

SECTION 3 - CHARACTERISTICS OF THE WATERSHED

SUBWATERSHEDS

It was decided that each of the 5 watersheds that comprise the Lower Flint River Watershed needed to be divided into subwatersheds each with an area from approximately 2mi² to 20mi². This would allow specific areas within the Lower Flint River Watershed to be looked at based on their unique conditions. This assisted with Total Maximum Daily Loads (TMDL) & identifying problems that may be specific to that location. Most of the Lower Flint watershed within Genesee County contained existing drainage districts. These existing drainage districts were used to divide the 5 watersheds into subwatersheds. Where drainage districts were not established, the areas along the watercourses were divided using contours to divide areas. Sometimes a jurisdictional boundary was used when necessary. Such as the north and west County line. In total the Lower Flint River was divided into 18 subwatersheds.

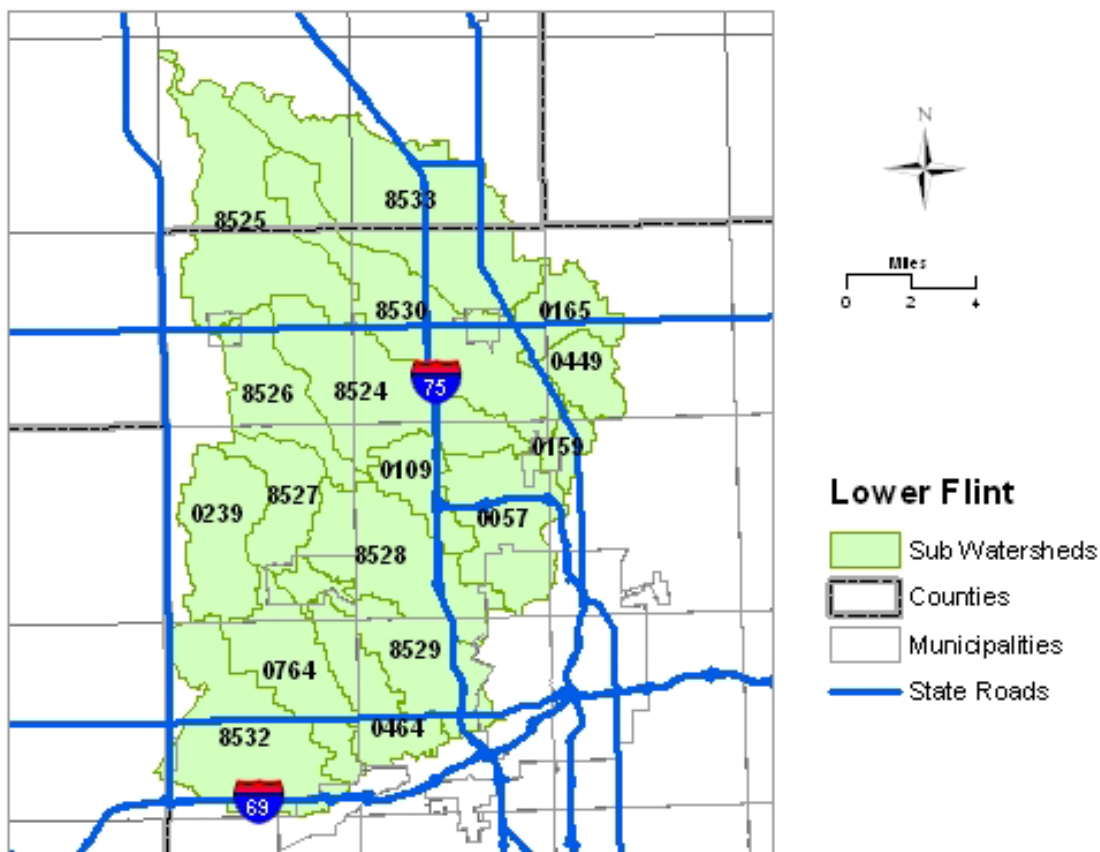


Figure 3-1 Subwatersheds

POLITICAL JURISDICTIONS

Table 3-1 Political Jurisdiction by Subwatershed

		Birch Run Twp	City of Clio	City of Flint	City of Flushing	City of Montrose	City of Mt Morris	City of Swartz Creek	Clayton Twp
0057	Lake Drain	0	0	3.3	0	0	0.42	0	0
0109	Central Drain	0	0	0	0	0	0	0	0
8524	Brent Run	0	0	0	0	0	0	0	0
	Brent Run Total	0	0	3.3	0	0	0.42	0	0
0239	Freeman Drain	0	0	0	0	0	0	0	0
0464	Messmore and Cronk	0	0	0	0.09	0	0	0	2.57
0764	Cole Creek	0	0	0	0.51	0	0	0.03	10.03
8525	Flint River 1	0	0	0	0	0.39	0	0	0
8526	Flint River 2	0	0	0	0	0.43	0	0	0
8527	Flint River 3	0	0	0	0.27	0	0	0	0
8528	Flint River 4	0	0	0.44	1.1	0	0	0	0
8529	Flint River 5	0	0	0.61	1.75	0	0	0	0.01
	Flint River, Lower Total	0	0	1.05	3.72	0.82	0	0.03	12.61
8532	Misteguay 1	0	0	0	0	0	0	0.97	18.14
	Misteguay Total	0	0	0	0	0	0	0.97	18.14
0159	Mason Drain	0	0	0	0	0	0.72	0	0
0165	Pine Run & Tryon	0	0	0	0	0	0	0	0
0449	Boutell & Branch	0	0	0	0	0	0	0	0
8530	Pine Run 1	0	1.04	0	0	0	0	0	0
	Pine Run Total	0	1.04	0	0	0	0.72	0	0
8533	Silver Creek1	11.57	0.08	0	0	0	0	0	0
	Silver Creek Total	11.57	0.08	0	0	0	0	0	0
	Lower Flint Total Area in Square Mile	11.57	1.12	4.35	3.72	0.82	1.14	1	30.75
	% of Watershed	5.21%	0.50%	1.96%	1.67%	0.37%	0.51%	0.45%	13.83%

*The City of Flint is a Phase 1 Community

Political jurisdictions regarding the Flint River and its tributaries are controlled by federal and state laws, county and municipal ordinances, and municipal by-laws. Regulatory and enforcement responsibility for water quantity and quality is multi-layered. Within the Lower Flint River Watershed alone, there are 15 Cities, Townships, and Villages in Genesee County and 3 Townships in Saginaw County. Of the 18 communities, only 12 are Phase 2 communities. The City of Flint is included in the *Lower Flint* River Watershed area calculations, but it is a Phase I community.

Flint Twp	Flushing Twp	Genesee Twp	Montrose Twp	Mt Morris Twp	Taymouth Twp	Thetford Twp	Venice Twp	Vienna Twp	Village of Lennon	Lower Flint Total Area in Square Mile	% of Watershed
0	0	0.64	0	9.03	0	0	0	0	0	13.39	6.02%
0	0	0	0	5.88	0	0	0	0	0	5.88	2.65%
0	0.68	0	6.7	4.32	0	0	0	6.96	0	18.66	8.40%
0	0.68	0.64	6.7	19.23	0	0	0	6.96	0	37.93	17.06%
0	11.24	0	0	0	0	0	0	0	0	11.24	5.06%
5.65	0.58	0	0	0	0	0	0	0	0	8.89	4.00%
0.03	1.17	0	0	0	0	0	0	0	0	11.77	5.30%
0	0	0	11.38	0	10.21	0	0	0.3	0	22.28	10.02%
0	2.48	0	6.97	0.17	0	0	0	0	0	10.05	4.52%
0	7.41	0	0	0	0	0	0	0	0	7.68	3.46%
0.75	2.86	0	0	10.66	0	0	0	0	0	15.81	7.11%
9.37	0.5	0	0	0.88	0	0	0	0	0	13.12	5.90%
15.8	26.24	0	18.35	11.71	10.21	0	0	0.3	0	100.84	45.37%
0	0.13	0	0	0	0	0	0.19	0	0.19	19.62	8.83%
0	0.13	0	0	0	0	0	0.19	0	0.19	19.62	8.83%
0	0	1.77	0	0.58	0	0.29	0	0.02	0	3.38	1.52%
0	0	0	0	0	0	4.19	0	1.93	0	6.12	2.75%
0	0	0.02	0	0	0	4.67	0	0.16	0	4.85	2.18%
0	0	0.11	1.28	0	3.3	0.55	0	15.13	0	21.41	9.63%
0	0	1.9	1.28	0.58	3.3	9.7	0	17.24	0	35.76	16.09%
0	0	0	0.14	0	6.65	0.03	0	9.65	0	28.12	12.65%
0	0	0	0.14	0	6.65	0.03	0	9.65	0	28.12	12.65%
15.8	27.05	2.54	26.47	31.52	20.16	9.73	0.19	34.15	0.19	222.27	100.00%
7.11%	12.17%	1.14%	11.91%	14.18%	9.07%	4.38%	0.09%	15.36%	0.09%	100.00%	

