3. Watershed Characteristics

Subwatershed Delineation

The subwatershed delineations and names do not necessarily correspond to Drain Commissioner assessment areas. The subwatersheds are defined as planning areas only for the purposes of this watershed plan.

Subwatersheds

The boundaries of the Grand River Watershed and its eighteen subwatersheds are based on United States Geological Survey (USGS) defined boundaries (USGS, 2005). These boundaries, or Hydrologic Unit Codes (HUCs), divide the United States into discrete, nested areas based on common drainage patterns.

The subwatersheds range in size from 3.5 to 12 square miles. Figure 3-1 presents a map of these subwatersheds. Table 3-1 lists them with corresponding areas and watershed coverage percentages.

Political Jurisdictions

The Grand River Watershed is a diverse watershed made up of 12 distinct political jurisdictions. While Aurelius Township, Delta Township, Eaton Rapids Township, City of Lansing, and Windsor Township are the five largest communities in the watershed, they represent very different types of communities.

Figure 3-1. Subwatersheds of the Grand River Watershed.

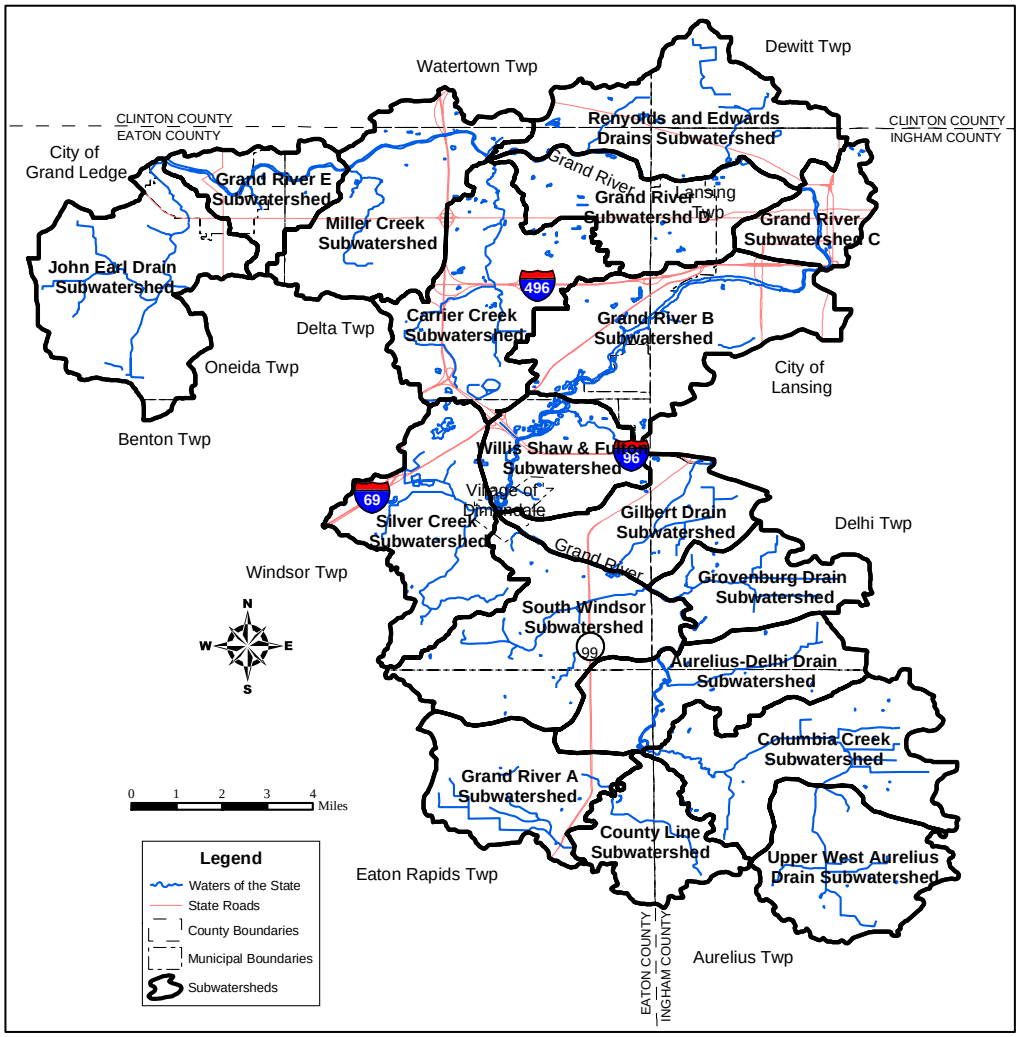


Table 3-1. Political Jurisdictions in the Watershed.

Subwatershed	Aurelius Township	Benton Township	Delta Township	Delhi Township	Dewitt Township	Village of Dimondale	Eaton Rapids Township	City of Grand Ledge	City of Lansing	Lansing Township	Oneida Township	Watertown Township	Windsor Township	Total Area (ac)	% of Watershed
Aurelius-Delhi Drain	1,958			1,729			1,519						145	5,352	6%
Carrier Creek			6,659										154	6,813	7%
Columbia Creek	6,853			1			17							6,872	7%
County Line	1,545						1,738							3,283	4%
Gilbert Drain				2,089		84			48				1,683	3,904	4%
Grand River A							4,512							4,512	5%
Grand River B			2,644						4,531	392			96	7,663	8%
Grand River C									2,305					2,306	2%
Grand River D			2,641						994	1,250				4,885	5%
Grand River E			928					1,089			850			2,867	3%
Grovenburg Drain				3,388									3	3,391	4%
John Earl Drain		113						611			6,788			7,512	8%
Miller Creek			5,597								83	708		6,388	7%
Reynolds and			871		2,532				1,944			1,029		6,376	7%
Silver Creek			2			118							5,718	5,837	6%
South Windsor				418		88	1,954						4,512	6,972	7%
Upper West Aurelius	5,080													5,080	5%
Willis Shaw & Fulton			47			313							3,250	3,610	4%
Total	15,436	113	19,387	7,626	2,532	603	9,740	1,699	9,822	1,643	7,721	1,737	15,561	93,622	100%
% of Watershed	16%	< 1%	21%	8%	3%	< 1%	10%	2%	10%	2%	8%	2%	16%	100%	---

Area given in acres. Blank boxes indicate that jurisdiction does not exist in subwatershed.

