Stream Flow
Current Plan

In 2009 the Coon Creek Watershed updated the hydrologic modeling for the watershed using XPSWMM (Wenck & Assoc, 2009)

These studies focused on determining:

- Peak Flows
- Runoff Volumes
- Peak Flow Times
- Runoff Hydrographs

Stream flow in the watershed is composed of ground and surface water (USGS 1985, Lord 1993, Moering 1993).

The National Flood Insurance Program sponsored flood insurance studies for the communities of Andover, Blaine, Coon Rapids, Ham Lake and the unincorporated areas of Anoka County, including what is now the City of Columbus.

Crest gauges are, or have been, in operation at various points along the main stem of Coon Creek and major tributaries since 1979.

Plan Updates

The XPSWMM model is an event based model that uses the NRCS Curve Number method to model the dynamic, unsteady flow of the watershed to account for the effects of storage and backwater in conduits and floodplains and the timing involved at a variety of geographic scales.

The model and the data contain results for the 2-, 10-, 25- and 100-year, 24-hour storm events.

Trends in Stream Flow

Effect of one inch Precipitation

Year	Effect
1985	does not produce significant runoff
1999	needs to be managed either through infiltration or rate control
2009	Water levels increase substantially

These observations derive from approximately the same locations within the watershed and reflect two important changes and conditions within the watershed:

- Urbanization

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- Stormwater Strategy

(Anoka County Water Atlases, ACD)

Time to Peak Flow (hrs)

			Hours		
Ditch	**Location**	**City**	**1999**	**2009**	**Chng.**
Coon Creek	Coon Hallow	Coon Rapids	32	24	-7.5
	Main Street	Coon Rapids	26	20	-6
	S Coon Creek Dr	Andover	25	17	-8
	Central Ave	Ham Lake	21	35	14
	Radisson Rd	Ham Lake	20	35	15
Sand Creek	Xeon	Coon Rapids	25	24	-1
	Central Ave	Blaine	18	27	8.8
Ditch 58	Andover Bld	Ham Lake	20	35	15

Peak Flows (cfs)

Peak Flow			**Cubic Feet per Second**		
Ditch	**Location**	**City**	**1999**	**2009**	**Chg**
Coon Creek	Coon Hallow	Coon Rapids	994	650	-344
	Main Street	Coon Rapids	853	370	-483
	S Coon Creek Dr	Andover	810	350	-460
	Central Ave	Ham Lake	470	315	-155
	Radisson Rd	Ham Lake	417	283	-134
Sand Creek	Xeon	Coon Rapids	267	150	-117
	Central Ave	Blaine	179	35	-144
Ditch 58	Andover Bld	Ham Lake	113	135	22

Volume of Flow

Volume			**Acre Feet**		
Ditch	**Location**	**City**	**1999**	**2009**	**Change**
Coon Creek	Coon Hallow	Coon Rapids	2600	2765	165
	Main Street	Coon Rapids	1734	1705	-29
	S Coon Creek Dr	Andover	1511	1490	-21
	Central Ave	Ham Lake	813	1004	191
	Radisson Rd	Ham Lake	724	876	152
Sand Creek	Xeon	Coon Rapids	494	544	50

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	Central Ave	Blaine	179	35	-144
Ditch 58	Andover Bld	Ham Lake	298	427	129

Flow Duration (Days)

Flow Duration			Days		
Ditch	Location	City	1999	2009	Change
Coon Creek	Coon Hallow	Coon Rapids	6	12	5.7
	Main Street	Coon Rapids	7.9	11	3.1
	S Coon Creek Dr	Andover	7.5	11	3.5
	Central Ave	Ham Lake	8.3	7	-1.3
	Radisson Rd	Ham Lake	8.3	6	-2.3
Sand Creek	Xeon	Coon Rapids	5.8	12	6.2
	Central Ave	Blaine	3	13	9.7
Ditch 58	Andover Bld	Ham Lake	5.4		

Implications of Changes in Stream Flow

Lower Coon Creek Flashiness

Lower portions of the watershed (Drainage area below U.S. 10) have become increasingly flashy over the past 20 years. This condition is a result of

<u>The Age of the Neighborhoods</u>: The subwatersheds that contribute directly to lower coon creek are fully developed and have been long before any of the current stormwater or water quality management programs. Most of the development in this portion of the watershed was built in the 1950's, 60's and early 70's when the stormwater paradigm was to prevent flooding by getting water off the land. Consequently the stormwater infrastructure focuses on collection and conveyance

<u>Coon Creek Flood Control Strategy</u>: The flood control strategy for Coon Creek in Coon Rapids has relied upon Coon Rapids below Main Street is discharge first and quickly since the 1960, 70's and 80's. This strategy was designed to accommodate increased volumes of water arriving in Coon Rapids from the then agricultural lands upstream. This strategy is well entrenched in the infrastructure and policies developed within the Coon Creek Watershed and remains a successful and prudent strategy to this day.

