Demand for Flood Control

Causes of Flooding and Property Damage

Floods occur when ponds, lakes, riverbeds, soil, and vegetation cannot absorb all the water. Water then runs off the land in quantities that cannot be carried within stream channels or retained in natural ponds, lakes, and man-made reservoirs. About 30 percent of all precipitation becomes runoff and that amount might be increased by water from melting snow.

The Watershed District has found that flooding can occur in the watershed both upstream and downstream from changes in land use.

The flooding is generally due to the flat nature of the watershed, and increases in the rate of runoff, and the volume of runoff resulting from site hardening. The result is often more water than a ditch or watercourse was designed to convey and can result in water backing up stream and preventing discharge and subsurface drainage from occurring.

Within the Coon Creek Watershed, Flooding is caused by many factors:

- Landscape Position
- Heavy rainfall
- Highly accelerated snowmelt
- Failure of dams, levees, retention ponds, or other structures that retained the water
- Unexpected drainage obstructions such as bank failures, ice, or debris can cause slow flooding upstream of the obstruction.

Flooding can be exacerbated by:

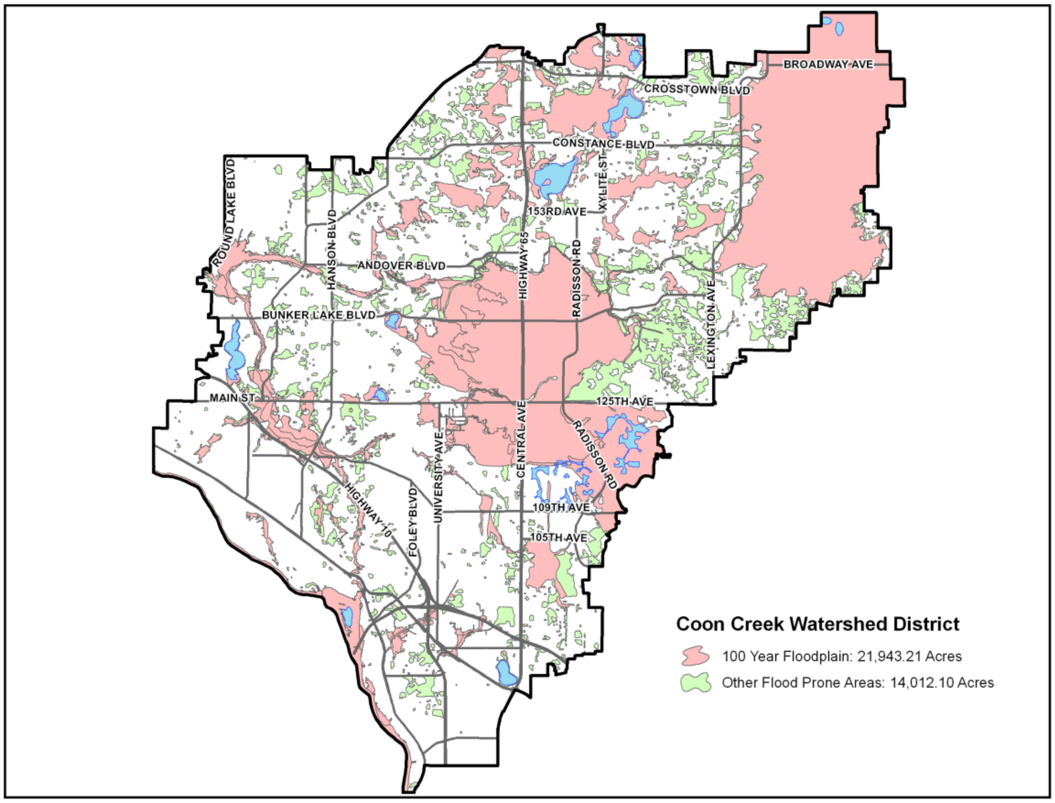
- Increased amounts of impervious surface

Landscape Position/ Flood Prone Areas

At present the system is designed and maintained to convey a 25 year event (4.7 inches in 24 hours) with no inconvenience or damage to people or property. The channel, combined with the flood plain and the District, Municipal and State regulations are designed to prevent or minimize structural as well as operational damage from the 100 year event (6 inches in 24 hours)

In the past 10 to 20 years, the District has experienced varying degrees of drought. Consequently, a significant number of the Watershed’s population have never seen or been forced to contend with what is required to live with naturally high water levels, or dealt with the consequences of poor land use decisions or circumventing rules designed to limit land uses inconsistent with the nature of floodplains.

The Federal floodplain maps for the watershed are shown below



Rainfall Over the past ten years annual precipitation has generally decreased causing drought conditions. While annual precipitation has generally been below the normal annual fluctuation and the droughty conditions are among the driest on record, the occurrence of below normal precipitation has not altered the expected frequency, duration and intensity for this area of the state.

Some flooding within the watershed generally occurs after approximately 4 inches of precipitation. The probability and durations for a 4 inch rain event are presented below

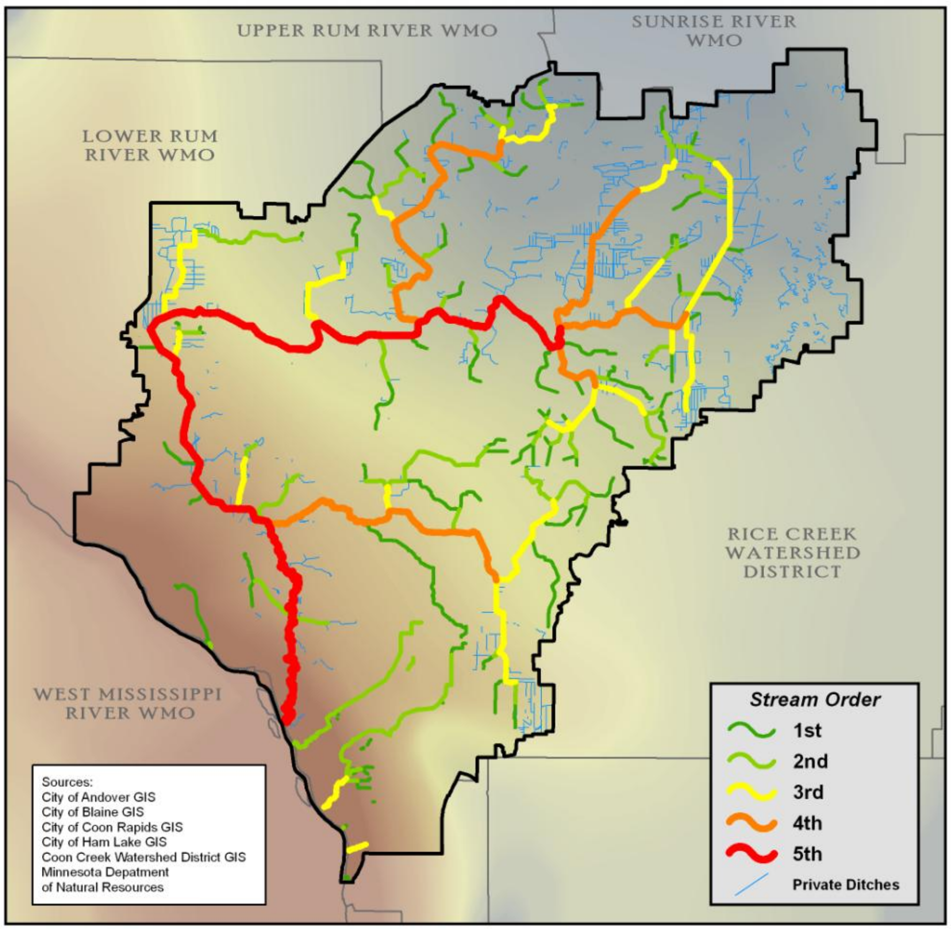
Frequency (Yrs)	Annual Probability	12 Hours (in)	24 Hours (in)	48 Hours (in)
5	20%			4.2
10	10%		4.1	4.8
25	4%	4.1	4.7	5.7
50	2%	4.6	5.2	6.3

