NRCS PRINCIPLES & BACKGROUND

The Natural Resources Conservation Service: Who We Are

With the mission of "Helping People Help the Land," the Natural Resources Conservation Service (NRCS) provides products and services that enable people to be good stewards of the Nation's soil, water, and related natural resources on agricultural lands. With our help, people are better able to conserve, maintain and improve their natural resources. Because of our technical and financial assistance, land managers and communities take a comprehensive approach to the use and protection of natural resources in rural, suburban, urban, and developing areas.

Our guiding principles are service, partnership, and technical excellence.

Since 1935, the Natural Resources Conservation Service (originally the Soil Conservation Service) has provided leadership in a partnership effort to help America's private land owners and managers conserve their soil, water, and other natural resources. NRCS employees provide technical assistance based on science that is suited to a customer's specific needs. We provide financial assistance for many conservation activities. Participation in our programs is voluntary. Our Conservation Technical Assistance (CTA) program provides voluntary conservation technical assistance to land-users, communities, units of state and local government, and other Federal agencies in planning and implementing conservation systems. We reach out to all segments of the agricultural community, including historically under-served (beginning farmers, limited resource and socially disadvantaged farmers and ranchers), to ensure that our programs and services are accessible to everyone. We also provide technical assistance to foreign governments and participate in international scientific and technical exchanges. We manage natural resource conservation programs that provide environmental, societal, financial, and technical benefits. Our science and technology activities provide technical expertise in such areas as animal husbandry and clean water, ecological sciences, engineering, resource economics, and social sciences. We provide expertise in soil science and leadership for soil surveys and for the National Resources Inventory, which assesses natural resource conditions and trends in the United States.

Montana Focused Conservation

Montana Focused Conservation is locally led. NRCS and Cascade Conservation District, with the help of additional partners, will convene a local working group to gather input from farmers, ranchers, conservation partners and other members of the community to develop a vision for conservation in Cascade County. This focused conservation will be "Partner-Centric," meaning that NRCS will be working with local, state, federal, and tribal partners along with nongovernmental organizations to

strategically focus agency investments on the highest-priority resource needs in Cascade County. By collaborating with partners, NRCS will be able to leverage funding sources from other groups to make the most effective use of limited federal conservation dollars. Leveraging funds increases the total conservation investment and ensures that conservation is developed to address a resource concern. By focusing and targeting conservation projects to specific areas, NRCS and partners will be able to invest time and funds more efficiently. This will help landowners achieve clearly identified natural resource goals on a landscape scale. These projects will also be focused on results. By emphasizing planning, NRCS staff will be able to work with local partners to set measurable goals and to track and achieve meaningful conservation results.

County information and location

When the Lewis and Clark Expedition made it to the Great Falls of the Missouri River on June 13, 1805, they became the first European descendants to see the Great Falls. The Great Falls of the Missouri are in Cascade County and Cascade is French for waterfall. It is the fifth-most populous county in Montana. As of the 2015 census the population was estimated at 82,278 people. According to the US Census Bureau, the county has a total area of 2,711 square miles which is 1.73 million acres. This make Cascade County the 21st largest county in Montana. The counties that border Cascade are Teton to the Northwest, Judith Basin to the East, Lewis and Clark to the West, Meagher to the South, and Chouteau County to the Northeast.

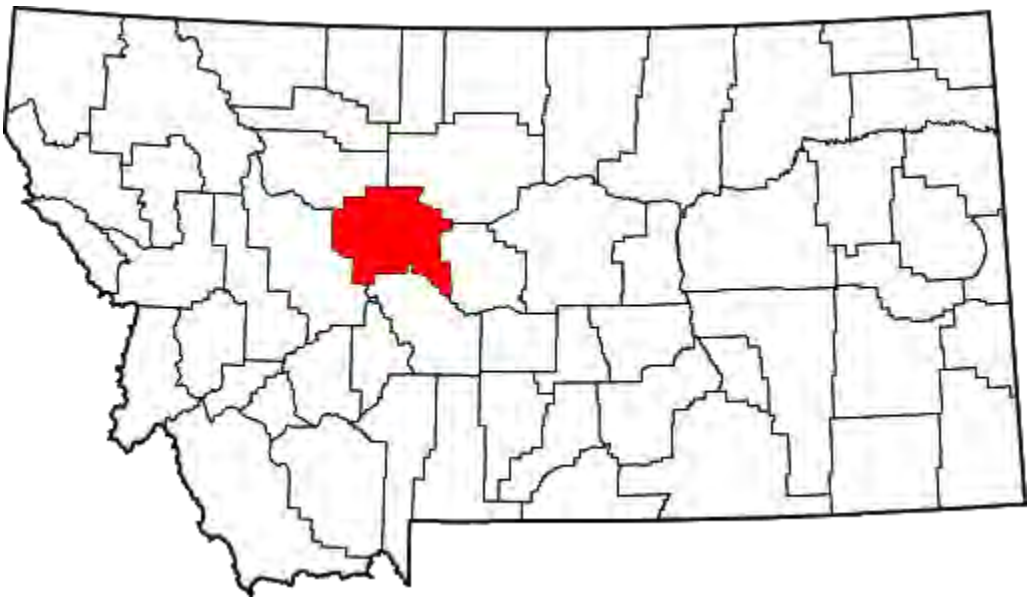


Figure 1, Location of Cascade County in Montana.

Section I: Introduction

VISION: Target and focus efficient management to shovel ready projects that address resource concerns (through/with/by/from) locally led objectives and partnerships.

MISSION: Develop and employ strategies that target, enhance and promote resource health and strength.

Mission Tagline: Locally Led Focused Conservation.

The purpose of the long-range plan is to concentrate NRCS's time and money in a more strategic and efficient manner. To take steps to solve resource concerns in Cascade County while partnering with other entities to leverage dollars or any other assistance available to achieve clearly defined natural resource goals. This plan will have a five-year timeframe and the plan can be adjusted as needed during this timeframe as more is learned about conservation areas of interest from partner collaboration.

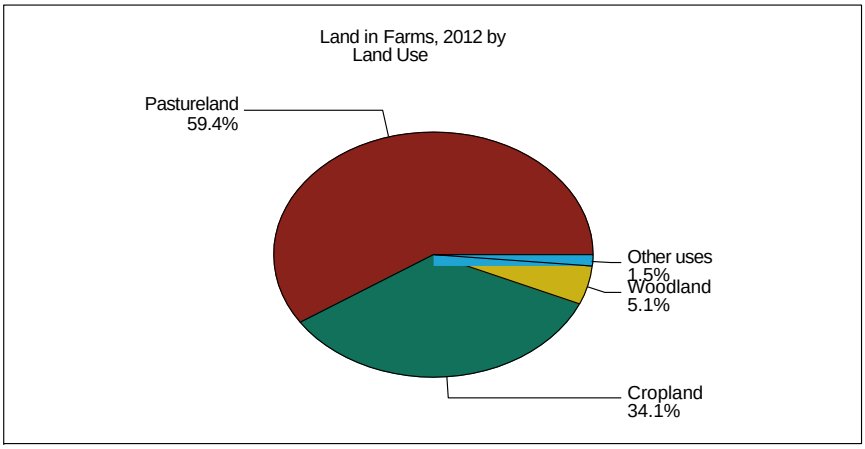
Partners:

NRCS, Cascade Conservation District, Sun River Watershed Group, Ducks Unlimited, Pheasants Forever, DNRC, DEQ, Fish, Wildlife & Parks, BLM, USDA Forest Service, FSA, Irrigation Districts and Missouri River Conservation Districts Council. More to come as focused conservation is developed.

Section II. Natural Resource Inventory

Humans

In 2012 Agriculture Statistics reported that there are 1,105 farms and the average size of a farm in Cascade County was 1,136 acres. This data does not account for land that is livestock only or considered a "Ranch". Figure 1 shows the farms by size and a percentage breakdown of the land use on the farm.



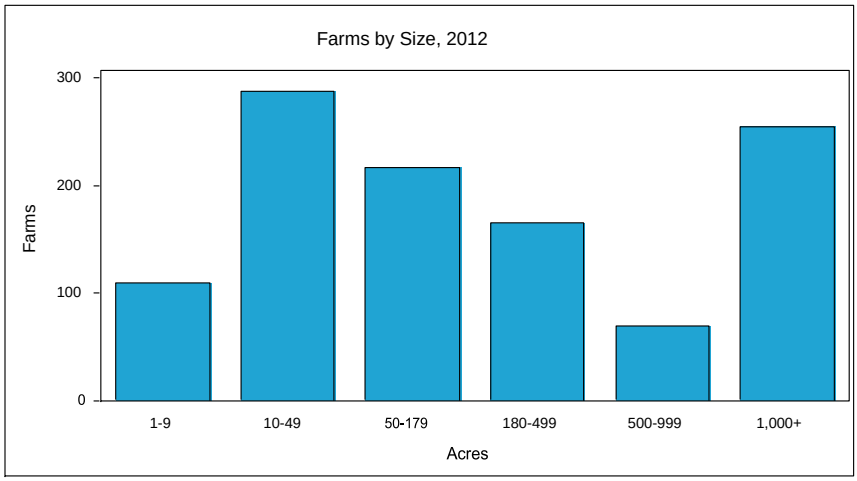


Figure 2 & 3 Farms by Size and Land in Farms. Source 2012 Ag Census, https://www.nass.usda.gov/Publications/AgCensus/2012/Online_Resources/County_Profiles/Montana/cp30013.pdf

Cascade County encompasses 1,735,340 acres. Land ownership is broken down by 309,610 (18%) acres is Public land and 1,425,429 (82%) acres of Private land. Since most land is private land this gives several opportunities to apply and implement conservation. Figure 4 shows the breakdown of land ownership of private and public lands. The top three public land owners are US Forest Service 178,000 acres, Montana State Trust Lands 78,535 acres, and US Bureau of Land Management 24,636 acres. Government owned land includes Bureau of Reclamation, City Government, US Dept of Defense, US Fish and Wildlife Service, Montana Fish, Wildlife, and Parks, BLM, Montana State Trust Lands and US Forest Service. Miscellaneous Government would be City, County, University and MTDOT. Private land encompasses the most acres in Cascade County. Data collected from Cadastral Map ArcGIS.

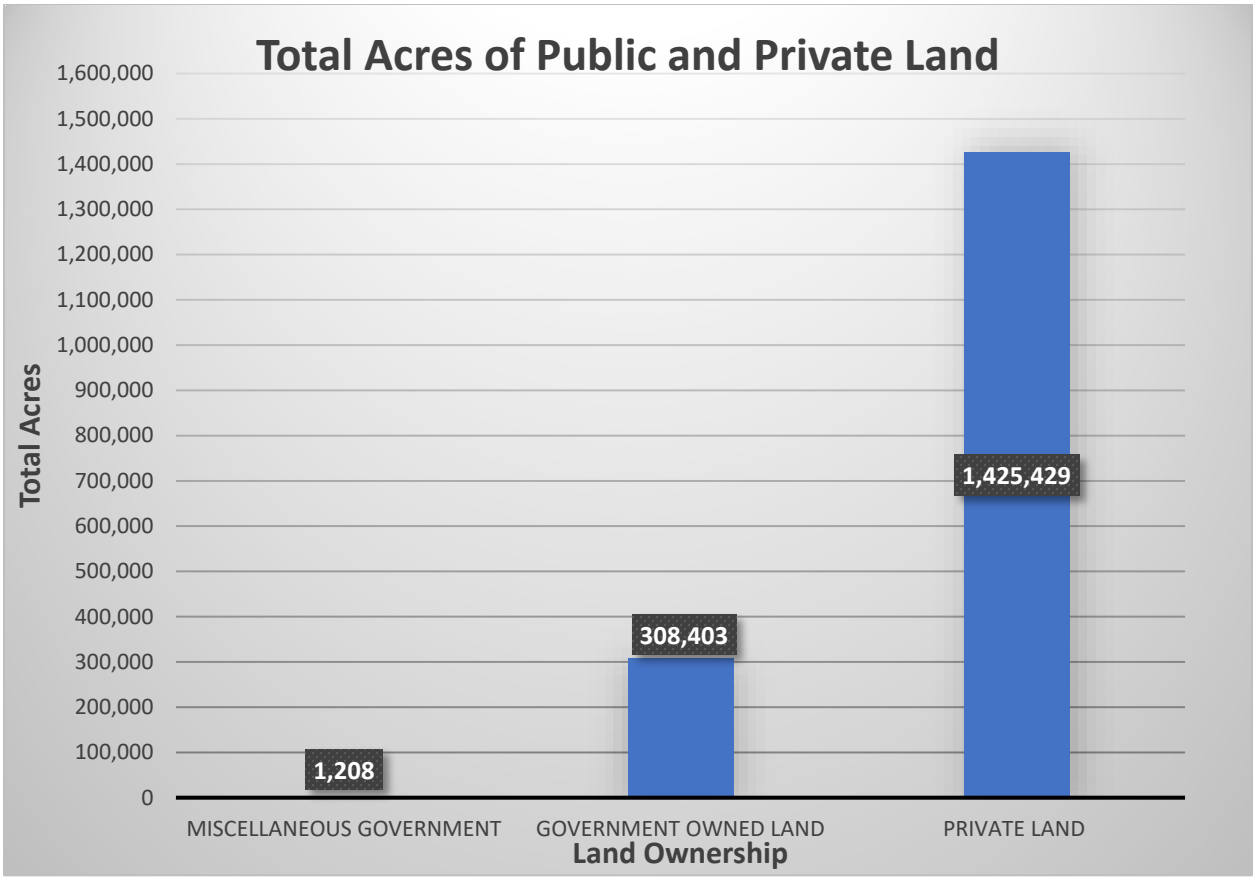


Figure 4, Total Acres of Public and Private Land.

