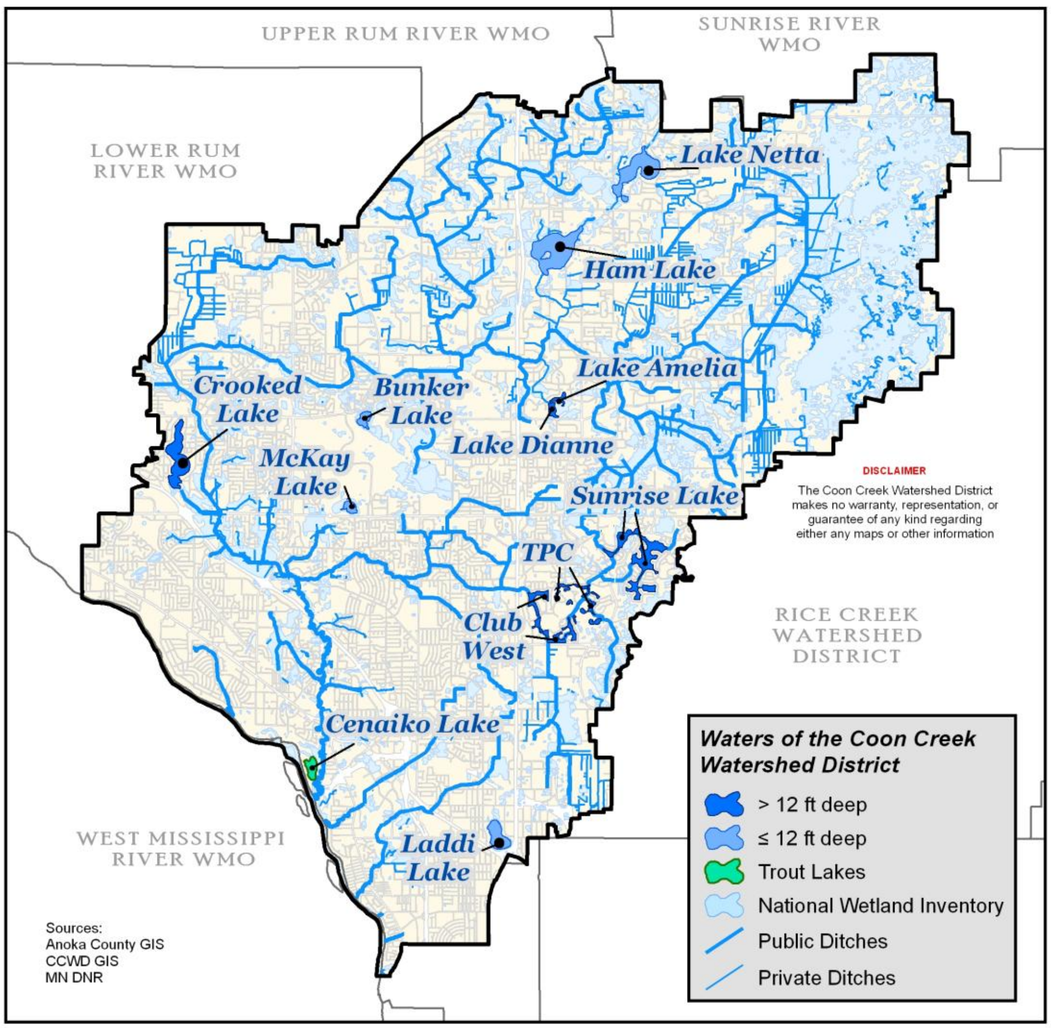
Demand for Water Quality

Water Quality Goals and Standards

Water quality goals and standards apply to a variety of water resources. Within the Coon Creek Watershed those resources and the amount within the watershed are:

Resource	Amount	Unit
Streams and Ditches	250	Miles
Deep Lakes (>12 Ft)	347	Acres
Shallow Lakes & Wetlands (<12 Ft)	15,508	Acres
Trout Lakes	29	Acres

Water Resources within the Watershed



General Groupings of Water Quality Concerns

Water quality issues, standards and management efforts are often organized around general groups of pollutants and concerns. This plan will address pollutants as follows:

- Sediment
- Nutrients
- Oxygen Demanding Substances
- Bacteria
- Chloride
- Water volume
- Aquatic Habitat

Water Quality Standards

Standards

Pollutant	**Streams**	**Deep Lake**	**Shallow Lakes & Wetlands**	**Trout Lake**
Sediment, Clarity & Turbidity	14 mg/L	3.3 Ft		4.6 Ft
	25 NTU			10 NTU
Nutrients				
Phosphorus	130 ug/L	40 ug/L	60 ug/L	20 ug/L
Nitrogen				10 mg/L
Oxygen Demanding Substances (DO)	5 mg/L Average daily minimum			
Bacteria	126 organisms /100 ml			
Chloride	230 mg/L			
Water Volume **(storm bounce & hydroperiod)**	1988 Volumes			
Highly Susceptible			No Chng	No Chng
Moderately Susceptible			0.5 ft	
Slightly Susceptible			1 ft	
Least Susceptible			No limit	
Biological Diversity				

Water Quality Capacity

There are three principle aspects of the biogeochemical processes that most substances must go through to become pollutants:

1. Availability
2. Detachment
3. Transport

Interrupting this process at any point will prevent a substance from being delivered to a receiving water. Some substances are more readily controlled at one step in the delivery process than another. Understanding this process and the characteristics of the pollutants helps to target best management practices to prevent delivery most effectively.

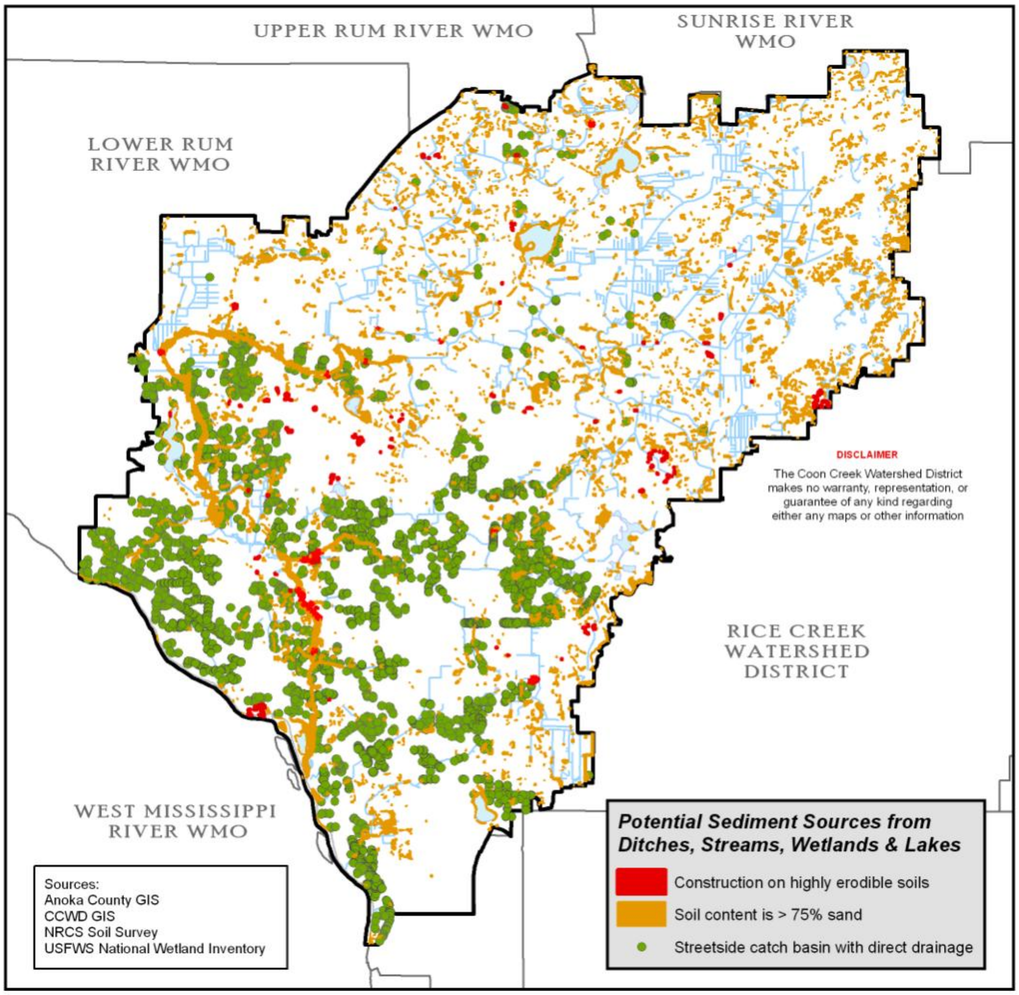
Availability

Obviously a material must be available before it can become a pollutant. The quantity of a material in the environment and its characteristics determine the degree of availability. In a watershed, the quantity of a certain pollutant in the environment is a function of the type and intensity of the land use within the drainage area.

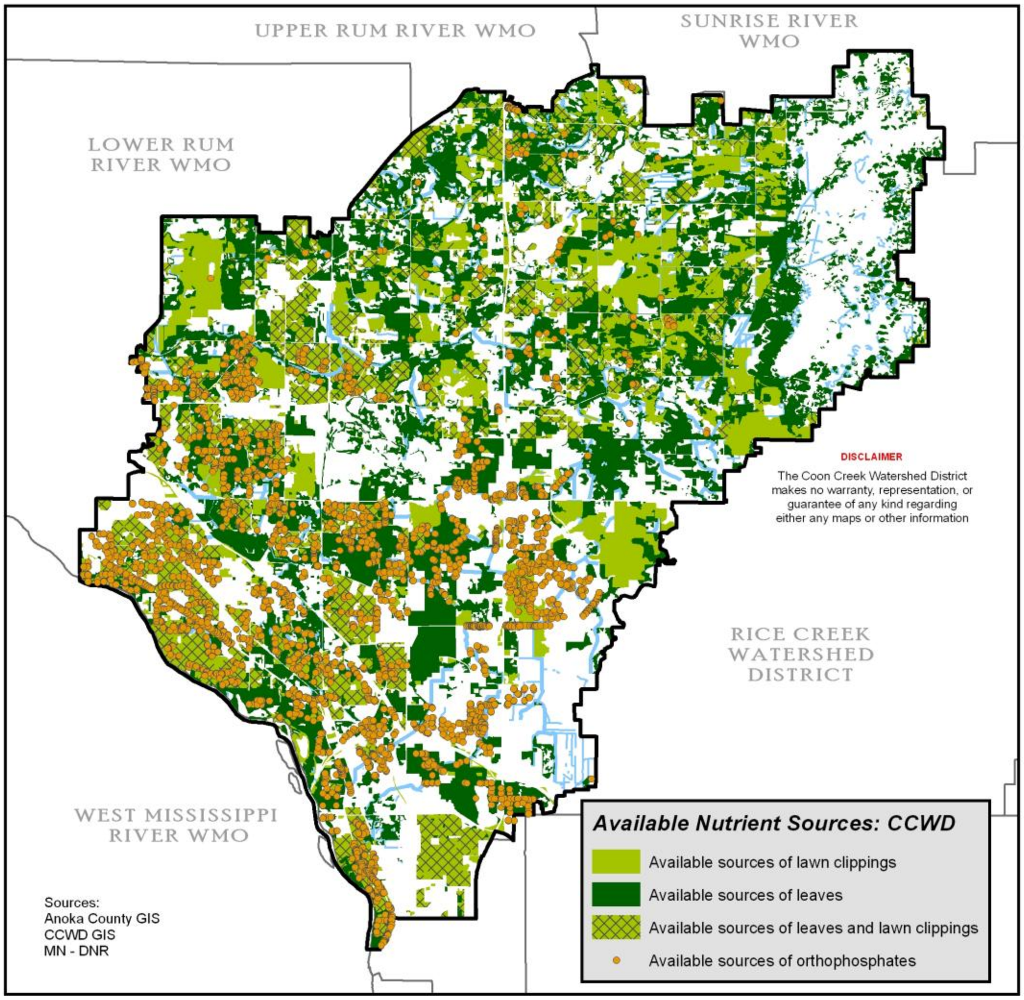
The major pollutants of concern are:

