

Chapter 2 – Land Use, Growth Trends and Infrastructure in the Watershed

2.1 History of Land Use and Settlement in the Region

Humans have inhabited Livingston County for centuries, or perhaps even thousands of years. There is evidence that suggests Native Americans such as the Ottawa, Chippewa and Pottawatomie all spent some time in the Livingston County area. These populations were the first to hunt, fish, actively manage the land through agricultural practices and manage wildlife habitat by controlled burning. In the early and mid-1800's, the area began to be explored and settled by Europeans. At that time, the US government worked out treaties with the natives of the land to gain ownership.

Historical documents indicate that early settlers were drawn to the area for the opportunity to receive free land. Shortly after the War of 1812, the federal government provided any veteran of that war with 160 acres of free land in Michigan. At that time, surveyors determined that the land in and around Livingston County was extremely wet and poorly suited for farming. This resulted in many of the veterans accepting free land that was being offered in Missouri instead. The then Governor of Michigan couldn't accept this and requested that a new survey be conducted. The new survey indicated that a fair amount of the rolling hills and sparsely wooded land was very well suited for agricultural uses. With this new information, the state began to sell the section parcels for \$2.00 to \$3.00 per acre. In addition, the land was abundant with fish and game, including bear and wolf. The county grew into quite an operation of commerce and manufacturing including hotels, mills, ironworks, and wagon shops. Livingston County had many gristmills and sawmills for processing grain and timber products. Wheat was by far the most prevalent crop. The county had one of the highest proportions of cattle in Michigan because of the availability of high quality marsh grasses for pasture. Sheep were also a major livestock animal. Brighton, Howell and Fowlerville thrived because they were on the Detroit, Lansing and Northern Railroad line (Chadwick, D. et al., 2003).

Indian trailways that were the main thoroughfare back in the day remain some of the major transportation corridors in the county today, including Grand River Avenue and White Lake Road. The advent of the Grand River Trail from Detroit to Lansing proved to be the cause for much of the growth in the area. Livingston Center, now known as the City of Howell, was centrally located between the two cities and was a popular resting stop for those traveling by foot and/or horseback. The location of Howell and its surrounding communities, combined with the natural rolling hills and abundance of lakes and other high quality natural features, continues to draw more settlement to the County (*Internet Research*).

2.2 Population Characteristics and Growth Trends

Within the USR watershed, there are few areas that are highly urbanized at this point in time, except for the City of Howell which is practically built-out; however, many communities are becoming urbanized at an ever-increasing rate. Figure 2.1 (also in Appendix A) shows the current urbanized areas in the watershed. Table 2.1 summarizes the estimated population of each watershed community based on July 2004 estimates, and the percent change in population from 2000 to 2004 (SEMCOG).