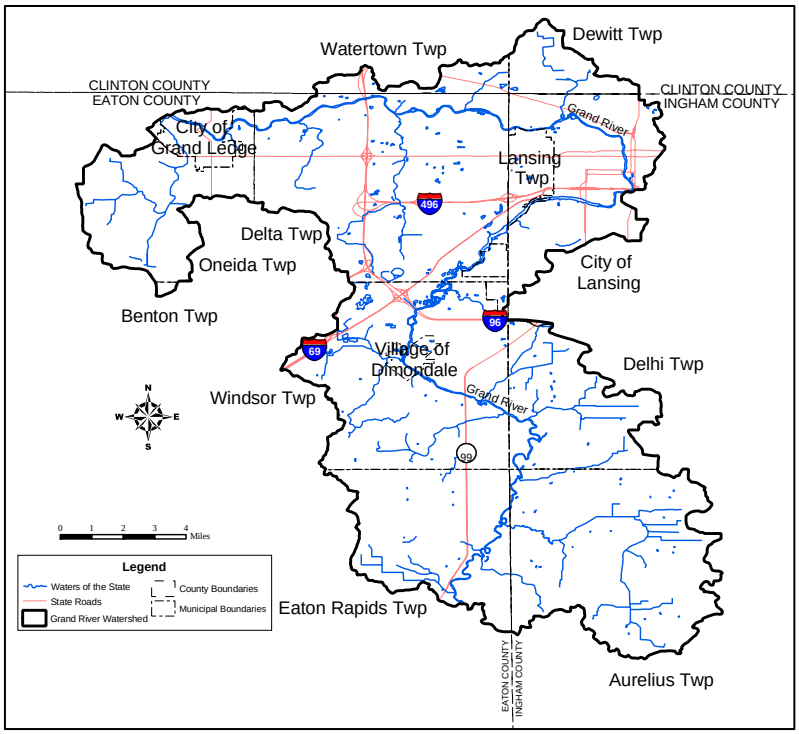
Aurelius, Eaton Rapids, and Windsor Townships are rural areas with increasing development pressure. Delta Township is more developed but still has rural and agricultural areas that can be protected. The City of Lansing is the center of the metropolitan areas and is almost completely developed. Figure 3-2 presents a map of these local units of government. Table 3-1 shows the acreage of each community in the watershed and watershed coverage percentages.

River Quote

"I started out thinking of America as highways and state lines. As I got to know it better, I began to think of it as rivers."

- Charles Kuralt

Figure 3-2. Local units of government in the Grand River Watershed.



Source: UM, 2005.

Source: RSGIS, 2005.

Demographics

The communities with the highest population in the watershed are the City of Lansing (51%), Delta Township (21%), and Delhi Township (8%). The other municipalities contribute 6% or less to the population in the watershed.

The fastest growing communities for the period from 1990 to 2000 include Aurelius Township (+30%), Eaton Rapids Township (+27%), Delhi Township (+18%), DeWitt Township (+16%), Oneida Township (+15%), and Delta Township (+14%). Communities showing population declines over this period include the City of Lansing (-10%) and Windsor Township (-7%).

Over the next 30 years, the watershed population is expected to grow overall by 6% every decade with growth rates of 8% for Delta Township, 8% for Delhi Township, 6% for the City of Grand Ledge, and 2% for the City of Lansing. The more sparsely populatied townships of Oneida, Eaton Rapids, Watertown, Windsor, and Benton are predicted to grow between 14% and 28% per decade. The other communities have predicted growth rates between 3% and 10%.

Table 3-2 shows the past, present and future population in the region and associated population change percentages for communities participating in the watershed management (non-participating communities shown in italics).

Table 3-2. Population in the watershed.

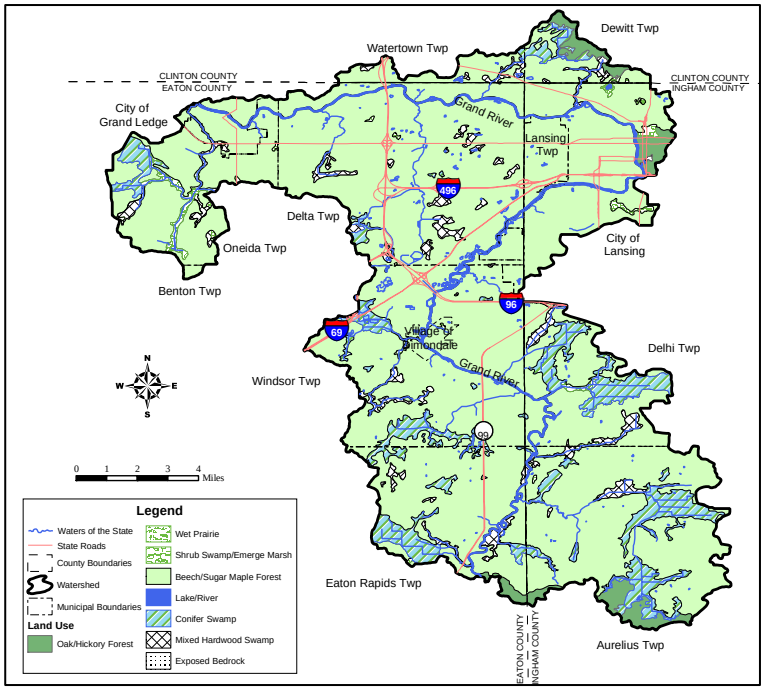
Community	Population in Watershed			Avg. % Change per 10 yr	
	1990	2000	2030	90-00	00-30
Aurelius Township	1,685	2,194	2,390	30%	3%
Benton Township	13	14	20	7%	14%
Delta Township	21,444	24,361	30,372	14%	8%
Delhi Township	7,971	9,375	11,613	18%	8%
Dewitt Township	1,306	1,518	1,899	16%	8%
Village of Dimondale	1,247	1,342	1,760	8%	10%
Eaton Rapids Township	1,337	1,702	2,812	27%	22%
City of Grand Ledge	6,328	6,516	7,621	3%	6%
City of Lansing	65,386	58,710	62,871	-10%	2%
Lansing Township	4,340	4,116	4,618	-5%	4%
Oneida Township	1,196	1,372	2,511	15%	28%
Watertown Township	282	315	482	12%	18%
Windsor Township	4,490	4,167	6,095	-7%	15%
Total	117,025	115,702	135,063	-1%	6%
Total (participating)	113,990	111,792	129,841	-2%	5%

Source: USCB, 2004; TCRPC, no date.

Land Use and Growth Trends

Historically, much of the Grand River Watershed was comprised of deep forests and wetlands. The majority of the upland land ecosystem was comprised of Beech/Sugar Maple Forests, with other areas comprised of Oak/Hickory Forests with interspersing conifer and hardwood swamps. Figure 3-3 shows a map of the land types in the watershed circa 1830 and shows a percentage breakdown of these land types.

Figure 3-3. Land types - circa 1830.