Available Sediment Sources

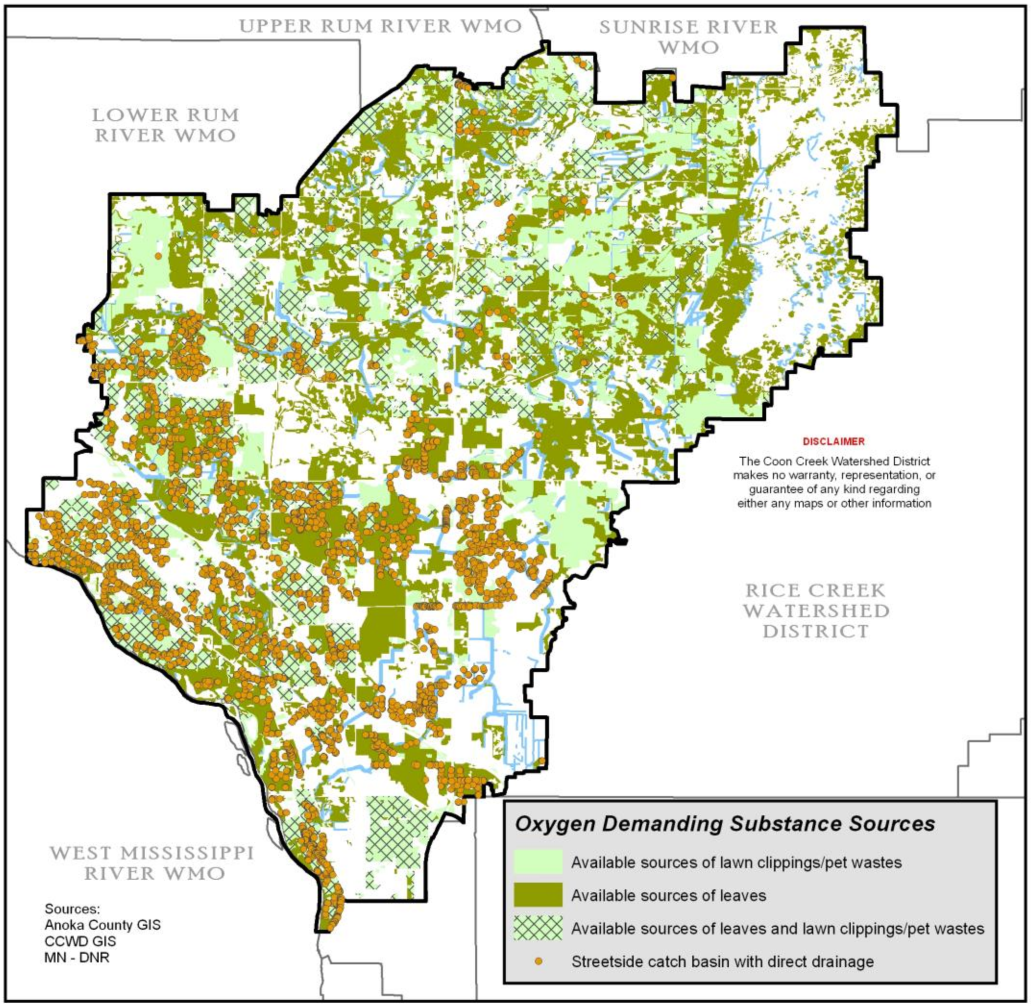
Form	Sources	Availability
Fine Sand	• Stream bank erosion • Bed load • Construction sites • Road de-icing	High



Available Nutrient Sources	Form(s)	Sources	Availability
	Phosphorus Nitrogen	• Lawn clipping • Leaves • Excessive use of fertilizer • Auto emissions • Road de-icing	Medium

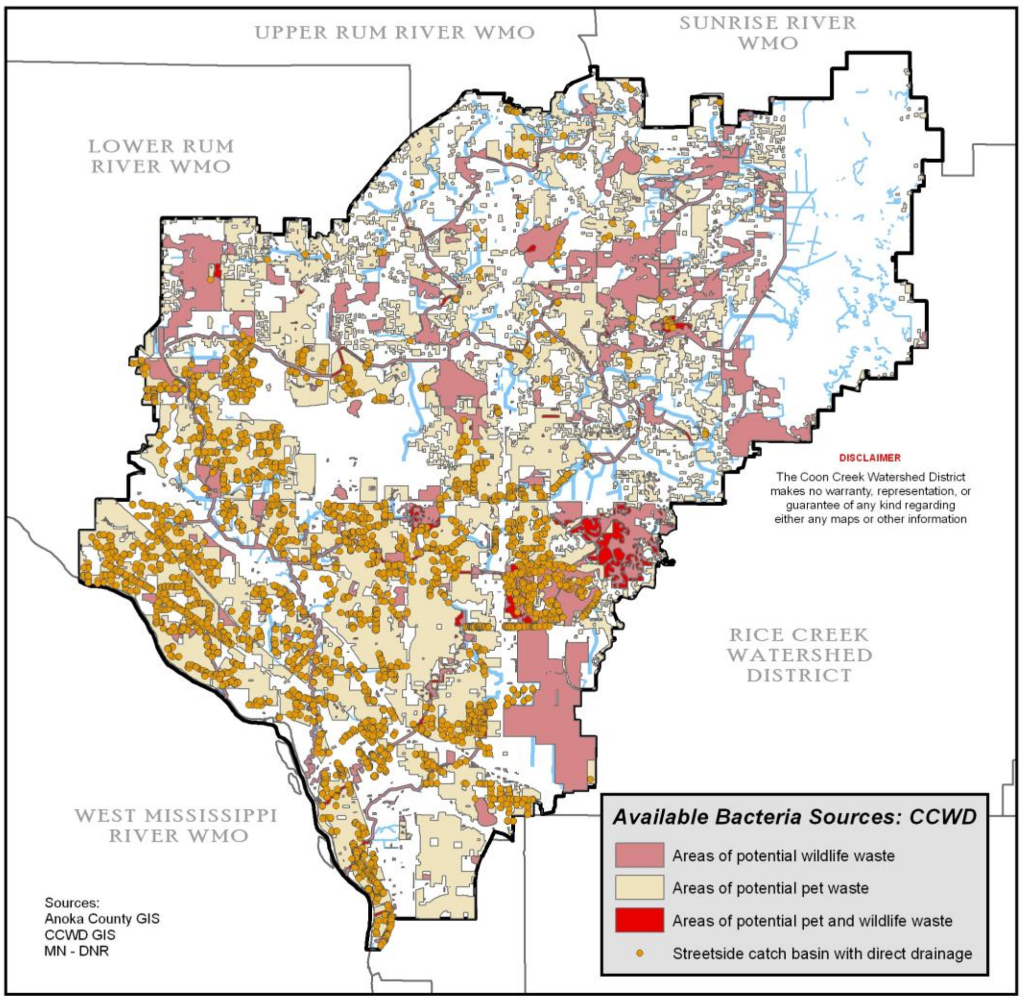


Available Oxygen Demanding Substances	Form(s)	Sources	Availability
	Pet wastes Street litter Lawn clipping Leaves	• Pet wastes • Street litter • Lawn clipping • Leaves	Low

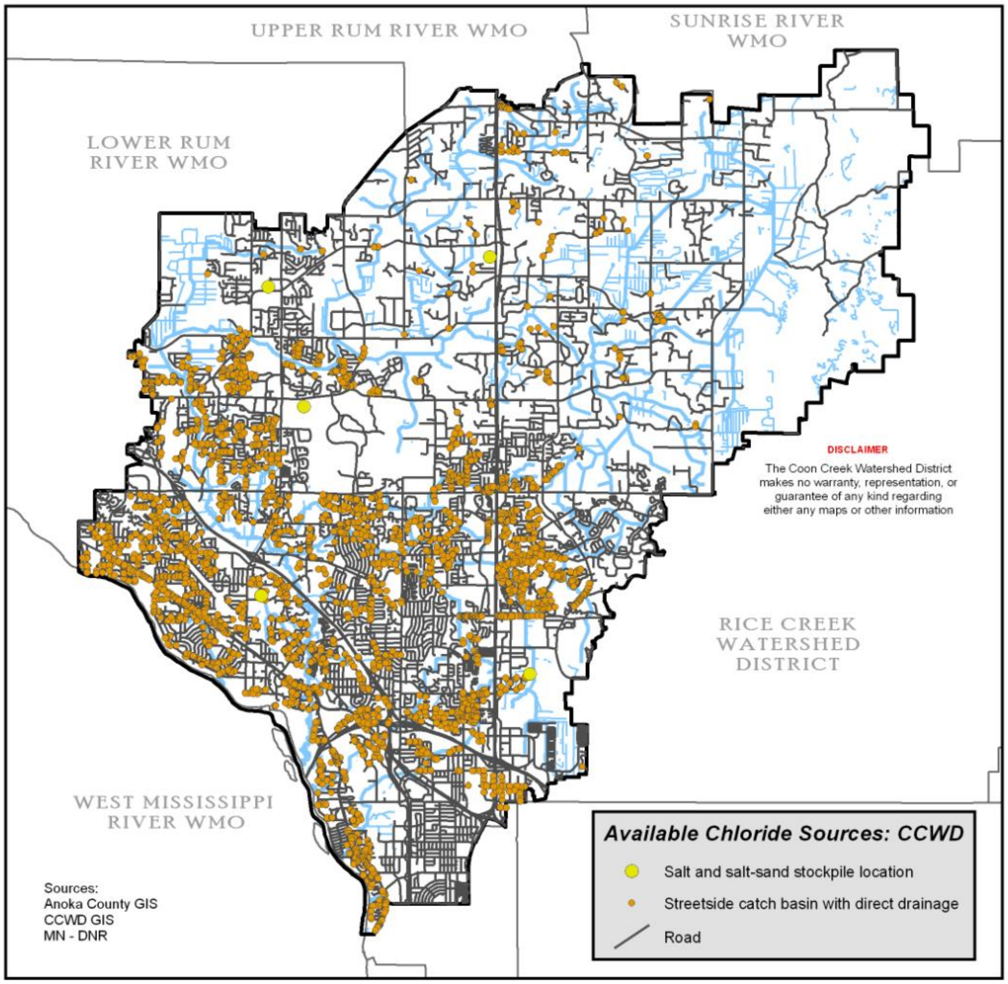


Available Sources of Bacteria

Form(s)	Sources	Availability
Coliform E. coli	• Pet waste • Wildlife waste • Self-reproduction	High