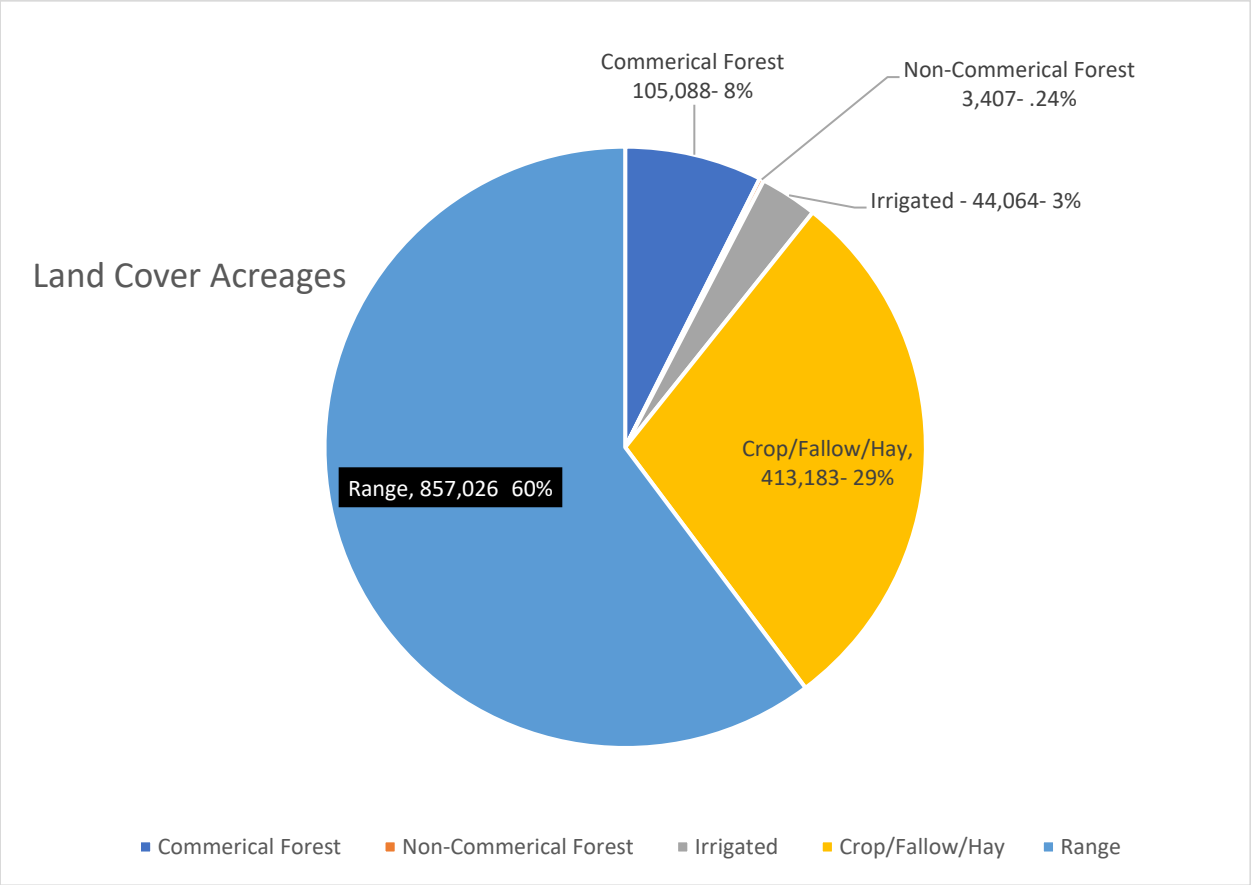


Figure 5, Agricultural land Cover by acres and percentage on Private land in Cascade County. Source Montana DOR 2017 FLU data.

A closer look at the private land Range is the dominant land use in Cascade County at 60%. Of the 3% of irrigated ground there is three types of irrigation practices: Flood irrigation covers 23,927 acres, Pivot irrigation covers 15,791 acres and sprinkler irrigation covers 4,449 acres.

Table 1 is showing how Cascade County ranks in the State and U.S. on commodity, crop and livestock. (D) withheld to avoid disclosing data for individual operations. Source 2012 NASS Ag census.

Cascade County – Montana

Ranked items among the 56 state counties and 3,079 U.S. counties, 2012

Item	Quantity	State Rank	Universe[1]	U.S. Rank
MARKET VALUE OF AGRICULTURAL PRODUCTS SOLD ($1,000)				
Total value of agricultural products sold	111,128	13	56	1,066
Value of crops including nursery and greenhouse	53,547	20	56	1,111
Value of livestock, poultry, and their products	57,581	9	56	826
VALUE OF SALES BY COMMODITY GROUP ($1,000)				
Grains, oilseeds, dry beans, and peas	42,984	18	55	912
Tobacco	-	-	-	-
Cotton and cottonseed	-	-	-	-
Vegetables, melons, potatoes, and sweet potatoes	(D)	(D)	39	(D)
Fruits, tree nuts, and berries	(D)	19	23	(D)
Nursery, greenhouse, floriculture, and sod	(D)	7	42	(D)
Cut Christmas trees and short rotation woody crops	(D)	11	11	1,499
Other crops and hay	8.791	16	56	337
Poultry and eggs	1,138	2	55	985
Cattle and calves	42,704	16	56	337
Milk from cows	4,294	2	27	761
Hogs and pigs	7,460	1	54	486
Sheep, goats, wool, mohair, and milk	684	14	54	244
Horses, ponies, mules, burros, and donkeys	616	11	56	442
Aquaculture	(D)	3	16	(D)
Other animals and animal products	(D)	22	53	(D)
TOP CROP ITEMS (acres)				
Wheat for grain, all	119,978	18	54	115
Winter wheat for grain	97,841	6	49	96
Forage-land used for all hay and hayage, grass silage, and greencrop	70,793	8	56	75
Barley for grain	26,265	8	55	32
Spring wheat for grain	21,018	23	53	123
TOP LIVESTOCK INVENTORY ITEMS (NUMBER)				
Cattle and calves	62,212	17	56	350
Layers	48,717	2	56	491
Pullets for laying flock replacement	23,932	3	48	391
Hogs and pigs	19,339	3	52	498
Broilers and other meat-type chickens	8,848	4	46	640

Table 2 Operator Characteristics. Source 2012 NASS Ag Census. (2) Data were collected for a maximum of three operators per farm.

Operator Characteristics	Quantity
Principal operators by primary occupation:	
Farming	528
Other	577
Principal operators by sex:	
Male	915
Female	190
Average age of principle operator (years)	59.7
All operators by race[2]:	
American Indian or Alaska Native	12
Asian	4
Black or African American	4
Native Hawaiian or Other Pacific Islander	-
White	1,776
More than one race	21
All operators of Spanish, Hispanic, or Latino Origin[2]	21

Soil

Figure 6 and 7 show the number of acres and map for the survey area that are considered important farmlands. Important farmlands consist of prime farmland, unique farmland, and farmland of statewide or local importance. This list does not constitute a recommendation for a land use. To identify the extent and location of important farmlands, the Natural Resources Conservation Service, in cooperation with other interested Federal, State, and local government organizations, has inventoried land that can be used to produce the Nation's food supply.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil quality, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. Prime farmland is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. In Cascade County Prime farmland is limited and only covers 11,766 acres and 65,975 acres if irrigated.

In some areas, land that does not meet the criteria for prime or unique farmland is "farmland of statewide importance" to produce food, feed, fiber, forage, and oilseed crops. The criteria for defining and delineating farmland of statewide importance are determined by the appropriate State agencies. Generally, this land includes areas of soils that nearly meet the requirements for prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some areas may produce as high a yield as prime farmland if conditions are

favorable. Farmland of statewide importance may include tracts of land that have been designated for agriculture by State law. This classification only covers 291,920 acres in Cascade County.

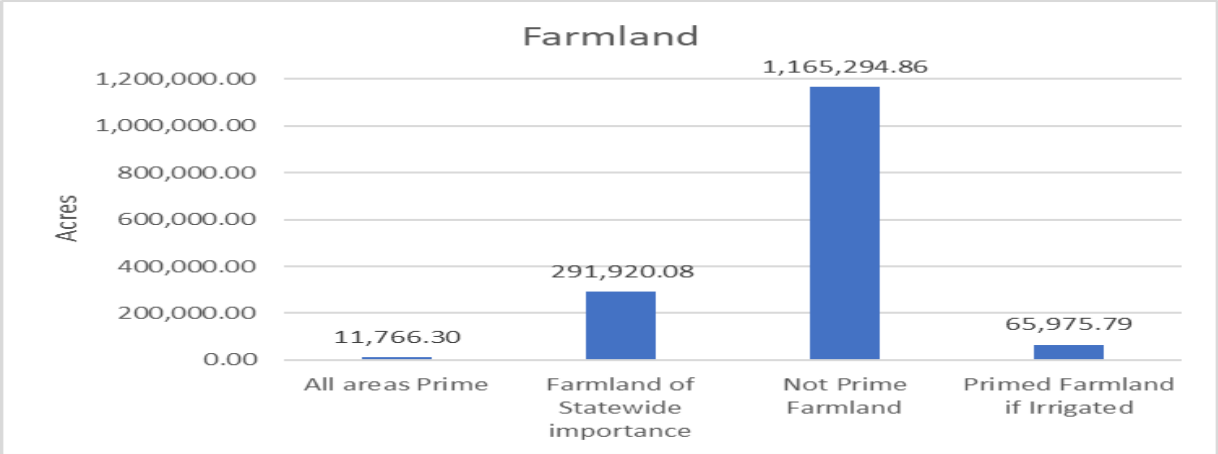


Figure 6, The total farmland in acres in Cascade County. Source, Soil Data.

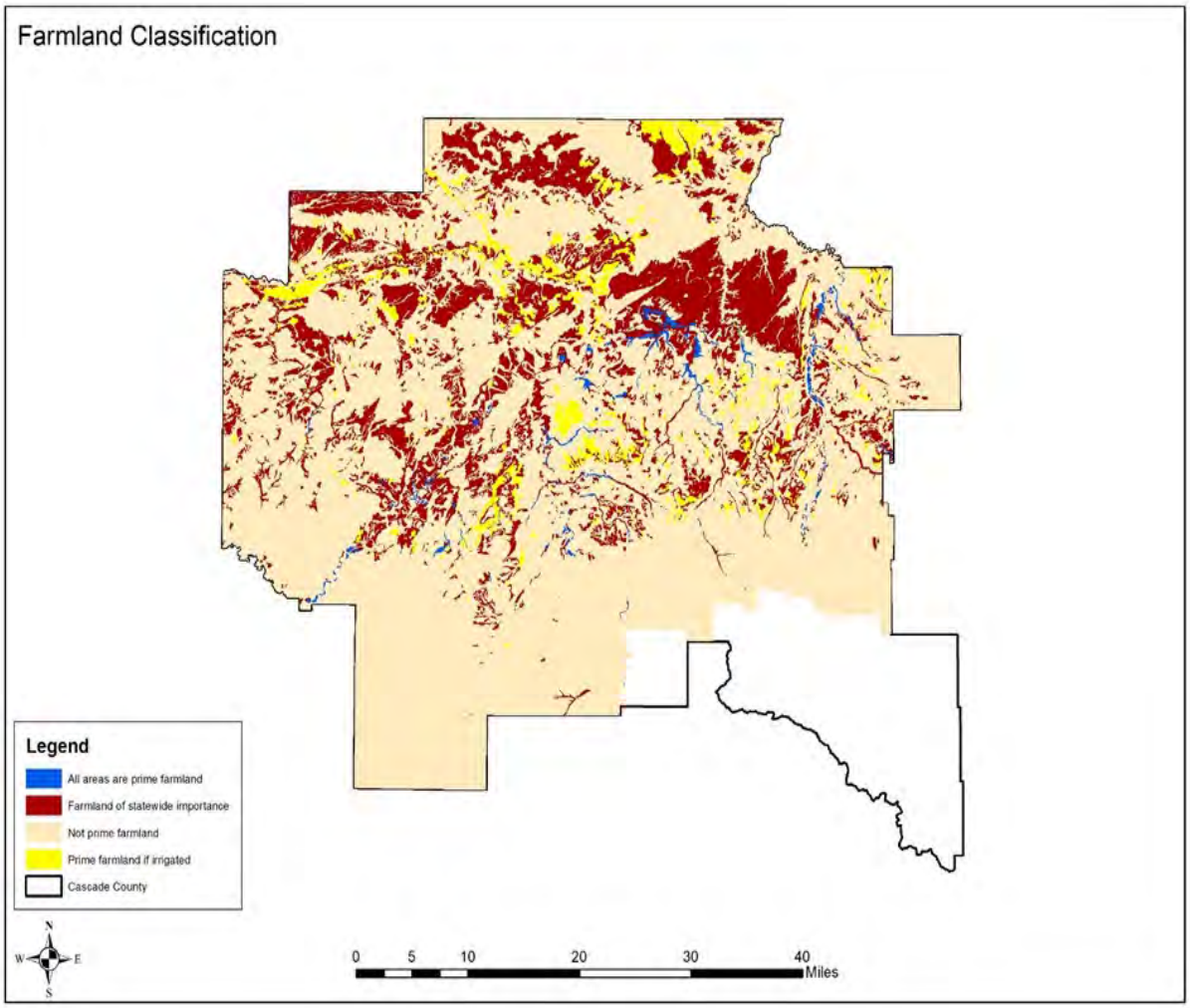


Figure 7, Farmland Classsification. The white area within the county boundary is unmapped soils.

There are four major problems in managing the soils of the area as cropland- wind erosion, water erosion and sedimentation, soil crusting, and saline seep. Each is explained briefly in the following paragraphs.

Wind erosion:

Wind erosion is a special problem in winter and early spring when there are persistent strong winds. Unless well managed, sands and clays are readily eroded during this period. Soils having a loamy surface layer can also erode if they are cultivated in wide strips or in blocks during dry periods when the wind velocity is high. Strip-cropping, cover crop, and utilization of crop residue help in maintaining good soil tilth and controlling wind erosion.

Water erosion and sedimentation:

Water erosion is slight to severe in cultivated fields where the slope is more than 2%. It is severe along Muddy Creek, Belt Creek, and Smith River. The sediment in Muddy Creek and the lower Sun River is a

major problem that requires intensive water management and a high level of cultural and vegetative practices on all land in the watershed.

Soil crusting:

Soil crusting is often a serious problem in obtaining adequate and uniform grain stands in the nearly level to slightly concave farming areas north and east of Great Falls. Reseeding or seeding to another crop is often needed. Most of the soils in these areas formed by water deposited material having a high proportion of silt and very fine sand. Generally, the surface layer is more than 50% silt and very fine sand and has a distinct grayish or "bleached out" appearance when dry. It is underlain abruptly by a clayey subsoil that has a slow or very slow rate of water transmission. These nearly continuous crusts and the very hard and durable clods usually form after the surface layer has been thoroughly wetted and then dried. Because the surface layer has a weak aggregate strength when wet, it tends to break down and puddle. The major management problems on these soils are the poor seedling emergence because of the crusted surface and the difficulty of preparing a favorable seedbed because of the cloddy surface layer.

