce the size of particles that can be carried and reduce streambank erosion.

Water Quality Inventory

Inventory water quality on all Coon Creek Watershed System lands as needed for management of all District resources. Inventory water quality characteristics when land and resource management plans are being developed. Develop statistical sampling design based on analysis procedures that provide the desired water quality interpretations.

Display the results of inventories characterizing water quality using maps, data bases, or other appropriate documentation. Inventories should be analyzed and interpreted to help establish management objectives. Water quality inventories must provide specific information sufficient to address issues and concerns identified in land and resource planning and management activities.

Analysis and Interpretation of Water Quality Data

Analyze and interpret water quality inventory data to predict the effect of proposed land management practices on present and future water quality. Use this information, along with watershed condition and other soil and water resource data, to develop improved design of management practices, provide a comparison of outputs under alternative management practices, and establish a basis for use in defining water resource management objectives. The analysis must be rigorous enough to make definitive statements concerning anticipated water quality response. Apply a risk analysis to selected alternatives.

Water Quality Standards, Rules and TMDLs

Participate in review of State standards and work toward change where consideration is not given to the following factors:

1. Standards should reflect local as well as State and Federal water quality objectives; be related to beneficial uses, and recognize natural background and variability

2. Compliance with approved best management practices

for control of nonpoint sources should constitute compliance with water quality standards and these practices should be based upon site-specific conditions and should include a consideration of political, social, economic, and technical feasibility.

3. Water quality standards that reflect nonpoint source conditions should be used to measure effectiveness of best management practices

4. Consideration should be given to evaluating certain water quality concerns, such as sediment, by observing a surrogate such as channel condition

5. Antidegradation policy should include a consideration of both time and space and should not be based on change at a single point

Water Quality Planning

Consider the quality of the District's water resources and establish goals and objectives for water quality management in the land and resource planning process. Inventory and analyze the characteristics of the water resource to provide background information for determining water quality management goals and objectives.

When establishing water quality management objectives, consider

1. The needs and concerns of local interests, as well as regional and state users

2. The long-term and short-term natural water quality characteristics

3. The cumulative effects of pollution sources in and out of the Watershed

Emphasize preventive conservation practices in all water quality management programs. Tailor such practices to individual site characteristics. Include definition of practices, application of practices and evaluation to ensure that prescriptions achieve water quality goals.

Coordinate Watershed District land management planning with water quality management planning by State and local agencies pursuant to Section 208 of Public Law 92-500, as amended (Clean Water Act).

Water Quality Monitoring

Water quality monitoring is an evaluation of the success of meeting water quality goals, objectives, and targets identified in the Comprehensive plan or Subwatershed plans. The Comprehensive plan provides guidelines for establishing a monitoring program. Included are criteria for identifying specific activities to monitor, expected precision, accuracy, and reliability of results, and for determining an appropriate balance between long-term and short-term monitoring. Consider utilizing surrogates for evaluation of water quality impacts. For example, evaluate channel condition in place of sediment sampling.

Plans of Operation

Water quality monitoring requires systematic sample design, data collection, analysis, and reporting processes. Design these systematic processes to meet monitoring requirements specified in the Watershed Plan or available guides and establish them in an approved monitoring plan of operation prepared prior to start of monitoring activities.

Pollution Control

Coordinate Watershed District plans and activities with water quality management planning and implementation efforts of local, State and local water quality management agencies

Delegate appropriate District personnel to advise other agencies when critical lands or facilities within the watershed are included in water related projects

Designate Watershed District coordinators to participate directly with the local or State water quality management agency in all levels of the stormwater management planning effort where Watershed District facilities and lands are significantly involved.

State and Local Water Quality Management

Identify the Watershed District as the management agency for lands or resources under Watershed District administrative control when developing cooperative agreements with individual Cities.