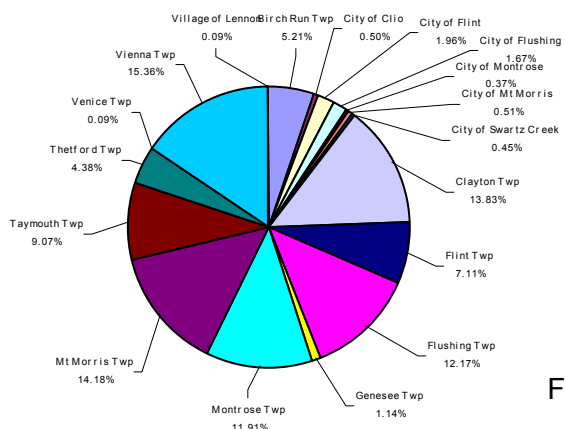
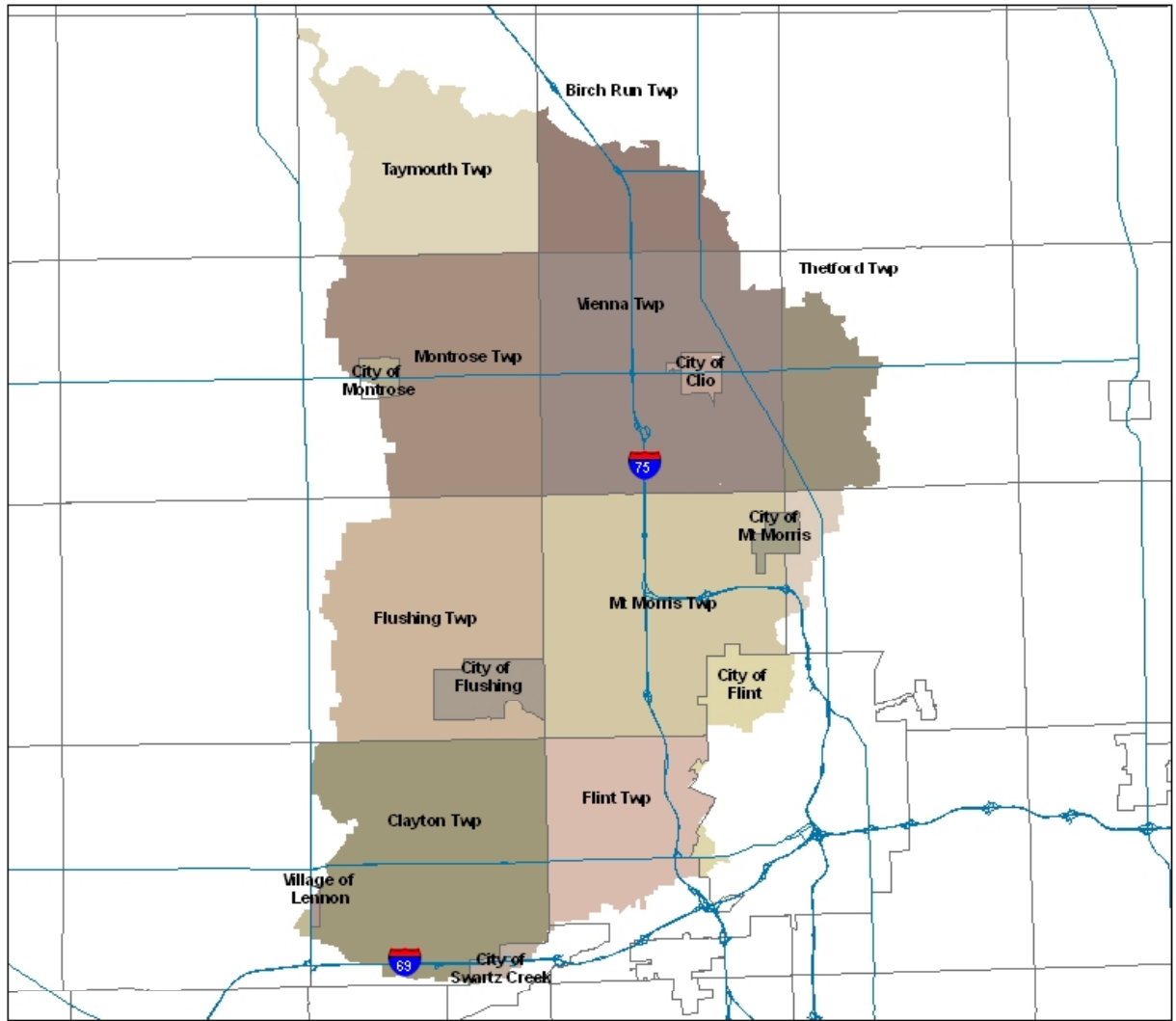


Figure 3-2 Political Jurisdiction by percentage



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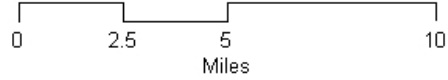


Figure 3-3 Local Units of Government

DEMOGRAPHICS

The Lower Flint River Watershed population has not significantly changed since 1990. The development that has occurred in this watershed has been largely commercial and concentrated along the major state road corridors of I75 and M57 (Vienna Road).

Table 3-2 Population Changes

Community	1990 Population within watershed	2000 Population within watershed	% Change from 1990 - 2000	Area within LOWER FLINT watershed in square miles
Birch Run Township	1742	2014	15.61%	11.57
Clayton Township	6493	6620	1.96%	30.75
City of Clio	2629	2483	-5.55%	1.12
City of Flint	17956	15938	-11.24%	4.35
Flint Township	23853	23576	-1.16%	15.80
City of Flushing	8542	8348	-2.27%	3.72
Flushing Township	9223	10230	10.92%	20.75
Genesee Township	1779	1782	0.17%	2.54
Village of Lennon	474	517	9.07%	0.19
City of Montrose	1811	1619	-10.60%	0.82
Montrose Twp	6236	6336	1.60%	26.47
City of Mt Morris	3292	3194	-2.98%	1.14
Mt Morris Township	25094	23627	-5.85%	31.52
City of Swartz Creek	1169	1229	5.13%	1.00
Taymouth Township	2563	2620	2.22%	20.16
Thetford Township	2381	2365	-0.67%	9.73
Venice Township	14	13	7.14%	0.19
Vienna Township	13019	12919	-0.77%	34.15
Total	130260	127430	-2.17%	222.27

U.S. Census Bureau Data,

LAND USE AND GROWTH TRENDS

Land Cover – Past, Present and Future

Prior to European settlement of the area, vegetation of the Lower Flint Watershed consisted of forested land with Beech-Sugar Forest (sugar maple, basswood, red oak, and white ash) with isolated pockets of Swamp Forest are scattered throughout the watershed in depressed areas.

When the first European explorers arrived around 1812 “it is probable that not more than a dozen white men had penetrated into the country of the *Saginaws*”. The Saginaw Valley was populated by Chippewa and Ottawa Indians, with the Chippewas being more numerous (Ellis 1879). However, Chippewa history tells that when they came into the area the Sauks and Onottoways inhabited the valley.

When early French fur traders moved into the Flint River Valley, they established an encampment at a natural river crossing used by Native Americans. The Indian name for this river was Pewonigowink meaning “river of fire stone” or river of flint. The crossing was located on the “southern bend” of the Flint River on the “Saginaw Trail” that ran between villages at the outlet of Lake St. Clair (Detroit) and encampments at the mouth of the Saginaw River. It was located very near the mouth of the Swartz Creek. This crossing became known as the “Grand Traverse” or great crossing place. A permanent trading post was established when Jacob Smith arrived in 1819 (Crowe 1945).

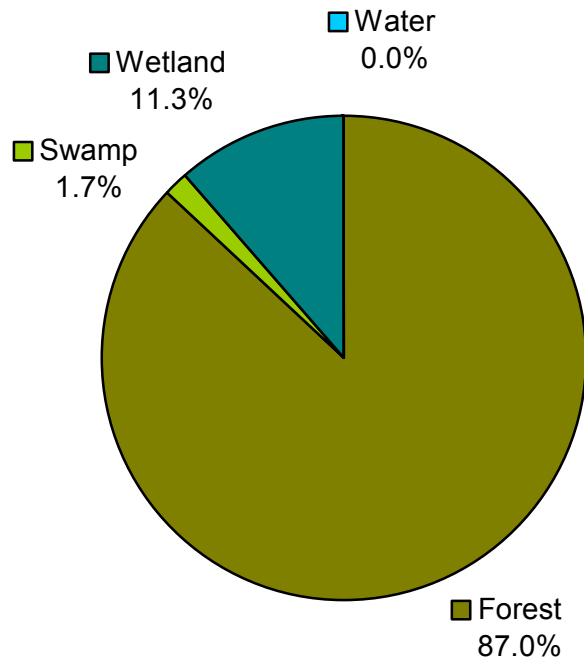
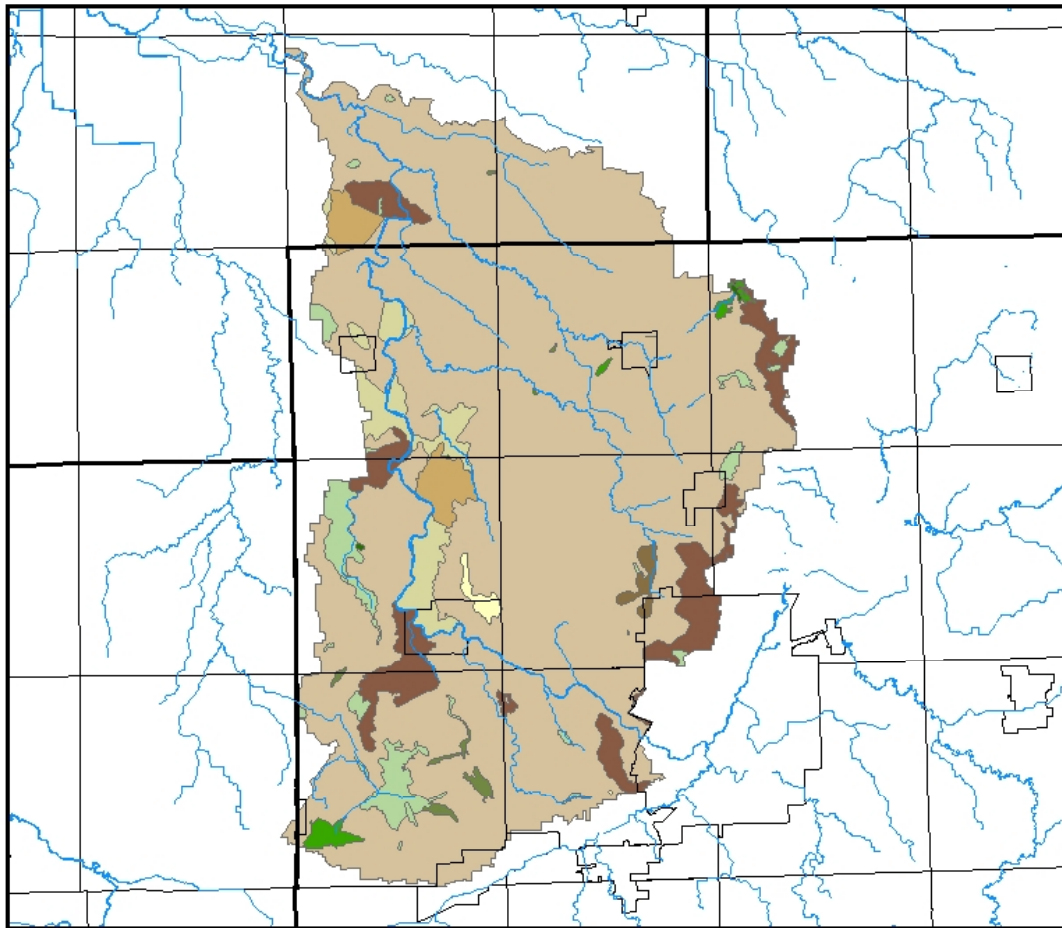