Saline seep:

Most soils in arid regions contain soluble salts. The salts released by weathering of soil material normally remain in soils of arid regions because not enough rain falls to fully wet the soil profile and leach the salts.

Saline seeps result when water moves through a saline soil, commonly formed in glacial till, and collects on top of impermeable underlying shale. The problem of excess water occurs mainly in areas of crop-fallow dryland farming. During the fallow periods, more water is received from precipitation than can be stored in the soil for use by the following crop. This excess water moves downslope over the shale until it reaches the soil surface. The water then evaporates, and dissolved salts are precipitated on the soil surface. The water is saline because salts have been leached from the subsoil, the glacial till parent material, and the shale. The predominate dissolved materials are sodium, magnesium, sulfate, and nitrate. The trace metallic elements, generally found in high concentrations, are aluminum, iron, manganese, strontium, lead, copper, zinc, nickel, selenium, chromium, molybdenum, and vanadium.

Saline seeps have increased at a rate of about 8 to 10 percent per year in parts of Cascade County as well as throughout the northern plains region in recent years. Improved crop management is needed to prevent the loss of valuable farmland, the deterioration of shallow groundwater aquifers, the contamination of adjacent streams and reservoirs, the increased erosion along nearby coulees, and the gradual deterioration of the wildlife habitat and recreation potential of the area.

Early detection of potential saline seep areas is needed so that the problem can be corrected. New or developed wet spots, areas of late maturing crops, the germination of seed in a seep area during dry periods, the growth of foxtail barley, and the prolific growth of kochia late in the season indicate areas that should be examined by soil probing, using electrical probe instruments to determine electrical conductivity (EC) of the soil and estimate the extent of seep development. Most of the saline seeps occur in the Northern portion of Cascade County.

Topography

Cascade County has an elevation range of 2,730 feet at its lowest point to 8,609 feet at the highest point. Figure 8 shows an elevation map of Cascade County.

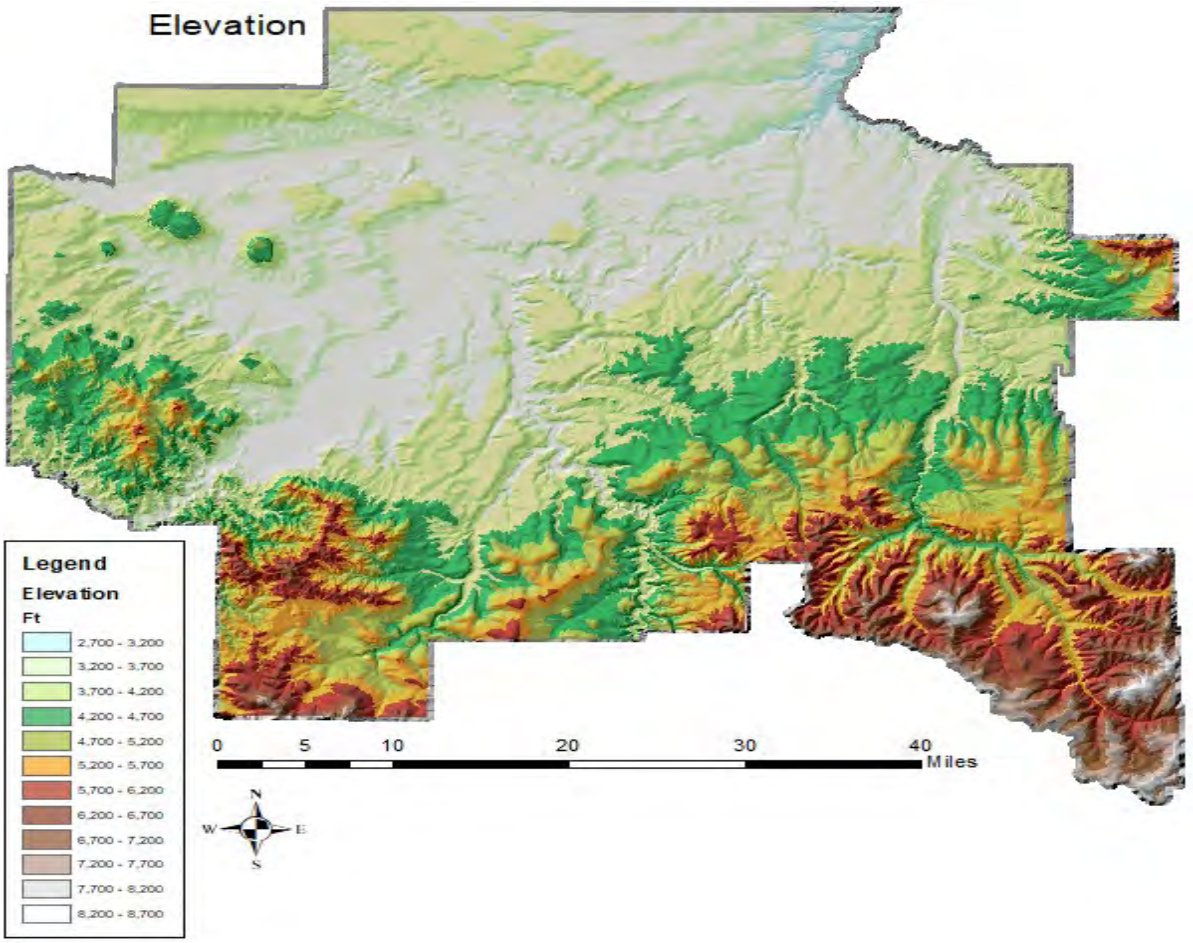


Figure 8 shows the elevation change in Cascade County.

COMMON RESOURCE AREA

Cascade County can be broken down into five Common Resource Areas (CRA). See Figure 9, for layout.

Area 1: Urban can be defined where the City of Great Falls is expanding into existing farm land. The focus here would be Green Infrastructure, Smart Irrigation, Technical assistance to small acreage landowners. This area does have small acreage farms and many of the existing farms are being encroached by Great Falls.

Area 2: Consists of forest, mines and range. This resource area is in the Belt Creek Watershed. This area has several abandoned coal and copper mines. The geology is such that when water and oxygen infiltrate these mines the water that seeps out into the watershed has a low pH (often a range of 3 to 6)

making this water highly acidic. This has created a water quality issue in this drainage and is one of the causes for the 303d listing. The forestry focus would be to develop a plan for fuels reduction and management. This would help to make the forest more resilient. Range land is the dominate land use in this area.

Area 3: Range land is the dominate land use in this area and this area is in two watersheds the Smith River and the Upper Missouri-Dearborn Rivers. Irrigation is predominately located on the Missouri and Smith rivers. There is mainly surface irrigation right and are pumped directly out of these two river systems.

Area 4: The bulk of this land is irrigated. Most irrigation water rights are surface rights from either the Sun River or one of the two irrigation companies.

Area 5: This area is where most of the dryland crop production happens. This area is also home to Benton Lake Refuge, which is a U.S. Fish and Wildlife Service (USFWS) refuge.

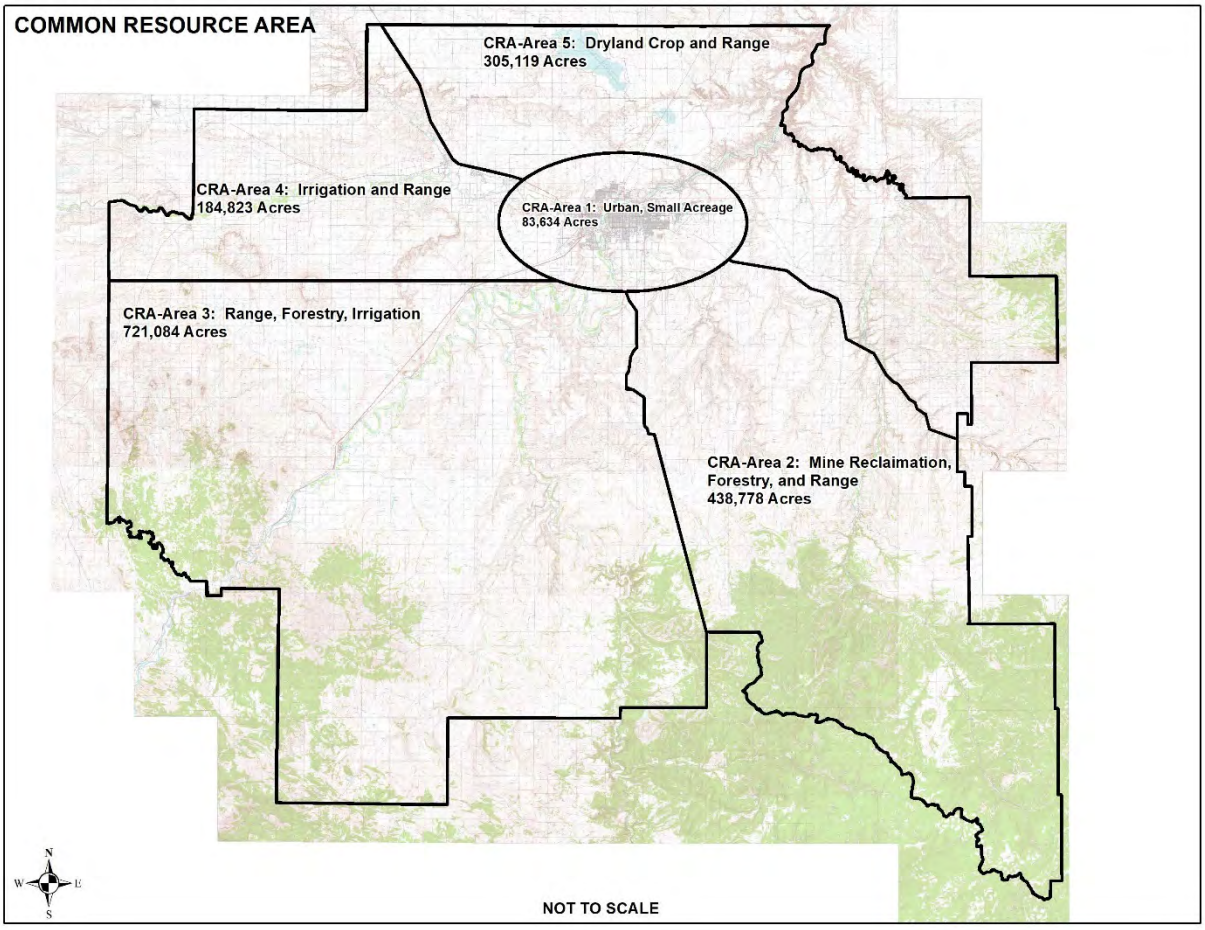


Figure 9 shows the Common Resource Area (CRA) for Cascade County. The CRA was developed by Cascade Conservation District and NRCS to narrow down resource concerns for a more focused approach.

Water

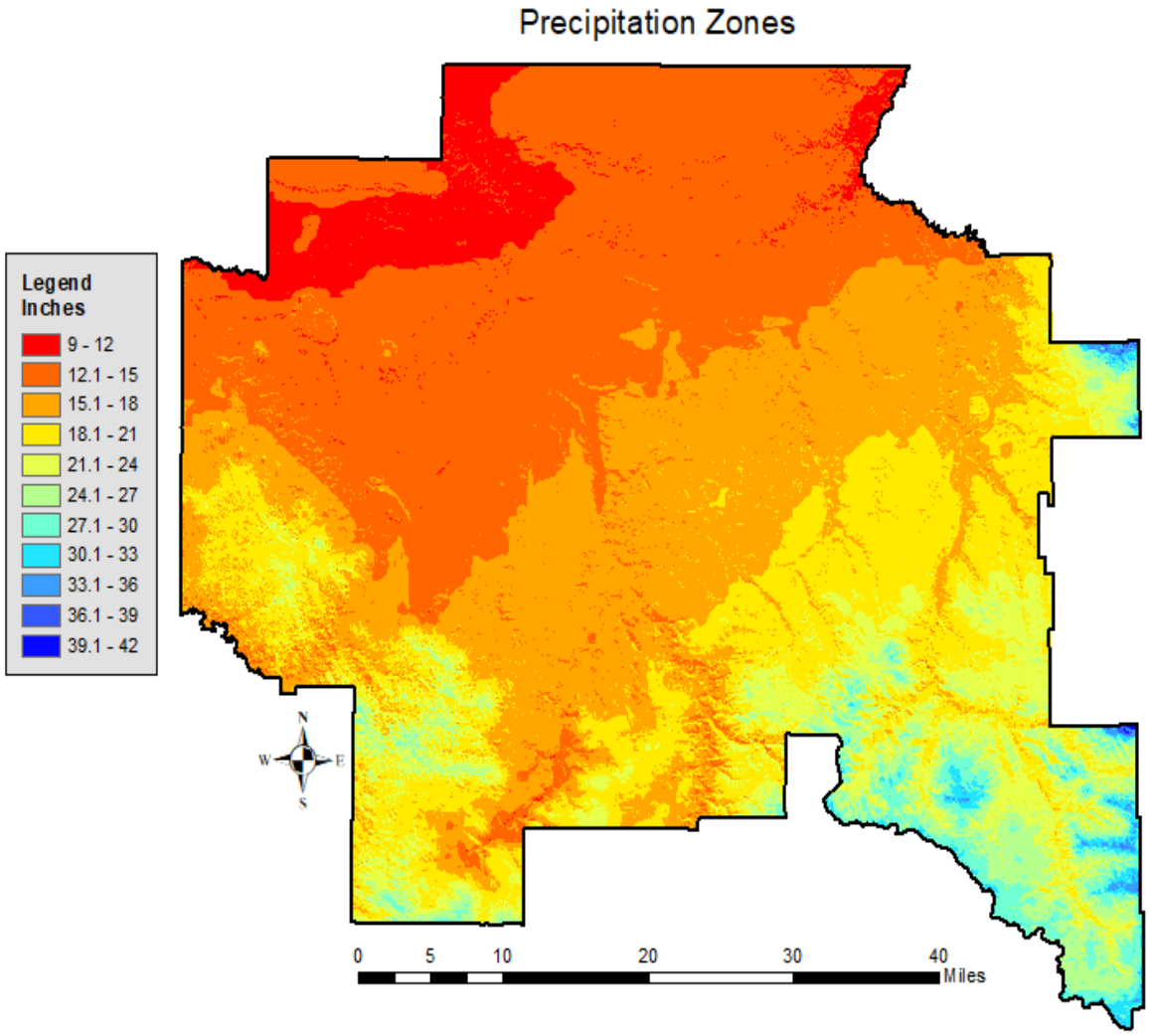


Figure 10 map of the precipitation zones in Cascade County.