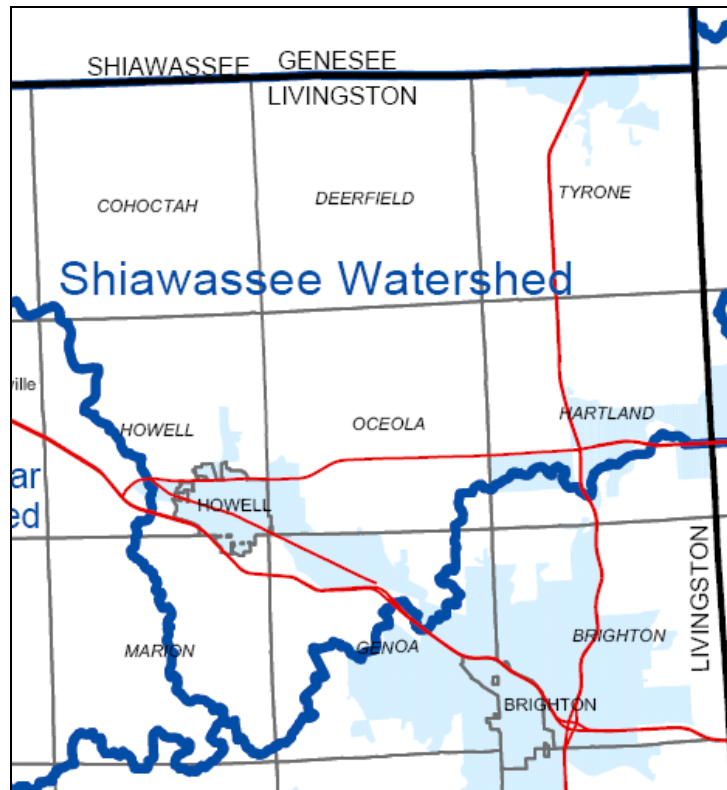


Figure 2.1 Urbanized Areas (shaded blue areas) in the Upper-2 Shiawassee River Watershed (SEMCOG, 2003)

Table 2.1 Population Characteristics of the Upper-2 Shiawassee River Communities

Community (ranked in order of fastest growing population)	Population Estimates (2004)	% Population Change (2000 to 2004)
Oceola Township	10,544	26.1
Marion Township	8,486	25.6
Hartland Township	13,768	25.2
Genoa Township	19,551	23.0
Tyrone Township	10,101	19.4
Howell Township	6,462	13.8
Cohoctah Township	3,613	6.5
City of Howell	9,771	5.8
Deerfield Township	4,321	5.7
Average:	9,624	16.8

By 2030, SEMCOG estimates that the population in the USR watershed will reach roughly 130,000 (a 78.1% increase from 2000)—this works out to be roughly 19,000 people per ten years, which accounts for almost half of the County’s overall growth over the next 30 years. The number of households in the watershed is expected to reach 51,000 (roughly a 96.2% increase from 2000).

Livingston County is surrounded by a number of urbanized population centers including Detroit, Ann Arbor, Flint and Lansing; as such, it continues to draw residents looking for a rural living environment. This rural environment is beginning to become jeopardized by the rapid development, and concern is being raised by area residents that the very reason they moved there may cease to exist within a few generations.

2.3 Socio-Economic Characteristics

Household income throughout the communities in the USR watershed indicates that on the whole it is an affluent area with the estimated median income in 2000 being \$66,905 according to the U.S. Census Bureau. This is greater than the average household income for the entire county (\$61,915). The predominant race is white and the predominant age group is 35-64 years, except for the City of Howell, which is predominantly 18-64 on the whole (64%) (SEMCOG, 2003). Table 2.2 summarizes the values for each watershed community.

Table 2.2 Socio-Economic Characteristics of the Upper-2 Shiawassee Watershed Communities

Community	Predominate Race (96% or higher)	Predominant Age (40% or higher)	Median Household Income (in 1999 Dollars)
Cohoctah Township	White	35-64	\$57,500
Deerfield Township	White	35-64	\$65,756
Genoa Township	White	35-64	\$71,398
Hartland Township	White	35-64	\$75,908
Howell Township	White	35-64	\$63,114
Marion Township	White	35-64	\$72,378
Oceola Township	White	35-64	\$76,139
Tyrone Township	White	35-64	\$75,994
City of Howell	White	35-64 (35%) 18-34 (29%)	\$43,958
Average:	White	35-64	\$66,905

2.4 Land Use Characteristics in the Watershed

Land use characteristics for the watershed were taken from each individual contributing watershed community. As such, the numbers provide a rough estimate of the current land use conditions. Data is from year 2000 based on Geographic Information System (GIS) data. The general land use categories within the USR watershed are summarized in Table 2.3.