<u>Higher intensity, shorter duration rain falls</u>: If we apply the changes discussed in the discussion on precipitation to the lower Coon Creek Watershed we see higher quicker peak discharges for these areas and a greater potential for flash flooding.

Increased Potential for Stream/Ditch Bank Erosion

The Creek and ditches are subject to the natural laws of physics and as such can be considered a delicately balanced mechanism that is constantly changing and evolving. The Creek and ditches must constantly adjust to changes, either natural or those caused by human activity, in order to maintain its balance. The most common compensating actions are streambank erosion and bed scour or sedimentation.

All streams and creeks naturally erode their beds and banks and deposit the resulting sediments. However, over time, natural systems tend to reach an equilibrium state where erosion at one location is roughly balanced by deposition at another. However, if events occur which alter the streamflow or sediment supply/characteristics, then accelerated or unexpected erosion may occur.

The principal factors affecting streambank/bed erosion are:
1. Flow Characteristics
2. Bank & Bed Material
3. Bank Vegetation

The streambed acts as a foundation for its banks. If streamflow or maintenance activities scour out the bed, and in the process erodes the bank toe, then the upper bank may no longer have any support and failure can follow. Alternatively, when a stream can no longer carry its sediment load, material will be deposited on the streambed. As a result the streambed will rise, reducing the capacity of the stream channel. When the next high flow occurs, the stream will seek to create sufficient area to convey the needed volume of water. As the water rises bed loads will be transported and the banks may be eroded.

Streambank failure is the result of several physical

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processes working singly or in combination. In general, these processes may be classified as either surface phenomena (the removal of soil particles from the bank by streamflow), or as subsurface phenomena (collapse of a saturated bank following a rapid drop in water level). The two are usually interrelated.

Streambank erosion is a continually occurring natural phenomenon that may be accelerated or decelerated by human activity. For most streams the majority of streambank erosion occurs during and just after high flows. Erosive forces during high flows may be 10 to 100 times greater than during normal flows.

A streambank is in a stable state when the forces acting on the bank that may cause failure do not exceed the ability of the bank to resist these forces. When a bank fails, it "sloughs off," either in a thin layer or as a large mass of soil material sliding down the bank. The cause of the failure can be either:

1. A reduction in the shear strength of the bank. These reductions in shear strength can be caused by:

    Absorption of Water
    Increased internal Pressure due to Groundwater within the Bank
    Movement of the Soil

2. An increase in the shear strength acting on the bank. Increases in shear stress can be caused by:

    Changes in Channel Shape
    Increased Loadings on the top of the bank
    Rapid Drawdown of water on the face of the bank

3. A combination of the above two factors.

Increased Turbidity & Suspended Solids

A consequence of the above factors is a water system that has a greater potential to generate erosive forces and suspend the sands that are so prevalent in the drainage area.

Management Needs

Decrease Velocities

Flow velocities need to be reduced to the point where they are not contributing to upstream flooding be retarding flow

Increase Stream Bank

Stream and Ditch banks containing highly erodible or

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Protection potentially highly erodible soils and are receiving flows contributing to erosion and eventually bank failure should be evaluated for some form of armoring.

Retrofit Studies and Projects Over the past 10 years the Watershed District has monitored water quality exceedences in Lower Coon Creek at Coon Hallow and Lions Park and on Sand Creek at Xeon.

In 2009 the Watershed sponsored a retrofit study for lower Sand Creek followed by 2 pond retrofit projects in 2010 that targeted the Sand Creek exceedences.

In 2010 the District sponsored a retrofit study of Woodcrest Creek in Lower Coon Creek and a stream bank stabilization of 1,800 feet to also target some of the contributors to the Turbidity and TSS levels being monitored at Coon Hollow

TMDL Development: Source Contributors These retrofit projects also are coordinated with the MPCA's planned efforts to develop a TMDL for Biota for the District in 2013