Cascade County ranges in precipitation from 9 inches located in the northwestern edge up to 42 inches, which is located on Barker Mountain in the southeastern portion of the county. The average precipitation in the agriculture-based production averaged around 16 inches. Figure 10 shows a map of the precipitation. For more detailed information on precipitation the following website can provide data: https://www.nrcs.usda.gov/wps/portal/nrcs/mt/snow/.

There are seven SNOTEL sites that are important to Cascade County for irrigation reasons. There is one SNOTEL site (Wood Creek) for Sun river watershed and for the Smith river watershed there are six SNOTEL sites (Stringer Creek, Onion Park, Deadman Creek, Spur Park, Boulder Mountain and Pickfoot Creek). The SNOTEL website can give up-to-date information on precipitation and can be located at the following website: https://www.nrcs.usda.gov/wps/portal/nrcs/mt/snow/. This information is

important because these sites can be used for common applications of snow survey products include water supply management, flood control, climate modeling, recreation, and conservation planning.

Watershed:

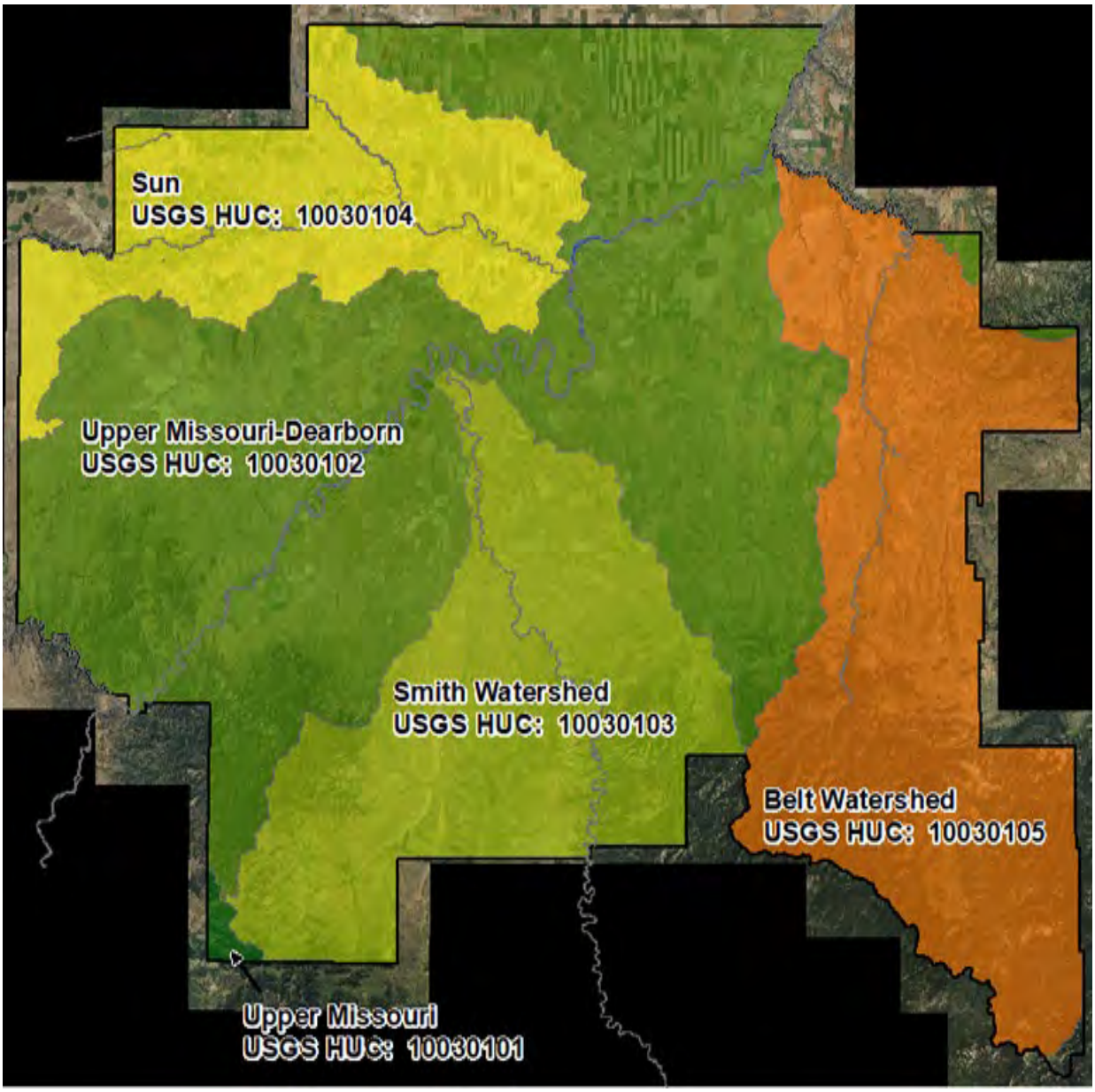


Figure 11 watershed map in Cascade County.

Cascade County has four major tributaries flowing to the Missouri River. The Sun River, Smith River, Dearborn River, and Belt Creek are all systems that drain into the Missouri river.

Belt Watershed HUC 10030105:

Belt watershed is approximately 603 square miles and starts in the Little Belt and Highwood Mountains. Most of the drainage area is in Cascade county and covers 386,042 acres. The basin contains approximately 186 named perennial streams, comprising a total length of about 442 miles of perennial stream habitat. Major tributaries to Belt Creek include Jefferson, Dry Fork, Tillinghast, Pilgrim, Logging, Big Otter, Little Belt and Big Willow creeks.

Stream Flow

A USGS stream flow gage on Belt Creek near Monarch (river mile 52.0) recorded an average annual flow of 192 cubic feet per second (cfs) for the 31-year period of record from 1951to 1982. A relationship was also developed to predict flows on Belt Creek at the Riceville Bridge at the lower end of Sluice Boxes State Park based on flows at the USGS Smith River below Eagle Creek Gage.

Land use in the Belt Creek drainage includes most types found east of the Divide. Timber harvest has been extensive in the past; however, harvest has been substantially reduced. Mountain pine beetle infestations and spruce budworm have had significant impacts on the forest health in recent years. Nearly all the land within the lower basin is managed for cattle ranching or farming. A substantial amount of livestock grazing occurs in this area. Only minor grazing occurs in the forested upper basin. Hay and some crop land exist along the stream, but little of it is irrigated. There has been extensive silver, lead, zinc and gold mining in the Little Belt Mountains in both the Carpenter-Snow Creek and Barker-Hughesville Mining districts. Along with the mining of various ore deposits, serious heavy metals pollution has occurred from several abandoned mining tailings. The water quality of streams in the Belt Creek drainage has been impaired because of runoff and groundwater. Both mining district sites are Federal Superfund sites and are in the early stages of remediation work.

This watershed is on the 303d list. See table 3 for location and cause name.

Fisheries Management of Belt Creek Watershed

Nineteen populations of genetically pure westslope cutthroat trout (WCT) currently occupy less than 15% (33 miles) of the total historic range in the drainage. Four of the populations are at a moderate risk of extinction over the short term. According to Montana Fish Wildlife and Parks (FWP) this area represents priorities where short- and long-term actions are required to reduce extinction risk and provide increased protection or expansion of the populations.

Smith Watershed HUC 10030103:

The Smith River drainage lies in west-central Montana in Meagher and Cascade counties, almost due south of Great Falls between the Big Belt Mountains on the west and the Little Belt and Castle Mountains on the east. The drainage in Cascade County is approximately 515 square miles. The total area covers 329,573 acres in Cascade county. Approximately 125 tributaries originate in the Big Belt and Little Belt mountains to join the Smith River. Some of the major tributaries originating in the Big Belt Mountains are Birch, Camas, Beaver, Rock, and Hound Creeks. Tributaries from the Little Belt Mountains are Newlan, Sheep, Eagle, Tenderfoot and Deep Creeks.

The Smith River is formed by the junction of the North and South Forks about 4 miles southwest of the town of White Sulphur Springs. The North Fork drains part of the southwest slopes of the Little Belt Mountains and the northwest slopes of the Castle Mountains. The South Fork originates along the southwest flank of the Castle Mountains and from the bench lands between the Castle and Big Belt Mountains. Hot water springs occur in the confluence area between the North and South forks, as well as at the headwaters of the South Fork and serve to elevate water temperatures in reaches of the upper drainage. The mainstem of the Smith River then meanders northwesterly about 41 miles through a broad upper valley before entering a deep mountain canyon near the confluence of Sheep Creek. The river twists north for approximately 45 miles between high limestone cliffs and conifer and grass-covered mountains before flowing another 12 miles through foothill grasslands. After Hound Creek enters the Smith, the river meanders another 24 miles through a relatively narrow, agriculturally developed valley flanked by rolling grasslands until it joins the Missouri River near the town of Ulm about 11 miles west of Great Falls.

In the early 1860s, the discovery of gold in the surrounding mountains stimulated a heavy influx of miners. As gold was depleted and mining operations abandoned, farming and ranching began to take over as the predominant land use in the basin, and they remain so today. Logging and recreation are other important land uses in the drainage.

Fisheries Management of the Smith River Watershed

The Smith River drainage holds about 1,220 miles of perennial streams, including approximately 100 named streams. There are approximately 741 miles of habitat capable of supporting salmonid fishes in the Smith River drainage. The Smith River Drainage is also home to several conservation populations of westslope cutthroat trout, providing opportunities to conserve this native species in the drainage. The long-term goal of cutthroat conservation in the Smith River Drainage is to have approximately 20% of the historically occupied habitat restored to secure conservation populations of cutthroat trout.

The fisheries resource is classified as high value by FWP for the floating section between Camp Baker and the mouth of Hound Creek, where most fishing pressure occurs. An average of 14,129 angler days was expended from the top of the float section to the mouth from 1982 through 2009. In 2015, the average annual revenue generated by this reach of river was estimated at over $5.8 million.

Stream Flows

The mean discharge at the USGS gage near Fort Logan (river mile 83.7) was 144 cfs for the 22-year period of record (1977 to 2016). The mean annual discharge of the Smith River for a 21-year period (1997 to 2017) that encompass a substantial period of drought at the USGS gage below Eagle Creek (River Mile 79.3) was 232 cfs and ranged from 109 to 523 cfs. Peak flows ranged from 472 cfs in 2001 to 4,030 cfs in 2011. The mean discharge of the Smith River for a 24-year period (1952-2016) at the USGS gage near Eden (river mile 27) was 341 cfs and ranged from 107 to 716 cfs. Peak flows, based on 33 years of data for the Eden gage from 1951 through 2017, varied from 719 cfs in 1961 to 12,300 cfs in 1953.

Waters in the Smith River drainage have been appropriated for irrigation, livestock and domestic uses. As in other areas of the state, appropriations are often several times the amount of water present. The

dewatering and warm irrigation return flows affect the trout fishery of the Smith River. Temperatures above 70° F, which are considered undesirable for trout growth and survival, occur in the river in mid-summer; water temperatures as high as 83°F have been recorded. The low water levels and elevated water temperatures are probably the greatest factor limiting present game fish populations. Enhancing in-stream flows is the key to benefitting the aquatic resources in the Smith River basin. At least two fish kills involving trout and mountain whitefish have been documented in the South Fork Smith and the mainstem near Eden Bridge; both occurred during periods of elevated water temperatures combined with dewatering of the river. Recurring fish kills involving stonecat have been reported in isolated lower sections of the floating reach over the past decade, generally occurring in late July. Investigations have not determined the cause, but disease or parasites and combined with stress are thought to be likely factors.

Impaired Waters

This watershed is on the 303d list. See table 3 for location and cause name.

Upper Missouri-Dearborn HUC 10030102:

The Upper Missouri River drainage includes the Missouri River and tributaries from Holter Dam near Wolf Creek downstream nearly 105 river miles to Morony Dam, 15 miles northeast of Great Falls. This river reach spans nearly 93 miles from Holter to Black Eagle Dam. Below Black Eagle Dam, the river is impounded by Rainbow Dam, creating a shallow run-of-the-river reservoir that is available for public fishing. Stream gradient averages only about 2 feet/mile and varies from 7.84 feet/mile at Pine Island Rapids to 0.52 feet/mile near Ulm. The river is surrounded by the Big Belt Mountains to the southeast and the east front of the Rocky Mountains to the northwest. Small communities along the river include Craig, Hardy, Cascade and Ulm. The river channel upstream of the Dearborn River has extensive side channel development. It becomes confined and entrenched in a single, deep channel as it flows through a mountainous canyon to the mouth of Sheep Creek. The river then meanders across a wide and flat prairie zone into Great Falls. Riparian vegetation consisting of a willow understory/cottonwood overstory lines much of the lower river. Major tributaries in this reach include Little Prickly Pear Creek, the Dearborn River, Sheep Creek, the Smith River and the Sun River. Minor tributaries include Rock, Wegner, Stickney, Hardy, Bird, Little Muddy, and Sand Coulee Creeks. The tributaries add considerable flow to the Missouri during spring runoff but contribute little flow during the remainder of the year. River characteristics and flow in this section are heavily influenced by the three upstream hydroelectric dams, Canyon Ferry, Hauser, and Holter.

Stream Flow

Annual mean flow measured below Holter Dam from 1946 to 2011 ranged from 3,008 to 8,497 cubic feet per second (cfs), while annual peak inflows to Canyon Ferry ranged from 3,370 to 34,800 cfs. From 1999 through 2007, a drought in central Montana reduced peak flows in the Missouri River substantially below the long- term average. Annual mean flow measured near Ulm (9 river miles downstream from the confluence of the Smith River) from 1948 to 2011 was 6,247 and ranged from 3,479 to 9,653 cfs; the annual peak flow ranged from 5,300 to 35,000 cfs.