Table 2.3 Current Land Use in the Upper-2 Shiawassee River Watershed (SEMCOG, 2000)

Developed or Altered Land:		
	Acres	Percent
Under Development:	1482	1.1%
Commercial/Office:	841	0.6%
Extractive:	419	0.3%
Industrial:	750	0.5%
Institutional:	523	0.4%
Transportation:	1117	0.8%
Residential:	27007	19.2%
Open Space or Undeveloped Land:		
Agriculture:	39838	28.3%
Water:	4062	2.9%
Wetlands/Woodlands:	34908	24.8%
Grassland/Shrub:	27169	19.3%
Cultural/Recreational:	2472	1.8%
Total:	140588	100

Figure 2.2 depicts a comparative analysis between developed land, agriculture, and land that remains in a natural or undeveloped state per subwatershed area. Developed land is defined as stated in Table 2.3.

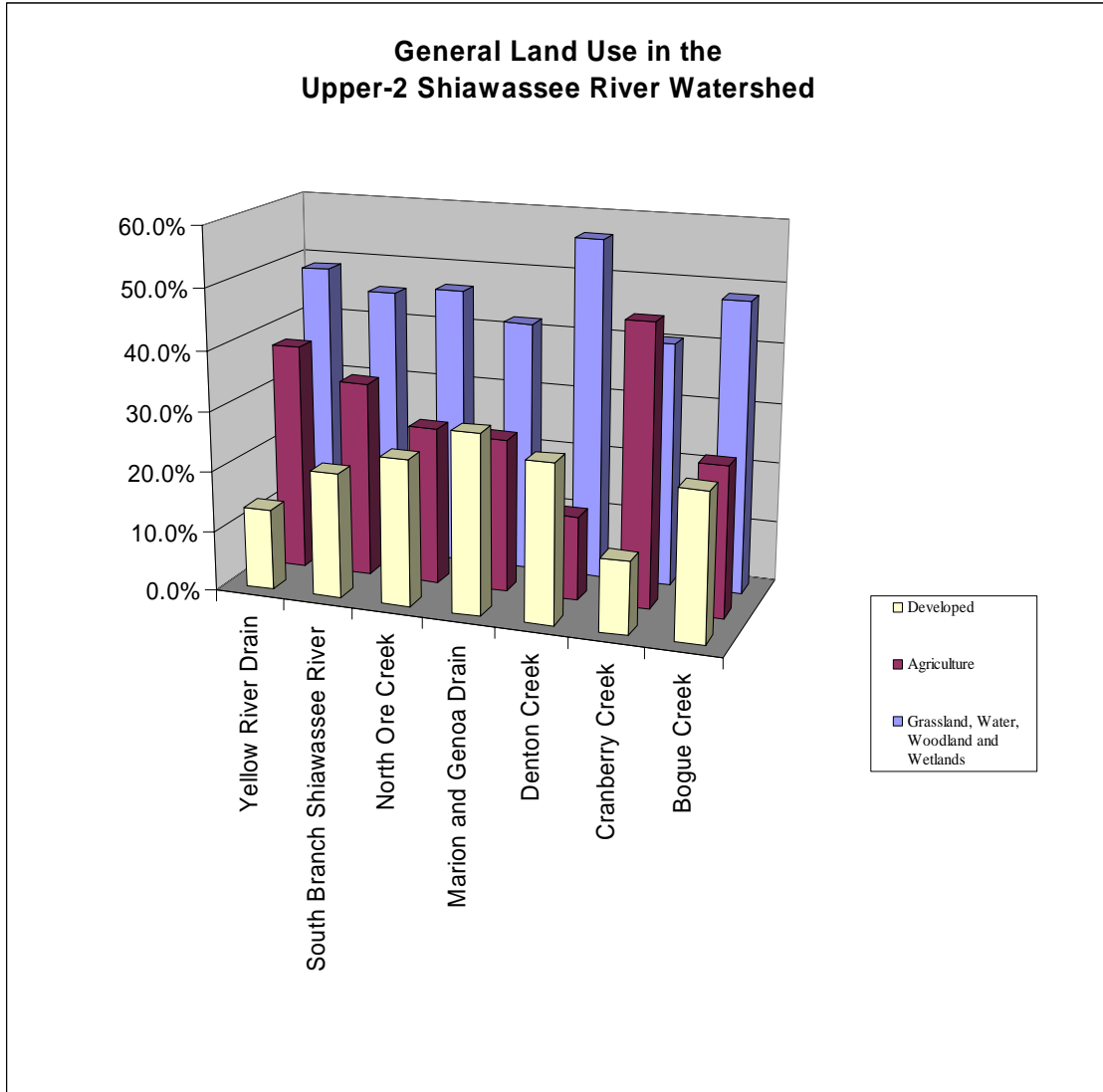


Figure 2.2 Comparative Analysis of Land Use in each Subwatershed of the Upper-2 Shiawassee River Watershed

2.5 Land Use Change in the Watershed

On a southeastern Michigan regional basis, a trend is occurring where development is exceeding the rate that the population is growing. SEMCOG reported that in only 10 years time, there has been a 17% increase in developed land, but only a 5% growth in population, and this translates to the primary driving factor in the land use change. Land is actually being developed three (3) times faster than the population is growing. As a result of the residential and non-residential development, the region’s land use for active agriculture has decreased by about 140,000 acres (13%) in this 10-year period. The trend is also going towards lower-density households.

The USR watershed is seeing the opposite trend with growth and development. Growth is occurring four (4) times faster (16.8%) than the rate of development (4.5%) over the course of the last four years (Table 2.1).

At the present time, statistics show that:

- Single-family residential land use growth is only occurring at a rate of 4.5% on average over the past five years (Figure 2.3), with the greatest increase in:
 - Genoa Township (9.4%)