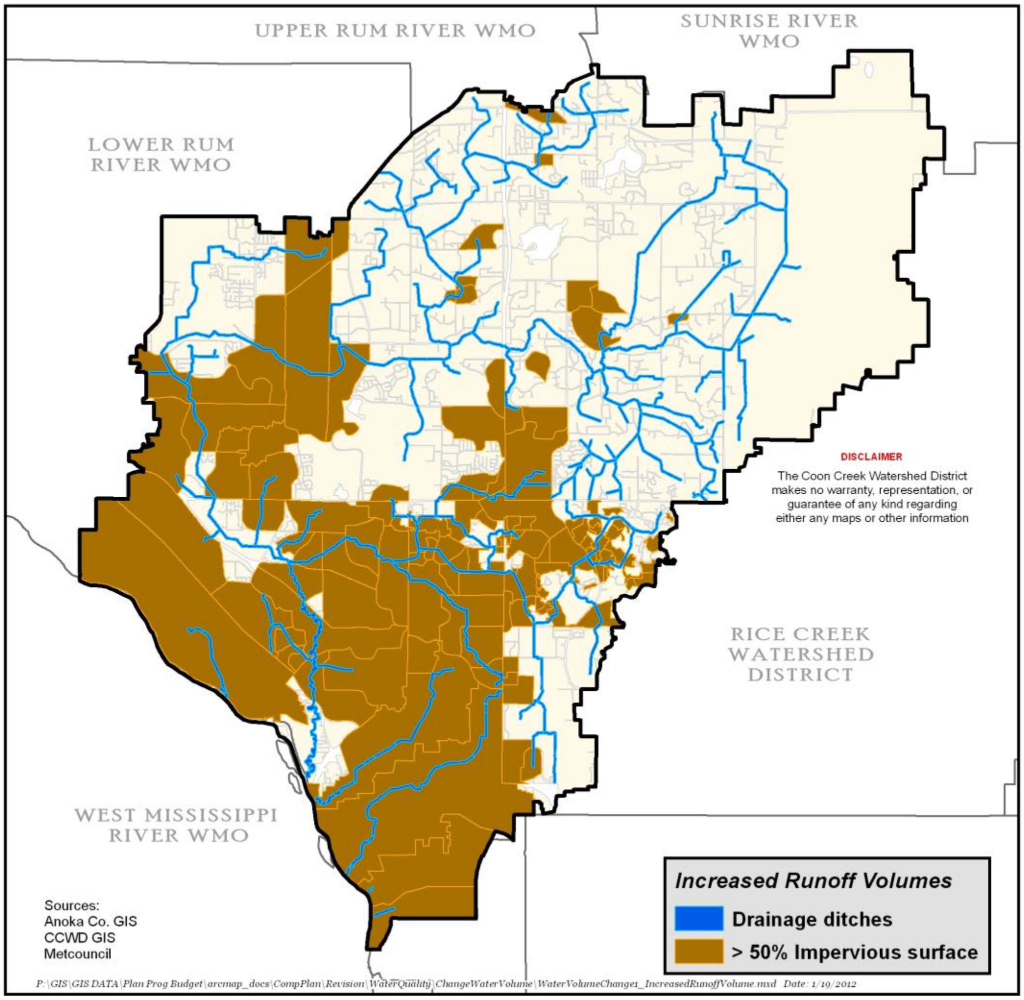


Available Sources of Chloride	Form(s)	Sources	Availability
	Chloride	• De-icing • Inadequate protection of stockpiles	Low



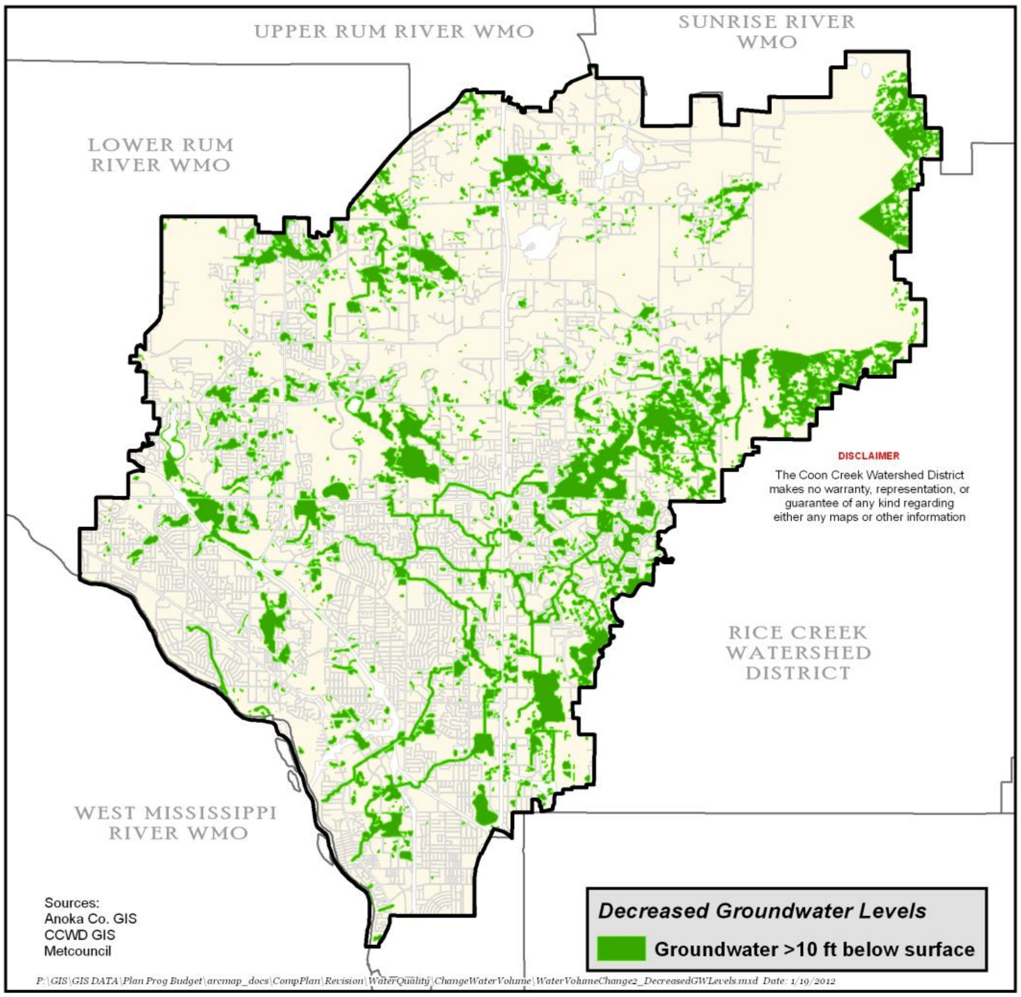
Available Sources of Water Volume Changes	Form(s)	Sources	Availability
	Increased runoff volumes	• Impervious surface • Drainage ditches	High

Available Sources of Increased Runoff Volume



Form(s)	Sources	Availability
Decreased Groundwater Levels	• Decline in surficial groundwater table • Regional drainage toward the Mississippi River	High

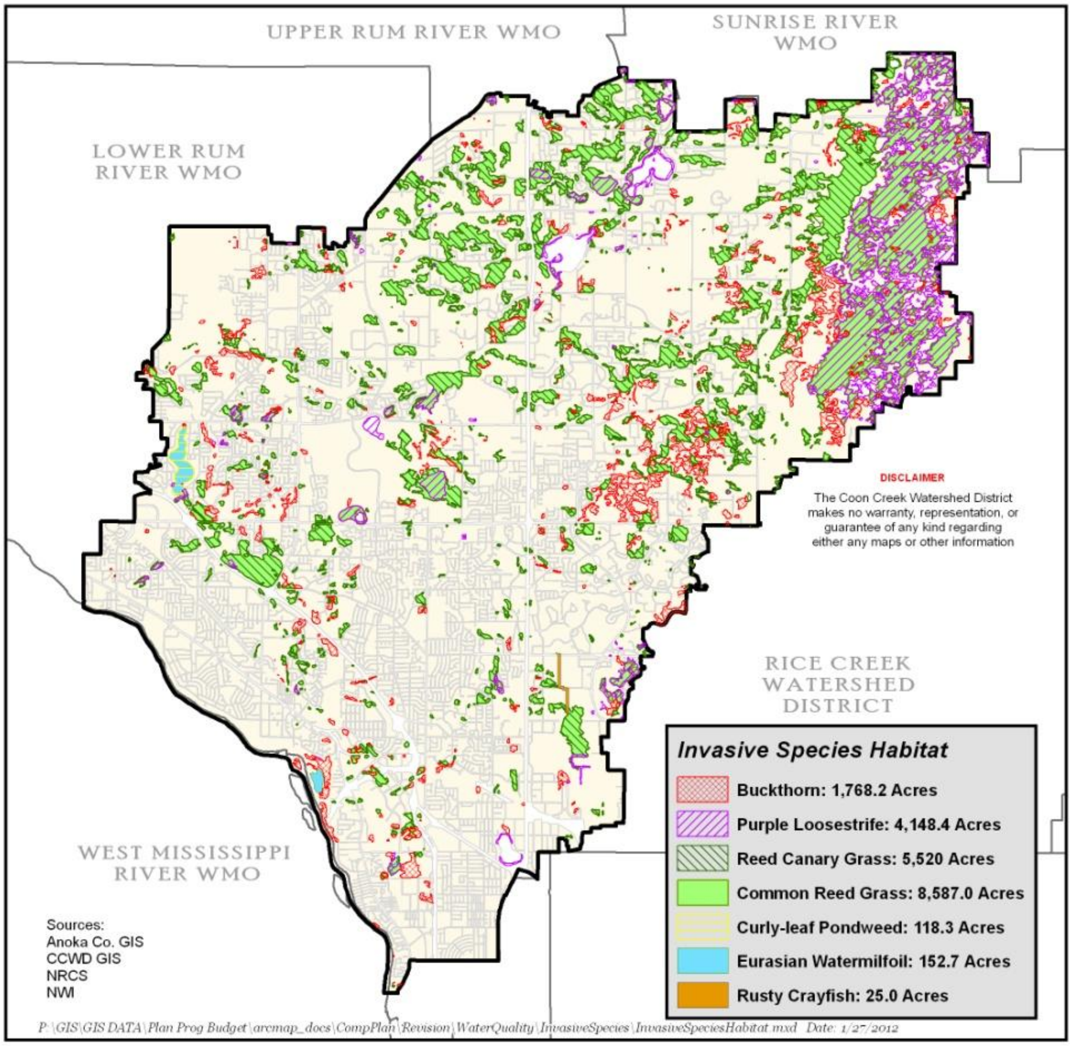
Map of Sources of Decreased Water Availability



Available Sources of Invasive Species

Form(s)	Sources	Availability
Invasive Plant Species	• Eurasian watermilfoil (*Myriophyllum spicatum*)	High
	• Curly-leaf pondweed (*Potamogeton crispus*)	Low
	• Flowering rush (*Butomus umbellatus*)	Low
	• Reed Canary Grass (*Phalaris arundinacea*)	Very High
	• Purple loosestrife (*Lythrum salicaria*)	Low
	• Buckthorn (*Rhamnus spp*)	High
	• Common Reed grass (*Phragmites australis subsp. australis*)	Low
Invasive Animal Species	• Rusty crayfish (*Orconectes rusticus*)	Moderate

Map of Distribution of Invasive Species



Detachment

Detachment is the process by which materials are dislodged from their original location and become mobile. The occurrence of detachment is the central issue leading to illicit discharge. The detachment process can either be physical or chemical.

- Physical detachment is the result of raindrop impact or overland flow.
- Chemical detachment involves dissolving soluble materials or ion exchange processes.