Fisheries Management of the Upper Missouri-Dearborn Watershed

Game fish species of the greatest interest to the public within this management area include rainbow and brown trout, mountain whitefish, walleye, and burbot (ling). The 35-mile reach from Holter Dam to Cascade Bridge is designated as one of Montana's premier "Blue Ribbon" trout fisheries. This reach supports an abundance of wild rainbow and brown trout, which are the dominant sport fish; the population includes trophy sized fish. Since 1982 FWP, has conducted population monitoring for rainbow and brown trout in this section of the river. Population estimates are derived using standardized methods, including night electrofishing to mark and recapture fish in the spring and fall. Estimates are based on trout 10 inches and longer. In fall 2011, rainbow trout in the Craig section were estimated at 6,034 per mile, which is the highest number on record. The 30-year mean is 3,036 rainbow trout per mile. In the Craig section, hatchery fish made up 20.2% of the fish sampled, enough to allow for an estimate of 1,605 hatchery rainbow trout fish per mile to be calculated. The presence of this number of hatchery fish in the Craig section is a significant departure from previous sampling efforts. The hatchery fish in this sample are thought to be from a flush from the reservoir complex upstream. For much of the past 18 years, trout populations appear resilient and show no evidence of decline. The FWP Commission established a "no limit for walleye" harvest regulation on the section of the Missouri River from Holter Dam to Cascade in 2011 as an effort to protect the rainbow and brown trout fishery. Trout numbers drop markedly below Ulm largely due to habitat changes. Consequently, the proportional abundance of burbot and walleye in the fishery increases in this reach. However, trout remain the dominant game fish. Other common species in this reach of the Missouri River include mountain whitefish, longnose and white suckers, carp (non-native aquatic invasive species), longnose dace, and Rocky Mountain sculpin. Fishing pressure in the reach is heavy, with the tail water fishery from Holter Dam to Cascade Bridge always ranking among the top 4 fisheries throughout the state during the past 17 years (1991-2007). This section of river has averaged over 91,000 angler days per year since 1991. In 2009, the average annual revenue generated by this 35-mile reach of river was estimated at $12.1 million. Economic statistics for angler use are based on goods and services anglers purchased during a typical fishing trip, including food, gasoline, bait, lures, license, outfitter-guide fees and lodging. This exercise produces a conservative estimate of the economic value of an angler day because only expenditures for non-durable goods were included and not durable goods such as boats, waders, fishing rods and vehicles.

Impaired Waters

This watershed is on the 303d list. See table 3 for location and cause name.

Sun Watershed HUC 10030104:

The Sun River is the second largest tributary of the Missouri River between Canyon Ferry and Fort Peck dams. This west-central mountain stream drains 1,979 square miles of the east slope of the Rocky Mountains. Its headwaters are within the Bob Marshall Wilderness. The upper Sun River basin is situated in steep limestone and shale mountains within the Lewis and Clark National Forest. Below Gibson dam, the Sun River exits the mountains onto the prairie, first through a series of glacial outwash terraces, then till-covered foothills, and, finally, through sedimentary bench lands. The mainstem of the Sun River downstream of Gibson and Diversion dams flows east 97 miles to its confluence with the Missouri River at Great Falls. The Sun River drainage lies within the bounds of Lewis and Clark, Teton, and Cascade counties. The drainage contains about 1,176 miles of perennial streams, of which about 321 are named. Major tributaries include the North and South forks, Willow, Elk, Mill Coulee and

Muddy creeks. There are 17 lakes or reservoirs within the drainage, totaling 5,097 surface acres. The reach from the mouth of Elk Creek downstream to the Missouri River at Great Falls is 65 miles in length and occupies a wide valley. The riparian zone is cottonwood dominated woodland with rose and willows being the common shrub species found in the understory. The average stream gradient in this lower reach is 9 feet/mile and varies from 17 feet/mile at the upper end to less than 3 feet/mile near the city of Great Falls. The composition of the channel substrate reflects the gradual decrease in stream gradient as well as the geology. Substrate in the upper third of this reach consists mostly of cobbles and gravel with moderate amounts of silt. Further downstream, channel substrate decreases in size and the deposition of silt increases. Below the confluence of Muddy Creek, and for the remaining 17 miles, there is excessive silt deposition. Approximately 80-90% of the sediment load of the Sun River at its mouth originates from Muddy Creek caused by return flows of the Greenfields Irrigation District of BOR's Sun River Project. The lower two-thirds of this reach is a major recharge area of return flows and surplus diverted irrigation water. Some tributary streams in the lower portion of the drainage transport these return flows and can function as valuable refuges for fish providing cooler water habitat during critical times of the year.

Stream Flows

Long-term USGS flow records are available for the lower Sun River near Vaughn, which is 14 miles upstream from the mouth. The average annual flow for the 77-year period of record is 672 cfs. Average monthly flows ranged from 254 cfs in January to 2,500 cfs in June. Peak flows at the Vaughn gage averaged 6,754 cfs and ranged from 681-53,500 cfs for the period of Record (1934-2011). Upstream at a USGS gage at Simms, where dewatering is most severe, the mean monthly flows for August and September is 151 and 138 cfs, respectively, for the period of record (1966-2011) compared to 558 and 441 cfs, respectively, at the near Vaughn gage. Present day flow regimens of the Sun River are largely regulated by Gibson Dam and the associated off-stream storage and irrigation delivery system of the Sun River Project, which includes Pishkun and Willow Creek Reservoirs. This system can accommodate a diversion of nearly 1,700 cfs from the river. Severe dewatering of the river below diversions has commonly occurred in the past. Irrigated agriculture is the largest consumptive use of water in the Sun River basin. Irrigated croplands include hay, alfalfa, and small grains including wheat and malting barley. Irrigation is widespread and intensive throughout the basin. Approximately 120,000 acres of land are irrigated by Sun River waters; 93,220 acres of that are by the BOR Sun River Project. The three major reservoirs in the drainage store about 159,000 acre-feet and supply water to the system throughout the growing season. It has been estimated that it would take about 450,000 acre-feet of controllable flow to meet all the irrigation needs in the Sun River basin, assuming an overall irrigation efficiency of 40 percent and crops consuming 1.5 acre-feet per acre or a total of about 180,000 acre-feet. This volume of water is not available during many years. For example, although the long-term average for Sun River basin inflows is approximately 592,000 acre-feet, inflows only averaged about 440,000 acre-feet for the period from 2003-2007. During this time, all but 13 percent of the water in the Sun River was diverted at least once for irrigation. Most of the 57,000 acre-feet that wasn't diverted was flow during the fall, winter, and spring runoff that could not be captured and stored or diverted. Of the water diverted for irrigation, approximately 27 percent or about 117,000 acre-feet was consumed, or almost one acre-foot of water consumed per acre of irrigated ground.

Fisheries Management of Sun River Watershed

Prairie streams entering the drainage from the south harbor several native minnow species including the rare northern redbelly x finescale dace hybrid in Adobe Creek. On average, the Augusta/287 section has the highest trout densities. However, the overall trout densities are extremely low in the Sun River when compared to other trout rivers in north central Montana. The long-term average trout densities are 116, 43, and 90 rainbow trout and brown trout 8 inches and longer per mile in the Augusta/287, Simms, and Sun River sections, respectively. In comparison, the long-term average density of rainbow trout and brown trout combined in the Smith River are 887 and 429, 8 inches and longer per mile in the Eagle Creek and Deep Creek sections, respectively. Low trout densities are caused by year-round chronic de-watering of the Sun River Basin, resulting from large-scale irrigation withdrawals. This dewatering is especially true in the Simms section area, where the river typically ceases to flow during the summer and is reduced to a series of disconnected pools. Despite drought conditions, trout densities have been relatively stable—at the low levels—in all three sections through the period of record.

Impaired Waters

This watershed is on the 303d list. See table 3 for location and cause name.

All of the above information can be found at the following URL;
http://fwp.mt.gov/fishAndWildlife/management/fisheries/statewidePlan/default.html

Table 3, 303d list in Cascade County, list is from Montana DEQ. Source: http://deq.mt.gov/water/resources/report

WATERBODY NAME / LOCATION	CAUSE NAME	HUC NO	HUC NAME	WATERSHED	BASIN	TMDL Planning Area	Water Type	Water Size	Units
SMITH RIVER, North and South Forks to Hound Creek	Phosphorus, Total	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	98.1	MILES
SMITH RIVER, North and South Forks to Hound Creek	Escherichia coli (E.Coli)	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	98.1	MILES
SMITH RIVER, Hound Creek to mouth (Missouri River)	Temperature	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	24.1	MILES
SMITH RIVER, Hound Creek to mouth (Missouri River)	Phosphorus, Total	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	24.1	MILES
NORTH FORK SMITH RIVER, Lake Sutherlin to mouth (Smith River), T9N R6E S21	Nitrogen, Total	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	23.0	MILES
NORTH FORK SMITH RIVER, Lake Sutherlin to mouth (Smith River), T9N R6E S21	Phosphorus, Total	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	23.0	MILES
NORTH FORK SMITH RIVER, Lake Sutherlin to mouth (Smith River), T9N R6E S21	Escherichia coli (E.Coli)	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	23.0	MILES
HOUND CREEK, Spring Creek to mouth (Smith River)	Nitrogen, Total	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	6.7	MILES
SHEEP CREEK, headwaters to mouth (Smith River)	Aluminum	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	41.3	MILES
BENTON GULCH, headwaters to mouth (Smith River)	Escherichia coli (E.Coli)	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	13.4	MILES

THOMPSON GULCH, headwaters to mouth (Smith River)	Sedimentation/ Siltation	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	10.8	MILES
THOMPSON GULCH, headwaters to mouth (Smith River)	Nitrogen, Total	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	10.8	MILES
NEWLAN CREEK, Newlan Reservoir to mouth (Smith River)	Sedimentation/ Siltation	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	9.0	MILES
NEWLAN CREEK, Newlan Reservoir to mouth (Smith River)	Temperature	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	9.0	MILES
NEWLAN CREEK, Newlan Reservoir to mouth (Smith River)	Escherichia coli (E.Coli)	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	9.0	MILES
NEWLAN CREEK, headwaters to Newlan Reservoir	Cadmium	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	13.3	MILES
NEWLAN CREEK, headwaters to Newlan Reservoir	Sedimentation/ Siltation	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	13.3	MILES
NEWLAN CREEK, headwaters to Newlan Reservoir	Phosphorus, Total	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	13.3	MILES
NEWLAN CREEK, headwaters to Newlan Reservoir	Nitrogen, Total	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	13.3	MILES
CAMAS CREEK, junction of Big and Little Camas Creeks to mouth (Smith River)	Escherichia coli (E. Coli)	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	14.3	MILES
MOOSE CREEK, headwaters to mouth (Sheep Creek)	Aluminum	10030103	Smith	Upper Missouri	Upper Missouri	Smith	RIVER	11.6	MILES
HUBER COULEE, headwaters to mouth (Sun River Valley Ditch)	Escherichia coli (E.Coli)	10030104	Sun	Upper Missouri	Upper Missouri	Sun	RIVER	3.6	MILES
MISSOURI RIVER, Sun River to Rainbow Dam	Chromium, Total	10030102	Upper Missouri-Dearborn	Upper Missouri	Upper Missouri	Missouri River	RIVER	7.0	MILES
MISSOURI RIVER, Sun River to Rainbow Dam	Mercury	10030102	Upper Missouri-Dearborn	Upper Missouri	Upper Missouri	Missouri River	RIVER	7.0	MILES
MISSOURI RIVER, Sun River to Rainbow Dam	Sedimentation/ Siltation	10030102	Upper Missouri-Dearborn	Upper Missouri	Upper Missouri	Missouri River	RIVER	7.0	MILES
MISSOURI RIVER, Sun River to Rainbow Dam	Selenium	10030102	Upper Missouri-Dearborn	Upper Missouri	Upper Missouri	Missouri River	RIVER	7.0	MILES
MISSOURI RIVER, Sun River to Rainbow Dam	Turbidity	10030102	Upper Missouri-Dearborn	Upper Missouri	Upper Missouri	Missouri River	RIVER	7.0	MILES
MISSOURI RIVER, Sun River to Rainbow Dam	Polychlorinated Biphenyls (PCBs)	10030102	Upper Missouri-Dearborn	Upper Missouri	Upper Missouri	Missouri River	RIVER	7.0	MILES
MISSOURI RIVER, Rainbow Dam to Morony Dam	Arsenic	10030102	Upper Missouri Dearborn	Upper Missouri	Upper Missouri	Missouri River	RIVER	9.1	MILES

Irrigated Lands

Today's management of irrigation water requires using the best information and techniques that current technology can provide in the planning, design, evaluation, and management of irrigation systems. Cascade County is not known for irrigation. Roughly 2.5 percent of the total acres is irrigated. There are four basic irrigation methods, along with many types of systems to apply irrigation water, include: surface, sprinkle, micro, and subirrigation. Cascade County practices two methods of irrigation surface and sprinkle. Most of the acres that are irrigated are from flood irrigation at 23,927 acres. Sprinkler irrigation (pivots, siderolls, end guns, etc.) makes up 20,136 acres. This totals around 44,064 acres of irrigated lands in Cascade County.

There are two irrigation districts in Cascade County. Both are in the Sun River Watershed and would be in Area 4 of the CRA. Ft. Shaw Irrigation District covers 20,968 acres of irrigated land. Greenfields Irrigation District starts in the neighboring county of Teton and covers 27,148 acres in Cascade County. Figure 12 is showing the location of the two irrigation districts and their areas of coverage.