 - Marion Township (8.8%)
 - Oceola Township (7.8%)
 - Hartland Township (6.3%)
 - All other areas less than 3.7%;
- Open Space is the highest category of land use for each subwatershed, except for the Denton Creek which is mostly single-family residential (23.1%) and the Cranberry Creek subwatershed which has more agriculture (46.6% agriculture and 41.1% open space) (Table H in Executive Summary);
- Agricultural land use is the second highest category of land use for each subwatershed (Table H in Executive Summary).
- Agricultural land use has only decreased by 2.5% watershed-wide, with the greatest loss in Marion Township (6.2%) (Figure 2.4);
- The majority of the commercial, industrial and institutional land use falls within the City of Howell (Figures 2.5, 2.11 and 2.12);
- Cultural, outdoor and recreational land use is less than 5% in any of the communities with Hartland Township having the most at 4.8% of its land area (Figure 2.6);
- Transportation and utility land use is less than 2% in all communities (Figure 2.7);
 - Howell Township has the most at 1.9%
- Grassland and shrub land use watershed-wide is at least 15% of the cover, except for the City of Howell (11.2%) (Figure 2.8);
 - Tyrone Township has the most at 25.4%
 - Greatest losses in this land cover have occurred in Genoa, Hartland and Oceola Townships, as well as in the City of Howell
- Extractive and barren land use is greatest in Howell Township (39.4%) (Figure 2.9);
 - Deerfield Township increased this land use 9.4% over the past five years
 - Tyrone Township decreased this land use 16.8% over the past five years
- Woodland and wetland land use ranges from 20-28% in all watershed communities, except for the City of Howell at 4.0% (2.10);
 - Losses did not exceed more than 2.0% over the last five years, except for Genoa Township which lost 4.0%.

Figures 2.3 through 2.12 illustrate the change in the various types of land use for each watershed community based on 1995 versus 2000 land use estimates.