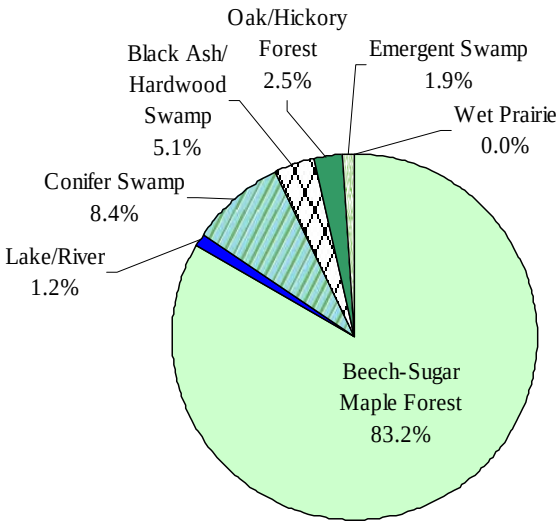
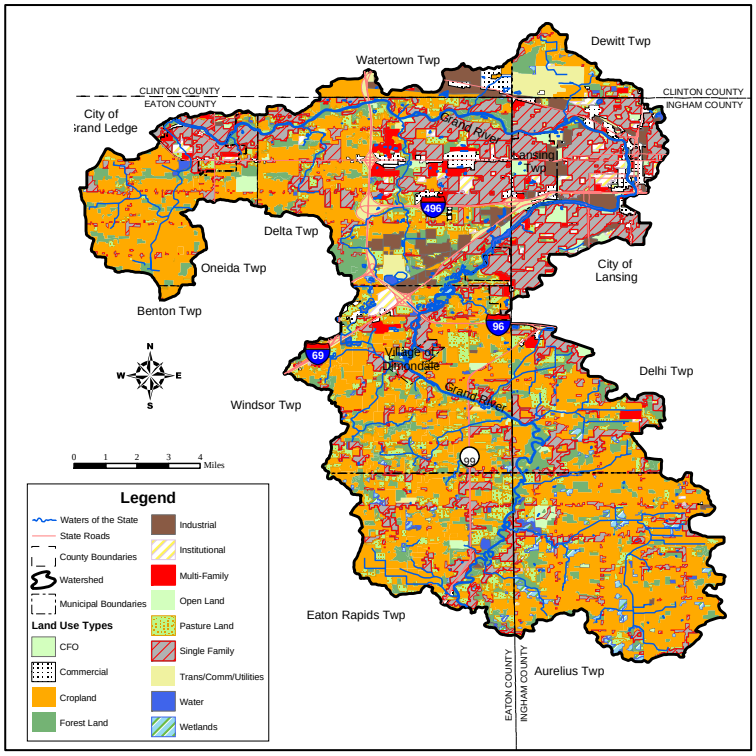
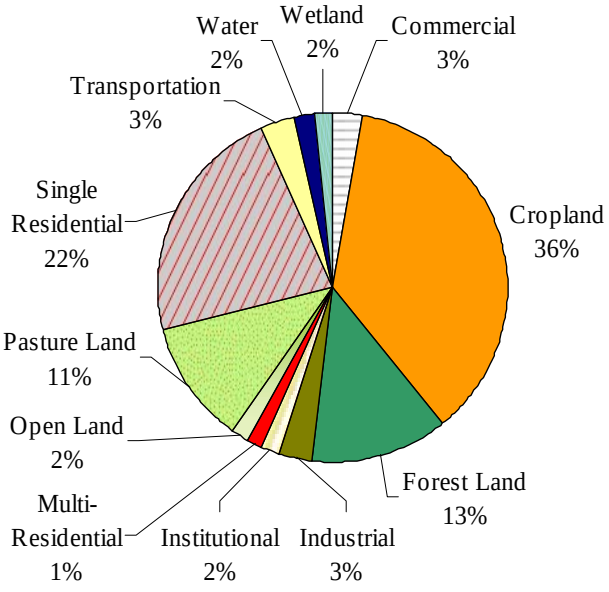


Figure 3-3 shows that a significant portion of the Grand River Watershed was forest or swamp/wetland of some type. Permanent human settlement brought great change to the landscape as the land was altered for human benefit. One example is that much of the wetlands were drained to provide land for farming, settlement, and transportation. This and other changes such as urban development, dams, river relocation, channelization and dredging significantly altered the landscape which we now see today (Figure 3-4).

Figure 3-4. Land types – present day.





Source: TCRPC, 2004.

Source: EPA, 2005.

These changes have resulted in a loss of 85 percent of both the forest cover and the wetlands.

Based on zoning ordinances for the various watershed communities, the projected future land use indicates that residential, industrial, and commercial land uses will expand in those areas currently seeing such land uses. This includes most of the watershed except for the southwestern area which is projected to be dominated by agricultural use. Figure 3-5 shows the future land use.

Urbanized Land Use

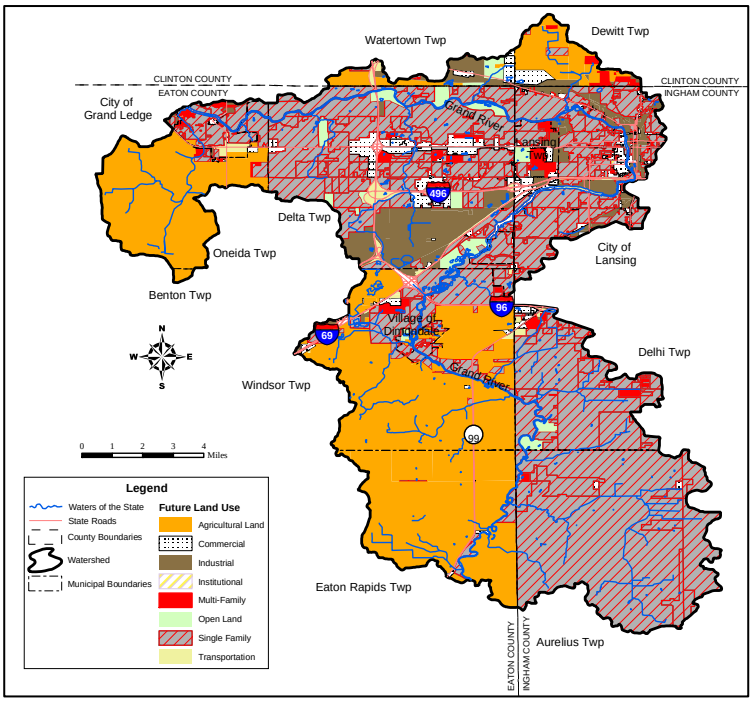
The major urbanization zones of the watershed include the Cities of Lansing and Grand Ledge; Delta, Delhi, Dewitt, and Lansing Townships. The predominant land use type within these communities is single-family residential.

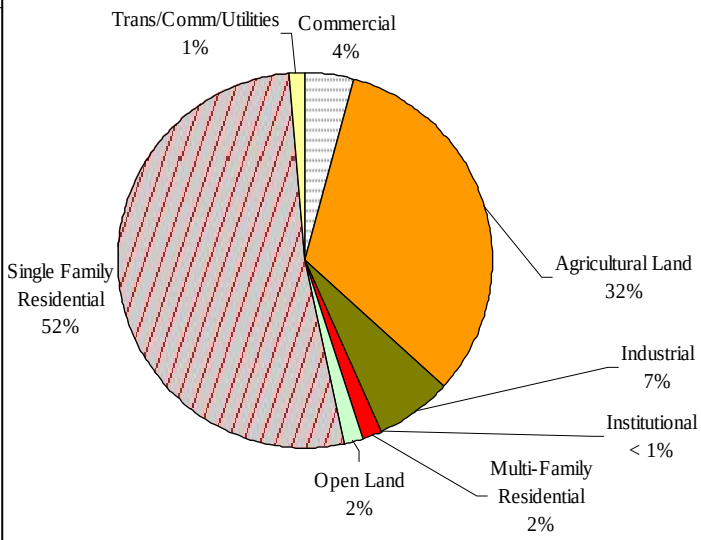
Several major thoroughfares transect the watershed including Interstate 69 (I-69), Interstate 496 (I-496), and Interstate 96 (I-96). US-127 parallels the eastern boundary of the watershed, but is not within the boundaries.