Pollutant	Detachment Process	Form	Detachment Agent
Sediment	Physical	Turbidity Erosion	Rain Peak flows
Nutrients	Physical	Phosphorus Nitrate Nitrite	Rain Excessive use of fertilizer
Oxygen Demanding Substances	Physical	Organic matter	Rain
Bacteria	Physical	Coliform E. coli	Temperature Flow regime
Chloride	Chemical	Chloride	Solubility Rain Flow regime

Transport

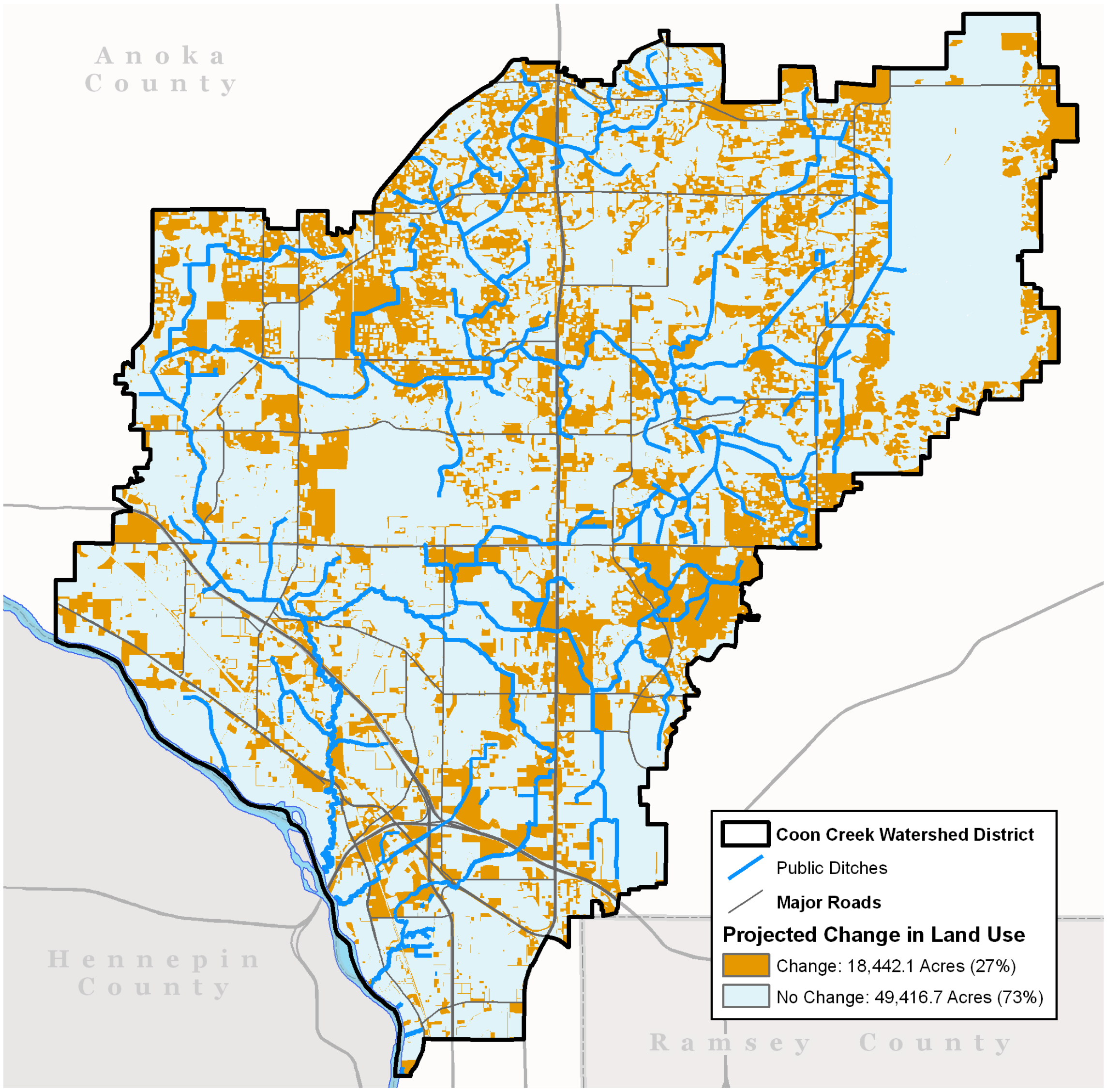
Transport is the final phase of the delivery process. Transport involves moving material from its point of detachment, to a receiving water.

The efficiency and effectiveness of transporting a pollutant is a function of the conductivity of the material through which the transporting medium must travel and reflect changes in the landscape.

The two most important landscape changes that can increase pollutant loading are:

1. Changes in landuse typically result in increases in the availability and potential for detachment.
2. Changes in hydrology typically increase the volume and rate of runoff, increasing the capacity to transport pollutants.

Changes in Land Use



Current Land Use	**Planned Land Use**					
	Ag	Comm	Ind	MFR	SFR	Vacant
Ag		138	8	440	1465	8
Comm			116	53	140	
Ind	12	84		23	169	
MFR		42	1		802	.5
SFR	71	138	12	265		7
Vacant	1002	1631	380	643	8430	

Changes in Hydrology

When the landscape changes (whether is agriculture or suburban uses) there are changes to the local hydrology. Site hardening, either through plowing or paving, of water that can infiltrate is decreased.
This increases the volume and velocity of water that runs off. This in turn decreases the time required to convey water to a certain point.

The result is higher peak discharges and shorter times to reach peach discharges. In a managed system, such as a roadway, this is beneficial. It reduces local flooding and makes for a safer road. It does however have other consequences that are not beneficial:

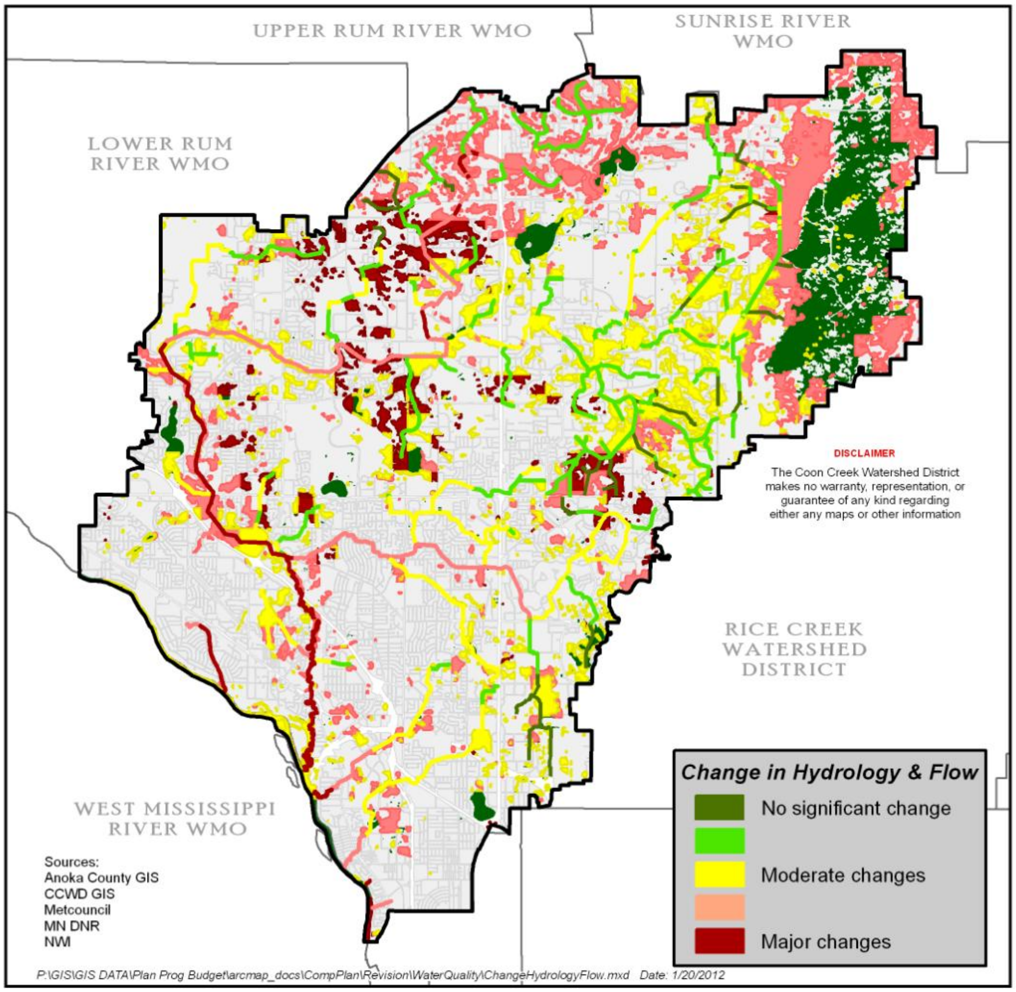
- Changes in stream flow and water source
- Changes to stream hydromorphology
- Changes to aquatic habitat

<u>Changes to Stream Flow and Water Source</u>

A change in land use alters the hydrology (rate and volume) of watersheds and streams by disrupting the natural water cycle. The changes in streams draining altered watersheds are very apparent as they respond to the altered hydrology during the change. Notable changes include:

- Increased runoff volumes
- Increased peak runoff discharges
- Greater runoff velocities
- Shorter times of concentration
- Increased frequency of bank-full and near bank-full events
- Increased flooding
- Lower dry weather flows (baseflows)
- Lowering of surficial groundwater

Changes in Stream Flow & Wetland Hydrology

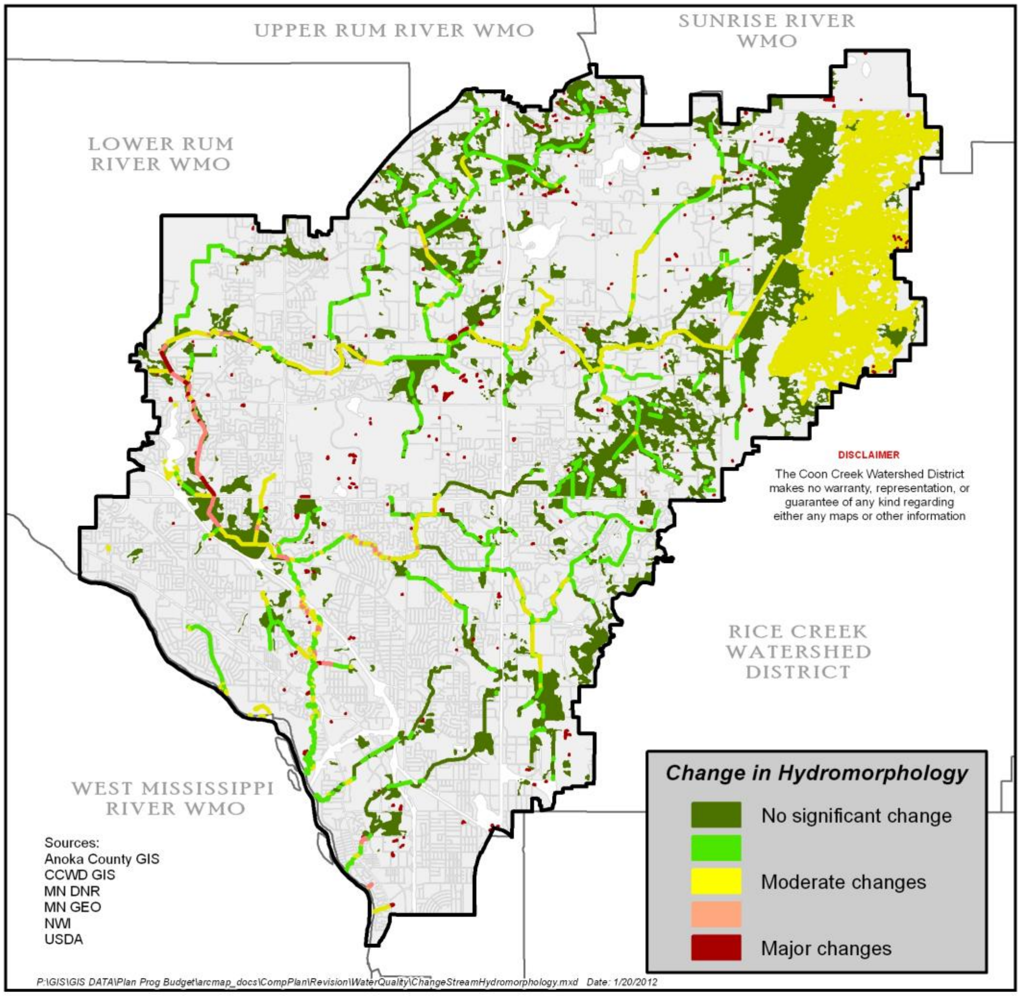


Changes to Hydromorphology

Changes in the rate and volume of runoff directly affect the morphology, or physical shape and character of a streams and drainageways. Some of the impacts include:

- Stream channelization and ditching
- Stream widening and bank erosion
- Higher flow velocities
- Stream down cutting
- Loss of riparian canopy
- Changes in the channel bed due to sedimentation
- Increase in floodplain elevation
- Change in wetland hydro-period

Changes in Stream and Wetland Hydromorphology

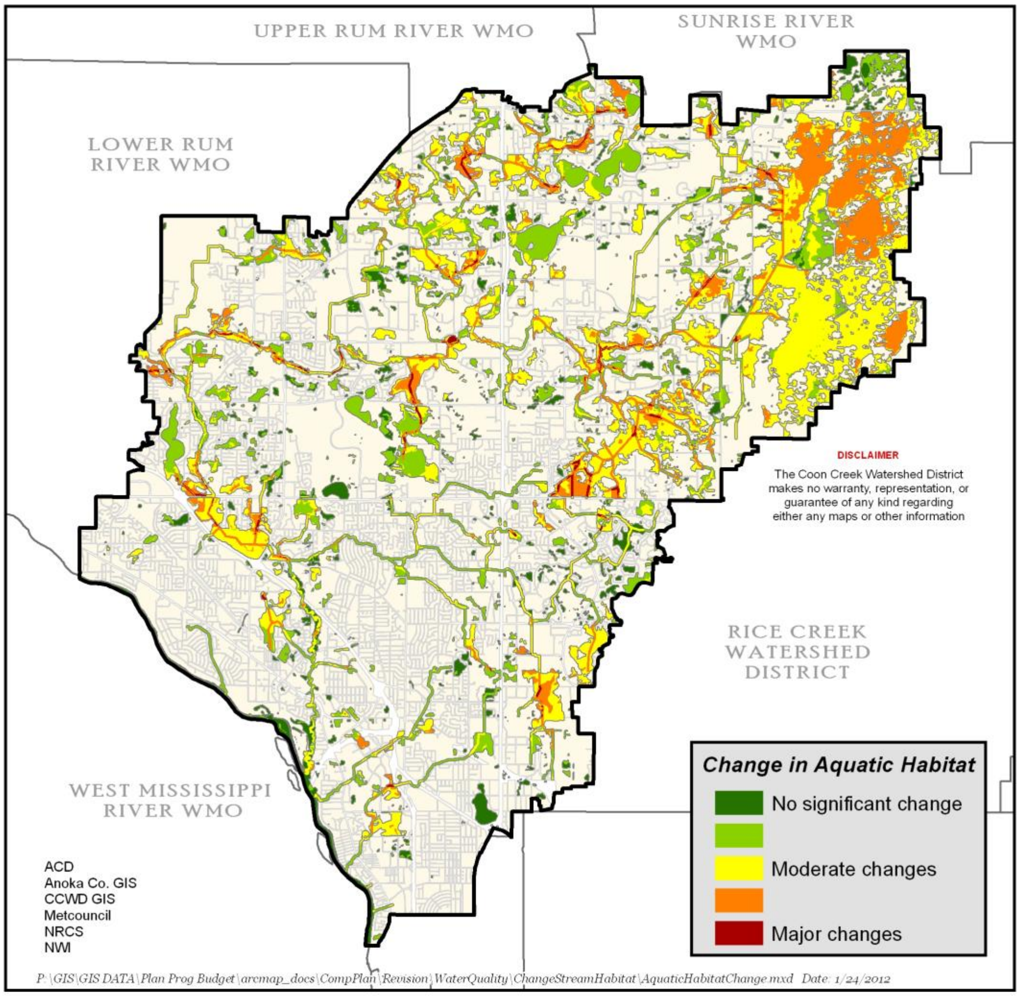


Changes to Aquatic Habitat

Perhaps the most significant impact that results from the physical changes to receiving water is to the habitat value of that water. Impacts on habitat include:

- Degradation of habitat structure
- Loss of pool-riffle structure
- Reduced base flows
- Increased stream temperature
- Decline in abundance and biodiversity

Changes to Aquatic Habitat



Current Water Quality

303d Impairment Listing

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.

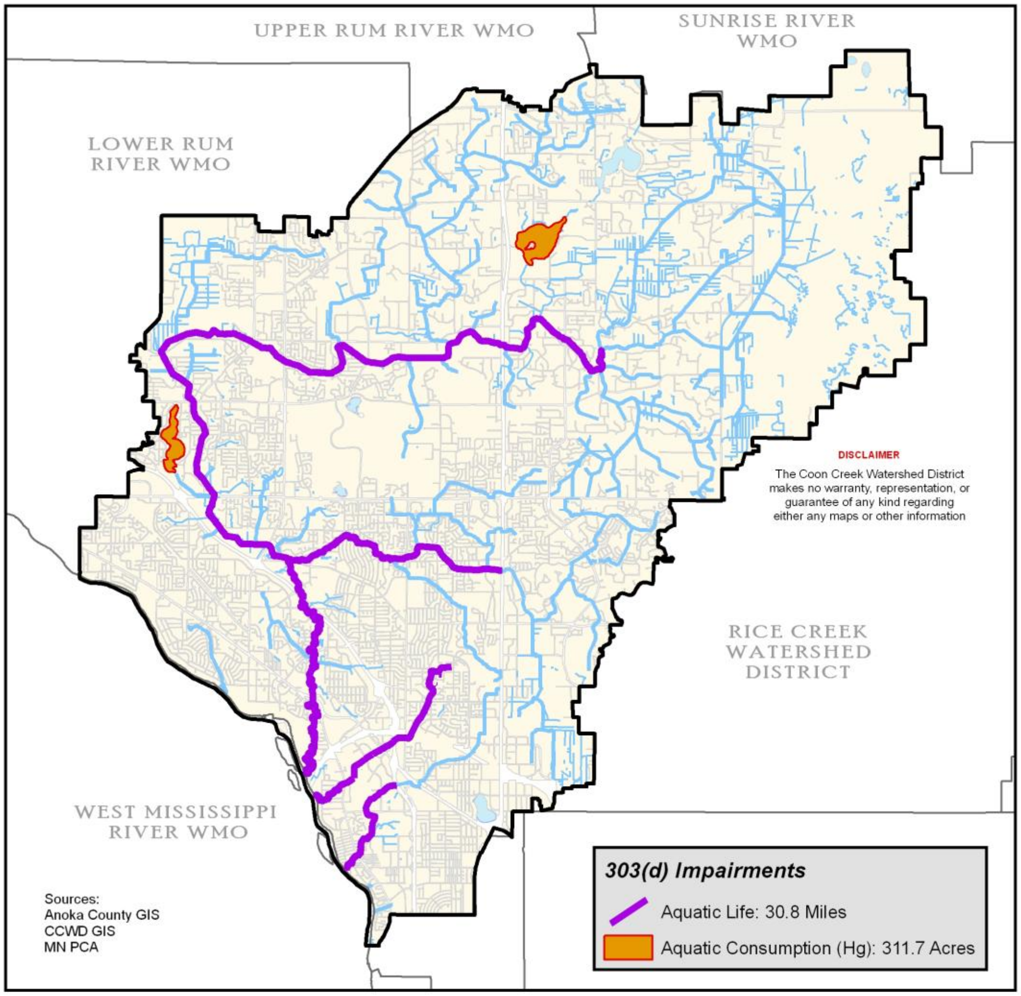
MPCA is currently working to revise its water quality standards (Mn Rule Chapter 7050) to incorporate a tiered aquatic life use (TALU) framework for rivers and streams. The TALU framework represents a significant revision to the water quality standards of the state's aquatic life use classification. The framework builds upon existing water quality standards with a goal of improving how water resources are monitored and managed. Additionally, these changes advance the ability to identify "stressors" and develop effective mechanisms to improve and maintain the condition of waters in the state of Minnesota. Adoption of TALU will only affect Class 2 (Aquatic Life) and Class 7 standards.

In 2011 the MPCA Monitored Coon Creek at Vail Street in Coon Rapids for Bacteria. The sampling was conducted as part of the Upper Mississippi River Bacteria TMDL study.

303(d) Listing Information

Reach name	Year Listed	Affected use	Pollutant or stressor
Coon Creek	2006	Aquatic life	Aquatic macroinvertebrate bioassessments
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
Crooked Lake	2008	Aquatic Consumption	Mercury in Fish Tissue
Ham Lake	2008	Aquatic Consumption	Mercury in Fish Tissue

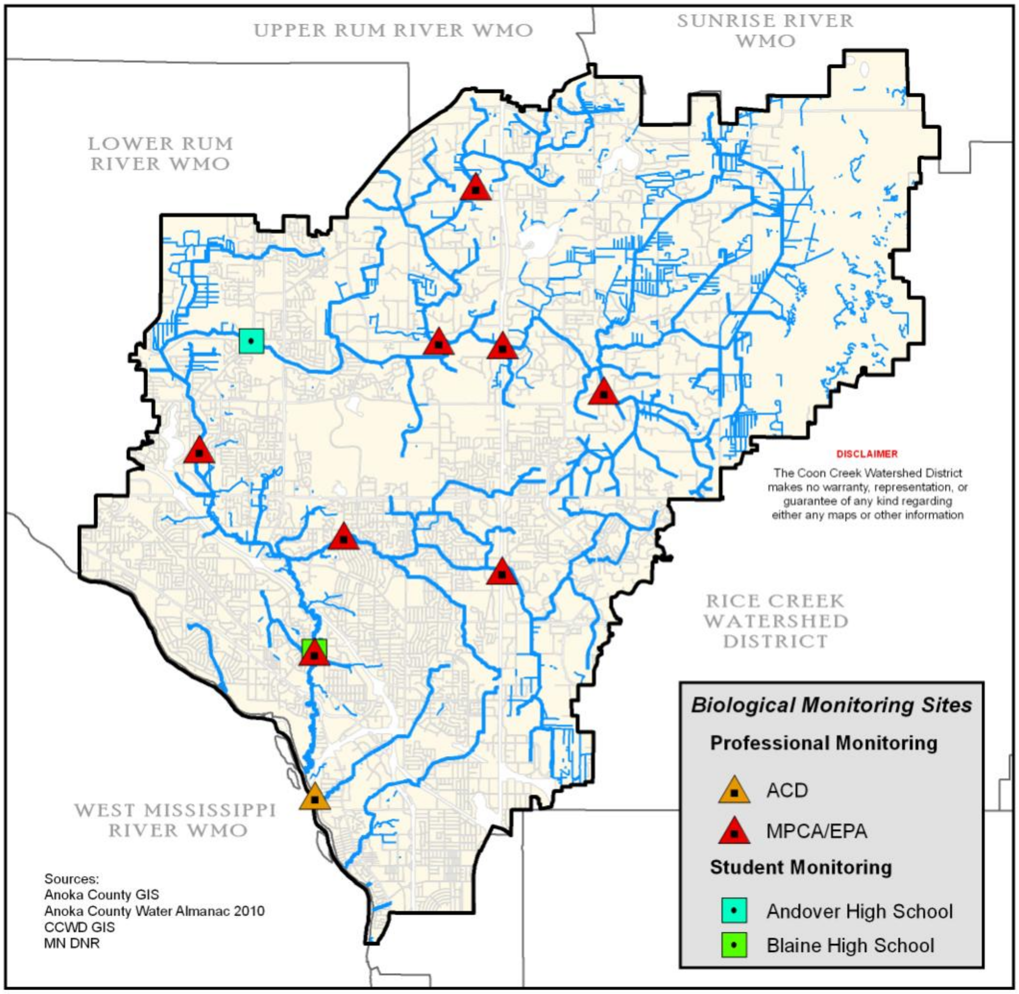
303(d) Impairments within the Coon Creek Watershed



Biomonitoring

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.