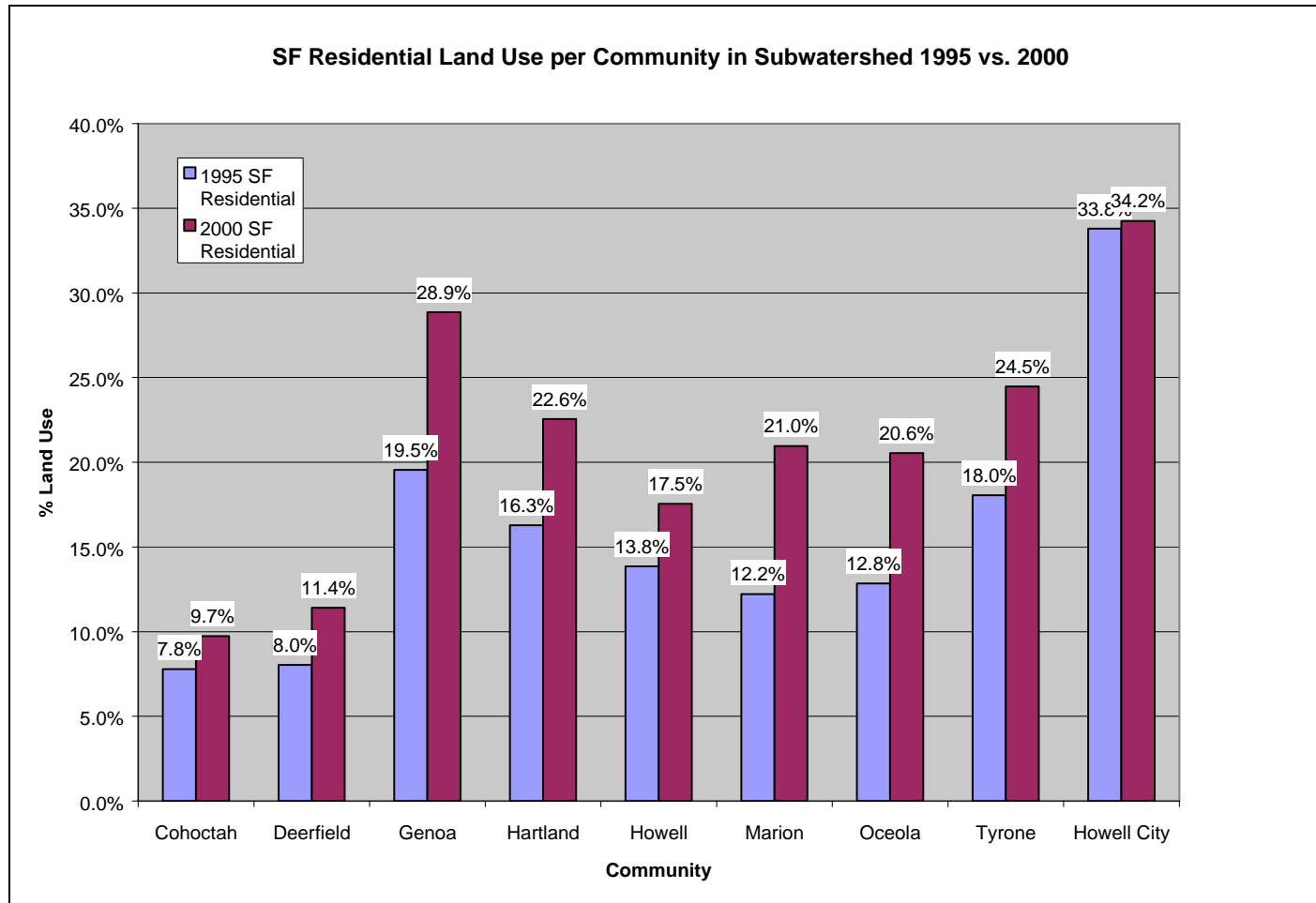


Figure 2.3 Change in Single-Family Residential Land Use from 1995 to 2000