100	1%	5.1	5.9	7.0

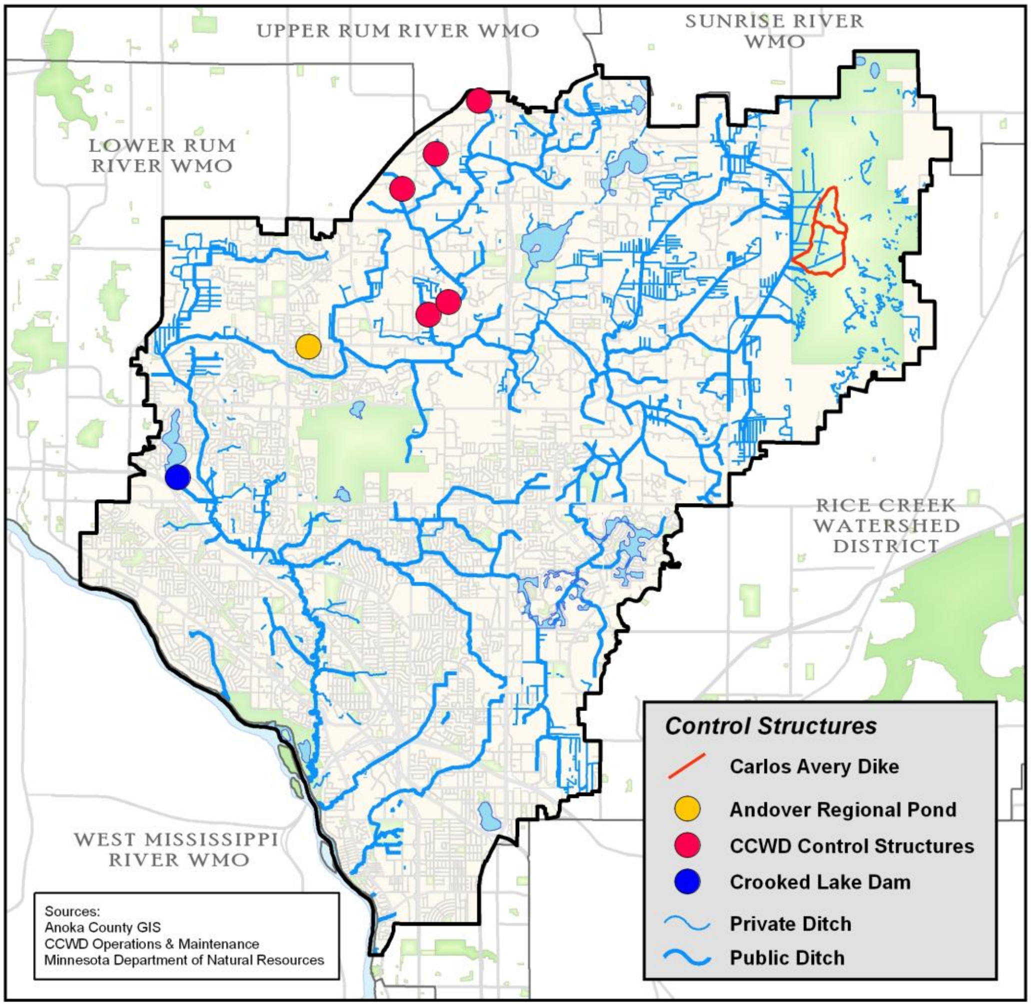
Snowmelt Rapid snow melt can be a source of water volumes beyond the capacity of the drainage system. During the spring when warm days and more direct sunlight are facilitating melt a warm front and or a rain event of relatively warm water can yield and equivalent of 4 or more inches of water resulting in both localized and regional flooding.

Frequency (Yrs)	Annual Probability	2 Day (in)	4 Day (in)	10 Day (in)
5	20%	4.2	4.9	6.3
10	10%	4.8	5.7	7.4
25	4%	5.7	6.6	8.8
50	2%	6.3	7.4	9.8
100	1%	7.0	8.1	10.9

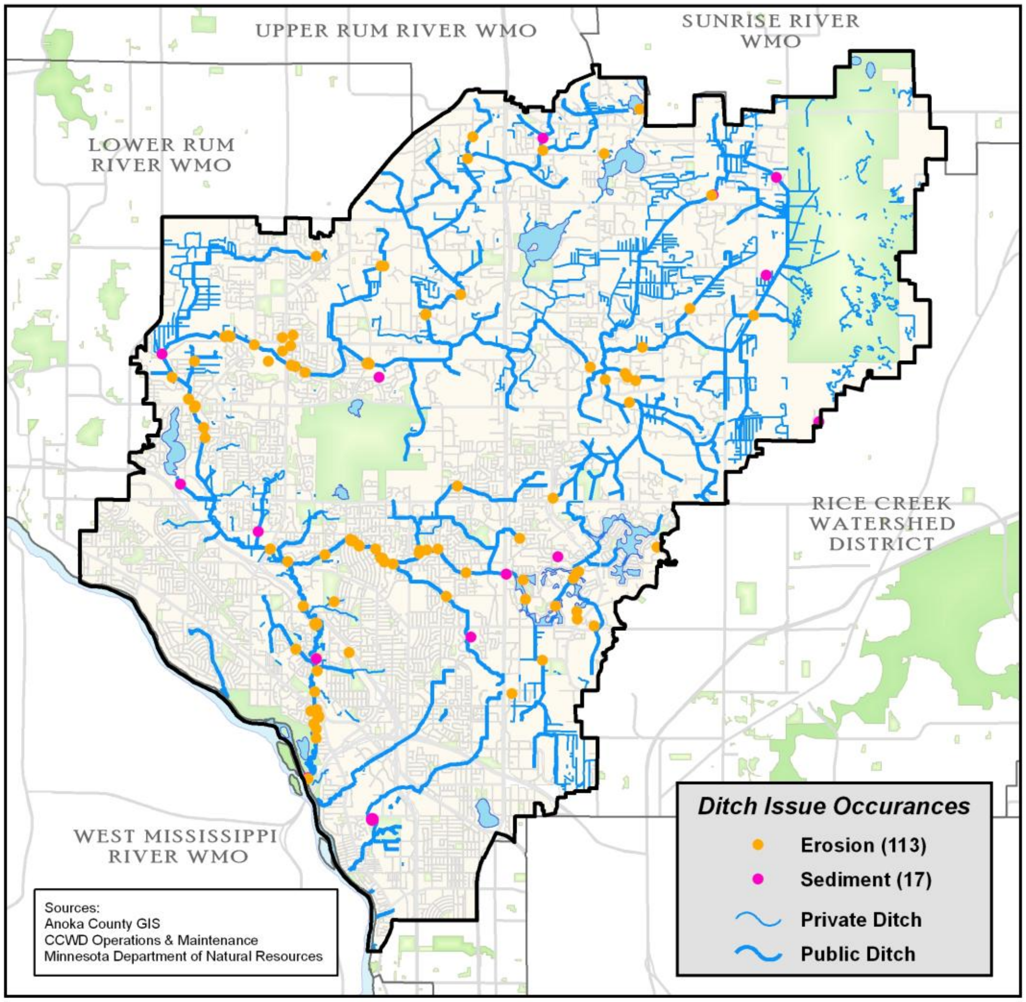
Rises in Groundwater Because of the naturally high ground water levels in the watershed and annual fluctuations of 3 to 5 feet flooding can occur in structures that do not have sufficient separation or are constructed at times when surficial groundwater levels are low.