Map of Biomonitoring Locations

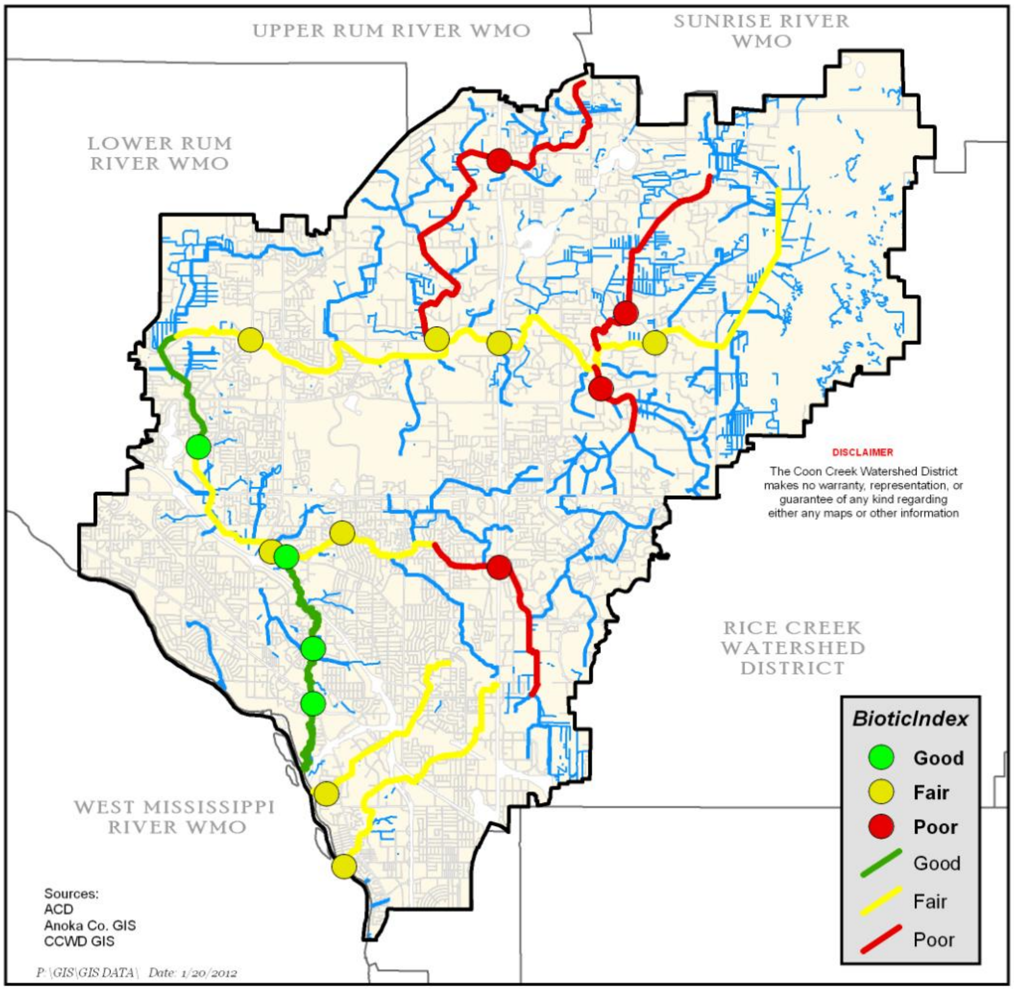


The biomonitoring suggests that stream health is similar to the average for Anoka County streams, despite the good quality habitat. Family Biotic Index (FBI) has been consistently higher than the county average, but the number of families and number of pollution sensitive families (EPT) has been similar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

Current Biotic Condition



Sediment & Turbidity

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

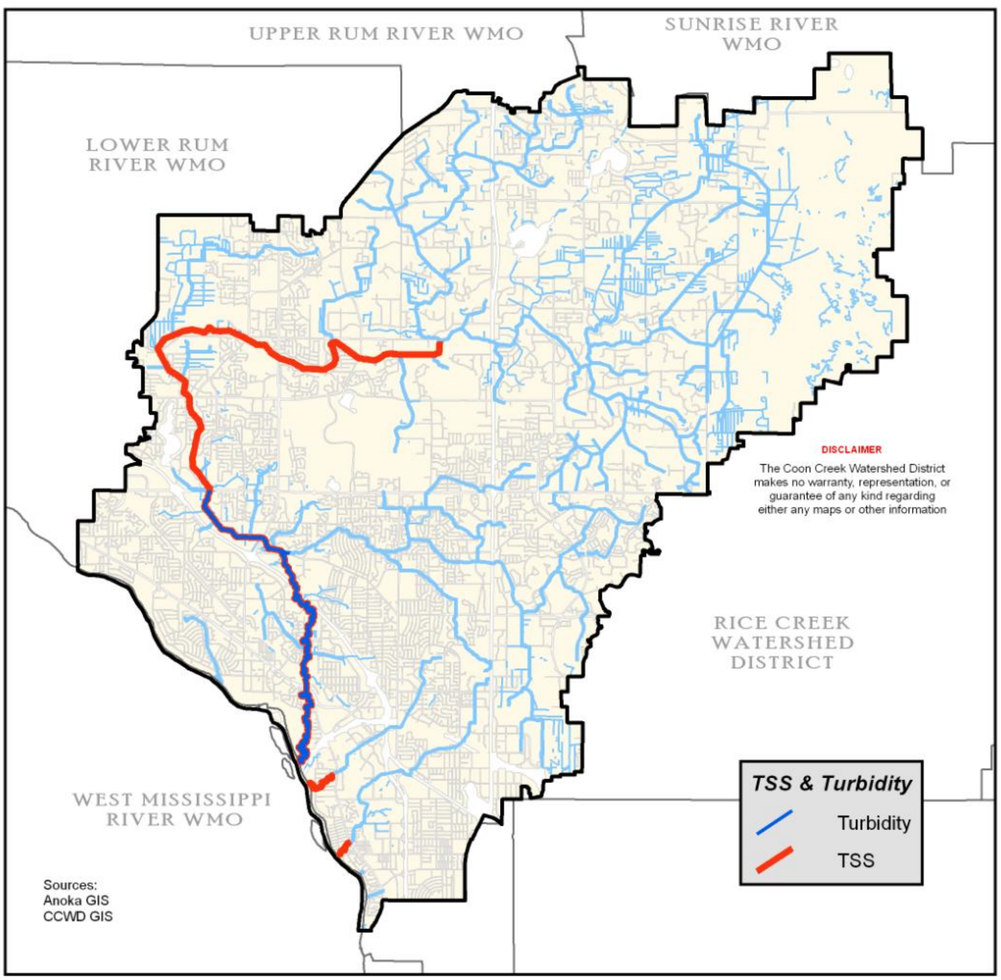
At least three observations and 10% of all observations must exceed the water quality standard of 25 NTU to be considered impaired.

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%

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

Location (Upstream to Downstream)	Median storm turbidity (NTUs)	Median storm TSS (mg/L)
Standard	**25**	**14**
Shadowbrook	13	19
Lions Park	30	20
Vale Street	39	46

Turbidity and Sediment Exceedences



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

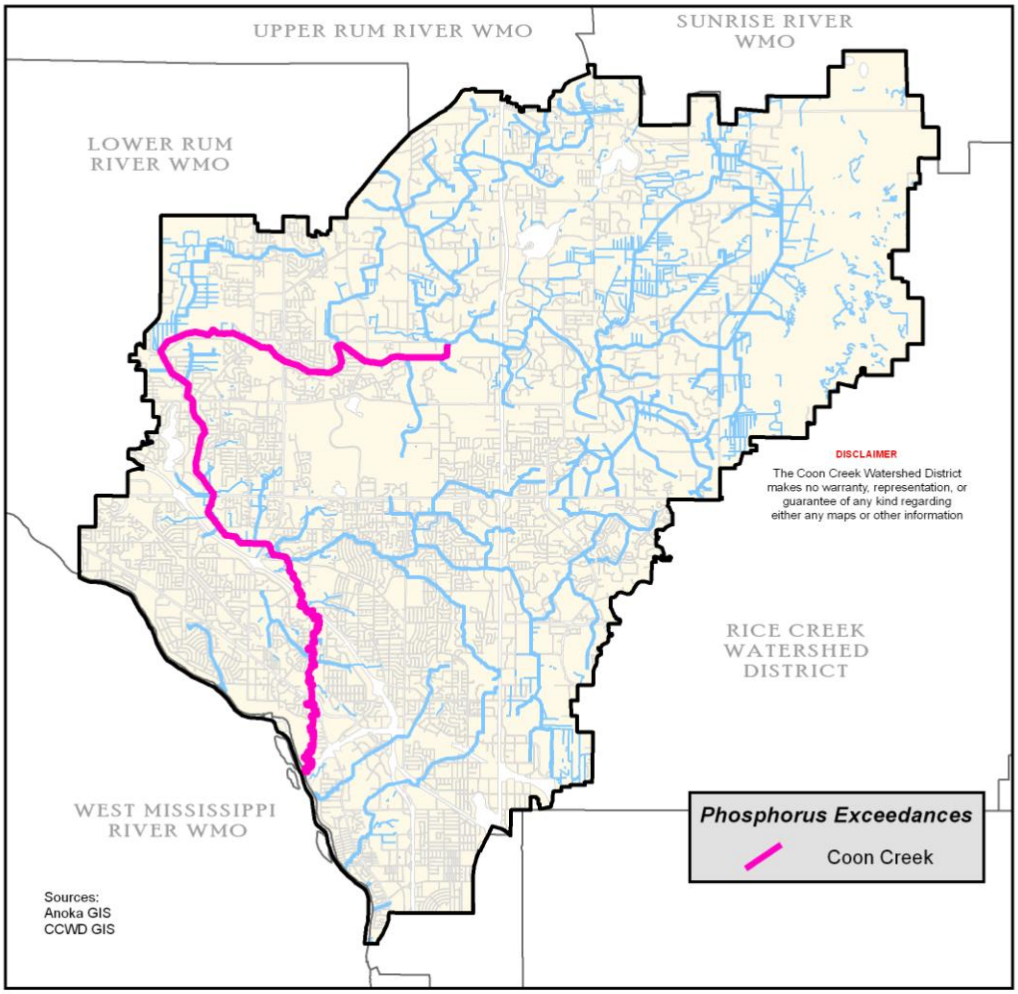
The 2000-2010 Comprehensive Plan reviewed the effects of geology and soils on water quality noting that studies of the outwash sands of the Anoka Sand Plain have found significant amounts of apatite, a mineral containing phosphorus (Larson 1985). Such apatite levels have the potential to raise the background 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.