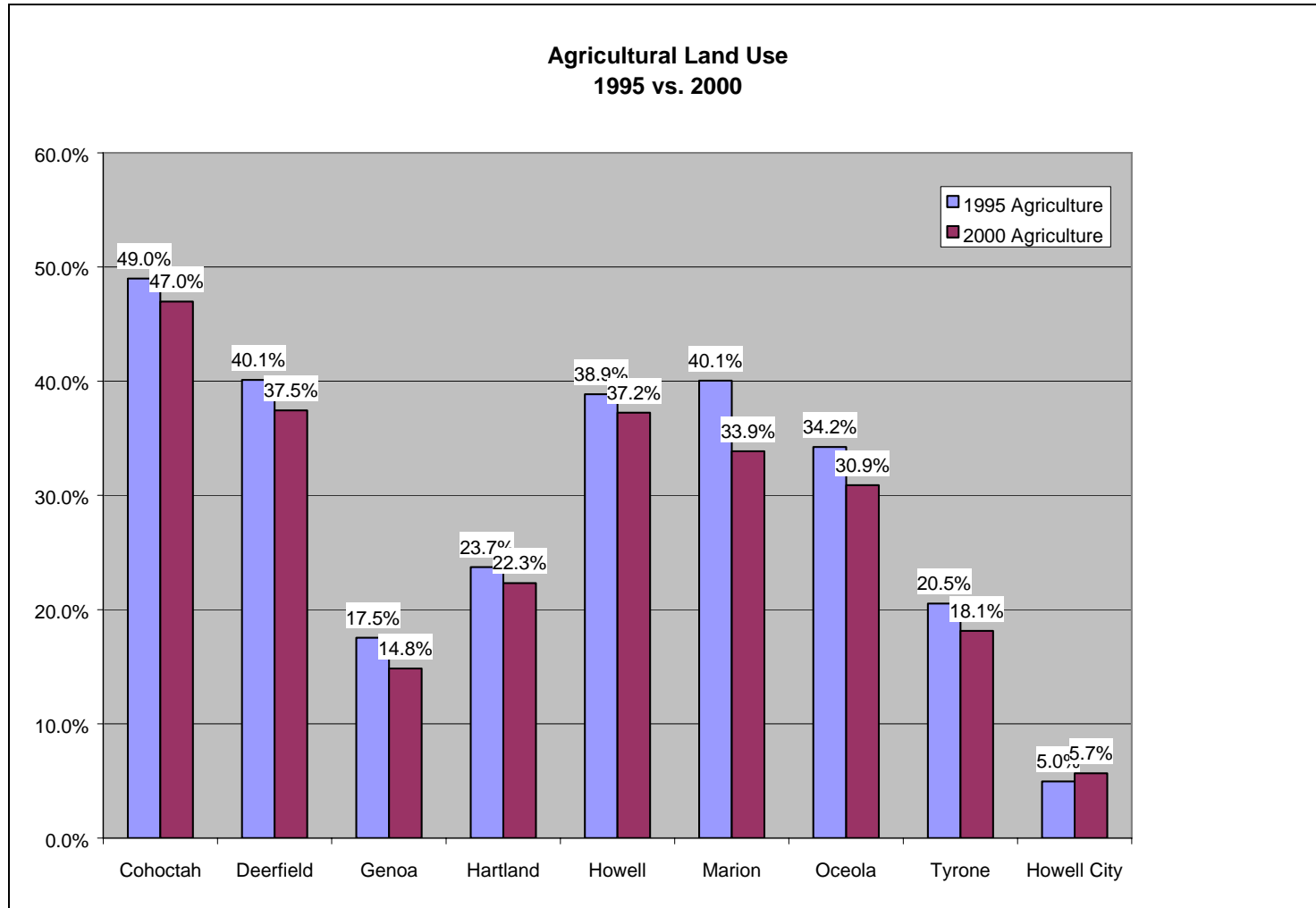


Figure 2.4 Change in Agricultural Land Use from 1995 to 2000