Sudden Release of Water or Failure of Impoundment Failure of water control structures, levees, retention ponds, or other structures that retain water can lead to localized flooding. There are eight such structures within the watershed.

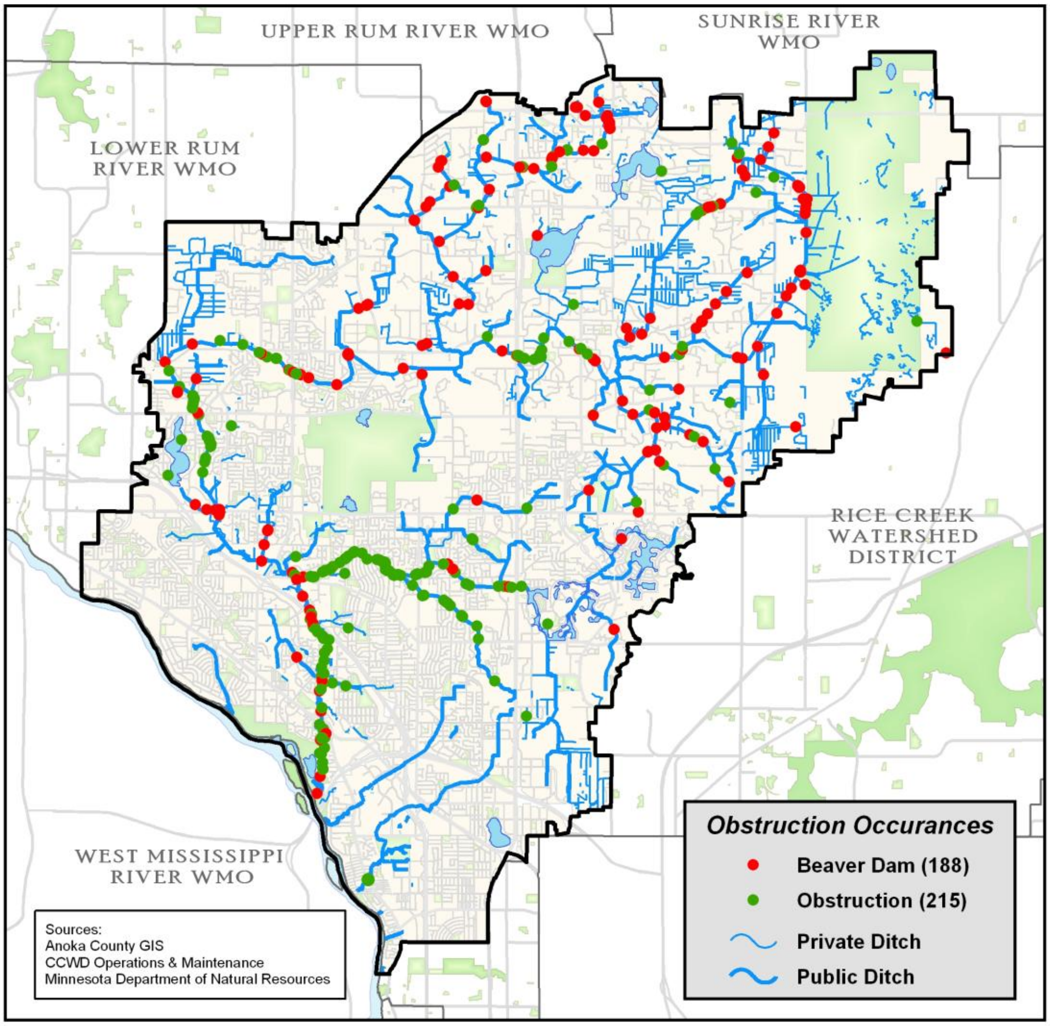


Sediment Buildup in Channel Sediment build up within a channel from either bank failures, erosion up stream or accumulation of bed load, acts to reduce the capacity of the channel and raise the elevation at a point in the flowage. Both situations result in ponding water upstream and require flows to leave the channel at a certain volume (flood) in order to continue downstream.



Obstructions Complete or partial obstruction of an outlet or drainage system due to:

- Culvert blockages from ice build up, or debris
- Trees down in the channel can form dams
- Beaver Dams

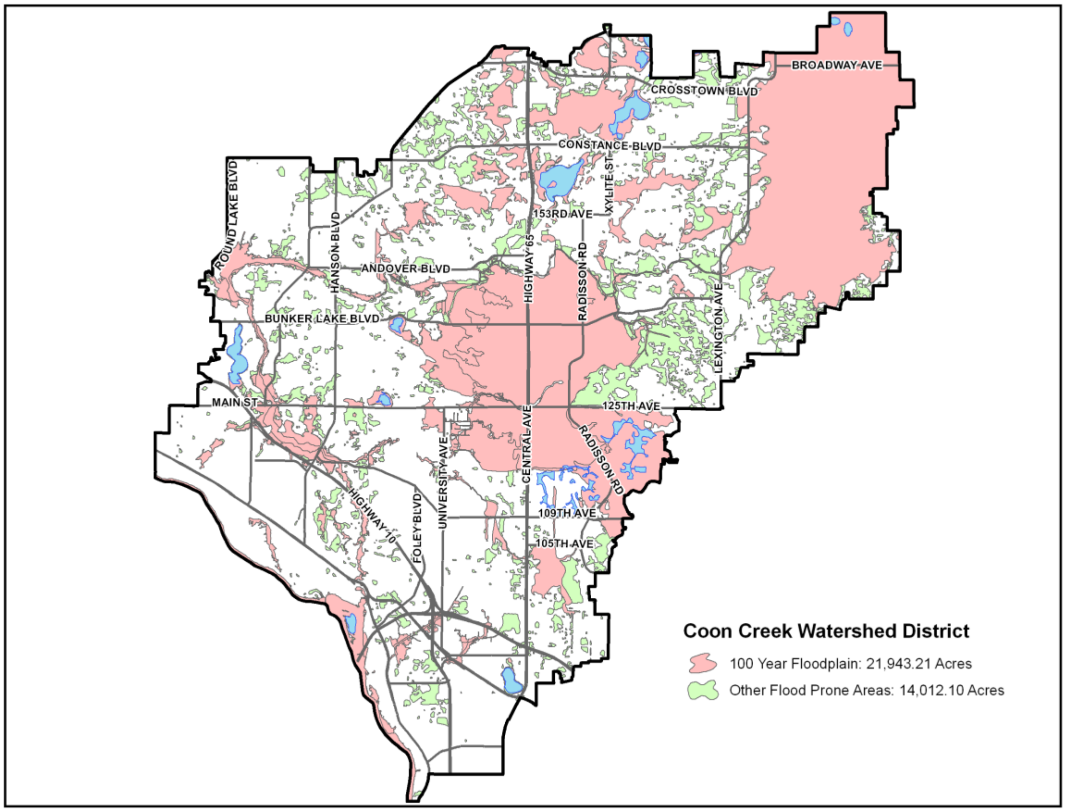


Flood Control Capacity

The Coon Creek Watershed is within the Anoka Sand Plain, an area of relative flat topography and historically high water tables. The result combines to make approximately one half of the watershed flood prone, hence the importance of drainage and maintenance and repair of the drainage system.

Within the Coon Creek watershed there are four strategies employed to control flooding and the impacts associated with floods. The strategies are used in combination to prevent and/or reduce the adverse effects of flooding.

The Federal floodplain maps for the watershed are shown below



Water Level Control

Water level control either through dams (impoundments) or pumps is a time honored flood control strategy. Dams act to hold or store 'excess' water from arriving downstream and either contributing to flood conditions through volume or the time of arrival.