These highways are crucial routes for transporting people and goods between metropolitan areas in the state. Additionally, they play a role in directing future urbanization by opening up more rural townships and cities to convenient intra- and interstate travel. Consequently, highway access and exit ramps become hubs for development.

Figure 3-5 illustrates that future urbanization is predicted, using master plans and zoning information, in the Cities of Lansing and Grand Ledge; Aurelius, Delta, Delhi, Dewitt, Lansing, and Windsor Townships. The population predictions presented in Table 3-2 support the projected land use growth observed in Figure 3-5. Population growth projections presented in Table 3-2 predominantly support the projected land use observed in Figure 3-5. Inconsistencies between these two data sources are apparent in Aurelius and Eaton Rapids Townships where population is either over- or underestimated.

Figure 3-5. Land types – future.





Agricultural Land Use

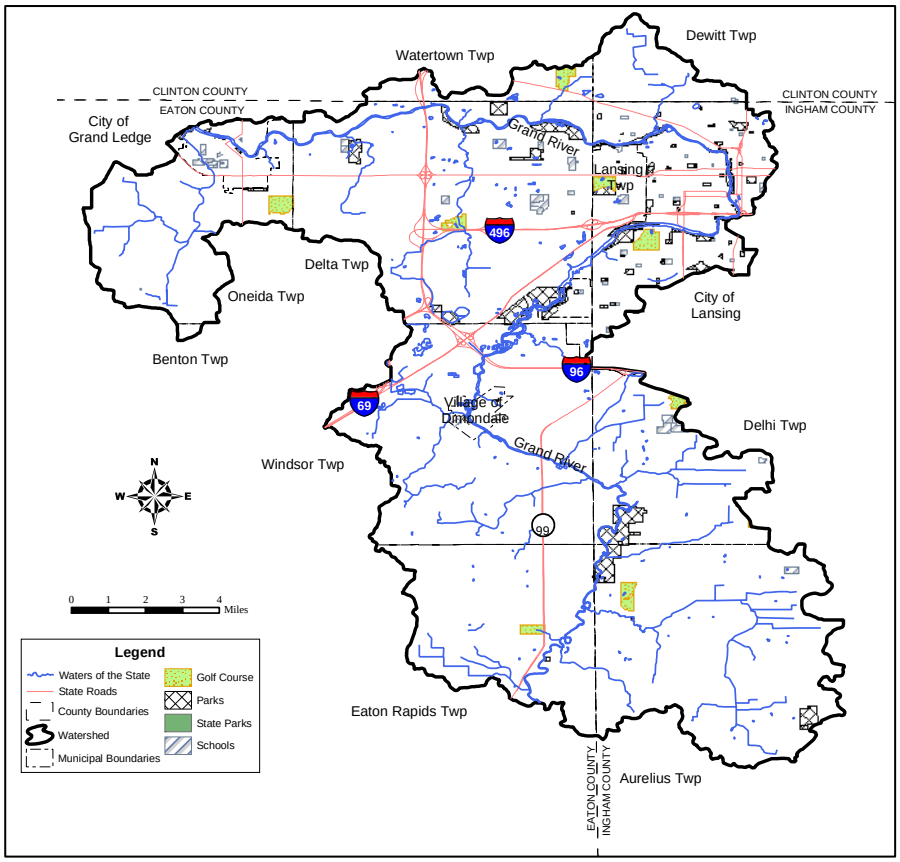
Agricultural land use includes those lands used for livestock pasture and those lands used to grow crops. Details of these uses are presented in the dialog box to the right. Based on present day land use and future zoning predictions, the total land used for agricultural purposes is expected to decrease by 15%.

Public Land

Public land is a valuable component of the land use within the watershed. This land provides recreation, resources, and opportunities to improve the watershed through best management practice implementation.

Figure 3-6 shows the location of the known public lands in the watershed. The public land uses include, parks, state parks, golf courses, schools, and universities. Approximately 5 percent of the watershed is composed of public lands. Of this 5 percent, parks make up about 61 percent of public lands, golf courses 22 percent and schools 17 percent.

Figure 3-6. Public lands.



Wetlands

In general terms, wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin, 1979).

Livestock

One-thousand and eighty-eight livestock farms with approximately 75,400 livestock head exist throughout Eaton County. Additional data is presented below:

Livestock	Farms	Head
Cattle / calves	342	13,096
(sold)	260	7,562
Beef cattle	226	3,082
Dairy cattle	43	2,083
Hogs / pigs	41	10,188
(sold)	46	30,359
Sheep / lambs	55	2,377
Layers (20 wks +)	63	4,297
Poultry (sold)	12	2,356
Total	**1,088**	**75,400**

Crops

Historically, crops grown in Eaton County consisted of oats, wheat and corn.

Today, eight-hundred and forty-seven farms in Eaton County* harvest approximately 171,000 acres of land. Specific crop data is presented below:

Crop	Farms	Acres
Corn for grain	387	65,025
Corn for silage	58	2,045
Sorghum for grain	0	0
Wheat for grain	180	13,106
Barley for grain	1	n/a
Oats for grain	41	925
Sunflower seed	0	0

Note that soybean is a main crop in the county although specific data is not available.
* This data is the entire County

Wetland Types

Aquatic Bed- Areas of shallow permanent water that are dominated by plants growing on or below the surface.

Emergent Wetlands- include marshes, fens, wet meadows, and potholes.

Forested- Forested swamps are found throughout the United States. They are often inundated with floodwater from nearby rivers and streams.

Open Water- Deeper, perennial pools within wetlands and shallow portions of lakes and rivers. Typically home to submerged plants.

Scrub/Shrub- Shrub swamps, are similar to forested swamps, except that shrubby vegetation predominates.

Unconsolidated Shore- Characterized by substrates lacking vegetation except for pioneering plants.

Source: Cowardin, 1979.

Wetlands can play critical roles in flood storage, nutrient transformation, and water quality protection and, as part of a healthy riparian corridor, may dampen the effects of impervious cover within the watershed. Important wetland functions and values include:

- Flood prevention and temporary flood storage, allowing the water to be slowly released, evaporated, or percolate into the ground and recharging groundwater.
- Sediment capture and storage.
- Wildlife habitat for a wide diversity of plants, amphibians, reptiles, fish, birds, mammals, and related recreational values.
- Water quality improvement by filtering pollutants out of water.
- The support of approximately 50 percent of Michigan's endangered or threatened species (Cwiekial, 2003).