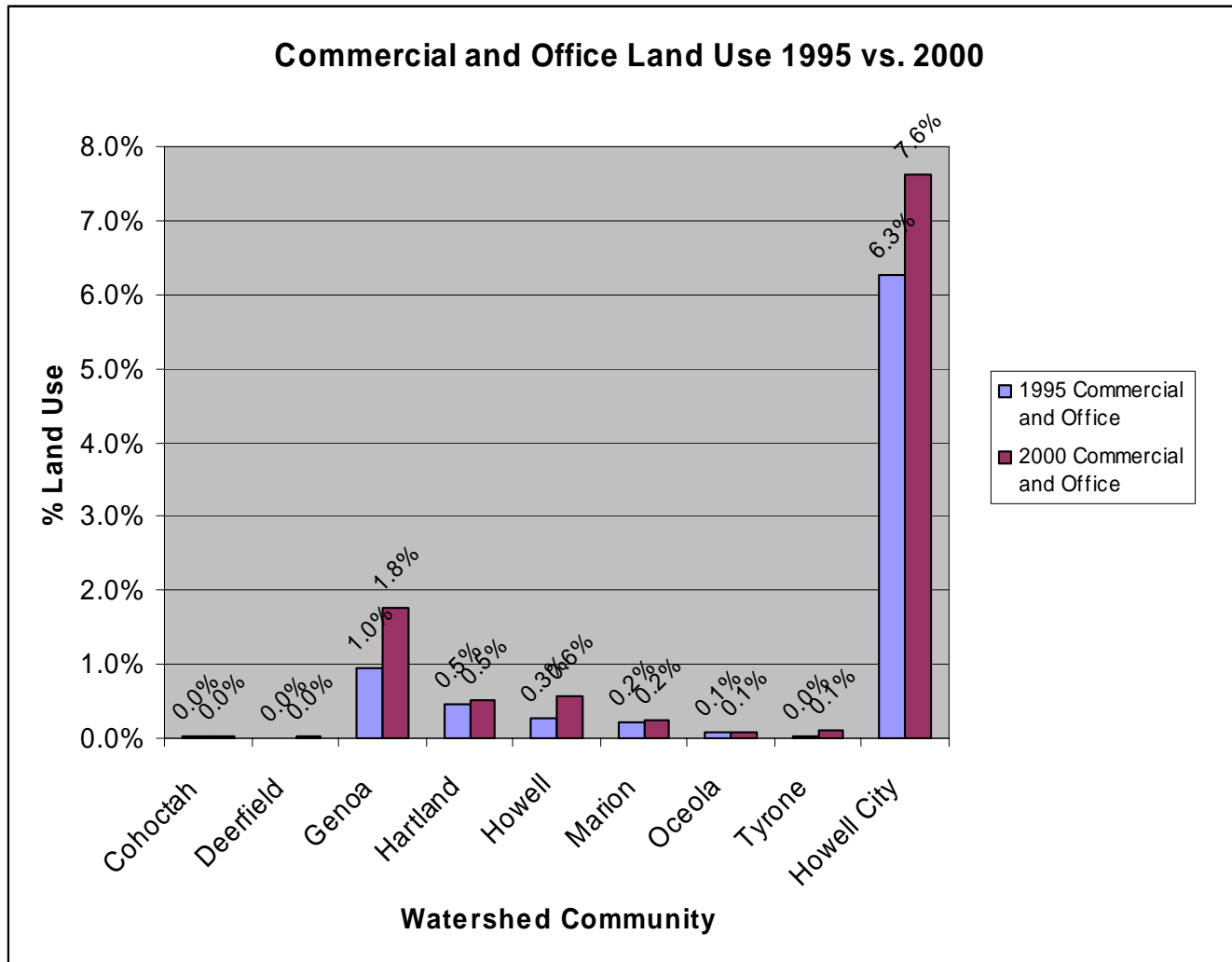


Figure 2.5 Change in Commercial and Office Land