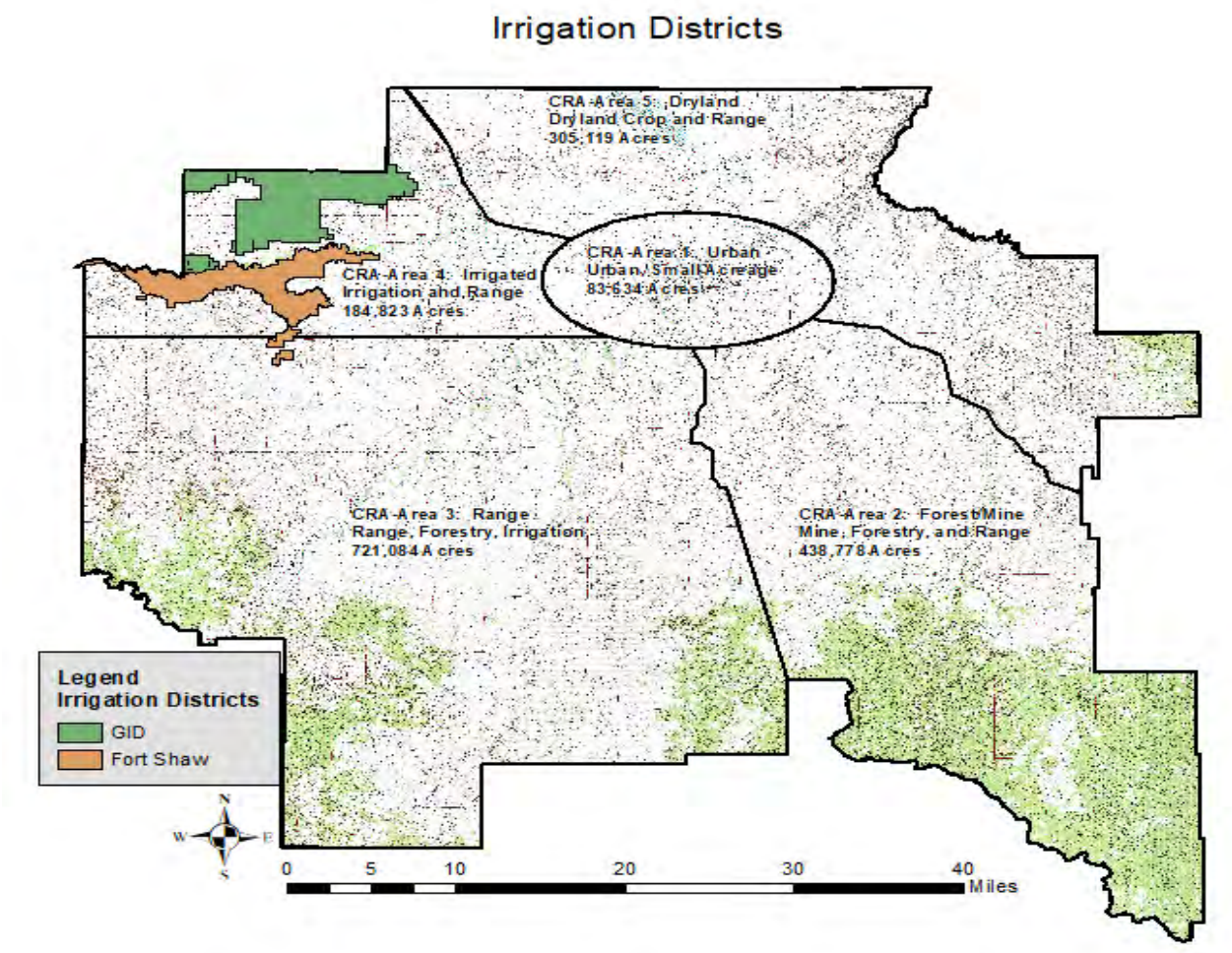


Figure 12 Fort Shaw and Greenfields Irrigation District boundary.

Groundwater Drinking Water

According to the Montana Bureau of Mines and Geology Cascade County has 6,603 wells. The following tables will give an estimate on number of wells drilled by year, number of wells by depth, reported water use and geologic source.

Table 4 Wells in Cascade County At-A-Glance

At A Glance	
Number of wells in County	6603
Deepest well on record (feet)	2301
Shallowest well on record (feet)	4
Most recent well on record	4/22/2019
Oldest well on record	6/1/1864
Number of water quality samples	983
Number of measured water levels	588329
Statewide Monitoring Network wells	28

Table 5 Wells drill in the last 20 years in Cascade County.

Wells by Year	
The table below shows the breakdown of wells reportedly drilled in the county during the last 20 years. Click the "show all" link to display all data available.	
2019	15
2018	86
2017	115
2016	92
2015	63
2014	82
2013	86
2012	73
2011	56
2010	44
2009	70
2008	86
2007	120
2006	103
2005	140
2004	138
2003	112
2002	164
2001	202
2000	193

Table 6 number of wells in Cascade County by depth.

Wells by Depth	
The table below shows the number of wells that fall between the depth ranges in the left hand column. All depths are listed in feet below ground surface.	
0 - 99	3308
100 - 199	1472
200 - 299	708
300 - 399	400
400 - 499	311
500 - 599	154
600 - 699	71
700 - 799	58
800 - 899	45
900 - 999	23
> 1000	53

Table 7 reported water use in Cascade County.

Reported Water Use	
The table below shows the number of each type of water use that has been reported for wells in this county.	
UNKNOWN	146
RECREATION	4
INJECTION	16
INDUSTRIAL	22
OTHER	36
PUBLIC WATER SUPPY	182
TEST WELL	69
UNUSED	76
WILDLIFE	2
FIRE PROTECTION	12
MEDICAL	1
MONITORING	980
COMMERCIAL	24
IRRIGATION	372
RESEARCH	26
GEOTHERMAL-EXTRACTION	1
GEOTECH	117
GEOTHERMAL-INJECTION	1
STOCKWATER	1140
DOMESTIC	4381
* Total	7608

* Number may differ from county total since one well may have several reported water uses.

Table 8 geologic source of wells in Cascade County.

Geologic Source	
The table below shows the breakdown of geologic sources for wells in this county. Note that not all wells in a county necessarily have had the geologic source code assigned.	
KOOTENAI FORMATION (217KOTN)	1097
MADISON GROUP OR LIMESTONE (330MDSN)	1003
ALLUVIUM (QUARTERNARY) (110ALVM)	490
GLACIAL GREAT FALLS LAKE SEDIMENTS (112GFLK)	474
SAND AND GRAVEL (PLEISTOCENE) (112SNGR)	455
SAND AND GRAVEL (HOLOCENE) (111SNGR)	359
COLORADO SHALE OR FM. (OF COLORADO GROUP) (211CLRD)	272
BLACKLEAF FORMATION (OF COLORADO GROUP) (217BCKF)	166
ADEL MOUNTAIN VOLCANICS (211ADLM)	161
MORRISON FORMATION (221MRSN)	108
FLOOD SHALE MEMBER (OF BLACKLEAF FM.) (217FLOD)	95
TERRACE DEPOSITS (PLEISTOCENE) (112TRRC)	87
PALEOZOIC UNDIFFERENTIIED (300UDFD)	57
SWIFT FORMATION (OF ELLIS GROUP) (221SWFT)	46
VAUGHN MEMBER (OF BLACKLEAF FM.) 217VGHN)	44
MARIAS RIVER FORMATION (OF COLORADO GROUP) (211MRRV)	30
FERDIG SHALE MEMBER (OF MARIAS RIVER FM.) (211FRDG)	27
JEFFERSON LIMESTONE (341JFRS)	26
WOLSEY SHALE OR FORMATION (374WLSY)	26
FLATHEAD QUARTZITE OR SANDSTONE (374FLTD	23
KEVIN SHALE MEMBER (OF MARIAS RIVER FM) (211KVIN)	23
SUNBURST SANDSTONE (217SBRS)	23
ALLUVIUM (PLEISTOCENE) (112ALVM)	20
VIRGELLE SANDSTONE MEMBER (OF EAGLE SANDSTONE) (211VRGL)	19
ALLUVIUM (HOLOCENE) (111ALVM)	18
CUT BANK SANDSTONE (217CBNK)	15
BOOTLEGGER MEMBER (OF BLACKLEAF FM.) (217BLGR)	14
ELLIS GROUP (221ELLS)	13
SAND AND GRAVEL (QUARTERNARY) (110SNGR)	13
VOLCANICS (TERTIARY) (120VLCC)	12
TWO MEDICINE FORMATION (OF MONTANA GROUP) (211TMDC)	10
GNEISS AND SCHIST (EARLY PROTEROZOIC OR ARCHEAN) (500GNSC)	10
DEVONIAN UNDIFFERENTIATED (340UDFD)	10
KIBBEY SANDSTONE (OF BIG SNOWY GROUP) (331KBBY)	9
GLACIAL DRIFT (112DRFT)	9
TAFT HILL MEMBER (OF BLACKLEAF FM.) (217TFHL)	7
PARK SHALE OR ARGILLITE (347PARK)	6
JURASSIC UNDIFFERENTIATED (220UDFD)	4
TELEGRAPH CREEK FORMATION (OF MONTANA GROUP) (211TPCK)	3
GLACIAL OUTWASH (PLEISTOCENE) (112OTSH)	3
MEAGHER LIMESTONE (374MGHR)	3
OTTER FORMATION (OF BIG SNOWY GROUP) (331OTTR)	3
CAMBRIAN UNDIFFERENTIATED (370CMBR)	2
VOLCANICS (CRETACEOUS) (210VLCC)	2
PLUTONIC ROCKS (EOCENE) (124PLNC)	1
PLEISTOCENE SILT AND CLAY (112SICL)	1
CANYON CLINKER (110CNKB)	1
SECOND CAT CREEK SANDSTONE (OF KOOTENAI FM) (217SCCK)	1
THIRD CAT CREEK SANDSTONE (BASAL KOOTENAI FM) (217TCCK)	1
LAKOTA SANDSTONE (OF INYAN KARA GROUP) (217LKOT)	1
PILGRIM LIMESTONE OR DOLOMITE (371PLGM)	1
BELT SUPERGROUP (400BELT)	1
THREE FORKS SHALE LIMESTONE OR FORMATION (337TRFK)	1

Air and Energy

Montana has adopted additional state air quality standards in addition to what the EPA has set for a standard. These Montana Ambient Air Quality Standards (MAAQS) establish statewide targets for acceptable amounts of ambient air pollutants to protect human health. Criteria air pollutants were

selected by EPA based on extensive scientific research showing the direct relationship between exposure to pollutants and their short- and long-term effects on human health and the environment. The list of pollutants are as follows: Carbon Monoxide (CO), Lead (Pb), Nitrogen Dioxide (NO_2 also referred to as NOx), Ozone (O_3), Particulate Matter (PM-10 and PM-2.5), Sulfur Dioxide (SO_2).

Nonattainment areas are areas that have violated the federal air quality standards for a specific pollutant such as CO, PM-2.5 etc. Montana has 13 official nonattainment areas. Great Falls is listed as a nonattainment area for CO. Sources contributing to the CO nonattainment status include vehicle emissions, wood burning sources, and industrial emissions. This nonattainment area is located on the 10th Ave corridor of Great Falls.

Air quality can be a concern because air pollution can linger in the atmosphere for long periods of time and can be transported great distances. These problems include impaired visibility, acid rain, and smoke from open and prescribed burning. Airborne particulate matter, which includes solid particles as well as liquid and gases, is the main ingredient in haze. Haze impairs visibility because the fine particles within the airborne particulate matter scatter and absorb light, limiting the ability to see distant objects. Some particles, such as sulfates and nitrates, become larger as humidity in the air increases, resulting in even more haze and reduced visibility. Weather conditions can also cause chemical reactions between air pollutants, creating fine particles that remain in the air for several days. As a result, particles transported from urban and industrial areas may contribute to poor visibility in national parks and other wilderness regions. Two of Montana's chief sources of visibility impairment are wildfires and prescribed burning. Other sources include unpaved roads, fallow fields, and soot from power plants, motor vehicles, and petroleum and industrial chemical facilities.

Prescribed burning is often used as a tool in forest and range management to increase habitat for wildlife, improve cattle range, dispose of crop residue, control pests and disease, and reduce wildfire hazards. Open burning is used by a variety of industries, landfills, and Montana residents to limit the accumulation of clean, untreated wood. Both open and prescribed burning release numerous air pollutants into the atmosphere, including particulate matter in the form of smoke. Cascade County controls open burning through their local county air programs and health departments. Open burning activities are conducted from March through November when there is better air dispersion. This eliminates complications from wintertime inversions, which hold smoke close to the ground, increasing the chances that pollution will have adverse health effects on local communities. A statewide Smoke Management Hotline provides up-to-date information about burning restrictions around the state.

Plants and Animals

Wetlands provide critical biological and economic benefits such as habitat, flood attenuation, and groundwater recharge. As of 2018, not all the riparian and wetland areas in Cascade County have been mapped to current FGDC standards. The Montana Natural Heritage Program's Wetland and Riparian Mapping Center is the designated source for modernized wetland and riparian mapping in Montana. The Montana Natural Heritage Program uses the Cowardin classification system which was adopted by the National Wetland Inventory (NWI) for wetlands mapping. The Cowardin wetland classification system separates wetlands first into systems, and then further separates systems into subsystems and classes. Figure 14 shows the areas for which modernized mapping has been completed. The only available wetlands mapping for the remainder of Cascade County is the outdated NWI Legacy mapping

completed between 1980-1989 by the NWI. Due to the mapping methods and scale, NWI Legacy mapping does not include riparian areas.

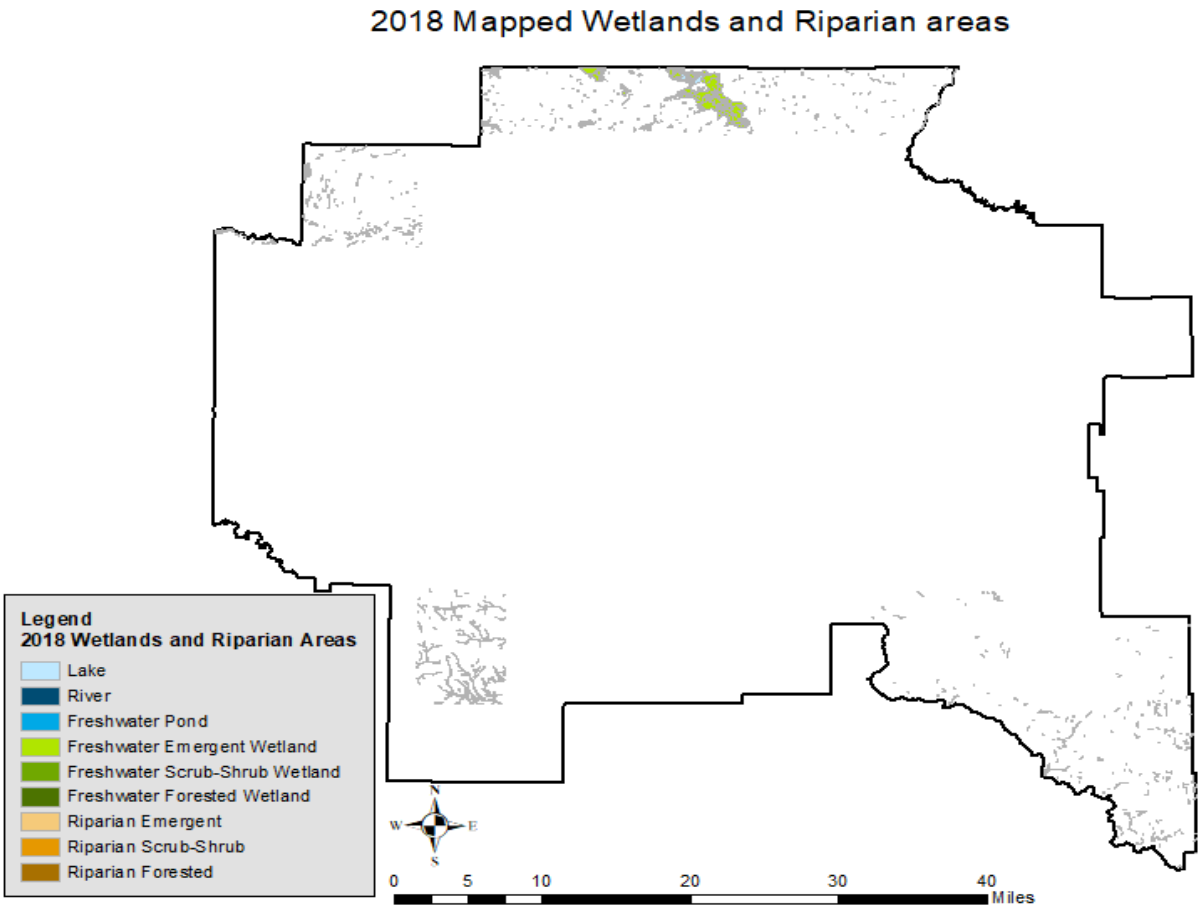


Figure 14 2018 Wetlands and Riparian areas with modernized mapping. Source Montana Natural Heritage Program 2019.