Figure 3-7. Wetlands.

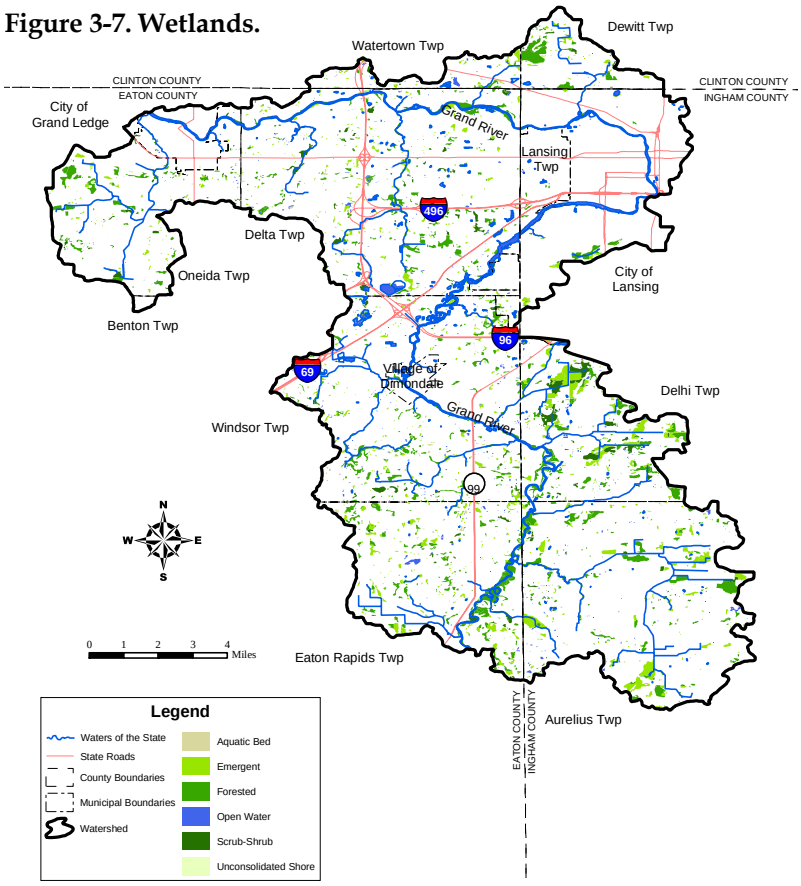


Figure 3-7 shows the location of wetlands in the watershed. Table 3-3 presents the wetland coverage for the subwatersheds. Currently, wetland coverage in the watershed is 9% of land area. Historically, wetlands have made up approximately 16 percent of the watershed. This means approximately 56 percent of native wetlands have been lost within the watershed. Generally speaking, those subwatersheds that have expansive contiguous areas of residential build-out, such as Grand River C and Grand River D have the lowest percentage of land mass existing as wetlands (2% and 5%, respectively).

Table 3-3. Wetlands.

Subwatershed	Wetland Acres	Wetland Coverage	Subwatershed Wetland (ac) per Watershed Wetland (ac)
Aurelius-Delhi Drain	586	11%	7%
Carrier Creek	585	9%	7%
Columbia Creek	637	9%	7%
County Line	527	16%	6%
Gilbert Drain	603	15%	7%
Grand River A	428	9%	5%
Grand River B	713	9%	8%
Grand River C	45	2%	1%
Grand River D	247	5%	3%
Grand River E	177	6%	2%
Grovenburg Drain	655	19%	8%
John Earl Drain	483	6%	6%
Miller Creek	446	7%	5%
Reynolds and Edwards	631	10%	7%
Silver Creek	406	7%	5%
South Windsor	737	11%	9%
Upper West Aurelius	354	7%	4%
Willis Shaw & Fulton	326	9%	4%
Watershed Total	**8,586**	**9%**	**100%**

The majority of wetlands in the watershed exist in the subwatersheds of Grovenburg Drain, County Line Drain, and Gilbert Drain (19%, 16%, and 15%, respectively).

Importance of Headwater Streams

Headwater streams and wetlands are often undefined, unmapped, small locations which provide the water that flows and maintains our river systems. The term "headwater" refers to the smallest stream or wetland that flows into a stream network. Regional studies have shown that these headwater streams and wetlands make up more than 80% of the nation's stream network. These waterways provide many of the benefits that scientists call "ecosystem services". They provide groundwater filtering and recharge, recycling of waste products, flood control, spawning and mating grounds for fish and wildlife, and the water for human use. Most importantly, headwater streams and wetlands provide the basis for improved water quality in our watersheds.

"THE PHYSICAL, CHEMICAL, AND BIOTIC INTEGRITY OF OUR NATIONS' WATERS IS SUBTAINED BY SERVICE PROVIDED BY WETLANDS AND HEADWATERS STREAMS"

- Where Rivers are Born:: The Scientific Imperative for Defending Small Streams and Wetlands, 2003

Climate

The climate of the Grand River Watershed can generally be described as one having a warm summer and a cool-to-cold winter.

The average temperature in the region is highly seasonal. The average temperature for the month of January, the coldest month, is 22.7 °F while August, the warmest month, has an average temperature of 71.2 °F – a difference of 48.5 °F.

The average annual precipitation is 32.82 inches. Like the temperature, it is seasonally variable, with February, the driest month receiving 1.57 inches on average, while June, the wettest month, receives 3.73 inches on average – a difference of about 2.2 inches.

In the months of October through April, a portion of precipitation typically occurs as snowfall. The greatest amount of snowfall occurs in January (13.4 inches on average – approximately equivalent to 1.3 inches of rainfall) and accounts for 75% of the precipitation for the month. The months of June through August average no snowfall, while May and September may receive trace amounts.

The wind in the region generally comes from the west / southwest at 9 mph during the summer and 12 mph during the winter. The peak gusts generally occur in the spring / early summer.

More detailed climatic information is presented in Table 3-4.

Table 3-4. Climatic variable data for the watershed.

Month	Average Temperature (°F)	Average Precipitation* (inches)	Average Snowfall** (inches)	Prevailing Wind Direction	Average Wind Speed (mph)	Peak Gust Wind Speed (mph)
January	22.7	1.78	13.4	SW	12	55
February	24.4	1.57	9.1	W	12	51
March	33.7	2.28	7.4	W	12	61
April	46.0	3.12	2.0	W	12	70
May	57.4	3.36	Trace	W	10	59
June	67.1	3.73	0.0	W	9	67
July	71.2	3.09	0.0	W	9	60
August	69.2	3.33	0.0	W	8	62
September	61.7	3.27	Trace	S	9	47
October	50.6	2.62	0.3	SW	10	58
November	38.1	2.56	3.6	SW	12	53
December	27.2	2.11	11.3	SW	12	54
Total	---	32.82	46.9	---	---	---

Note: Temperature and precipitation data is an aggregate of data from Ionia, Clinton, Shiawassee, Barry, Eaton, Ingham, Calhoun, Jackson, St. Joseph, Branch, and Hillsdale Counties from 1931-2000. The snowfall data is an average of the 30-year means for stations in Lansing and Jackson. The wind data is from a station in Lansing from 1930-1996.