Volume control, primarily through infiltration, is intended to reduce the volume of water flowing into the creek or stream that is subject to flooding.

Rate control is the process of detaining water in a pond or other structure and releasing small enough quantities to achieve essentially the same result as volume control, reduce the amount of water contributing to out of bank flow.

Pumps are typically employed to protect relatively small areas (1 to 10 lots) for discreet periods of time (days to weeks) and are used in conjunction with dikes or some structure such as a road, to separate the structure from the water.

Barriers

Barriers, such as dikes, flood walls or embankments are intended to separate flood prone lands and structures from flood waters which would inundate those areas without the presence of the dike.

Channel Alteration

Altering the creek channel involves modifying the stream channel to speed up or slow down water in order to prevent or reduce flood conditions. Much of the system has already been altered or improved as public ditches, where the channel has been straightened, widened and deepened to facilitate drainage and get water off the land.

The caution of sole reliance on this strategy is the potential to contribute to down stream flooding.

Control Land Use

Floodplain zoning is perhaps the most widely used method to avoid or reduce the damage caused by flooding. Minnesota Statute 103F establishes a comprehensive approach to solving flood problems by emphasizing nonstructural measures, such as

- floodplain zoning regulations,
- flood insurance,
- floodproofing, and
- flood warning and response planning.

By law, Minnesota's flood prone communities are required to:

1. Adopt floodplain management regulations when adequate technical information is available to identify floodplain areas; and
2. Enroll and maintain eligibility in the National Flood Insurance Program (NFIP) so that the people of Minnesota may insure themselves from future losses through the purchase of flood insurance.

At the state level, the DNR has promulgated minimum standards for floodplain management entitled "Statewide Standards and Criteria for Management of Flood Plain Areas of Minnesota" (Minn. Rules 6120.5000 - 6120.6200).

These standards have two direct applications:
1) all local floodplain regulations adopted after June 30, 1970 must be compliant with these standards; and
2) all state agencies and local units of government must comply with Minnesota Regulations in the construction of structures, roads, bridges or other facilities located within floodplain areas delineated by local ordinance.

Local floodplain regulatory programs, administered by county government, predominately for the unincorporated areas of a county, and by municipal government for the incorporated areas of a county, must be compliant with federal and state floodplain management standards.

Both federal and state standards identify the 100-year floodplain as the minimum area necessary for regulation at the local level. These regulations are intended to protect new development and modifications to existing development from flood damages when locating in a flood prone area cannot be avoided.

Current Distribution of Flood Control Efforts

An assessment of how well an area is draining relative to the biogeochemical processes that support a service and an area's service capacity.

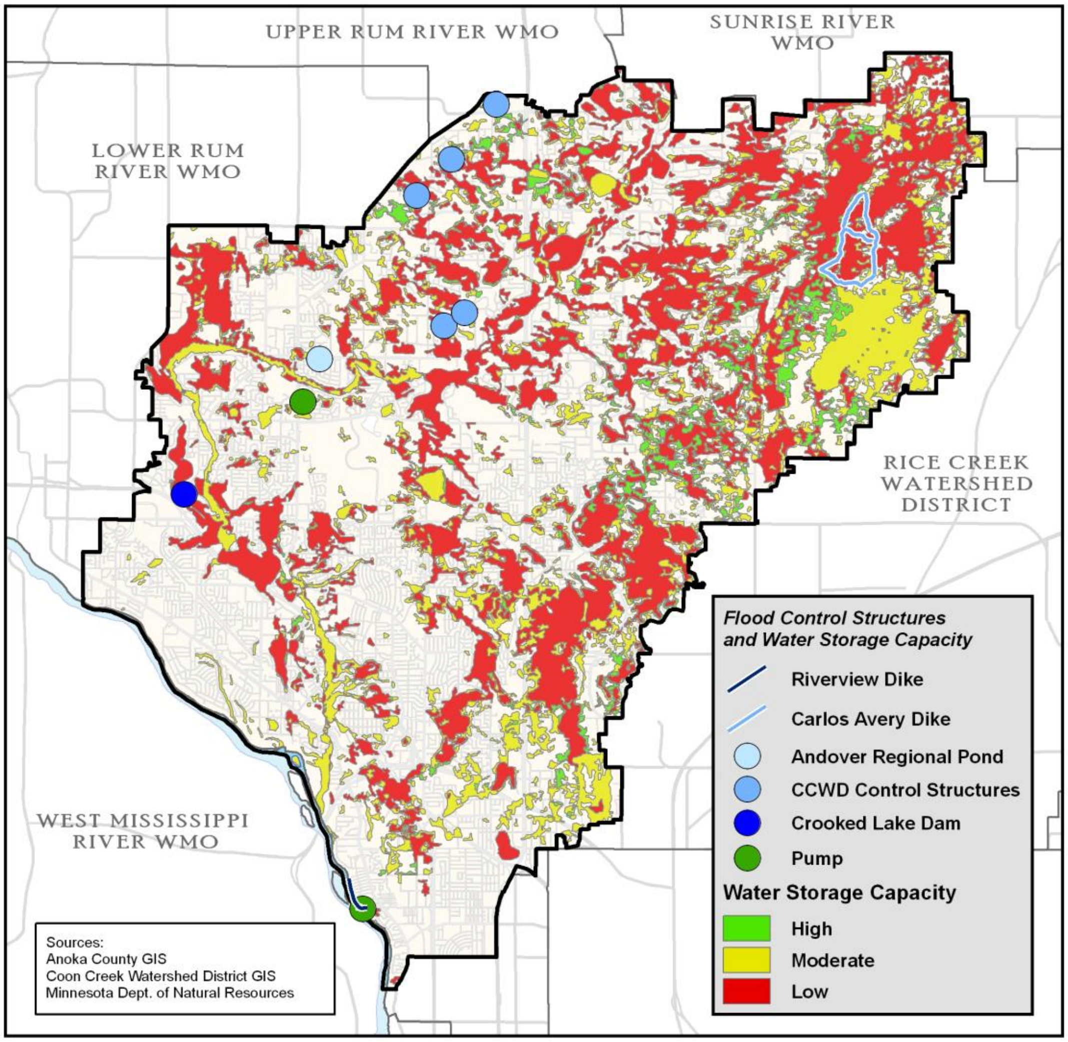
The level of flood control (provision of a beneficial uses, specific benefits and services) reflects the level and type of biogeochemical functions and any other off-site characteristics that either limit or enhance the ability to provide the chosen service. It is in essence a product of the level of function and the service capacity