Storm flow During storms TP is 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.

Total Phosphorus Median Total Phosphorus (ug/L) Stormflow

Site	County Median	Coon Ck	Sand Ck	Pleasure Ck
St Standard	**130**			
Shadowbrook	126	174		
Lions Pk		194		
Vail St		192		
Xeon St			94	
Mississippi R				69

Phosphorus Exceedences



Oxygen Demanding Substances

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

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.

Dissolved oxygen was at acceptable levels commonly found in the area

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 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:

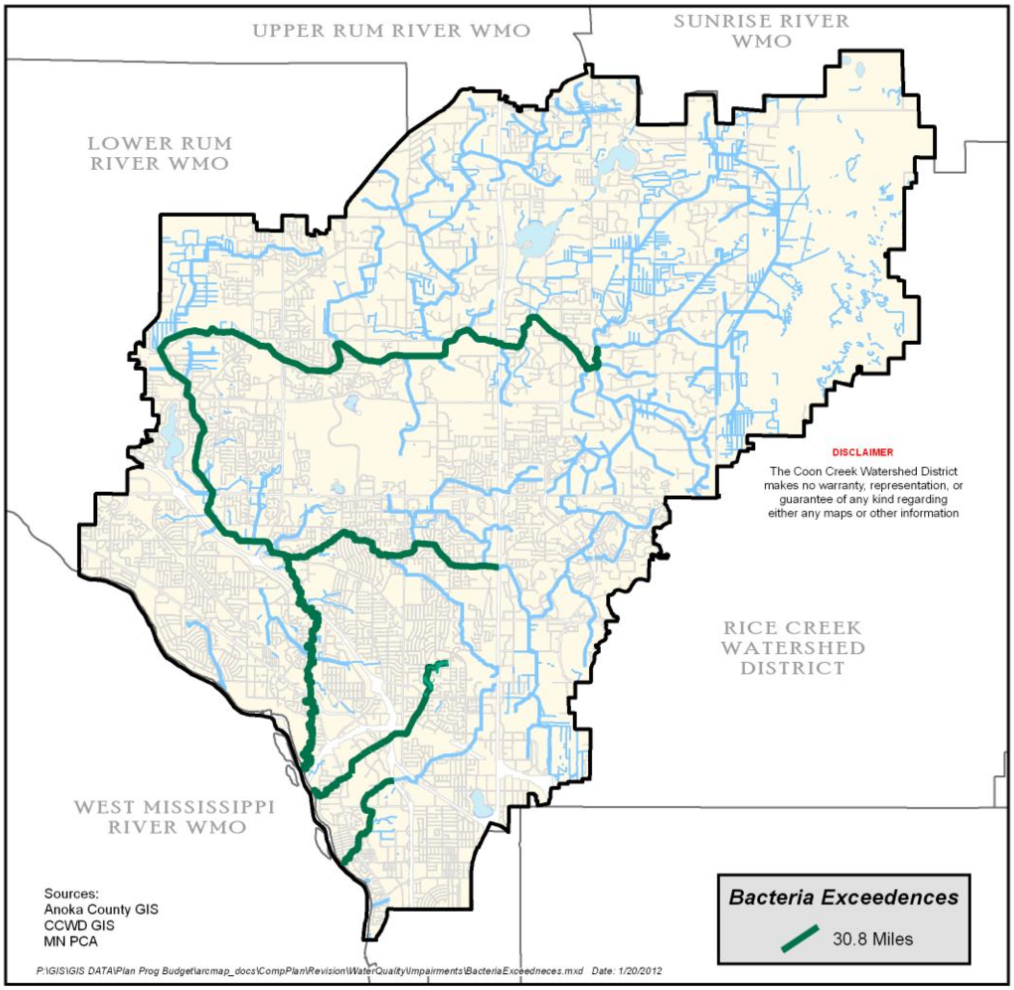
1. Headwater storm water ponds
2. Storm water runoff from throughout the watershed.

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

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

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.

Bacteria Exceedences



Chloride

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.

Site	County Median	Coon Ck	Sand Ck	Pleasure Ck
St Standard		230	230	230
Median	12	49	75	
Maximum		85		**262**
Shadowbrook		37		
Lions Park		52		
Vail St		63		
Xeon St				
Mississippi R				159
96th Lane				71
99th Lane				70

Volume/Rate

The District has begun to see a change in both the volume and rate of stormwater. While considerable work remains to done, the Districts drainage sensitive use, ponding and infiltration policies as well as the District's retrofit efforts remain the building blocks for holding the line and beginning to decrease volume.

Value of Water Quality

Value of Ensuring Water Quality

The economic value of ensuring water quality within the watershed is both direct and indirect.

1. The direct value is the cost of protecting human health, supporting a healthy environment and encouraging a productive landscape

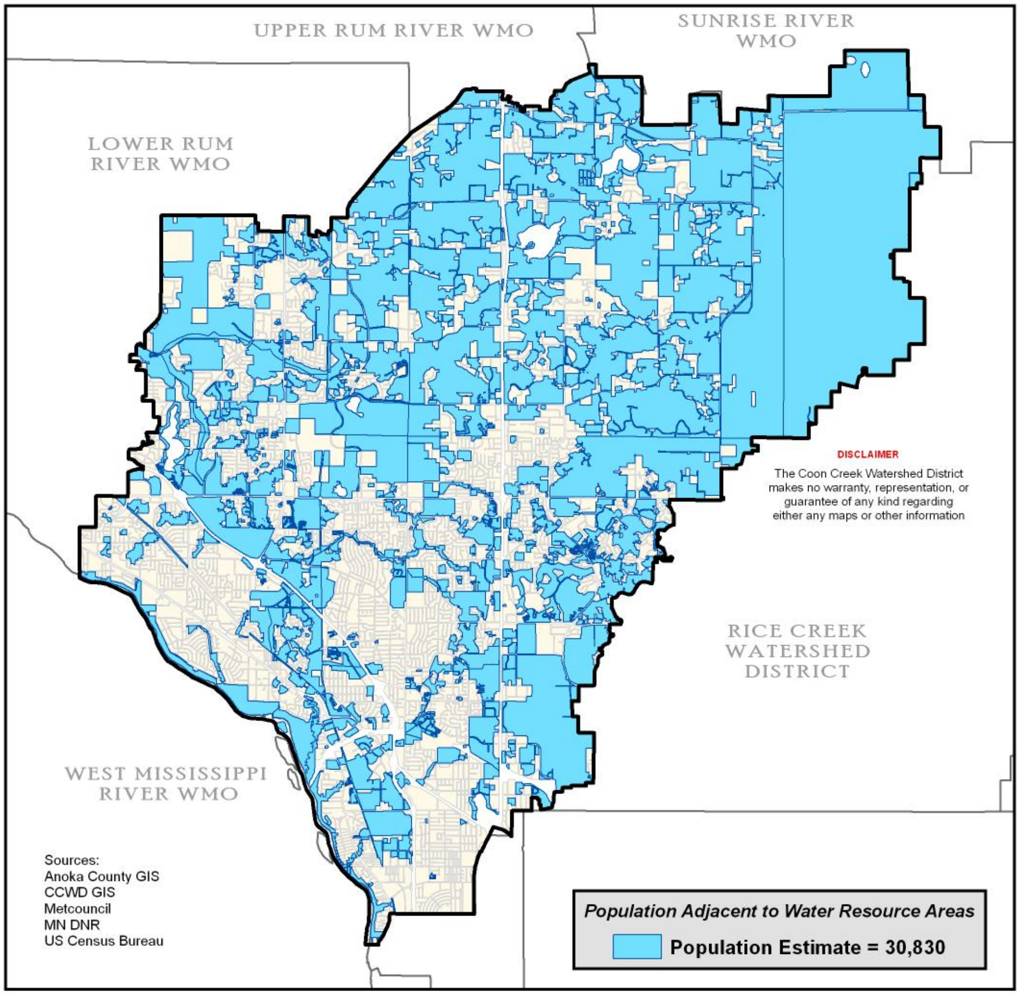
2. The indirect value is based on the prevention of property damage and achieving compliance with state and federal water quality standards and TMDLs through planning, regulatory monitoring and maintenance activities geared toward preventing degradation or remediation of water quality impacts.

The cumulative economic value of water quality within the Coon Creek Watershed is approximately $5 to 7 billion dollars

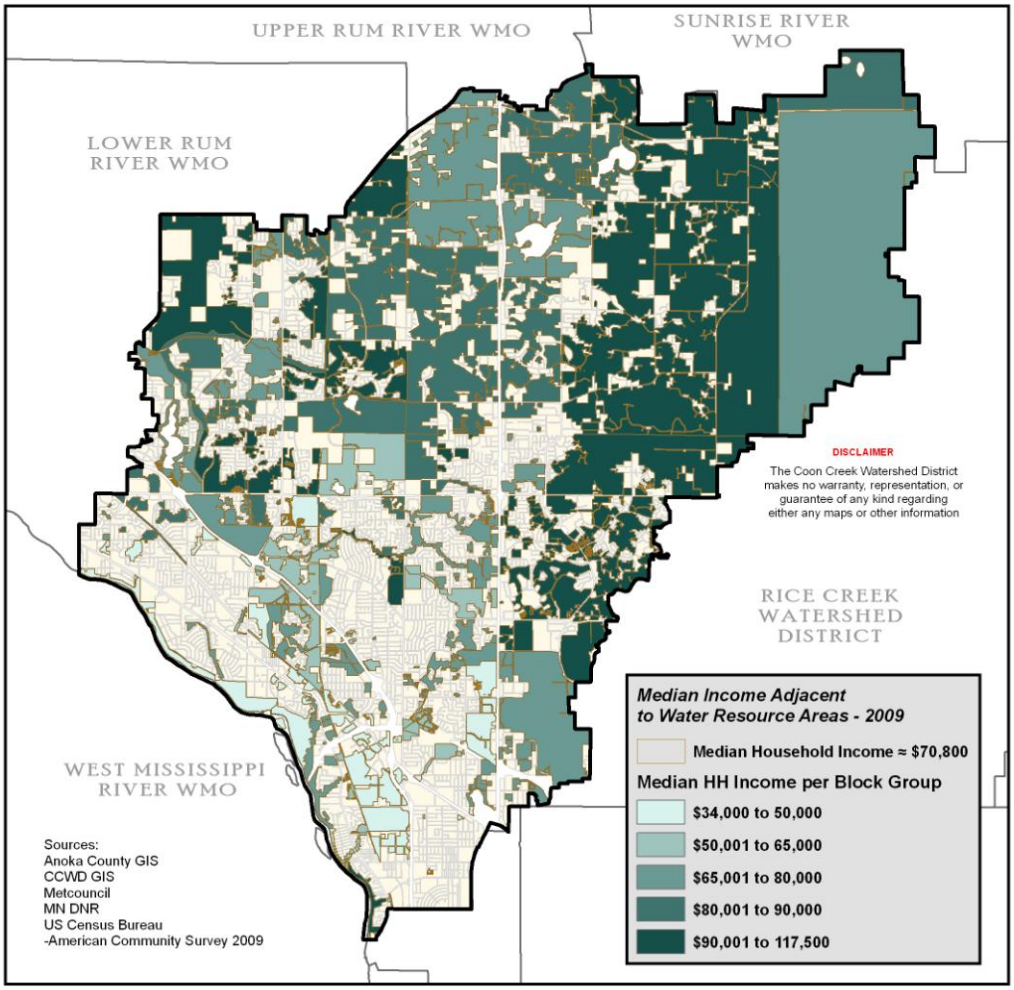
Population Served

Approximately 30,830 people within the watershed are directly or indirectly affected by the quality of adjacent water resources. By 2020 that number is expected to be 33,000.