Figure 3-4 Ecosystems, circa 1830s by percentage



COVERTYPE

- BEECH-SUGAR MAPLE FOREST
- BLACKASH SWAMP
- LAKE/RIVER
- MIXED CONIFER SWAMP
- MIXED HARDWOOD SWAMP
- MIXED OAK FOREST
- OAK-HICKORY FOREST
- SHRUB SWAMP/EMERGENT MARSH
- WET PRAIRIE
- WHITE PINE-MIXED HARDWOOD FOREST
- WHITE PINE-WHITE OAK FOREST
- County
- Municipalities
- River

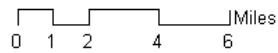


Figure 3-5 Ecosystems, circa 1830s

The City of Flint grew up at the site of the “Grand Traverse” and the pioneer immigrants who were largely from the “Genesee Country” of Western New York, concentrated along the banks of the Flint River, taking up farming, lumbering, and manufacturing. Permanent human settlement brought great change to the landscape as the land began to be altered for human benefit.

In the 1830’s, much of the County of Genesee, including most of the Lower Flint River Watershed, had been sectioned off and land sold, mostly in parcels of 80 to 200 acres. Much of this area was first logged for personal use and farming. Through the 1800’s and most of the 1900’s farming remained the predominant land use in the Lower Flint River.

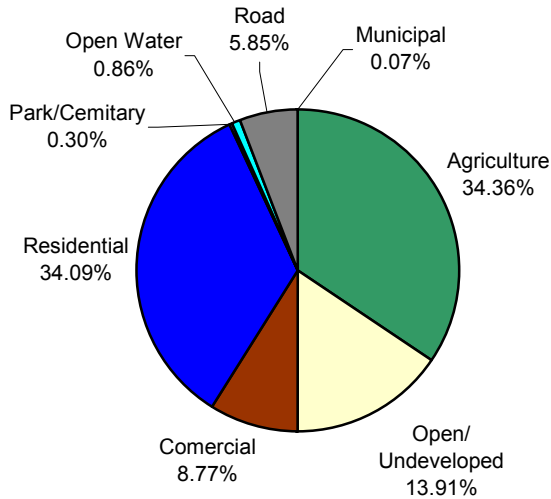
Although Michigan was primarily an agricultural state, including much of Genesee County, before the Civil War, lumbering became the principal economic activity in the new state during the second half of the 19th century. Within Genesee County, the completion of the railroad in 1862 afforded practicable communication with outside markets; and this, with increased demand created by the great civil war, inaugurated for the lumber interests an era of prosperity from 1866 to 1873, such as they had never known before.

With a good supply of high quality lumber and the ability to move supplies from town to lumbering camps, it is not surprising that Flint became a center for transportation producing horses, horse harnesses, horse drawn vehicles and ox carts. By 1900, Flint was building 150,000 vehicles per year, both wagons and carts. As the pine forests were exhausted, Flint’s attention turned to other industries and the transition to automobile manufacturing was natural (Crowe 1945). In 1903, Buick Motor Company began production of the Buick automobile. Under the business genius of Will Durant, formerly of Durant-Dort Carriage Company, Buick Motor Company convinced suppliers such as Champion Spark Plug Company, Weston-Mott (Axle) Company, and Fisher Body Company to relocate in Flint. Flint became the birthplace of General Motors and the United Auto Workers (UAW) union. Even today, Flint is often referred to as Buick City and its prosperity centered on the manufacture of automobiles.

After World War II, prosperity fostered population increase and diversifying communities. Gasoline was inexpensive, new highways were built, and General Motors, the UAW and Flint flourished. Outlying communities of Flint, Flushing & Vienna Townships experienced growth and were desirable locations to live and work. Advancements in the gasoline engine allowed for increased agriculture and farming dominated watershed land use.

Presently the Lower Flint River Watershed is changing. A community, whose economic welfare traditionally was tied to the prosperity of General Motors, has had to seek economic stability through diversification. New businesses have become important and development of industrial properties to attract new business has been a challenge. More recently, the increased demand for new residential and small commercial development is replacing agriculture.

Figure 3-6 Current Land Cover by percentage



Current land use for Genesee County was determined by using the assessment classification for each parcel of land. Open/Undeveloped areas are undeveloped residential and commercial properties. Open water and recreation were merged with the parcel map and given their own classifications. In Genesee County the recreational land was determined to be County/Municipal Parks only, golf courses are considered developed property.

City of Flint is a NPDES Phase I community and was not included. Within the City of Flint boundaries, the land is largely developed with residential and some commercial. There are several City Parks spread throughout the populated areas.

There is no consistent source for future land cover within the Lower Flint River Watershed. The Genesee County Land Bank has been compiling a comprehensive inventory of Master Plans and Ordinances for Municipalities within Genesee County. The inventory covers all ordinances including environmental. This can provide a resource to measure a community's ordinance for effectiveness against what other communities are doing. This inventory will be made available once it is complete.

Currently each Municipal Master Plan may have a different future land use. The land use may be for the ultimate developed condition or for a defined period of time. Such as what the development will look like in 2020. Currently there is no standardized method for classifying Current or Future Land Use among the Municipalities. Below is a list of Community Master Plans with future land use and when they were prepared. Each community has their master plan on file.

1978
Village of Lennon

2000
City of Flushing

2004
Flushing Township
Mt. Morris Township
City of Swartz Creek

1995
City of Mt Morris

2001
Genesee Township
Clayton Township

2005
City of Montrose

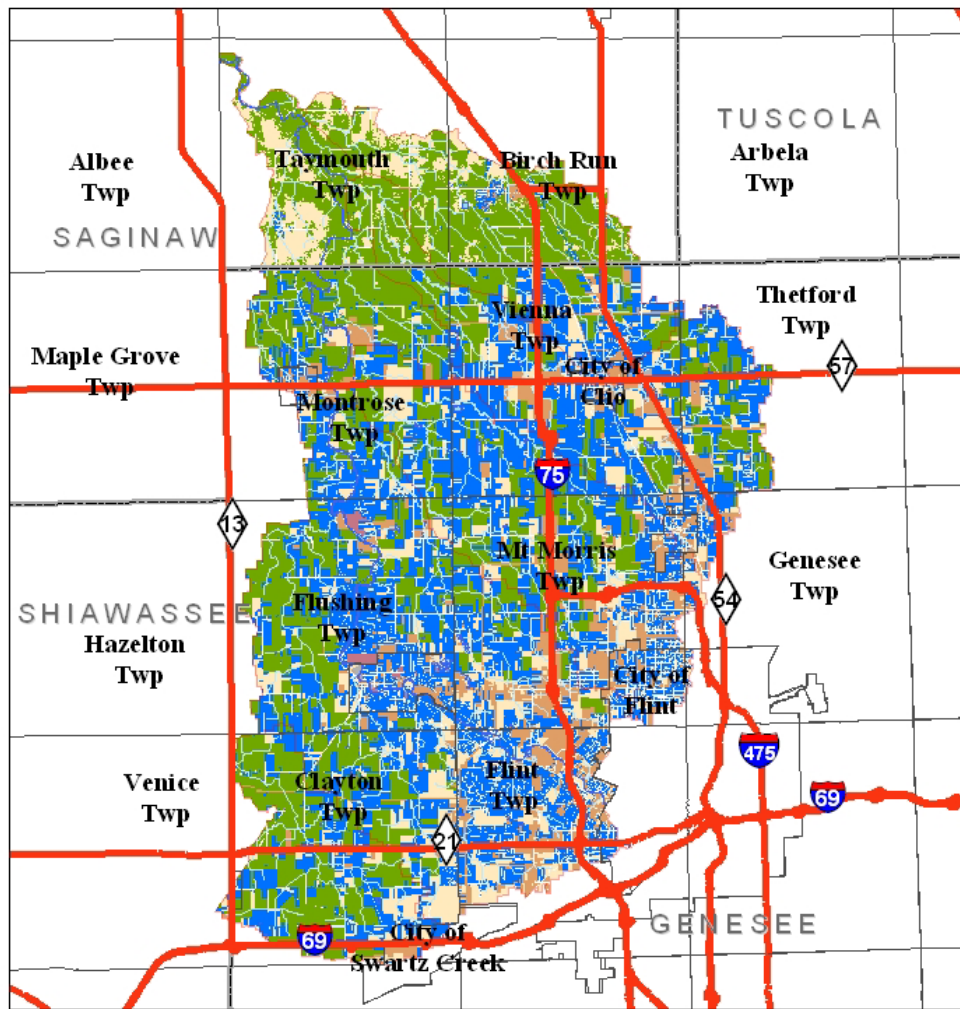
1998
Montrose Township

2002
Vienna Township

2008
Flint Township

1999
City of Clio

2003
Thetford Township



- State Roads
- Lake
- River
- Current Land Use**
- Municipal
- Parks/Cemetaries
- Agriculture
- Open/Undeveloped
- Commercial
- Residential

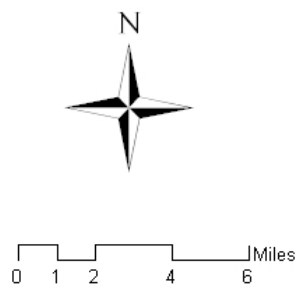


Figure 3-7 Current Land Covers

Urbanized Land Use

Within the Lower Flint River Watershed the largest increases to population within the watershed have been along the state road corridors. When comparing the individual communities current land uses to future land use, many areas that are current open areas or agriculture are classified in the future land use as residential or commercial. Many of the open/undeveloped areas in figure 3-7 are already zoned and assessed as residential or commercial but as of 2003, they have not been developed.