Water Control Structures

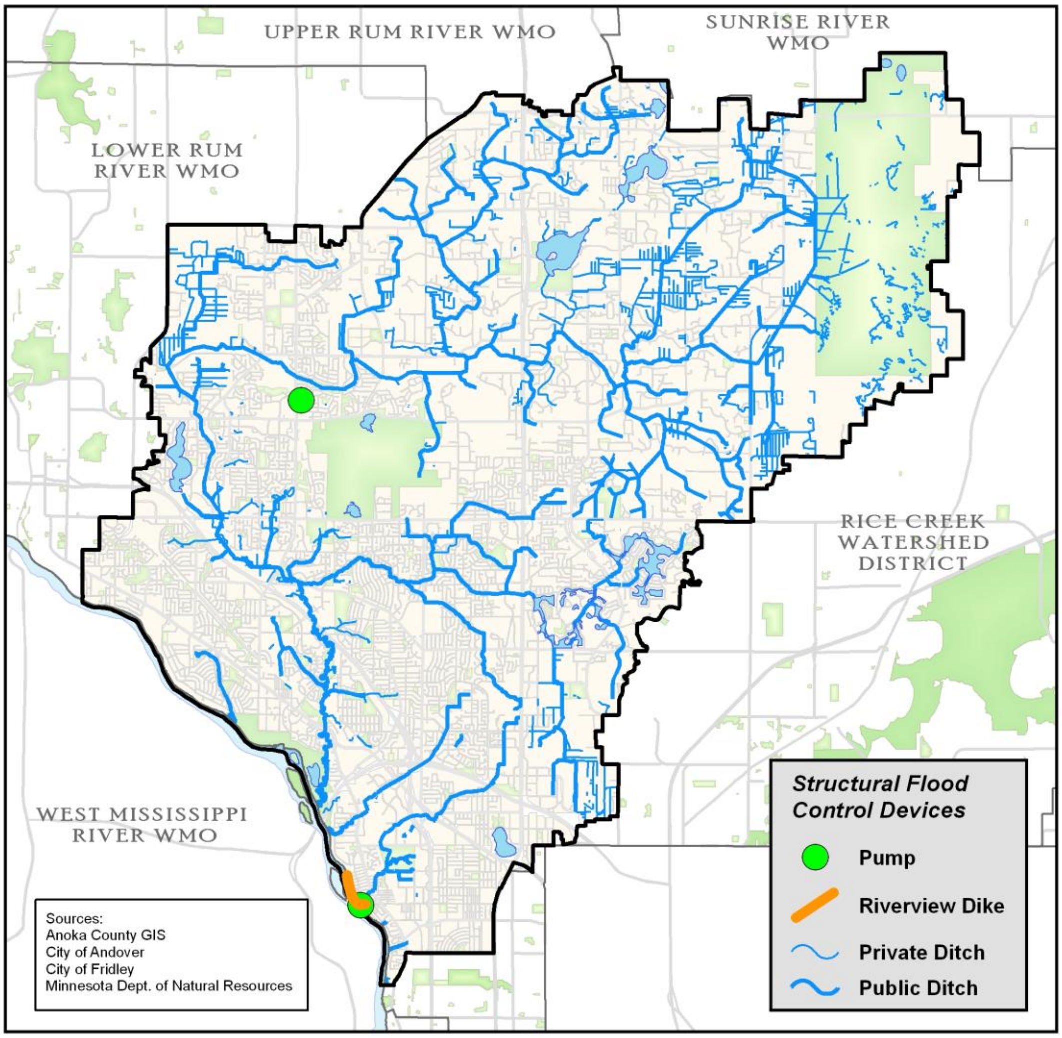
There are two dams, two pumps and hundreds of stormwater ponds designed to retain or detain water in order to reduce downstream peaks or volume of water and thereby reduce water levels associated with flooding.

The retention and detention functions are also achieved through wetlands

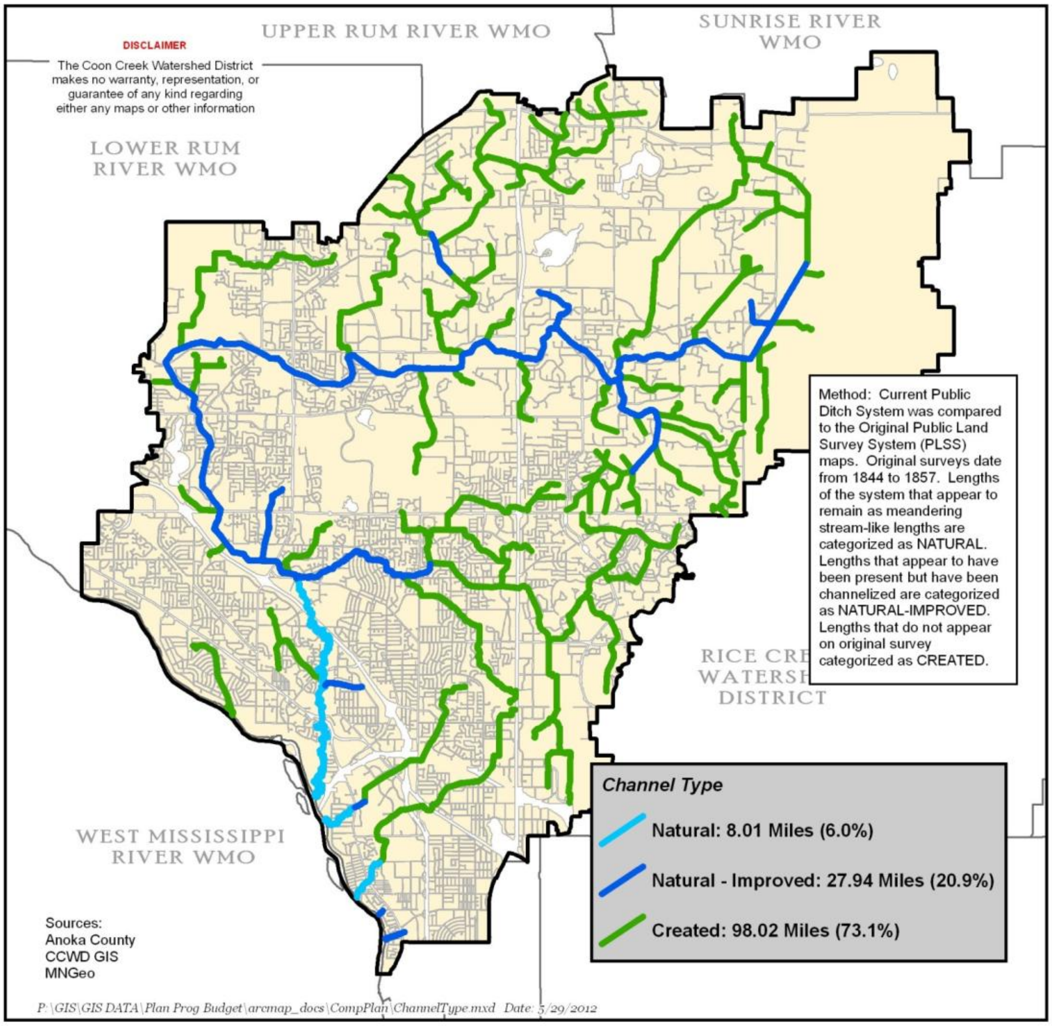
Functional capacity of Wetlands to store storm and flood waters