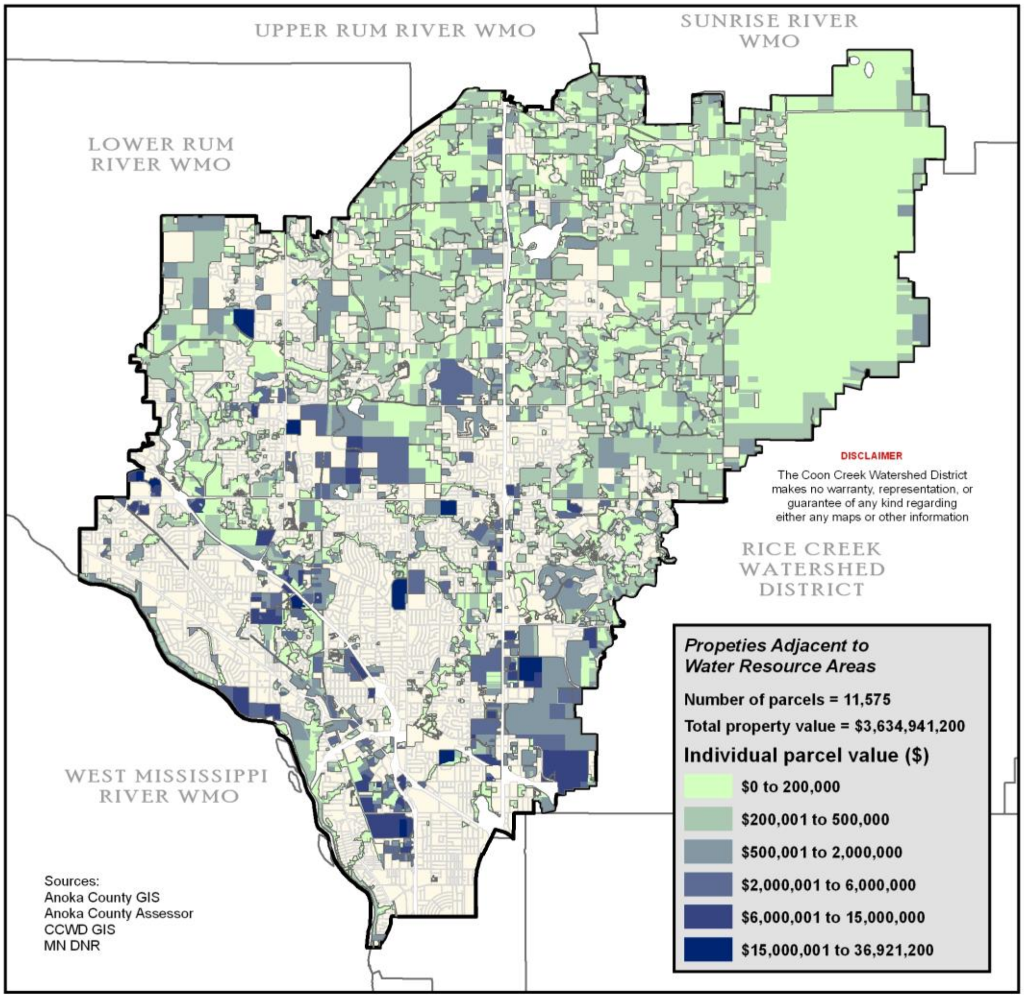
2010 Population adjacent to Water Resource Areas



Income Median household income of people living adjacent to water resources is $70,800.



Property Value In 2010 the watershed contained approximately 11,575 parcels valued at $3.635 billion where the quality of the adjacent lake and waters is critical to property values.



Substitutes There are no natural substitutes for water quality

The Marginal Value of Water Quality The marginal value for Water Quality remains high.

In spite of water quality regulations and other control efforts, as development has occurred, water quality has become a watershed issue making additional local control efforts that much more valuable.

Stressors to Water Quality

Involves an assessment of the exposure and vulnerability of water quality through 2020

Risks of disruptions to water quality 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.

The stressors identified relate the information presented earlier in this chapter to the District's role and priorities in managing water quality.

Altered Hydrology Conditions resulting from periodic dewatering or inundation of habitat (including high velocities and rapidly changing flow resulting from:

- Non-natural variations in flows due to withdraws
- Decreased/altered flows from flood control and other water control structures and ponds
- Lake or pond fluctuations
- Ditching of wetlands
- Channelization of streams

Aquatic Invasive Species Conditions that cause the loss or impairment of recreational opportunities and habitat/ecological integrity of aquatic or riparian habitat due to:

- Human dispersion (aquaria release, ballast release, boat/trailer transfer)
- Natural spread (avian transfer)

Channel Erosion Increased sediment & nutrient loading due to mass wasting and stream disequilibrium (erosion/transport/deposition) from:

- Increased peak flows (watershed ditching/draining, impervious cover runoff, climate change)
- Sediment discontinuity (Control structures, culverts)
- Channelization practices (Channel dredging. Straightening and armoring)
- Bed and bank disturbance

Encroachments Loss of habitat, equilibrium and ecological process due to encroachments within or adjacent to floodplains, wetlands, lakes, and streams from:

- Earthen fill
- Roads
- Buildings
- Utilities
- Stream crossings
- Dams/control structures

Land Erosion Increased fine sediment and nutrient loading due to erosion of exposed soils and gully erosion from:

- Ditching (conveyed surface flow)
- Cropland
- Construction sites
- Stormwater runoff

Nutrient Loading Non-erosion loading to surface waters from:

- Over-fertilization (Urban & agriculture)
- Inadequately treated domestic waste
- Animal waste

Pathogens From anthropogenic wastes attributable to:

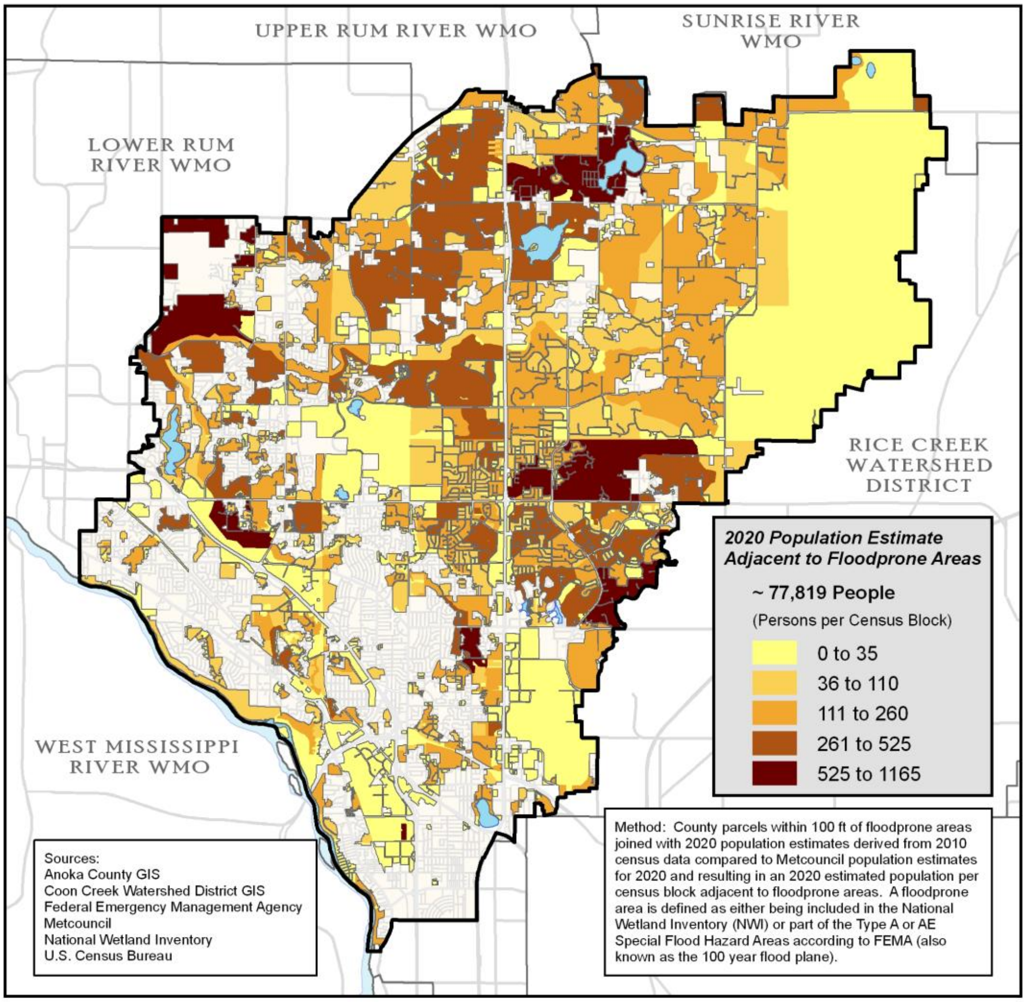
- Poorly-functioning septic systems
- Domestic animals
- Agricultural runoff
- Nuisance wildlife

Expected Future of Water Quality

The quality of water in 2020 will depend on:

Population

	2010	2020	Pct Chg
Andover	21,188	27,188	28%
Blaine	60,643	71,943	19%
Columbus	508	623	23%
Coon Rapids	65,700	66,000	0%
Fridley	27,000	26,900	0%
Ham Lake	15,017	16,686	11%
Spring Lake Park	6,710	6,710	0%
Total	196,766	216,050	10%



Expected Water Quality

Bacteria Not sure what can be done for bacteria levels. Signage of potential public health concerns and advisories on contact or consumption of water should physical contact be made with the water.

Biota Not sure what can be done for biota given that most of the system serves utilitarian uses such as agricultural drainage or stormwater conveyance and needs periodic maintenance and excavation.

Chloride Chloride appears to be as much of a shallow groundwater problem as a surface water problem. As such, a considerable amount of Chloride is already in the system and will continue to be detected during monitoring.

However, the District can encourage and address further applications of chloride through contact with road authorities, retailers and public education.

Total Suspended Solids (TSS) and Turbidity The District should be able to significantly reduce TSS and turbidity through its stormwater retrofit and bank stabilization efforts. Factors limiting success lie in the fine sands that underlie most of the watershed and the degree to which those fine sands represent a bed load which is simply a natural part of low gradient stream in the Anoka Sand Plain.

Volume/Rate The District has begun to see a change in both the volume and rate of stormwater. While considerable work remains to done, the Districts drainage sensitive use, ponding and infiltration policies as well as the District's retrofit efforts remain the building blocks for holding the line and beginning to decrease volume.

Service Preferences

	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