Agricultural Land Use

Around the edges of the Lower Flint River Watershed, the land becomes more agricultural. According to the USDA office the 2 predominant cash crops are corn and soybean. On a much smaller scale other cash crops within the watershed are hay, wheat, and small grains.

Based on Conversations with the local USDA office, of the 15 dairy operations in Genesee County only one is within the Lower Flint River Watershed. It has an average of 50-150 head of cattle.

The census of agricultural data for the below table is based on the entire Flint River watershed. Within Genesee County the numbers below reflect the Upper, Middle and Lower Flint River Watersheds combined.

There are no known Concentrated Animal Feeding Operations (CAFO's) in the Lower Flint River Watershed.

Table 3-3 Livestock in the Lower Flint River Watershed

Beef Cattle	384
Dairy Cattle	536
Swine	1168
Sheep	184
Horse	1063
Chicken	1223
Turkey	166

USDA Census of Agriculture 2002

Riparian Buffer

Studies of impervious cover impacts to surface waters indicate that one of the key variables influencing watershed response is the presence or absence of an intact (wooded) riparian corridor or buffer. These riparian buffers act as a filter for storm water entering the stream corridor through overland flow. The riparian buffers are able to reduce erosive water velocities; extract sediment, nutrients, and other contaminants; and allow additional storm water to be infiltrated into the soil.

The Conservation Reserve Enhancement Program (CREP) has stabilized over 400 acres of erodible soil within Genesee County. The CREP program seeks to improve water quality and wildlife habitat by bringing conservation practices onto agricultural land. Of the 400 acres half has been stabilized by installed buffer strips and the other half has stabilized highly erodible soil with steep slopes by a practice called solid field. Most of the 400 acres that has been entered into CREP has been in the Lower and Upper Flint River Watersheds.

Currently buffer strips along sensitive areas are recommended as a Best Management Practice (BMP), but there are no current requirements. Within the Action Plan in Chapter 8 there is an action item to draft a buffer strip ordinance.

Wetlands

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 (Cwikiel, 2003).

Other than the National Wetland Inventory maps (NWI) or the Michigan Department of Environmental Quality (MDEQ) assessments, locally there are not any wetland inventories or assessments. The Drain Commissioner's Office has on file MDEQ permits and wetland assessments for individual development properties that have been submitted for review. This information has not been compiled.

Another action item that is being proposed is to identify existing floodplains and wetlands that will then be ranked for value. This would allow a mechanism to choose which areas need to be protected first.

As the below map shows, there are very few wetlands in the Lower Flint River Watershed. One third to one half of those wetlands shown are adjacent to the watercourses. The wetlands on the below map were identified in the Wetland Inventory Map from 1979. By then much of the City of Flint and surrounding area had already been developed and the land had been altered.

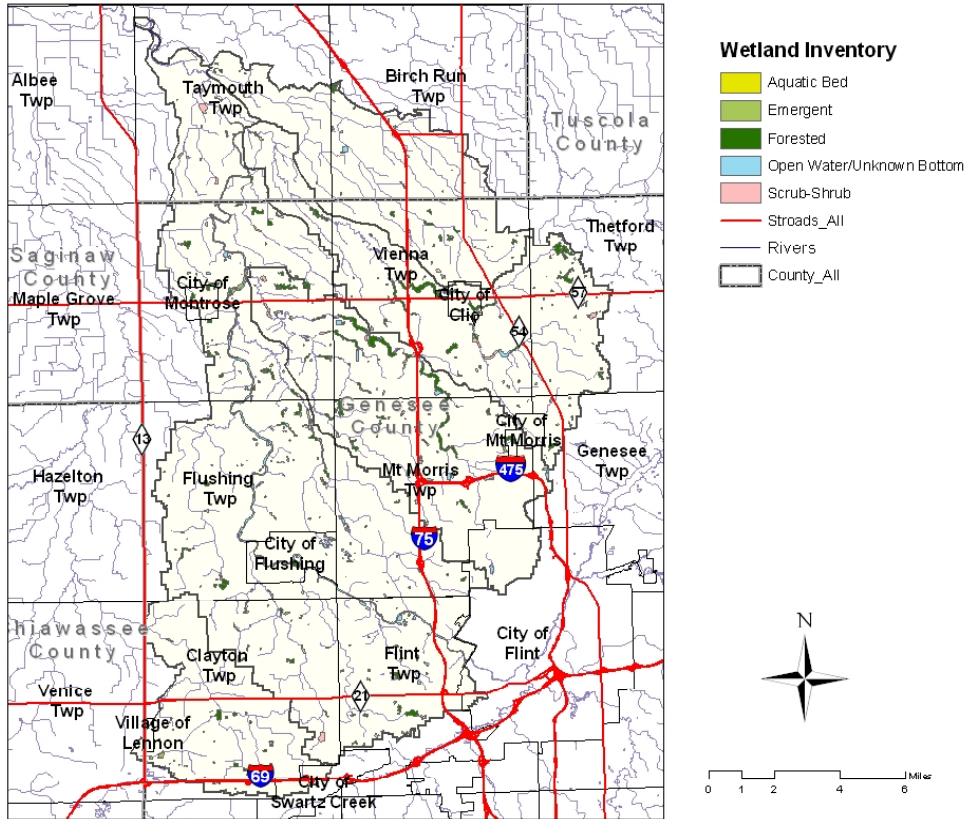


Figure 3-8 Wetlands
 Source: National Wetland Inventory

CLIMATE AND TOPOGRAPHY

Table 3-4 Temperature & Precipitation

	Average High	Average Low	Average Precipitation	Record High	Record Low
January	29°F	13°F	1.57 in	65°F (1950)	-25°F (1976)
February	32°F	15°F	1.35 in	63°F (1984)	-22°F (1967)
March	43°F	24°F	2.22 in	78°F (1990)	-12°F (1978)
April	56°F	34°F	3.13 in	87°F (1990)	6°F (1982)
May	69°F	45°F	2.74 in	93°F (1988)	22°F (1966)
June	78°F	55°F	3.07 in	101°F (1988)	33°F (1998)
July	82°F	59°F	3.17 in	101°F (1995)	40°F (1965)
August	80°F	58°F	3.43 in	98°F (1988)	37°F (1982)
September	72°F	50°F	3.76 in	97°F (1953)	26°F (1991)
October	60°F	39°F	2.34 in	89°F (1963)	19°F (1974)
November	47°F	30°F	2.65 in	79°F (1950)	-7°F (1949)
December	34°F	19°F	2.18 in	67°F (1982)	-12°F (1989)

Source: AccuWeather

The land in the Lower Flint River Watershed descends gradually from the southeast to the northwest (leaving out of account the surface undulations) (Ellis). The highest elevation is in The City of Flint at 750 above sea level, per the USGS 5' contour map The Flint River itself is at elevation 690 as it leaves the City of Flint to the west. Near the Northwest corner of Montrose the Flint River leaves the County and the Lower Flint River Watershed at elevation 620 above sea level and approximately 50 ft above Lake Huron. Water erosion of the glacial formations produced the present landscape.

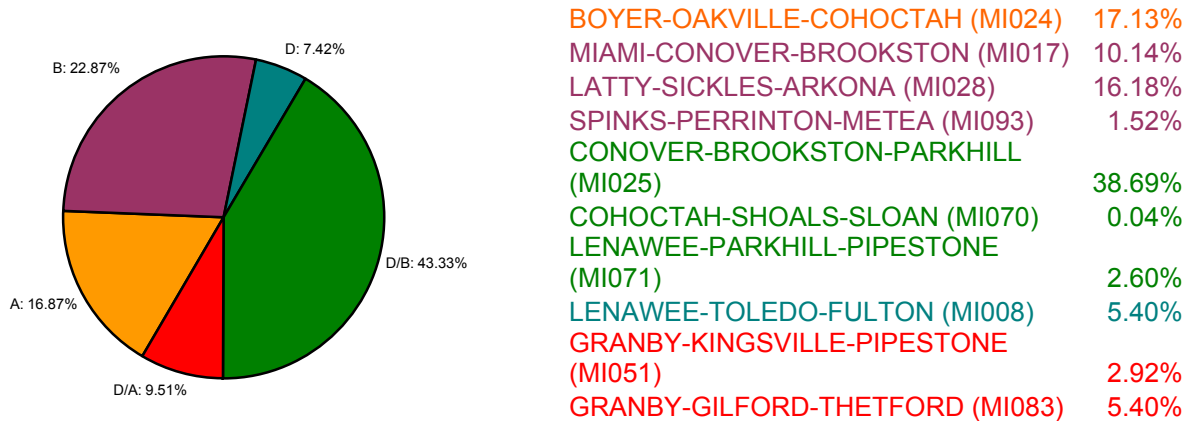
GEOLOGY AND SOILS

Several ice sheets advanced over Genesee County and retreated during the glacial period. The most recent ice sheet or glacier was during the end of the Wisconsin glacial period, some 9,000 or more years ago. Several distinctive geological features were formed in Genesee County during this last period of glaciation. Soon after the southernmost part of Genesee County emerged from the retreating Saginaw ice lobe, the lobe halted and built the Fowler Moraine. This moraine starts in Lapeer County, continues southwesterly across Genesee County until it reaches the western part of Grand Blanc Township, and then turns west. Melt waters from the ice lobe were dammed up by the Portland Moraine, and following the path of least resistance, they flowed westward to form the Shiawassee River. Masses of material known as glacial till were deposited from the melt off. Later the climate changed again, and the Saginaw lobe halted and built the Flint Moraine. This moraine is marked by a line running through Forest, Thetford, Genesee, and Flint Townships and through the corner of Clayton and perhaps Gaines Townships. Creating the east and south border of the Lower Flint River Watershed.