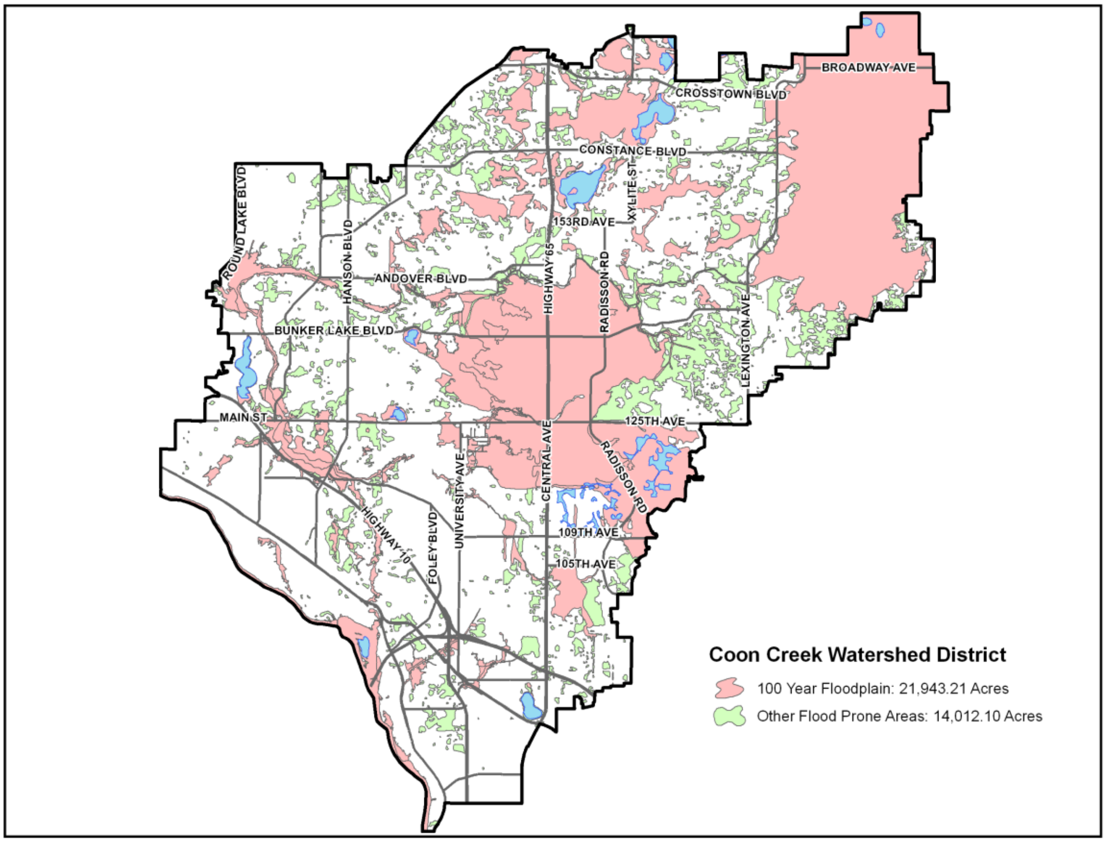
Barriers and Dikes There is only 1 dike within the watershed designed to protect adjacent lands from flooding. The Riverview dike is in Fridley adjacent to the Mississippi river.



Channel Alteration Approximately 285 miles of stream channel have been straightened, deepened and in some cases widened for the sole purpose of moving water to facilitate drainage and discourage flooding.



Land Use Control and Floodplain Zoning



Value of Flood Control

The necessary factors and conditions that affect aggregate demand for a service within the Coon Creek Watershed.

The initial value is based on the expected value per unit of service and is used to modify the level of service.

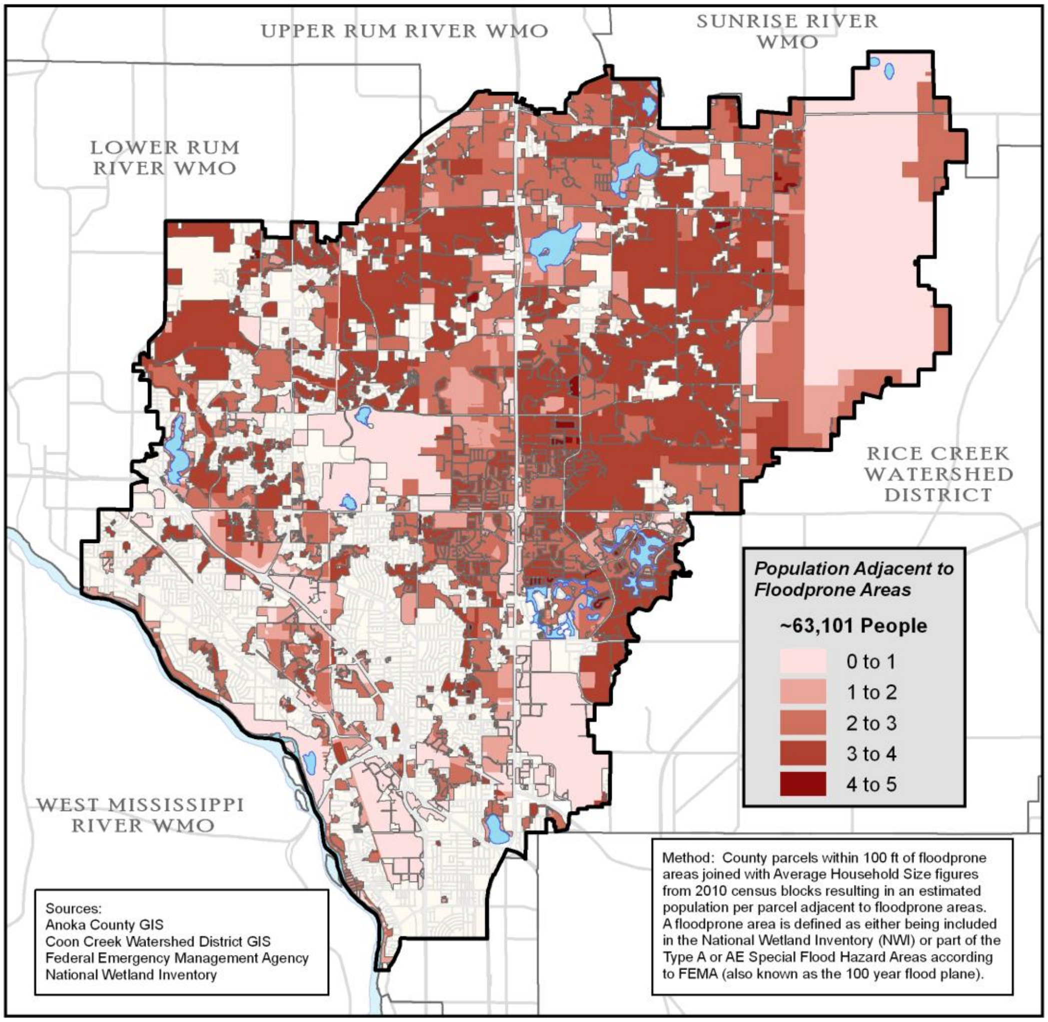
In general the factors that affect aggregate demand for drainage within the Coon Creek Watershed at a particular location include:

1. The number of people with access to the service
2. Their incomes and wealth
3. The cost in time or money of getting and keeping access to the service
4. The availability of perfect or near-perfect substitutes for the service
5. People’s expressed or revealed preferences for this service compared with other competing services