* - Includes snowfall. ** - As a general rule, divide the snowfall amount by ten to convert to equivalent inches of rainfall.

Source: NOAA, no date; NCDC, 1998; NCDC, 2002.

Soil Associations

The eleven soil associations present in the watershed include:

- Urban land/Marlette/Capac
- Marlette/Capac/Owosso
- Oshtema/Houghton/Riddles
- Marlette/Oshtemo/Capac
- Marlette/Capac/Parkhill
- Capac/Marlette/Colwood
- Houghton/Palms/Edwards
- Houghton/Gilford/Adrian
- Boyer/Cohoctah/Houghton
- Marlette/Capac Association
- Capac/Parkhill Association

Geology and Soils

Michigan has been subjected to four glacial periods: Wisconsian, Illinoian, Nebraskan, and Kansian. The last of these continental glaciers, the Wisconsian, existed approximately 11,000 years ago and is responsible for much of the development of Michigan's underlying geology, soils, topography, and the Great Lakes.

In the Grand River Watershed the predominant underlying geology is predominantly:

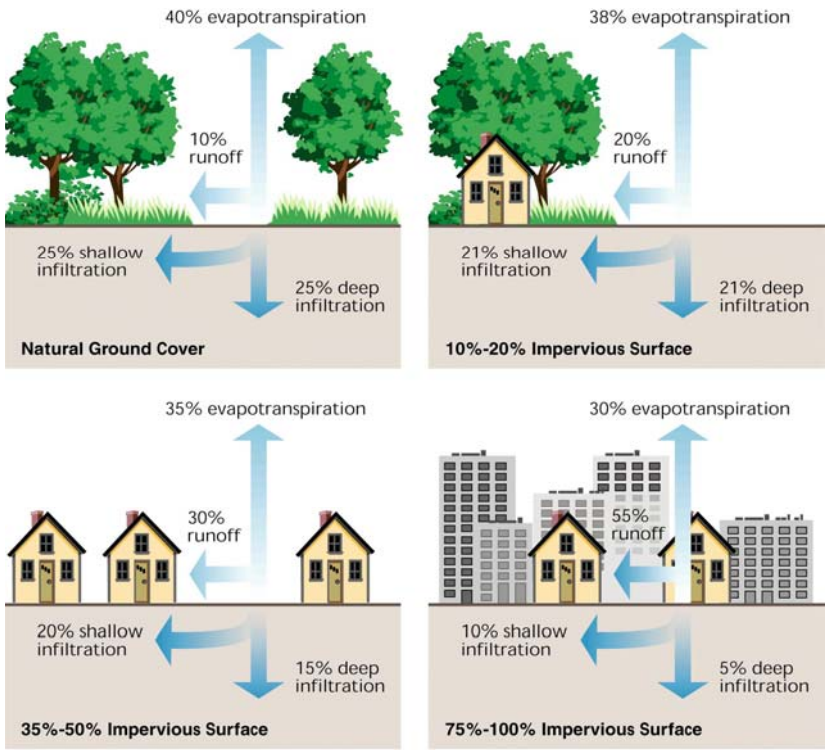
- Glacial till – poorly sorted and poorly rounded material ranging in size from pebbles to boulders
- Glacial outwash – finer material deposited by glacial melt water
- Lacustrian material – fine materials deposited in still or ponded glacial meltwater
- Alluvian material – recently deposited material from local rivers and streams

Each of these deposited materials, along with organic material, are the parent materials of the soils present in the watershed. These soils are predominantly sandy, loamy, sandy loams, clay loams or muck soils and are commonly classified as hydrologic soil group B. The topography of the watershed ranges from 800 to 1,000 ft above sea level with rolling plains having slopes ranging from 0 to 30 percent. This, in combination with the soil groups, provides a wide variety of drainage from poorly to very well drained landscape.

Hydrology

Hydrology is the study of water and the circulation of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere. Understanding how hydrologic components respond to land use changes and site development is the basis for developing successful watershed and storm water management programs. Traditional development practices tend to cause a sharp increase in the total volume, peak flow rate and frequency of rainwater reaching the rivers and lakes. In addition, channels experience more bankful flood events each year and are exposed to critical erosive velocities for longer intervals. Since impervious cover prevents rainfall from infiltrating into the soil, less flow is available to recharge ground water. Consequently, during extended periods without rainfall, baseflow levels are often reduced in urban streams. Figure 3-8 illustrates the relationship between impervious cover and surface runoff.

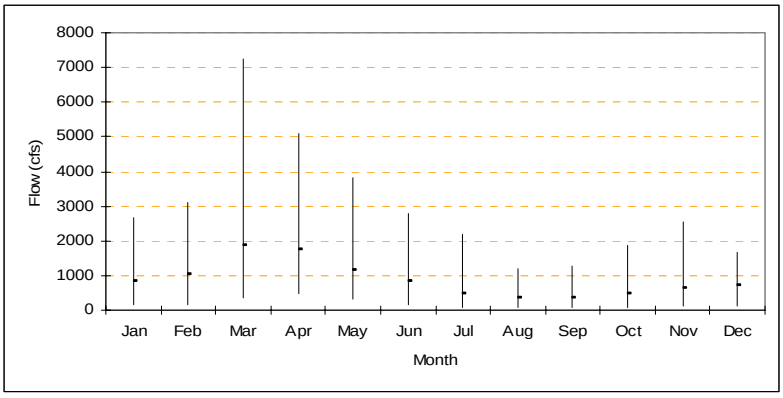
Figure 3-8. Effects of urbanization on runoff.



Source: FISRWG, 1998.

Figure 3-9 provides a summary of USGS stream gauging data from 1901 to 2003 at station 04113000, North Grand River Avenue bridge in Lansing, Michigan (USGS, 2005). The presented information is the monthly mean streamflows in cubic feet per second (cfs). The vertical bar above each month illustrates the range of flow recorded and the horizontal tick mark on each vertical bar is the monthly mean stream flow. Stream flow has varied from a low of 61 cfs in August 1936 to a high of 7,242 cfs in March 1904.

Figure 3-9. Streamflow data for Grand River at Lansing, MI.