There are roughly 13,915 acres in Cascade County with modernized wetland and riparian mapping.

The following table shows the type and number of acres of wetlands and riparian areas that are included.

Table 9, Wetland Type and number of Acres. Data from the Montana Natural Heritage Program.

WETLAND TYPE	ACRES
Freshwater Emergent	8,450
Freshwater Forested	18.4
Freshwater Forested/Shrub	589
Freshwater Pond	242.3
Freshwater Scrub-Shrub	17

Lake	481.4
Riparian	875.5
Riparian Emergent	120.9
Riparian Forested	206.7
Riparian Scrub-Shrub	68.9
Riverine	2844.8

Agricultural lands provide some habitat for certain wildlife species. The habitat conditions are never static and can always be improved. In addition to the agricultural lands there are several easements and Wildlife Management areas that aid in preserving wildlife habitat. These sites are managed by FWP, USFWS, Helena-Lewis & Clark National Forest, Department of Defense, The Nature Conservancy of Montana, American Farmland Trust, Ducks Unlimited, Montana Land Reliance and USDA. These easements can be broken down to two types Conservation Easement and Access Easements. Montana lands with conservation easements are private lands parcels on which a public agency or qualified Land Trust has placed a Conservation Easement in cooperation with the land owner. As of December 2016, Montana Natural Heritage Program reported that Cascade County has a total of 78,891 acres of Conservation Easements. The table below shows a breakdown of these easements.

Table 10, Easement Holder and number of Acres in Cascade County. Source Montana Natural Heritage Program.

Easement Holder	Acres
Montana Land Reliance	71,542
Montana Fish, Wildlife and Parks	6,541
US Department of Agriculture	555
Ducks Unlimited	253
Total Acre	78,891

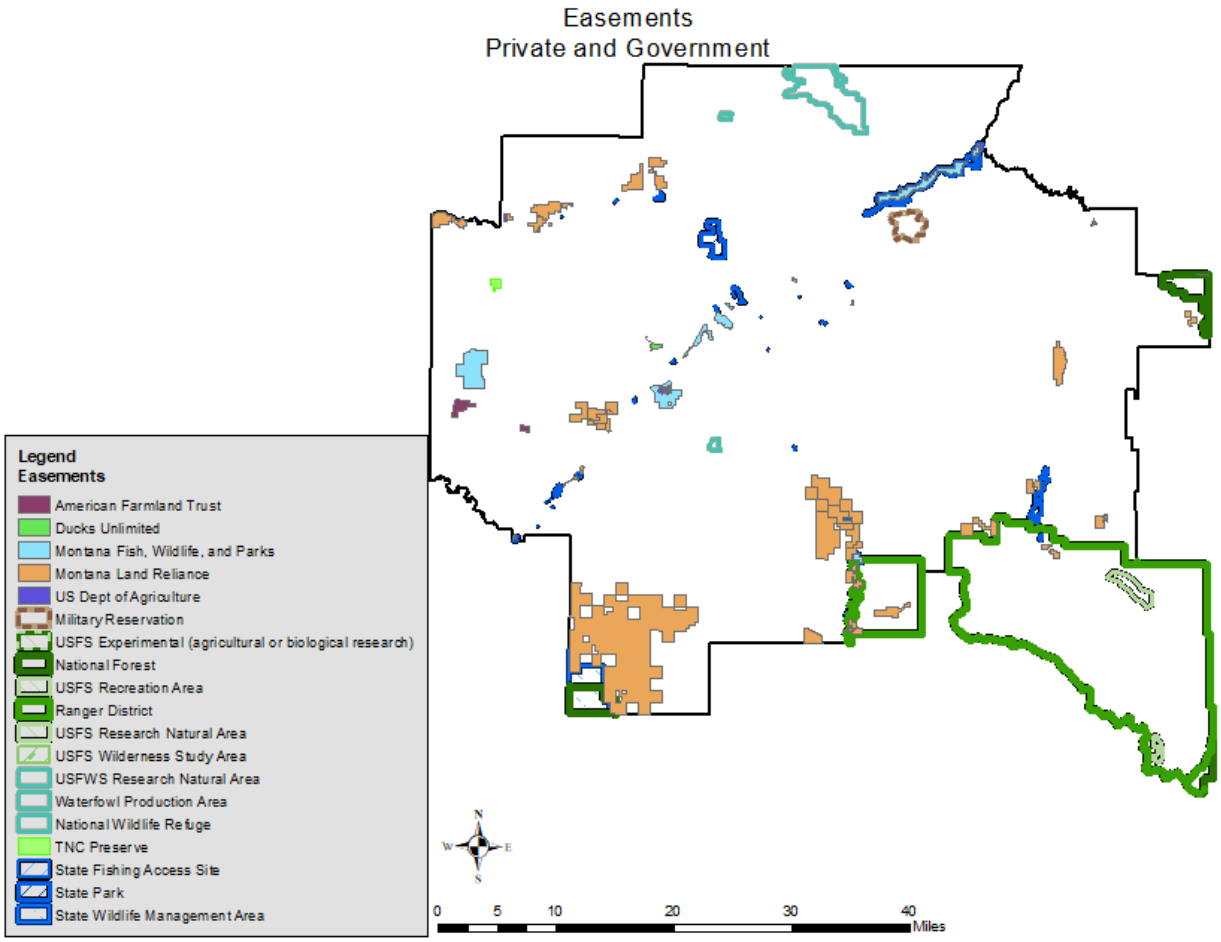


Figure 15, Easements that are Private or Government. Source Montana Natural heritage Program.

Species of Concern

There are 57 animal and 26 plant Species of Concern in Cascade County. Montana plant and animal Species of Concern are native Montana plants and animals that are "at risk" due to declining population trends, threats to their habitats, and/or restricted distribution. Special Status Species are species that have some legal protections in place but are otherwise not Montana Species of Concern. The bald eagle is a Special Status Species because, although it is no longer protected under the Endangered Species Act and is also no longer a Montana Species of Concern, it is still protected under the Bald and Golden Eagle Protection Act of 1940. The following is the list of the 57 animal and 26 plant Species of Concern as of November 2019.

Table 11, 57 animal and 26 plant Species of Concern.

SPECIES	STATE RANK	HABITAT
MAMMALS		
Townsend's Big-eared Bat	S3	Caves in forested habitats
Black-tailed Prairie Dog	S3	Grasslands

SPECIES	STATE RANK	HABITAT
Spotted Bat	S3	Cliffs with rock crevices
Wolverine	S3	Boreal Forest and Alpine habitats
Eastern Red Bat	S3	Riparian forest
Hoary Bat	S3	Riparian and forest
Little Brown Myotis (Bat)	S3	Generalist
Fringed Myotis (Bat)	S3	Riparian and dry mixed conifer forest
Merriam's Shrew	S3	Sagebrush grassland
Grizzly Bear	S2S3	Conifer forest
SPECIES	**STATE RANK**	**HABITAT**
BIRDS		
Northern Goshawk	S3	Mixed conifer forests
Sprague's Pipit	S3B	Grasslands
Golden Eagle	S3	Grasslands
Great Blue Heron	S3	Riparian forest
Burrowing Owl	S3B	Grasslands
American Bittern	S3B	Wetlands
Ferruginous Hawk	S3B	Sagebrush grassland
Chestnut-collared Longspur	S2B	Grasslands
Veery	S3B	Riparian forest
Baird's Sparrow	S3B	Grasslands
Brown Creeper	S3	Moist conifer forests
Black Tern	S3B	Wetlands
Evening Grosbeak	S3	Conifer forest
Black-billed Cuckoo	S3B	Riparian forest
Bobolink	S3B	Moist grasslands
Pileated Woodpecker	S3	Moist conifer forests
Peregrine Falcon	S3	Cliffs/canyons
Pinyon Jay	S3	Open conifer forest
Cassin's Finch	S3	Drier conifer forest
Black-necked Stilt	S3B	Wetlands
Varied Thrush	S3B	Moist conifer forests
Loggerhead Shrike	S3B	Shrubland
Franklin's Gull	S3B	Wetlands
Black Rosy-Finch	S2	Alpine
Gray-crowned Rosy-Finch	S2	Alpine
Lewis's Woodpecker	S2B	Riparian forest
Clark's Nutcracker	S3	Conifer forest
Long-billed Curlew	S3B	Grasslands
Black-crowned Night-Heron	S3B	Wetlands
White-faced Ibis	S3B	Wetlands
Horned Grebe	S3B	Wetlands
Forster's Tern	S3B	Wetlands

SPECIES	STATE RANK	HABITAT
Common Tern	S3B	Large rivers, lakes
SPECIES	**STATE RANK**	**HABITAT**
REPTILES		
Spiny Softshell	S3	Prairie rivers and larger streams
Plains Hog-nosed Snake	S2	Friable soils
Greater Short-horned Lizard	S3	Sandy/gravelly soils
SPECIES	**STATE RANK**	**HABITAT**
AMPHIBIANS		
Great Plains Toad	S2	Wetlands, floodplain pools
SPECIES	**STATE RANK**	**HABITAT**
FISH		
Northern Redbelly Dace	S3	Small prairie rivers
Northern Redbelly X Finescale Dace	S3	Small prairie streams
Blue Sucker	S2S3	Large prairie rivers
Sturgeon Chub	S2S3	Large prairie rivers
Westslope Cutthroat Trout	S2	Mountain streams, rivers, lakes
Sauger	S2	Large prairie rivers
Pallid Sturgeon	S1	Large prairie rivers
SPECIES	**STATE RANK**	**HABITAT**
INVERTEBRATES INSECTS		
Gillette's Checkerspot (Butterfly)	S2	Wet meadows
Alberta snowfly	S2	Mountain Streams to Rivers
SPECIES	**STATE RANK**	**HABITAT**
INVERTEBRATES MOLLUSKS		
Western Pearlshell (Mussel)	S2	Mountain streams, rivers
PLANT SPECIES OF CONCERN		
SPECIES	**STATE RANK**	**HABITAT**
FERNS		
Meadow Horsetail	S2	
GYMNOSPERM		
SPECIES	**STATE RANK**	**HABITAT**
Whitebark Pine	S3	Subalpine forest, timberline
FLOWERING DICOTS		
SPECIES	**STATE RANK**	**HABITAT**
Musk-root	S3	Rock/Talus

SPECIES	STATE RANK	HABITAT
Roundleaf Water-hyssop	S3	Wetland/Riparian
Slender Indian Paintbrush	S2	Wetland/Riparian
Chaffweed	S2	Wetland/Riparian
SPECIES	**STATE RANK**	**HABITAT**
Smooth Goosefoot	S2	Sandy sites
Long-styled Thistle	S2S3	Meadows (Montane-subalpine)
Pale-yellow Jewel-weed	S3	Riparian
Floriferous Monkeyflower	SH	
Square-stem Monkeyflower	S2	Wetland/Riparian
Small-flowered Pennycress	S3	Meadows (Moist, Montane to alpine)
Missoula Phlox	S3	Slopes/ridges (Open, foothils to subalpine)
Silver Bladderpod	S2S3	Sandy sites
Dwarf woolly-heads	S2S3	Wetland/Riparian
Autumn Willow	S3	Wetland/Riparian
Alkali-marsh Ragwort	S3	
Slim-pod Venus'-looking-glass	S3	
Many-flowered Viguiera	S2S3	Aspen woodlands
FLOWERING PLANTS MAGNOLIOPSIDA		
SPECIES	**STATE RANK**	**HABITAT**
Crawe's Sedge	S2S3	Wetland/Riparian
Many-headed Sedge	S1S2	Wetland/Riparian
Schweinitz's Flatsedge	S2	Sandy sites
Northern Wildrye	S2	Wetland/riparian (mesic openings/streambanks, low-elevation)
Foxtail Muhly	S2S3	
Guadalupe Water-nymph	S2S3	Aquatic
BRYOPHYTES		
SPECIES	**STATE RANK**	**HABITAT**
A Conecap Moss	S1	

Table 12, Montana Species Ranking Codes.

Rank	Definition
S1	At high risk because of **extremely limited** and/or **rapidly declining** population numbers, range and/or habitat, making it highly vulnerable to global extinction or extirpation in the state.

S2	At risk because of **very limited** and/or **potentially declining** population numbers, range and/or habitat, making it vulnerable to global extinction or extirpation in the state.
S3	Potentially at risk because of **limited** and/or **declining** numbers, range and/or habitat, even though it may be abundant in some areas.
S4	Apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining.
S5	Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range.
SX	Presumed Extinct or Extirpated - Species is believed to be extinct throughout its range or extirpated in Montana. Not located despite intensive searches of historical sites and other appropriate habitat, and small likelihood that it will ever be rediscovered.
SH	Historical, known only from records usually 40 or more years old; may be rediscovered.
SNR	Not Ranked as of yet.
SU	Unrankable - Species currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNA	A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities as a result of being: 1) not confidently present in the state; 2) non-native or introduced; 3) a long distance migrant with accidental or irregular stopovers; or 4) a hybrid without conservation value.