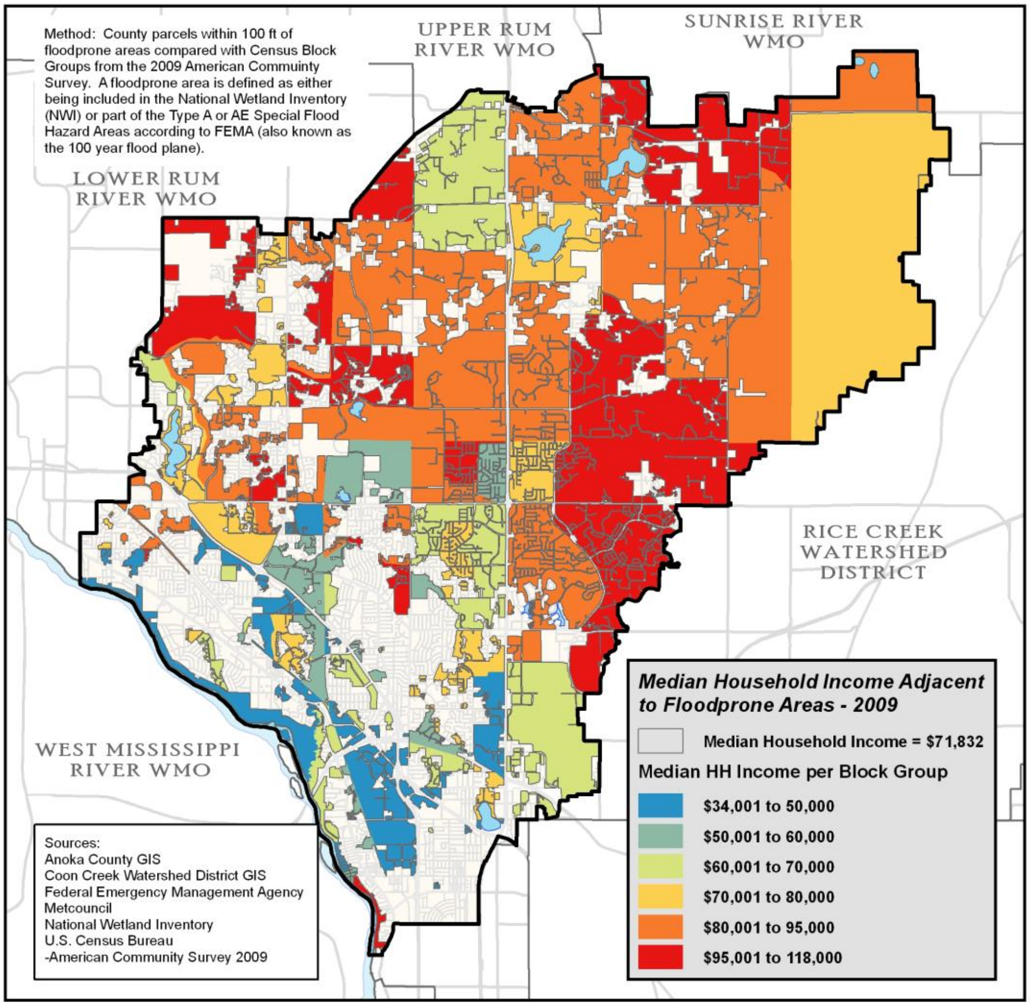
The following factors/conditions will be considered in assessing the value of drainage to a particular area within the watershed.

Population Approximately 63,101 people live adjacent to the flood prone lands. By 2020 that number is expected to be 77,819

2010 Population adjacent to Floodprone Areas

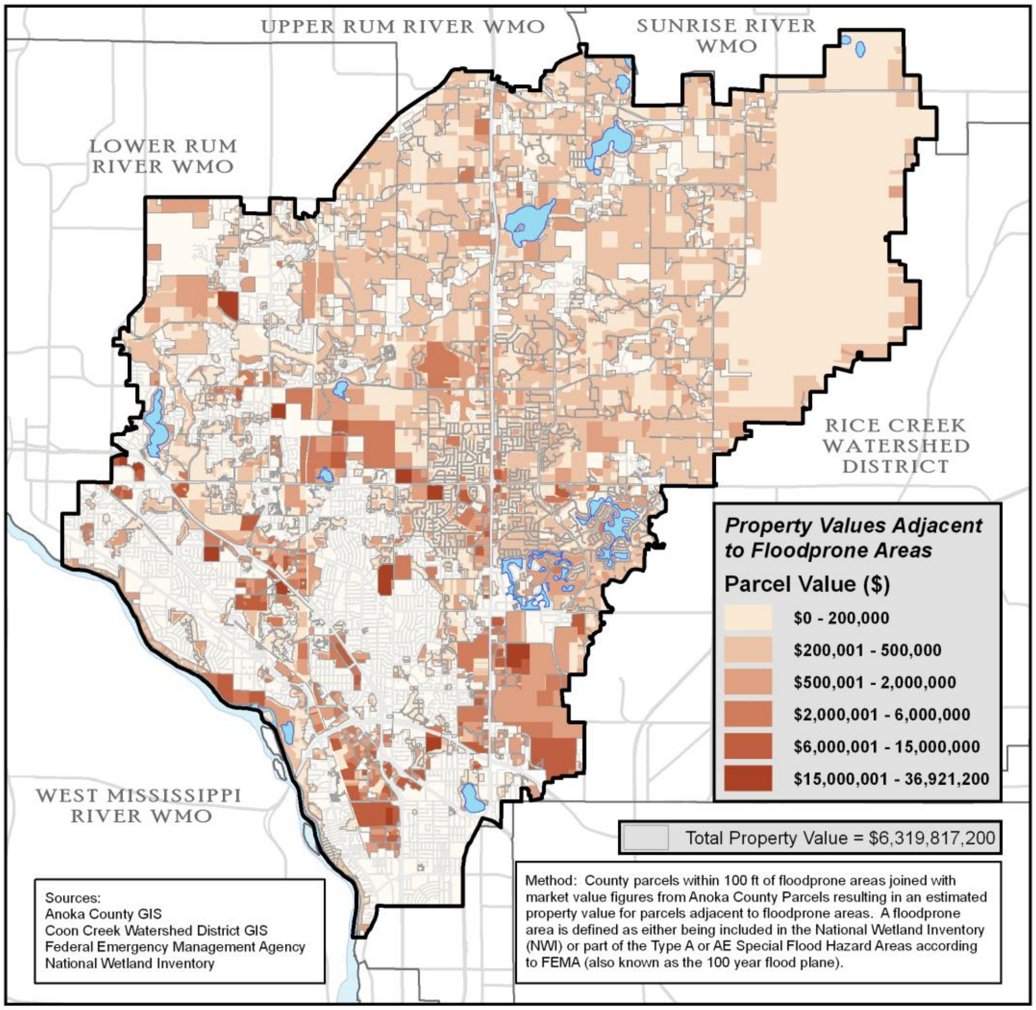


Income Map of income and wealth of property adjacent to flood prone lands



Property Value The total value of flood prone land within the watershed is $6,319,817,200. The average value of flood prone land within the watershed is $141,361 per acre. The average value of non-flood prone land is $296, 365.

Map of value of property adjacent to flood prone lands



Substitutes	The only substitutes for flood control would be property that outside the floodplain
Adoption of Substitutes	Adoption of these alternatives lands is a function of cost. Non flood plain land
The Marginal Value of Flood control	The marginal value for flood control remains high. In spite of floodplain regulations and other control efforts, as development has occurred, flooding has become more localized making additional local control efforts that much more valuable

Risks to Flood Control

Involves an assessment of the exposure and vulnerability of the water and related resource functions for a given time period

Risks of disruptions to services differ from site to site and are associated with the exposure and vulnerability of the drainage system itself and the vulnerability and exposure of important landscape features that affect the functional capacity of the system. Threats that cause risk can arise from physical, social or managerial actions or processes.

Climate Change (Moderately high probability)

According to the 2003 report on climate change by the Soil and Water Conservation Society, total precipitation amounts are increasing, as are storm intensities in the upper Midwest. In addition, precipitation is projected to increase by around 15% in winter, summer, and fall, with little change projected for spring.

This trend will significantly increase the frequency with in which we receive 4 inch and greater precipitation events and shorten the time in which we would receive that rain.

The result would be increased occurrence of flooding at the local and subwatershed level and rendering water control structures as though they are under sized.

Rises in Surficial Groundwater (Seasonally high probability)

In 2011 the watershed experienced several record setting months for precipitation following a very wet winter and fall. By mid fall surface and groundwater levels were falling rapidly.

The risk of rises in groundwater on a seasonal basis is high, however, permanent rises over the next ten years are low.

Sudden Release of Water from an Carlos Avery WMA (Very Low Probability)

Only Carlos Avery WMA would be capable of a sudden release that could create or contribute to flooding. While at one time, the CAWMA was compelled to release water from pool 13 during high water periods to protect the integrity of the outlet and dike containing the pool, the creation of an armored overflow to the south of the existing outlet to Coon Creek in the 1990's has eliminated, or at least greatly reduced, the need to pull boards from that weir structure to lower the pool was all but eliminated.