Point Sources of Potential Pollutants

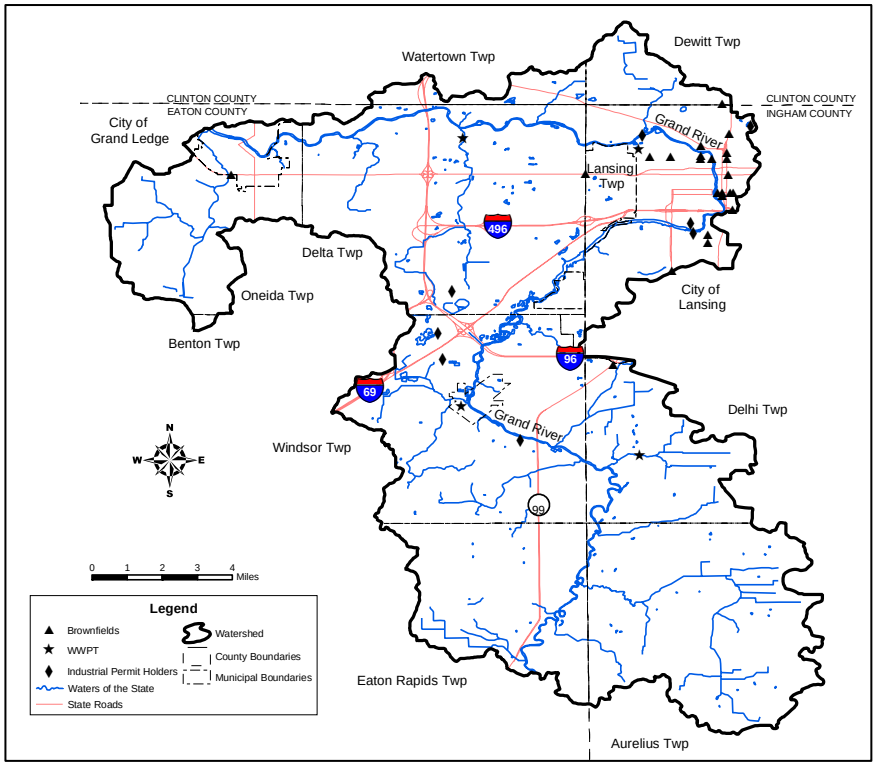
Within the watershed, there are twelve facilities that are permitted to discharge certain pollutants though the National Pollutant Discharge Elimination System of the Clean Water Act of 1972. These include the Lansing, Delta, Delhi, and Windsor/Dimondale Waste Water Treatment Plants (WWTPs) and eight others (four in Lansing, three in Windsor Township, and one in Delta Township). These are identified in Figure 3-10.

Additionally, pollutants may be released from known pollutant sites called "brownfields". These typically include such things as abandoned and operating gas stations, commercial business land and development, and convenience stores. The bulk of these are in the Lansing/Lansing Township area with two others in Grand Ledge and another in Delhi Township. There are an additional two sites in the watershed that are included on the federal National Priorities List (NPL) as sites needing remediation: Adam's Plating and Barrels, Inc. These sites are not included on the map as address information was not readily available.

Furthermore, there are five facilities in the watershed identified as Hazardous Waste Treatment, Storage and Disposal facilities. The sites are not included on the map for security reasons.

On a subwatershed basis, point sources are of most concern in the Grand River B, C, D and Reynolds and Edwards Drain.

Figure 3-10. Point sources.



Sewer and Septic System Service Areas

Sanitary sewer service is an important factor that has the potential to affect water quality in the watershed. Where this service does not exist, homes dispose of their waste through a private septic system. Collectively, private systems present a greater risk of pollutant discharge to waters as compared to a centralized treatment facility that is associated with a sanitary sewer system. Sanitary (and combined) sewer service coverage in the watershed is shown in Figure 3-11.

Generally, the most populous areas of the watershed are those that have sanitary sewer service. The systems serving the watershed include:

- Delta Township (serving much of Delta Township)
- Grand Ledge (serving the City of Grand Ledge and portions of Oneida Township)
- Lansing (serving the City of Lansing and Lansing Township)
- South Clinton County Municipal Utilities Authority (serving Dewitt Township and portions of Watertown Township)
- Delhi Township (serving portions of Delhi Township)
- Windsor/Dimondale Township (serving Dimondale and portions of Windsor Township)

Some of the above systems serve small portions of surrounding communities. The Grand Ledge WWTP and SCCMUA do not discharge their effluent in the watershed.

As a whole, only 33% of the watershed land area has sanitary sewer service. On a subwatershed basis, those with the most service include Prairie and Grand River C (100%), Grand River D (95%), Grand River B (89%), Carrier Creek (87%), and Reynolds and Edwards Drain (81%). Those with little or no service include Aurelius-Delhi Drain (0%), Columbia Creek (0%), County Line (0%), Grand River A (0%), Silver Creek (0%), South Windsor Drain (0%), Upper West Aurelius Drain (0%), Willis Shaw and Fulton Drain (2%), and John Earl Drain (8%). The remaining subwatersheds have between 16 and 44 percent sanitary sewer service.

Figure 3-11. Sanitary sewer service.

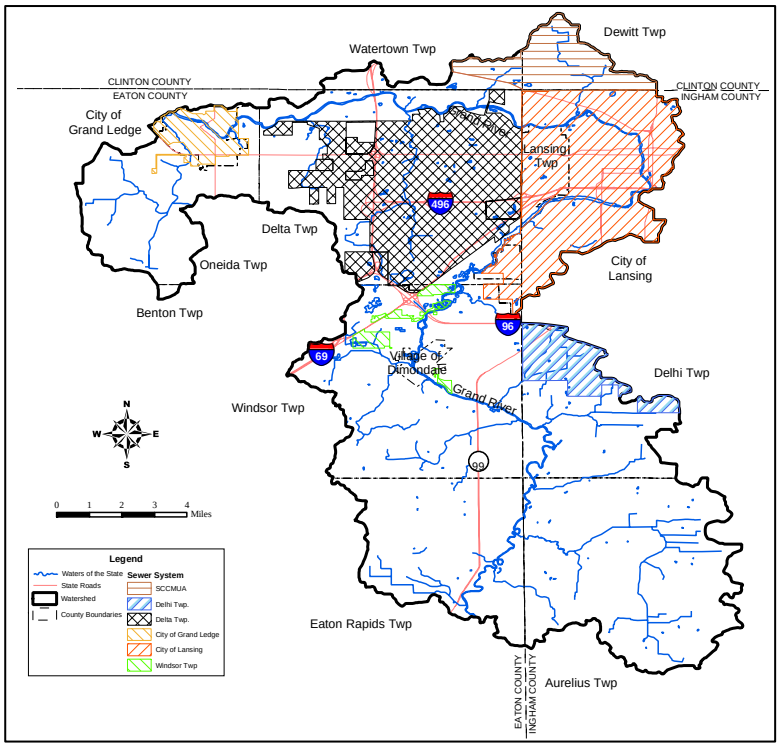
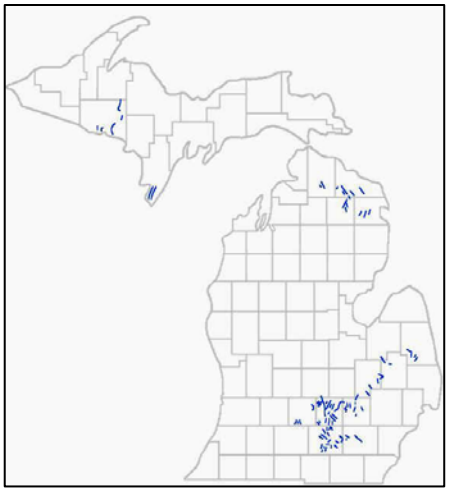


Table 3-5. Sewer service areas.