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geological forces. The characteristics of a soil are determined by 1) the physical and mineral composition of the parent material; 2) the climate under which the soil material has accumulated and existed since accumulation; 3) the plant and animal life on and in the soil; 4) the relief or lay of the land; 5) the length of time the forces of soil development have acted on the soil material.

The Lower Flint River Watershed is made up of the below soils.

Figure 3-9 Hydrologic Soil Groups by percentage



The USDA Natural Resources Conservation Service (Formerly the Soil Conservation Service) produced a soil survey for each county. The survey has classified and named the soils. Adjacent soils have been grouped into soil associations based on their landscape that has a distinctive proportional pattern of soils. These soil associations are useful for a general idea of what kinds of soils are present over a large area. Each soil has a corresponding hydraulic classification ranging from A-D and is referred to as hydraulic soil groups. The hydraulic soil groups are defined as:

A: (low runoff potential). Soils having high infiltration rate even when thoroughly wetted and consisting chiefly of deep, well to excessively drained soils with moderately fine to moderately coarse texture. (Will drain well in all weather conditions)

B: Soils having a moderate infiltration rate when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse texture.

C: Soils having a slow infiltration rate when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water or soils with moderately fine to fine textures.

D: (High Runoff potential). Soils having a very slow infiltration rate when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material. (Will drain poorly in all weather conditions)

HYDROLOGY

The Lower Flint River Watershed contains only 310 acres of lakes. Most of these are comprised of small isolated pockets of open water on private land. More than half are less than 1 acre and would be considered ponds. Only 17 lakes are larger than 5 acres, and one of those is an old gravel pit. There are 145 miles of rivers with an additional 245 miles of creeks and drains. Of the larger watercourses that have base flow all year long there is the Brent Run, Misteguay, Pine Run, and Silver Creek. All these watercourses flow into the Flint River that flows through the watershed from the Southeast to the northwest. Refer to Figure 3-8. Each of these watercourses is fed through a series of swales, road ditches and county drains. Many of the smaller drains and watercourses have intermittent flow and are dry most of the time. Many of the watercourses have been dedicated as county drains over the years and have had maintenance done on them. As areas are developed, it is common for enclosures to be placed to cross the drain watercourse or sometimes relocations are made. Some of the drains that have been petitioned for are entirely man made, meaning a ditch may be constructed where one did not exist before or a new storm system is placed in pipes. Historically since large areas of the Lower Flint River Watershed were agricultural there are many unmapped private farm tiles that drain low areas within the watershed.

The USGS has 1-stream gauge within the watershed. This gauge is located in section 4 of Flint Township. Details on this gauge are located in Chapter 4. When reviewing the flows from a Flint River gauge located downstream of the City of Flint there were some dramatic flow changes. (Flow data reviewed from 2001) On several occasions a rapid increase in flow was recorded in the Flint River. The flow increase was compared to nearby rain gauge data located upstream of the stream gauge. During times where there were 3 or more days of no rain followed by a quick 0.5-inch rain event this resulted in a rapid increase of flow. For example the flow went from 401cfs on April 5, 2001 to 1450 cfs on April 6, 2001. In May the flow went from 420cfs to 1360cfs in 1 day under

similar conditions. In June of the same year the flow went from 1180cfs to 2030cfs for a 0.8-inch rain event. The Flint River has doubled or tripled its flow very quickly in response to what are relatively small rain events. This is called flashiness. This is a problem because stream flow is linked to and regulates ecological integrity. Changes in stream flows and flow regimes limit and sometimes eliminate many aquatic species within a stream system. Flow stability is critical to support balanced diverse fish communities and is an important component of habitat suitability.

There are four characteristics to hydrology, which become important for a watershed plan: volume, peak flow, time to peak (flashiness), and frequency of flows (particularly bankfull conditions). Development typically increases the volume, the peak, and the frequency and decreases the time to peak.

Development in a watershed changes the hydraulic characteristics. Urbanization tends to fill in low areas, that previously provided storage and pave over pervious areas, that had provided infiltration into the soil. Less flow is available to recharge ground water. Storm sewer pipe systems along with curb and gutter speed up how fast the water is concentrated and transported to the outlet. These activities change the four characteristics to hydrology. Volume and the peak flow are increased. The time to peak occurs quicker. And smaller rain events produce a larger frequency of flows. In addition, channels experience more bankfull flood events each year and are exposed to critical erosive velocities for longer intervals.

The physical, chemical, and biological integrity of a given stream system has been shown to be strongly correlated to the amount of impervious cover (the area covered by rooftops, streets, parking facilities, and other hard surfaces) in the sub-basin or watershed (Schueler, 1994). Imperviousness appears to be one of the principal indicators of watershed "health," and analysis of stream systems across the country seems to indicate that there are thresholds at which watershed imperviousness results in degradation of water quality and physical stream processes.

The conversion of natural landscapes (i.e. farmland, forests, and wetlands) into urban landscapes creates a layer of impervious surface. Urbanization has a significant impact on hydrology, morphology, water quality and ecology of surface waters. The amount of impervious cover in a watershed can be used as an indicator to predict how severe differences are in character of urban watersheds and natural watersheds.

In natural settings, there is very little runoff, with most of the rainfall being filtered by the soils, and supplying deep-water aquifers. In urbanized areas, however, less and less rainfall is infiltrated, and as a result, less water is available to streams. Additional changes in urban streams due to increased impervious cover includes enlarged channels, upstream channel erosion contributing greater sediment load to the stream, in stream habitat structure degrades and declining water quality.

"Even small increases in impervious change stream morphology and degradation of aquatic habitat. The relationship between impervious cover and Subwatershed quality can be predicted by a simple model, projecting current and future quality of streams and other water resources." (CWP)

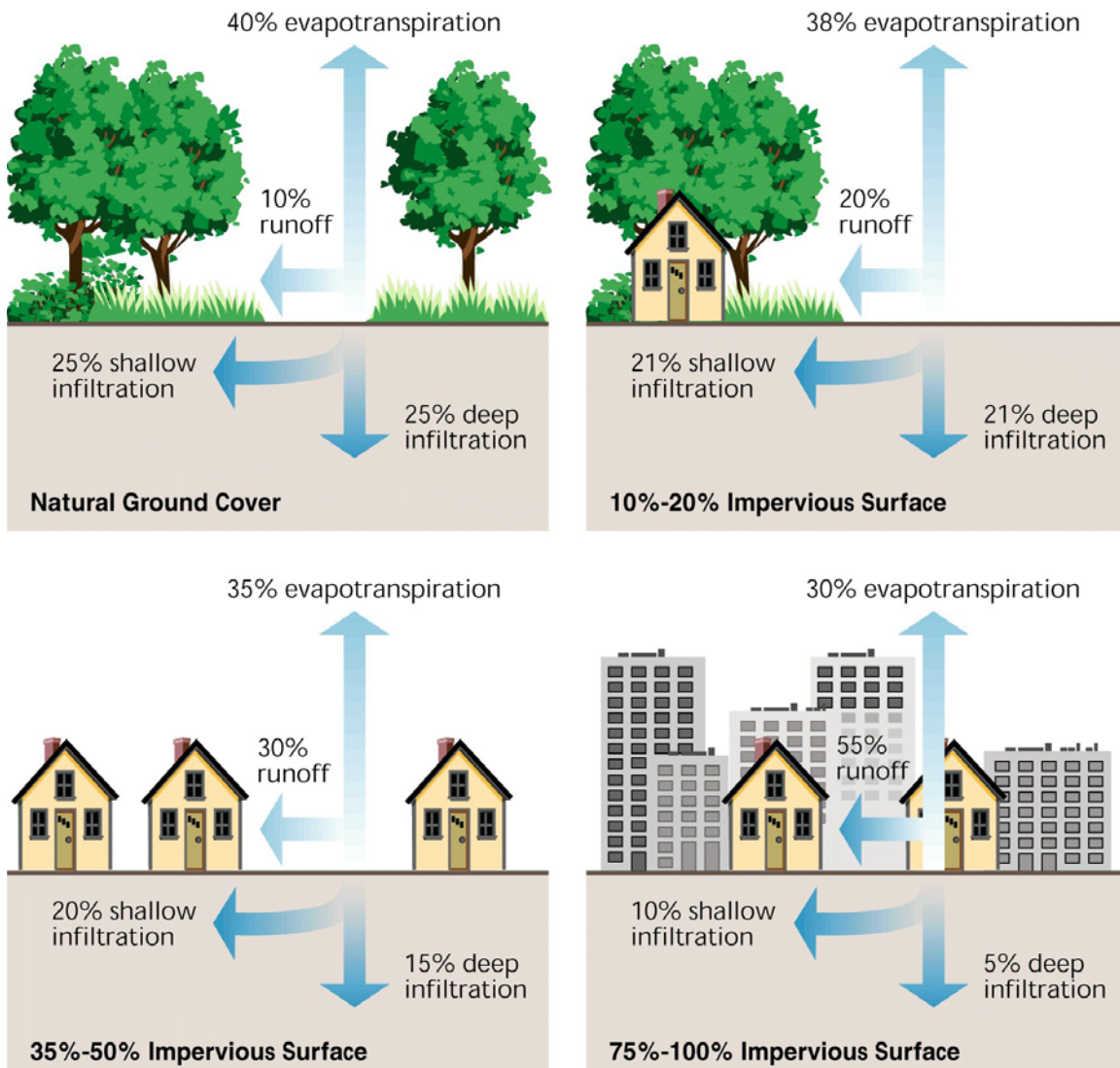


Figure 3-10 Effect of urbanization on runoff
Source: FISRWG, 1998

Research indicates that zones of stream quality exist, most noticeably beginning around 10% impervious cover, with a second threshold appearing at around 25-30% impervious cover. These thresholds are powerfully modeled in The Impervious Cover Model, classifying streams into three categories, sensitive, impacted, and non-supporting. Watersheds with less than 10 percent imperviousness appear to exhibit natural chemical, physical, and biological quality. Between 10 and 25 percent imperviousness river systems show signs of degradation. Beyond 25 percent imperviousness, the damage to physical, chemical, and biological integrity may be irreversible it is important to understand the Impervious Cover Model, a powerful model predicting quality of streams based on impervious cover change, is not without its limitations. (Schueler, 1994).