Failure of Impoundment Structures

The chance that an outlet structure controlling water levels to decrease peak flows or volume of failing is low.

(Low probability) Most structures only hold back 1 to 3 feet of water, the sudden release of which would attenuate within a mile of flow and would be contained within the channel.

Sediment Buildup and Decrease in Channel Capacity (Very High Probability) Sedimentation and silting in of creek and ditch channels will occur. Creek flows through sand cuts and movement of bed loads will occur in places where flow velocities are in excess of 3 feet per second, and will settle out and accumulate in an over areas where flow velocities drop below 3 feet per second.

The result is a constant and steady 'filling in' of the channel, decreasing the volume of the channel below the banks in the area. The result is either a further slowing down of water upstream and therefore additional deposition of sediment and or localized flooding at ever smaller volumes of water. If the channel is an agricultural drainage ditch, designed to remove water from the soil profile, the time required to drain the rooting zone will increase and flooding and plant stress will result.

Obstructions (Very High Probability) The chance of obstructions occurring within the drainage system and creating flooding is very high.

As precipitation and therefore flows become more volatile, obstruction from tree fall or vegetative litter flushed and accumulating in culverts increases. In addition, with the economic downturn, the incentive to replace culverts with undersized and shorter pipe becomes greater and leads to insufficient flow and increased ease to bury or damage culverts during road maintenance.

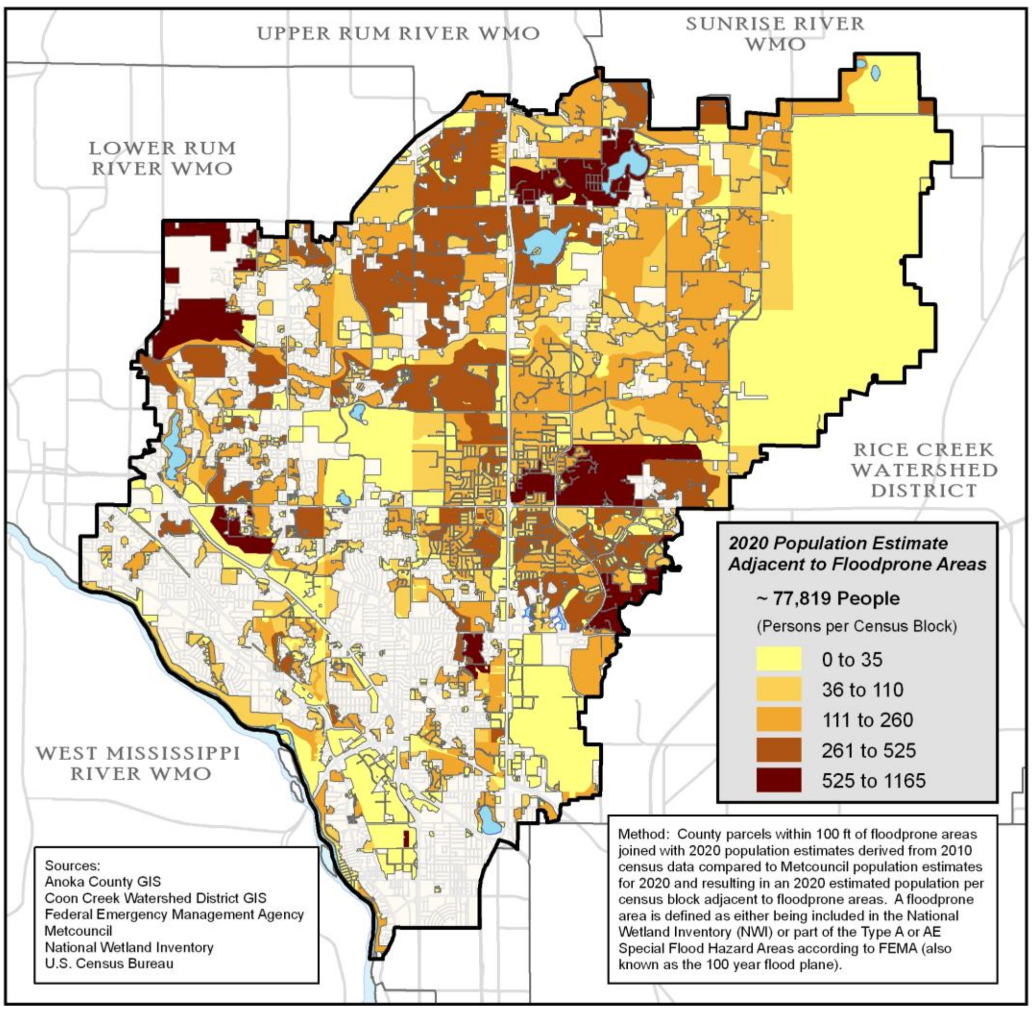
Expected Future of Flood Control

The quantity and quality of flood control in 2020 will depend on:

Population

	2000	2010	2020	Pct Chg
Andover	17,450	21,188	27,188	28%
Blaine	46,845	60,643	71,943	19%
Columbus	479	508	623	23%
Coon Rapids	62,295	65,700	66,000	0%
Fridley	27,449	27,000	26,900	0%
Ham Lake	11,782	15,017	16,686	11%
Spring Lake Park	7,090	6,710	6,710	0%
Total	173,390	196,766	216,050	10%

Projected 2020 Population of Floodprone Lands



Expected Operation and Maintenance of Flood Control Efforts

All lands within the Coon Creek Watershed depend on some form of stormwater drainage facility:

- Drainage Ditches
- Storm Sewer
- Roadside Ditches
- Creeks
- Wetlands Or
- Groundwater through infiltration facilities.

In March 2009 the Coon Creek Watershed District adopted Rules that require all land use modification to use Best Management Practices (BMPs) to reduce flooding. Section 13 of that rule requires maintenance of those facilities.

Effective Operations and Maintenance (O&M) is one of the most cost-effective methods of ensuring reliability, safety and efficiency in the drainage system. Inadequate maintenance of the drainage system and stormwater treatment practices can be a major cause of inadequate performance.

In addition to keeping a site from flooding, properly maintained drainage system can help reduce surface water and groundwater pollution. Stormwater treatment facilities cost many thousands of dollars to install, and require more maintenance than a system of pipe and catch basins.

Stormwater maintenance is necessary to protect streams, lakes, wetlands and groundwater. Proper maintenance helps assure that stormwater conveyance systems:

- Operate as they were designed
- Are cleaned so that area stormsewer are not overwhelmed and become pollutant sources

Expected Risk of Flooding Events

Localized flooding and flash flooding can be expected to increase as a result of increasingly intense and localized precipitation events.

Amount of Flood Prone Land

The amount of flood prone is not expected to change in the next 10 years.

Service Preferences

Reflects the preferences expressed in a survey of citizens, City Engineers and water resource professional conducted in April and May of 2011.

In April and May 2011 29 citizens, engineers from the seven cities within the watershed and water resource professionals who are members of the ‘planning advisory committee’ were administered a paired comparison survey of the beneficial uses of and the demands on water resources.

While Aquatic life was ranked third on the national level, it was ranked 8th by citizens and local professionals and 5th by all water resource professionals.

	Citizens	City Engineers	Water Professionals	National
Drinking water	1	1	1	1
Water Quality	2	2	2	2
Flood Control	**2**	**2**	**3**	**5**
Groundwater Recharge	4	4	4	7
Storm Protection	6	5	6	6
Drainage	5	8	7	8
Aquatic life and recreation	8	8	5	9
Hunting and Fishing	8	8	9	10
Irrigation	9	9	10	4
Livestock and wildlife watering	10	10	8	11
Aesthetics	11	11	11	12
Industrial use and cooling	13	13	12	3