Combination or Range Ranks

S#, S#	Indicates that populations in different geographic portions of the species' range in Montana have a different conservation status *(e.g., S1 west of the Continental Divide and S4 east of the Continental Divide).*

Invasive Species

Invasive weeds and other species are a priority in Cascade County and were directed as such at the Local Workgroup meetings. Several invasive plant species have been seen and recorded, however there is not any information to tell the number of acres each species is covering. A table is provided below showing the number of times each plant has been seen in Cascade County.

Cascade County Invasive Species Observation Occurrences

Table 13, Number of Observed Invasive Species Occurrences in Cascade County. Source Montana Natural Heritage Program.

Species Common Name	Number of Observed Occurrences
Canada thistle	720
Cheatgrass	22
Common Buckthorn	1
Common Hounds'-tongue	577
Common St. Johns'-wort	1
Common Tansy	4
Curly-leaf Pondweed	34
Dalmatian Toadflax	604
Diffuse Knapweed	116
Dyer's Woad	1
Eurasian Water-milfoil	1
Field Bindweed	226
Hoary Alyssum	19
Leafy Spurge	1993
Meadow Hawkweed	2
Oxeye Daisy	35
Perennial Pepperweed	1
Purple Loosestrife	13
Russian Knapweed	19
Spotted Knapweed	1564
Sulphur Cinquefoil	20
Tall Buttercup	4
Whitetop	693
Yellow toadflax	6
Total Observed Occurrences	6676

Ventenata has recently been spotted. Other invasive species such as the eastern heath snail, located in the Belt Creek watershed is a new priority.

SECTION III: Analysis of Conservation Activity

A review of what has happened with conservation over the last ten years has revealed that there have been 462 practices applied. The top 10 conservation practices are listed in the following table. The programs that delivered these practices are EQIP, CTA-General, WHIP, WRP and CRP.

Table 14, Top 10 practices installed using EQIP funds.

Practice Code	Practice Name	Total Amount
516	Livestock Pipeline	159,689.5 Ft
382	Fence	149,285 Ft
528	Prescribed Grazing	47,574.3 Ac
430DD	Irrigation water Pipeline	26,145.3 Ft
645	Upland Wildlife Habitat Management	22,723.3 Ac
590	Nutrient Management	19,368.1 Ac
595	Pest Management	16,212.9 Ac
362	Diversion	12,942.1 Ft
327	Conservation Cover	11,151.3 Ac
329	Residue and Tillage Management	5,990.2 Ac

For all the practices listed above, NRCS is 100% of the contributor to the practices that have been installed. In the past there was not any emphasis to seek or to leverage other partners.

In addition to the above practices that NRCS has provided help on, private land owners have installed several conservation practices on their own. Amounts were not given, but it is important to document what has been completed in the last 10 plus years. This list is below and is not an all-inclusive list as there are more practices that have been installed but this office is unaware of them.

- Field windbreaks
- Grassed Waterways with Ponds
- CRP
- Living Snow Fences along Roads
- Conversion of Tillage to no till, strip cropping, residue management
- Mining reclamation
- Streambank Restoration projects throughout the county
- Wells and Spring Developments
- Cross Fencing
- Pollinator Plantings
- Field Plaining
- Thinning project in Harley creek
- Number of open ditches that have been lined or put into pipelines
- Automated Headgates
- Water measuring devices
- Irrigation efficiency changes
- Grazing management changes

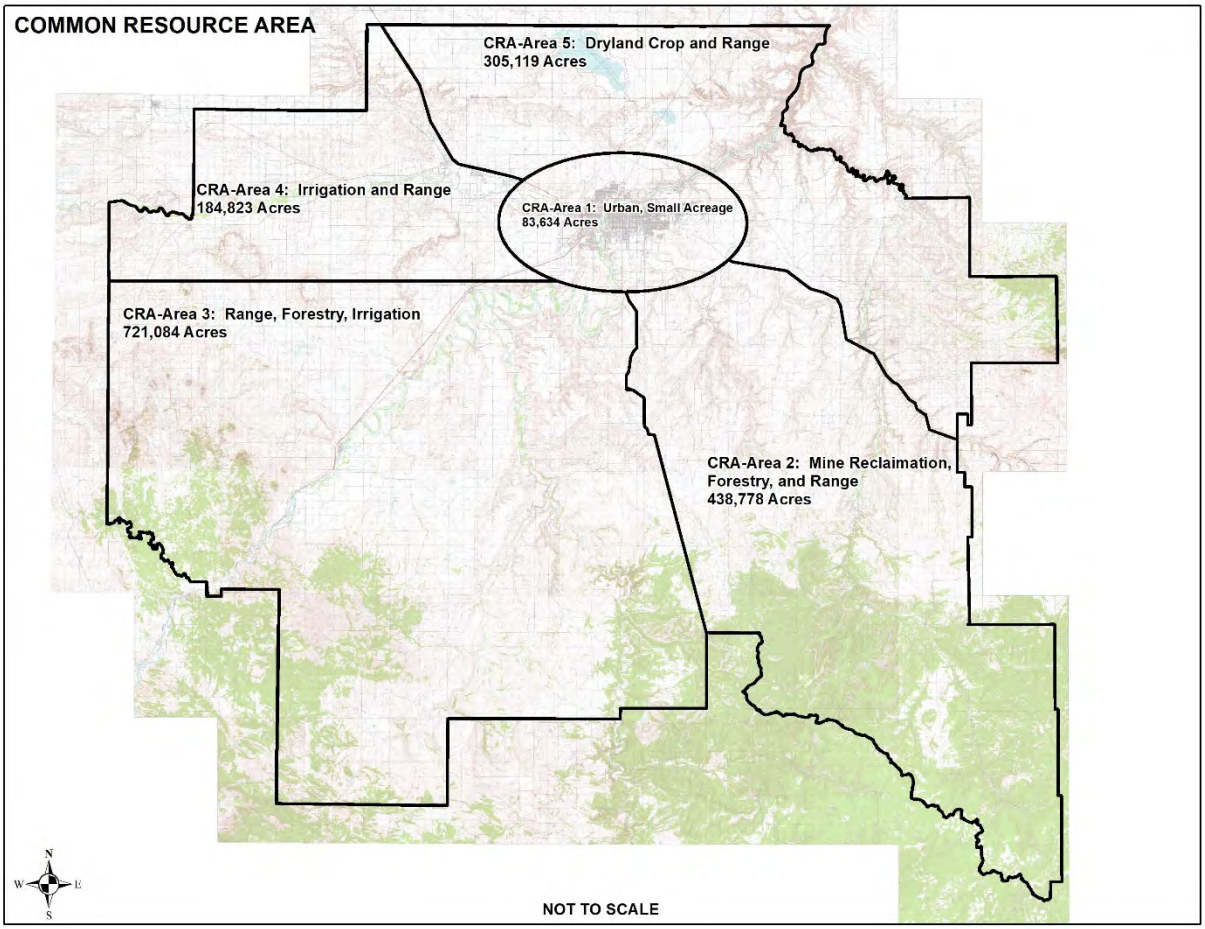
The locally lead meetings revealed that the resource concerns that need addressed are listed below and are not in any order of priority:

1. Soil Erosion wind and water: Streambank erosion was the biggest concern in all the meetings held.
    a. Soil Condition: Soil Health is a concern in Cascade County. Education of soil health and other types of practices is highly recommended.
2. Water quality and quantity: Too much chemical and fertilizer runoff, Alkali/saline seeps, storm water runoff from urban development, acidic water from abandoned mines.
    a. Excess water in the irrigated areas creating excess water and salinity issues.
3. Plants Suitability, Condition and Management: Invasive and Noxious Weeds and snails: Leafy spurge, Hounds tongue, Spotted and Russian Knap weed, Dalmatian toadflax, Hoary cress Whitetop, Oxeye daisy and Hoary Alyssum. Cheatgrass is a problem and was a concern in the locally driven meeting and should be noted. Ventenata has been recently discovered in Cascade County and must be addressed before the density is above the economic threshold.
    a. Heath snail has recently become an issue in the Belt Creek drainage.
    b. Forestry: Fire mitigation, thinning and downfall.
4. Animals Domestic and Wildlife: Cheatgrass on range, livestock water, overgrazing on pastures, range and small acreages.

The above lists do not mean that all these resource concerns have been addressed throughout the county. Solving resource concerns is not a static approach and should not be addressed as such. In general, if there is an issue that needs to be address it will be done so by a locally driven process. This Long-Range Plan is taking the approach to address resource concerns based off information received from the Local Working Group meetings. What resource concerns remain that need to be addressed and which of these resource concerns that will be addressed with NRCS investment will be discussed in Section IV.

Section IV: Natural Resource Problems and Desired Future Outcomes

Below is what each Local Working Group (LWP) in each CRA decided was their priority resource problems. The map of these areas is included to identify each area.



For each area the resource concerns are listed from highest to lowest priority.

CRA 1:

1. Storm water runoff
2. Urban development
3. Overgrazing by small landowners

CRA 2:

1. Weeds: Leafy Spurge, Knapweed (Russian and Spotted), Whitetop, Oxeye Daisy, Dalmatian Toadflax, Yellow Allysum, Houndstongue, Hoary Allysum, Cheatgrass.
2. Forestry thinning and fire mitigation
3. Bank erosion on streams
4. Heath Snail
5. Water quality from abandon mines
6. Chemical resistant weeds

CRA 3:

1. Weeds: Leafy spurge, Knapweed (Russian and Spotted), Whitetop, Dalmatian Toadflax, Cheatgrass, Ventenata
2. Riparian Bank erosion
3. Livestock water
4. Education needs on Cover crops, grazing and other resource topics
5. Saline seeps
6. Gophers and Coyotes
7. Bare soil/lower plant succession

CRA 4:

1. Bank erosion
2. Weeds: Leafy Spurge, Houndstongue, Whitetop, Cheat grass, Knapweed (Russian and Spotted)
3. Water quality
4. Alkali spots/seeps
5. Irrigation efficiency

CRA 5:

1. Saline seeps
2. Weeds: Leafy Spurge, Knapweed (Russian and Spotted), Whitetop, Dalmatian Toadflax
3. Streambank erosion
4. Storm water runoff and fertilizer runoff
5. Soil quality

The list above is how each area prioritized their resource concerns. The order in which these concerns will be addressed will be based on financial needs, complexity to address project, and ready, willing and able participants. The above resource concerns are not inventoried. The best approach to gaining knowledge on the magnitude to these problems is going to be reaching out to producers and inventorying the areas. Some of the concerns that are known are as follows: 54% of the irrigated ground in Cascade County is being irrigated by flood irrigation. This is an inefficient way to irrigate and because of salts in the soils and shale formation it is creating poor soil condition and water quality and quantity issues. Invasive plants are an issue. There has been no survey conducted to give number of acres covered, however Montana Natural Heritage Program has a program that registers siting of noxious and invasive plants and animals. To date there have been 6,676 recorded observations of noxious weeds. Table 13 shows the plant and number of times that it was sited in Cascade County. Soil health and erosion is a continued issue. In the last couple of years high amounts of precipitation has fallen in the spring. This has created streambank erosion problems on the Sun River, Smith River, Missouri River and Muddy Creek drainage areas.

It is unknown what the resource trends are. It is safe to say that in recent years the number of acres of noxious weeds and the number of feet of streambank erosion has increased to point to where local landowners are noticing the issue. To pinpoint one source to each of the resource concerns above cannot be done. In most cases there are several reasons to each resource concern and these reasons cannot be determined until an inventory of the watershed is completed.

In most cases goals and objective will be determined by quantities to be installed using a realistic approach. The desired outcome will be determined when each targeted implementation plan (TIP) is developed. In most cases the number of years to implement each TIP will be 3 to 5 years. This will depend on size and scope of the project. Each TIP will need to be planned out in advance of submitting for funding and in most cases, this will be one year in advance. This will be done to give time for proper planning and design of the TIP.

There are two major resource concerns that overlap all the CRAs. Streambank erosion and weeds were the two main concerns in 4 out of 5 CRAs.

Priority #1: Excessive Plant Pest Pressure. This resource concern is a something that can be planned, inventoried and implemented immediately. It meets the vision and mission of NRCS, and it is a priority for other agencies as well. A Coordinated Resource Management team has been initiated to discuss a partnership so that funds may be leveraged together to address this issue. This problem is also one that can be inventoried, planned, and implemented in the timeframe of our objectives (3 to 5 years). The cost to achieve success is feasible and achievable since there are so many partners involved. No legislation and regulations will impact addressing the resource concern and this resource concern will meet the national, state, and local objectives. Success to address this issue will be measured by number of acres of weed cover reduced.

Priority #2: Streambank Erosion. This problem has multiple resource concerns tied to it, which are erosion, water quality, inadequate habitat for fish and wildlife and in some cases can affect irrigation water efficiencies. This resource concern is going to take some time to develop a solution. It is a high priority in 4 of the 5 CRA. In order to address this concern data must be collected. This will require time and help from partners to collect. From this data we will be able to identify goals, objectives and cost to implement a solution. This problem does support NRCS's mission and vision. The reason to make this priority #2 is because of the data that is needed. The collection of this data must start immediately in order to address it in the next 2 to 5 years. This data collection will determine the funds needed to address the issue. These resource concerns will meet the national, state, and local objectives.

Section V. Prioritization of Natural Resource Problems and Desired Outcomes

When setting goals to address the resource concerns the strategy of SMART will be used. The SMART strategy is as follows:

S= Specific

M= Measurable

A= Attainable

R= Realistic

T= Trackable over a specific time period

For Cascade County the field office will deliver the following:

- Specific action to address the resource concern.
- A measurable amount to address that is feasible and financially responsible.
- Attainable within the timeframe of the objective 3-5 years.
- Realistic results and change from current condition to predicted condition.
- Trackable will be conducted by monitoring and follow up before, during and after plan is developed.

All resource concerns are important, however NRCS in Cascade County does not have the means and capability to address every resource concern. Priority to resource concerns will be given if it is a concern of the CRA, preliminary planning has been conducted to give a plan of action based off quantities for materials needed, timeframe, financial needs and partners involved. A preliminary plan is needed for NRCS to measure what the potential success and investment will be. This will also give NRCS a measure or a pulse on what producer is ready, willing and able to participate.

Section VI. Targeted Implementation Plans and Investment Portfolio

The strategic plan for Implementation of Targeted Implementation Plans (TIP) is to host an annual Landowners meeting in each of the CRA. This will represent the Local Workgroup Meeting. In these meetings we will review what has been done, what is currently being done and ask for suggestions to where our focus should be for the next project. Once a resource concern priority has been completed, we will discuss a new resource concern to be added.