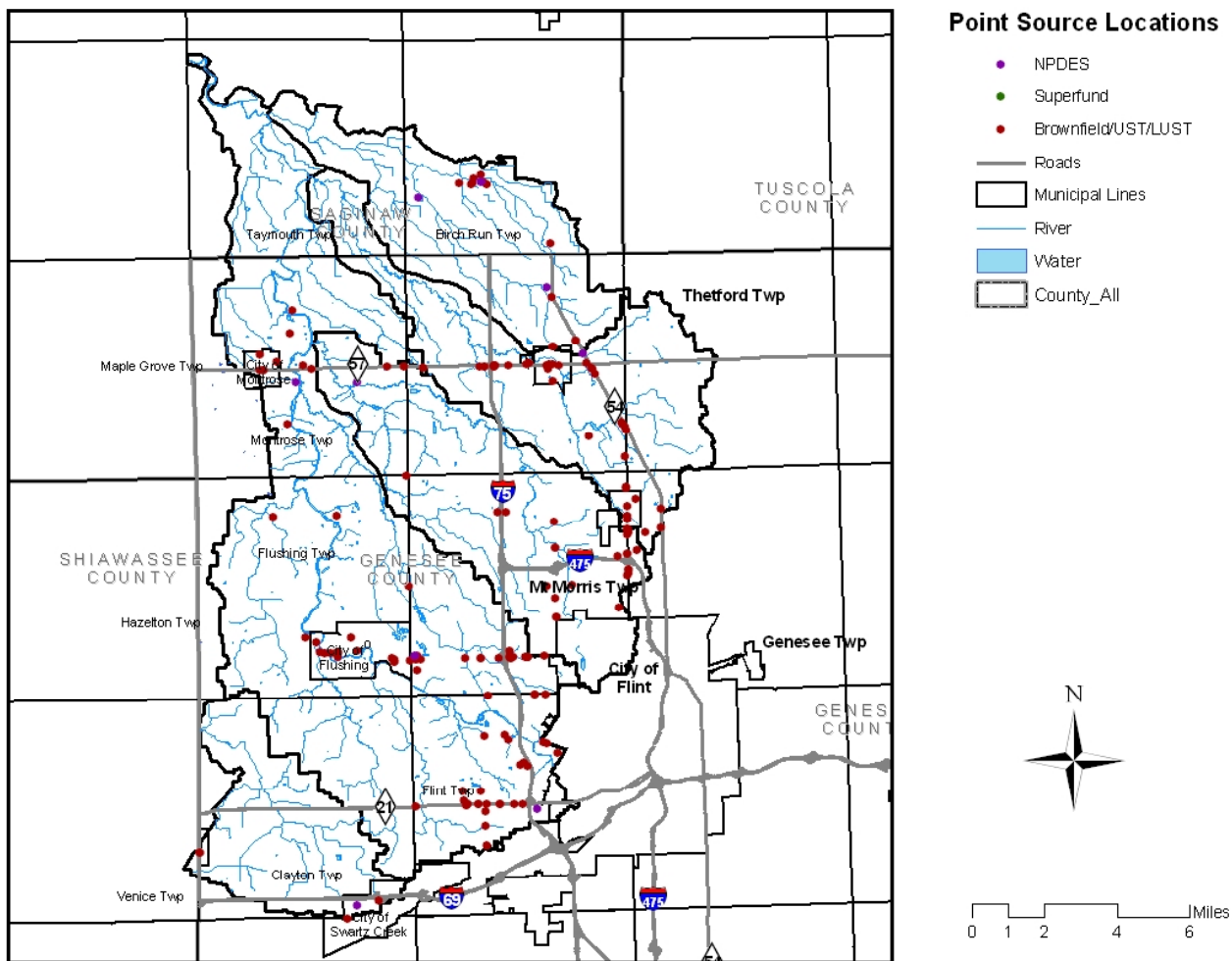


Figure 3-11 Point Sources

POINT SOURCES OF POTENTIAL POLLUTANTS

Table 3-5 Point Sources

DESCRIPTION	PERMIT	OWNER-SHIP	STATUS	SUB-WATERSHED	MUNICIPALITY	RECEIVING WATERS
Superfund Sites						
BrownField Sites / Underground Storage Tanks (UST/LUST)						
Dye Rd Dump	25000008	Private	Interim	8529	Flint	Flint River, Lower
Linden Road LF	25000016	Private	Interim	8529	Flint	Flint River, Lower
Al's Furniture	25000044	Private	Interim	8529	Flushing	Flint River, Lower
GMC Fisher Guide Coldwater Rd	25000012	Private	Contact Lead Dist	57	Flint	Brent Run
Mt Morris Dumpsite	25000056	Private	Delisted	159	Mt Morris	Pine Run
Clio Johnson St. Plating	25000019	Private	Inactive	8530	Vienna	Pine Run
McKinley and M57 Dump Site	25000017	Private	Interim	8526	Montrose	Flint River, Lower
Kish Landfill	25000015	Private	Contact Lead Dist	8525	Montrose	Flint River, Lower
Birch Run Gasoline Contam	73000128	Private	Inactive	8533	Birch Run	Silver Creek 1
Total Superstop, Lennon	8103	Private	Open	8532	Springfield	Misteguay
Toys R US	50001177	Private	Open	464	Unknown	Flint River, Lower

DESCRIPTION	PERMIT	OWNER-SHIP	STATUS	SUB-WATERSHED	MUNICIPALITY	RECEIVING WATERS
BrownField Sites / Underground Storage Tanks (UST/LUST)						
Union Super Stop #13	8090	Private	Open	464	Novi	Flint River, Lower
Kessel Food Market -	39957	Private	Open	8529	Westerville	Flint River, Lower
NRT	50005499	Private	Open	8529	Unknown	Flint River, Lower
Conex Inc	50002453	Private	Open	8529	Unknown	Flint River, Lower
Amoco Oil #5861	5665	Private	Open	8528	Flint	Flint River, Lower
Sunshine Food Stores,	2197	Private	Open	8528	Not Recorded	Flint River, Lower
Total Station #1820	8091	Private	Open	8529	Southfield	Flint River, Lower
Amoco Oil, #0194	5708	Private	Open	8528	Livonia	Flint River, Lower
Super Flite Oil Company	21661	Private	Open	8528	Saginaw	Flint River, Lower
Speedway #8756	20106	Private	Open	8528	Springfield	Flint River, Lower
Former Archies Service	50005636	Private	Open	8529	Unknown	Flint River, Lower
Northwest Marathon	16720	Private	Open	8528	Flint	Flint River, Lower
Davison Oil - Shell	39740	Private	Open	8528	Davison	Flint River, Lower
Flushing Dpw	1314	Private	Open	8529	Flushing	Flint River, Lower
Amoco Oil #5762	5690	Private	Open	8528	Birmingham	Flint River, Lower
K-mart #3069, Pierson Road	813	Private	Open	8528	Troy	Flint River, Lower
Mattis Fuel Co	1654	Private	Open	8528	Flushing	Flint River, Lower
Mooney Oil #14	35380	Private	Open	8528	Melvindale	Flint River, Lower
Hasman Auto Sales	40484	Private	Open	8528	FLINT	Flint River, Lower
Central Concrete Products	5136	Private	Open	8528	Flint	Flint River, Lower
Mattis Car Wash	40644	Private	Open	57	Flushing	Brent Run
Central Distributor	18546	Private	Open	8529	Flushing	Flint River, Lower
NRT Owner	50002171	Private	Open	8529	Unknown	Flint River, Lower
Union Super Stop #11	8092	Private	Open	764	Flushing	Flint River, Lower
Quick-save Food Store #12	2200	Private	Open	8529	Flushing	Flint River, Lower
Moore's Mobil Service	7692	Private	Open	8528	Flushing	Flint River, Lower
Mt Morris Twp Fire Dept	1342	Private	Open	57	Mount Morris	Brent Run
Union Super Stop #16	1655	Private	Open	57	Lansing	Brent Run
K-mart #4099, Saginaw Road	769	Private	Open	57	Troy	Brent Run
Action Auto #8, 3/11/92	12977	Private	Open	57	Mount Morris	Brent Run
Amoco - Stanley Rd, Phil Flint	19451	Private	Open	57	Mount Morris	Brent Run
Scharrer Corners	33857	Private	Open	57	Mount Morris	Brent Run
Louie's Service	35771	Private	Open	57	MT MORRIS	Brent Run
Jenkins Service Inc	17712	Private	Open	159	Mount Morris	Pine Run
Former Fedchenko Site	35764	Private	Open	159	Flushing	Pine Run
Former O'brien Cleaners	50002329	Private	Open	159	Unknown	Pine Run
Brentcreek Country Store	34710	Private	Open	239	Flushing	Flint River, Lower
Autozone Inc	39352	Private	Open	159	MEMPHIS	Pine Run
Khourys Market	50000485	Private	Open	8524	Unknown	Brent Run
Mcdonalds Restaurant	50001706	Private	Open	8530	Unknown	Pine Run
Water Wonderland S C	3721	Private	Open	8530	CLIO	Pine Run
Rolison's Service	16819	Private	Open	8530	Clio	Pine Run
Bill Voorhers	41559	Private	Open	165	Clio	Pine Run
Quick Stop Food Store	38039	Private	Open	8526	Clio	Flint River, Lower
Shannons Diversified	1549	Private	Open	8526	Montrose	Flint River, Lower
Short, George	50001440	Private	Open	165	Unknown	Pine Run
Vienna Rd Nrt	50001962	Private	Open	8526	Unknown	Flint River, Lower
Former Clio Filling Station	50005124	Private	Open	8525	Unknown	Flint River, Lower
Midway Market	1845	Private	Open	8524	Flushing	Brent Run
Sunshine Food Store, Clio	2201	Private	Open	8524	Not Recorded	Brent Run
Amoco #137	5837	Private	Open	8530	Flint	Pine Run
Conlee Country Store	567	Private	Open	8530	Clio	Pine Run
Sunoco #0354-5605	4156	Private	Open	8530	Clio	Pine Run
Action Auto #41	20108	Private	Open	8530	Grand Rapids	Pine Run