Subwatershed	Sanitary Sewer	Private Systems
Aurelius-Delhi Drain	0%	100%
Carrier Creek	87%	13%
Columbia Creek	0%	100%
County Line	0%	100%
Gilbert Drain	44%	56%
Grand River A	0%	100%
Grand River B	89%	11%
Grand River C	100%	0%
Grand River D	95%	5%
Grand River E	40%	60%
Grovenburg Drain	16%	84%
John Earl Drain	8%	92%
Miller Creek	34%	66%
Reynolds & Edwards	81%	19%
Silver Creek	0%	100%
South Windsor Drain	0%	100%
Upper West Aurelius Drain	0%	100%
Willis Shaw & Fulton Drain	2%	98%
Total	**33%**	**67%**

Heron Rookery

Esker Locations in Michigan



Source: Schaetzl , 2005.

Significant Natural Features to be Protected

Michigan has a number of significant natural features located across the State. These natural features can provide public benefits which may include recreation, bird watching, hunting, fishing, camping, hiking, off-roading, and water sports. These areas also include critical habitat for different species of plants, mammals, amphibians, reptiles, birds, fish, and macroinvertebrates. The features identified in the watershed are presented in Table 3-6.

Threatened and Endangered Species

The Michigan Department of Natural Resources (MDNR) provides information on threatened and endangered species in Michigan by watershed. This work is coordinated by the Michigan Natural Features Inventory (MNFI).

A species is classified as **endangered** if it is near extinction throughout all or a significant portion of its range in Michigan.

A species is **threatened** if it is likely to become classified as endangered within the foreseeable future throughout all or a significant portion of its range in Michigan.

A species is of **special concern** if it is extremely uncommon in Michigan or if it has a unique or highly specific habitat requirement and deserves careful monitoring of its status. A species on the edge or periphery of its range that is not listed as threatened may be included in this category along with any species that was once threatened or endangered but now has an increasing or protected, stable population.

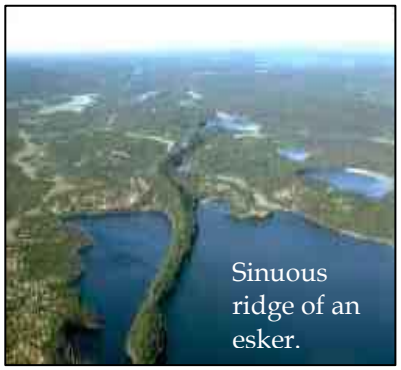
A species is **extinct** if it can no longer be found anywhere in the world. An **extirpated** species is one which doesn't exist in Michigan, but can be found elsewhere in the world.

A species is **stable** if it is not included in the above categories and the population is not declining drastically. A stable species is breeding and reproducing well enough to maintain current population in a given area.

Table 3-6 includes the species of plants and animals found in the watershed which are listed as threatened, endangered, or of special concern.

Eskers

An esker is a geographic natural feature that is formed when glacial meltwater carves subsurface river tunnels within the ice sheet. As the flow of water descreases or is blocked, sediment accumulates beneath the glacier. When the glacier recedes, a snake-like ridge composed of sand and gravel remains. The longest esker in Michigan extends from DeWitt to Mason running through Holt and Lansing. Much of the Mason Esker has been excavated for concrete roadway construction (Schaetzl 2005).


Sinuous ridge of an esker.

Source: Geological Survey of Canada

Table 3-6. Threatened and endangered features in the watershed.

Feature Type[1]	Name	Scientific Name	Federal Status[2]	State Status[2]	Aurelius-Delhi Drain	Carrier Creek	Columbia Creek	County Line Drain	Gilbert Drain	Grand River A	Grand River B	Grand River C	Grand River D	Grand River E	Grovenburg Drain	John Earl Drain	Miller Creek	Reynolds & Edwards	Silver Creek	South Windsor	Upper West Aurelius	Willis Shaw & Fulton
G	Moist Acid Cliff													X		X	X					
F	Rich Forest, Central Midwest Type	Mesic southern forest									X								X			X
G	Esker											X										
G	Pennsylvanian earth history													X			X					
H	Great Blue Heron Rookery	Great Blue Heron Rookery									X		X					X	X			X
O	Beak Grass	Diarrhena americana		T							X	X	X					X	X			X
O	Blanding's Turtle	Emys blandingii		SC							X								X			X
O	Cat-tail Sedge	Carex typhina		T								X	X					X				
O	Davis's Sedge	Carex davisii		SC								X										
O	Eastern Box Turtle	Terrapene carolina carolina		SC			X														X	
O	False Hop Sedge	Carex lupuliformis		T							X	X	X					X	X			X
O	Ginseng	Panax quinquefolius		T	X		X	X	X	X					X					X	X	
O	Goldenseal	Hydrastis canadensis		T	X			X	X	X					X					X		
O	Indiana Bat or Indiana Myotis	Myotis sodalis	LE	E	X	X		X	X	X	X	X	X		X			X	X	X		X
O	Kentucky Coffee-tree	Gymnocladus dioicus		SC	X	X		X	X	X	X	X	X	X	X		X	X	X	X		X
O	King Rail	Rallus elegans		E												X						
O	Least Shrew	Cryptotis parva		T							X	X							X			X
O	Panicled Hawkweed	Hieracium paniculatum		SC										X		X	X					
O	Purple Wartyback	Cyclonaias tuberculata		SC									X					X				
O	Raven's-foot Sedge	Carex crus-corvi		T	X			X	X	X	X	X	X		X			X	X	X		X
O	Regal Fern Borer	Papaipema speciosissima		SC	X			X	X	X	X	X	X		X			X	X	X		X
O	Showy Orchis	Galearis spectabilis		T	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
O	Small-fruited Panic-grass	Panicum microcarpon		SC										X		X	X					
O	Weed Shiner	Notropis texanus		X	X			X	X	X	X				X				X	X		X
O	White or Prairie False Indigo	Baptisia lactea		SC	X		X	X	X	X					X					X	X	
O	Virginia Flax	Linum virginianum		T										X		X	X					
O	Virginia Spiderwort	Tradescantia virginiana		SC							X	X	X					X	X			X
O	Woodland Vole	Microtus pinetorum		SC							X	X	X					X	X			X

[1] – F = Forest, G = Geographical, H = Habitat, O = Organism
[2] – LE = Listed as endangered, LT = Listed as threatened, SC = Special concern, T = Threatened, E = Endangered

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