DESCRIPTION	PERMIT	OWNER-SHIP	STATUS	SUB-WATERSHED	MUNICIPALITY	RECEIVING WATERS
BrownField Sites / Underground Storage Tanks (UST/LUST)						
	2195	Private	Open	8530	Flushing	Pine Run
Vienna Rd Alley Way	40655	Private	Open	8530	CLIO	Pine Run
Conlee Oil Co	41992	Private	Open	8530	Clio	Pine Run
Webster & Garner	17688	Private	Open	8530	Clio	Pine Run
Montrose D P Health	14739	Private	Open	8525	MONTROSE	Flint River, Lower
Mill Street Station	1477	Private	Open	8533	Clio	Silver Creek 1
Blue Lakes Charters	35902	Private	Open	8533	Clio	Silver Creek 1
Storage Garage	41625	Private	Open	8533	Frankenmuth	Silver Creek 1
Birch Run Express Stop	1699	Private	Open	8533	Saginaw	Silver Creek 1
Super Stop #19	8086	Private	Open	8533	Birch Run	Silver Creek 1
Dunkin Donut #2318	19034	Private	Open	8533	Flint	Silver Creek 1
Miller Property - Birch Run	37410	Private	Open	8533	Davison	Silver Creek 1
Bader Bros Inc	40669	Private	Open	8533	Reese	Silver Creek 1
Speedway #8862	13413	Private		8532	Swartz Creek	Misteguay
BP Gas Station	5836	Private		8532	Swartz Creek	Misteguay
Speedway #8797	8103	Private		8532	Lennon	Misteguay
N & J Oil Inc	40388	Private		464	Flint	Flint River, Lower
Used Car Mega Lot	39235	Private		464	Flint	Flint River, Lower
Speedway #2210	17515	Private		464	Flint	Flint River, Lower
K-317	8090	Private		464	Flint	Flint River, Lower
Patsy Lou Williamson	37740	Private		464	FLINT	Flint River, Lower
Mobil/1-stop Food Store	38601	Private		8529	Flint	Flint River, Lower
Sam's Club #8291	41001	Private		8529	Flint	Flint River, Lower
Corunna Road Amoco	19459	Private		8529	Flint	Flint River, Lower
#69 Corunna & Maxwell Shell	40262	Private		8529	Flint	Flint River, Lower
Kroger #413	39957	Private		8529	Flint	Flint River, Lower
Speedway #8745	12961	Private		8529	Flint	Flint River, Lower
Corunna Road Sunoco	18958	Private		8529	Flint	Flint River, Lower
Flint Twp Fire Dept	7027	Private		464	Flint	Flint River, Lower
Mobil	506	Private		8529	FLINT	Flint River, Lower
Flint Osteopathic Hospital	9454	Private		8529	Flint	Flint River, Lower
Ballenger Hwy Mobil Inc	508	Private		8529	FLINT	Flint River, Lower
Flushing 400 Inc	18962	Private		8529	FLINT	Flint River, Lower
Container Specialties Inc	13434	Private		8529	FLINT	Flint River, Lower
Flint Nw	11698	Private		8529	Flint	Flint River, Lower
GCDC	8226	Private		8529	FLINT	Flint River, Lower
Saraki Inc	39464	Private		8529	Flint	Flint River, Lower
R & D Oil Inc	5665	Private		8528	Flint	Flint River, Lower
Dalton Airport Assoc Inc	34260	Private		8529	FLUSHING	Flint River, Lower
Flushing Marathon	8091	Private		8529	Flushing	Flint River, Lower
Speedway #2346	17548	Private		8528	Flushing	Flint River, Lower
Frank McNally Inc	7972	Private		8529	Flushing	Flint River, Lower
Mattis Car Wash	35216	Private		8528	Mount Morris	Flint River, Lower
Meijer Gas Station #28	17052	Private		8528	Flint	Flint River, Lower
Northwest Marathon	16720	Private		8528	Flint	Flint River, Lower
Pierson Rd Shell	39740	Private		8528	Flint	Flint River, Lower
I-75 & Pierson Rd BP Inc	5690	Private		8528	Flint	Flint River, Lower
Mattis Fuel Co	1654	Private		8528	Flint	Flint River, Lower
Rich Oil #8754	35380	Private		8528	Flint	Flint River, Lower
Flushing Sunoco	4161	Private		8529	Flushing	Flint River, Lower
Flushing ESS	11697	Private		8529	Flushing	Flint River, Lower
Quick-sav #12	2200	Private		8529	Flushing	Flint River, Lower
General Electric Co	13465	Private		8528	FLINT	Flint River, Lower
City of Flushing Fire Dept	33935	Private		8529	Flushing	Flint River, Lower

DESCRIPTION	PERMIT	OWNER-SHIP	STATUS	SUB-WATERSHED	MUNICIPALITY	RECEIVING WATERS
BrownField Sites / Underground Storage Tanks (UST/LUST)						
Waste Water Treatment Plant	8797	Private		8527	Flushing	Flint River, Lower
Flushing Warehouse	36342	Private		8527	Flushing	Flint River, Lower
Albert Chevrolet	7057	Private		57	Flint	Brent Run
Albert Chevrolet	7057	Private		57	Flint	Brent Run
Summit Middle School	36156	Public		57	Flint	Brent Run
Reliable Investment LLC	19457	Private		57	Flint	Brent Run
Mona Z Fuel Inc	12215	Private		57	Mt Morris	Brent Run
TA Stations, Inc	12977	Private		57	Mt Morris	Brent Run
Riley Building	36155	Private		57	Mount Morris	Brent Run
Ghotra Petroleum LLC	19451	Private		57	Mt Morris	Brent Run
Scharrer Corners	33857	Private		57	MT MORRIS	Brent Run
Kroger #407	40983	Private		57	Mount Morris	Brent Run
Eid Gas Station	40552	Private		57	Mount Morris	Brent Run
Mobil 1-Stop Food Store	509	Private		159	Mount Morris	Pine Run
Kelly's Investments LLC	8087	Private		8527	Flushing	Flint River, Lower
F & M Petroleum	19458	Private		109	Mt Morris	Brent Run
Quick-sav #7	13025	Private		109	Mount Morris	Brent Run
Sunshine Foods #121	2203	Private		159	MT MORRIS	Pine Run
Mt Morris Citgo	4165	Private		159	Mount Morris	Pine Run
Mt Morris Con. Schools	35507	Private		159	Mount Morris	Pine Run
Speedway #8386	33540	Private		159	Mount Morris	Pine Run
Montague Tool & Mfg Co	7634	Private		8530	Clio	Pine Run
M L Taylor Landscaping & Excavat	8799	Private		8526	Montrose	Flint River, Lower
Northpointe Marathon #1	35560	Private		8530	Clio	Pine Run
Clio Co	11680	Private		449	Clio	Pine Run
Conlee Oil	533	Private		8530	Clio	Pine Run
Conlee Mart	38039	Private		8526	Montrose	Flint River, Lower
Clio Mini Mart	38625	Private		165	Clio	Pine Run
Murphy USA # 7387	41954	Private		8530	Clio	Pine Run
Dunkin Donuts/amoco 2296	5837	Private		8530	CLIO	Pine Run
Conlee Oil Mobil	567	Private		8530	Clio	Pine Run
I-75 & Vienna Sunoco Inc	4156	Private		8530	Clio	Pine Run
#66 Clio Shell	38627	Private		8530	Clio	Pine Run
Fast Track	19464	Private		8530	Clio	Pine Run
Clio Area Schools	12457	Public		8530	CLIO	Pine Run
Webster & Garner Inc	17688	Private		8530	Clio	Pine Run
Aldrich Citgo	40288	Private		165	CLIO	Pine Run
Montrose Community Schools	6700	Private		8526	Montrose	Flint River, Lower
Clio Marathon	1477	Private		8533	Clio	Silver Creek 1
Blue Lakes Charters & Tours	35902	Private		8533	Clio	Silver Creek 1
Genesee County W&W	15552	Public		8525	MONTROSE	Flint River, Lower
Birch Run/ Amoco #6	38786	Private		8533	Birch Run	Silver Creek 1
USF Holland Inc	15919	Private		8533	Birch Run	Silver Creek 1
Active NPDES Permits						
GCRC-Swartz Cr M. Garage	MIS510237	Private		8532	Swartz Creek	Misteguay
Venture Automotive-Flint	MIS510103	Private		8529	Flint	Flint River, Lower
Central Concrete Products Inc	MIS510487	Private		8528	Flushing	Flint River, Lower
GCRC-Montrose M Garage	MIS510238	Private		8526	Montrose	Flint River, Lower
Brent Run Landfill	MIS510151	Private		8524	Montrose	Brent Run
Blue Lakes Charters & Tours	MIS510154	Private		8530	Clio	Pine Run
R & R Ready Mix-Clio	MIS510644	Private		8533	Clio	Silver Creek 1
Birch Run WWSL	0	Private		8533	Birch Run	Silver Creek 1
Mooney Oil Corp-Birch Run	0	Private		8533	Birch Run	Silver Creek 1

Data from USEPA National Priorities list; MDEQ Brownfields- USTfields Database; MDEQ Active NPDES permits list.

SEWER AND SEPTIC SYSTEM SERVICE AREAS

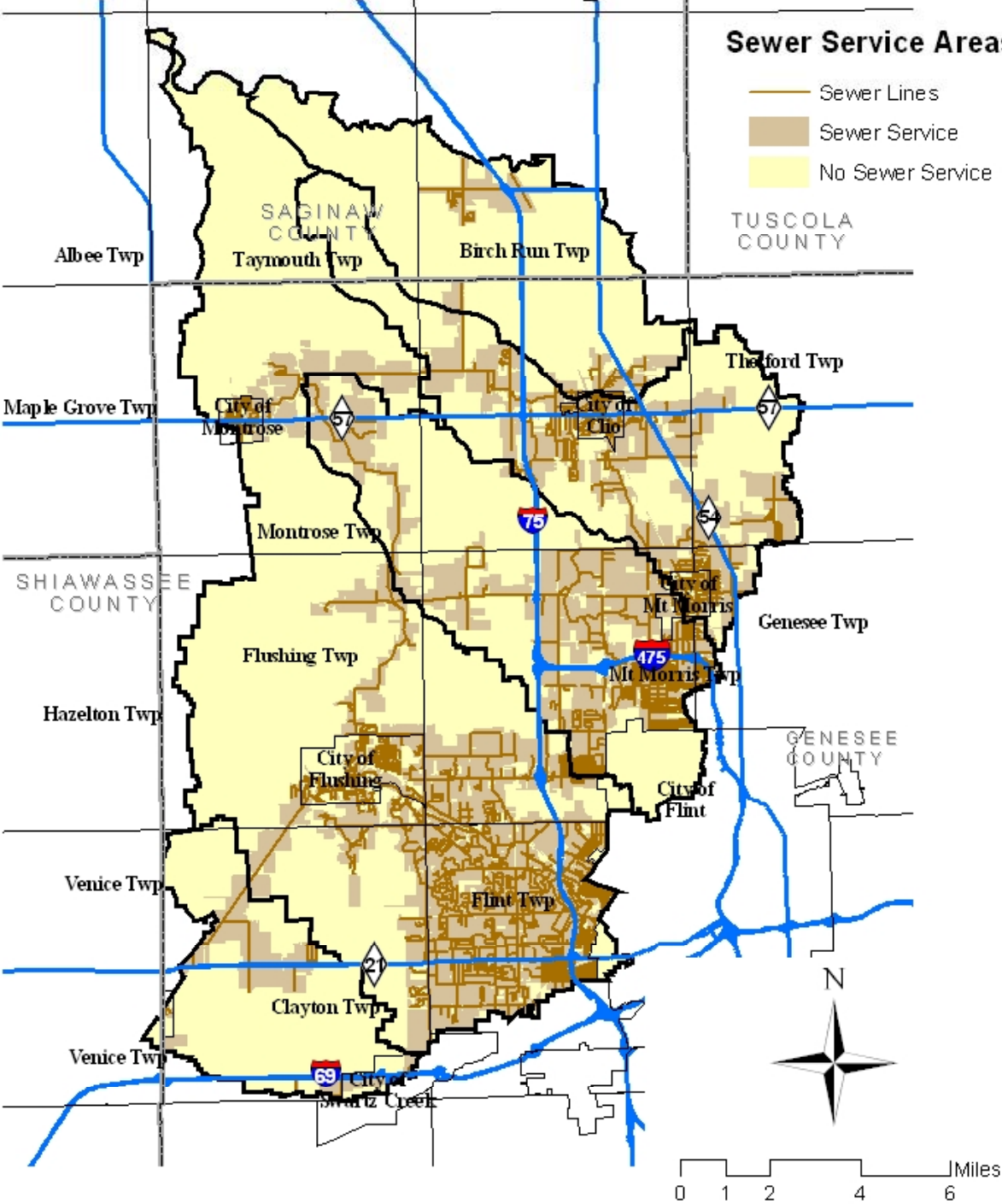
Wastewater is dealt with by either a system of sanitary sewers leading to a wastewater treatment plant or by on-site sewage disposal systems (OSDS). On-site sewage disposal systems typically include a septic tank and an absorption field. OSDS typically serve single-family residences in less urbanized settings, although community septic systems are becoming more common in newer developments. The Sewer Service Areas Map Figure 3-11 depicts the areas within the watershed that currently have access to sanitary sewers.

Within Genesee County the sanitary sewer systems has been predominantly constructed since 1960's. . This system has been extended outside the County by contract, to serve isolated developments.

If properly designed, constructed and maintained, both OSDS and sanitary sewers can provide for disposal of sewage in a safe and environmentally responsible manner. If either type of system fails, inadequately treated sewage can be a threat to aquatic ecosystems and human health due to harmful bacteria and excess nutrients. Along with regulation, education is often considered central to addressing potential issues with OSDS. Owners, particularly those moving from areas with sanitary sewers to those with OSDS, often have limited understanding of the functioning and maintenance of OSDS. This lack of knowledge can lead to poor function and premature failure, leading to contamination of the ground and surface waters. Several action items in chapter 8 have been proposed to address both sanitary and OSDS.

The installation and maintenance of septic systems within the watershed are regulated by the County Health Department; however there is no system currently in place to monitor the functioning and maintenance of these systems following installation.

Figure 3-12 Sewer Service Areas



SIGNIFICANT NATURAL FEATURES TO BE PROTECTED

Michigan has a number of significant natural features located across the State. These natural features can provide a number of 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 Michigan Department of Natural Resources provides information on threatened and endangered species in Michigan by watershed. This work is coordinated by the Michigan Natural Features Inventory.

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.

A review of the Michigan Natural Features Inventory did not show any occurrence of species of plants or animals, which are listed as threatened, endangered, or of special concern within the Lower Flint River Watershed.

Table 3-6 shows the species of plants and animals, which are listed as threatened, endangered, or of special concern. Since the watershed has experienced urbanization and population growth, certain types of land are less common than in the past. In order to protect these areas and species, sensitive areas in the watershed have been identified.

Threatened and endangered species information was taken from the Michigan Natural Features Inventory. Those animals/plants listed above are within the Lower Flint River Watershed. Most of the above animals/plants are found in the Brent Run Watershed and the Silver Creek Watershed.

Table 3-6 Threatened and Endangered Species

Scientific Name	Common Name	Sub Watershed Found	Federal Status	State Status
<i>Elaphe vulpine gloydi</i>	Eastern Fox Snake	Silver Creek		T
<i>Galearis spectabilis</i>	Showy Orchis	Silver Creek		T
<i>Jeffersonia diphylla</i>	Twinleaf	Brent Run		SC
<i>Ludwigia alternifolia</i>	Seedbox	Brent Run		SC

(Source: Michigan Natural Features Inventory)

Key: SC = Special Concern E = Endangered T = Threatened
 PE = Proposed Endangered C2/C3 = Candidate

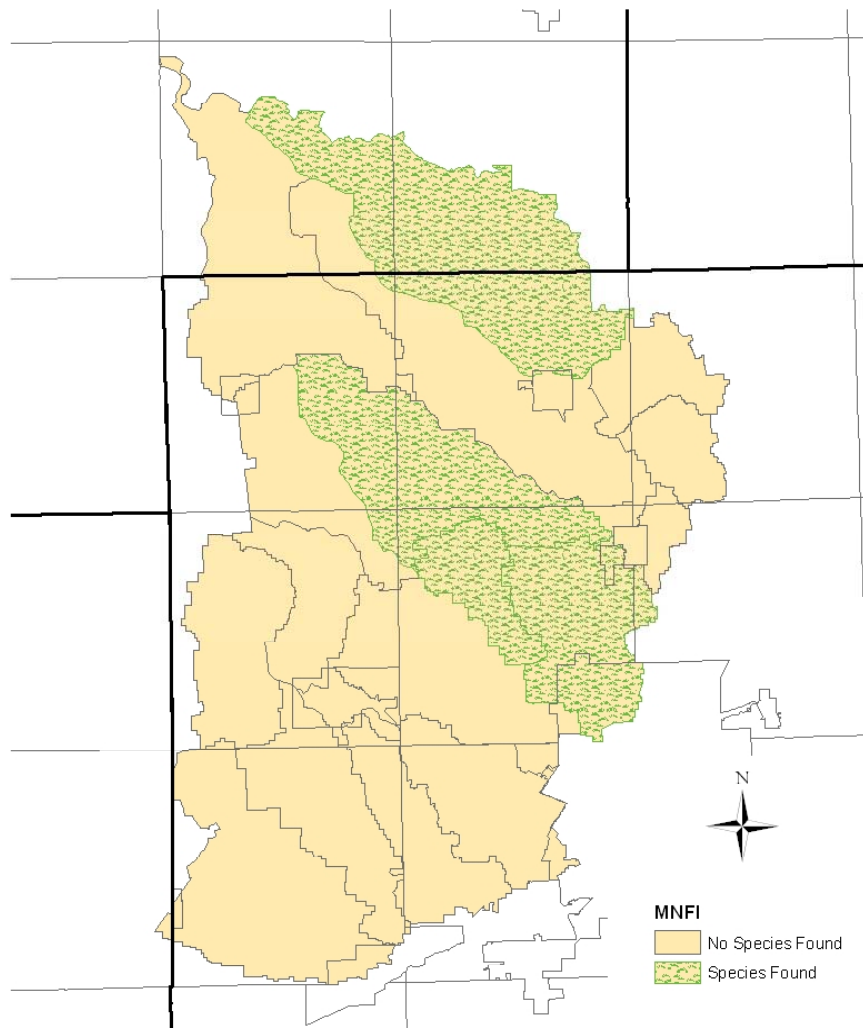


Figure 3-13 Natural Features Area(s)

Source: Michigan Natural Features Inventory