Use from 1995 to 2000

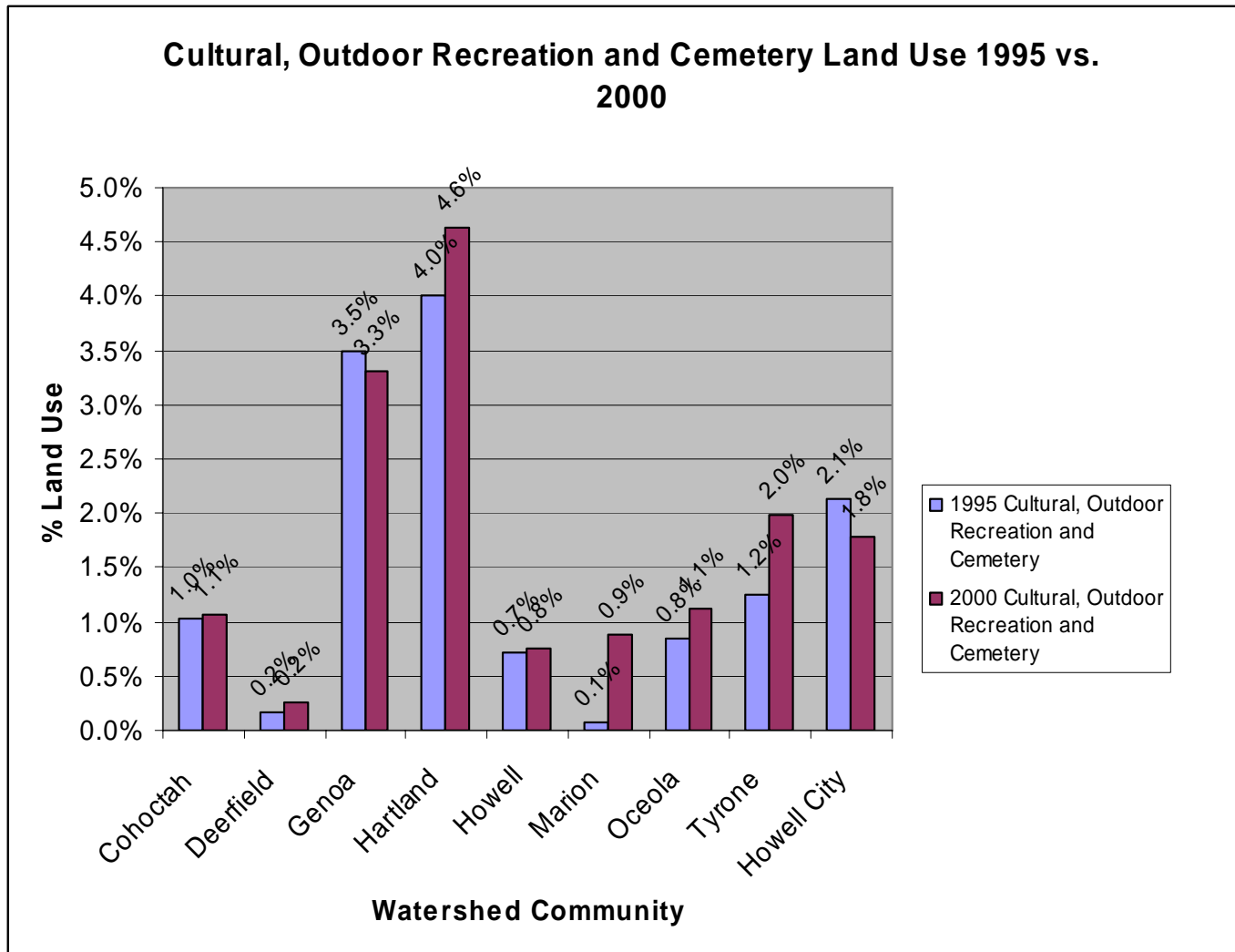


Figure 2.6 Change in Cultural, Outdoor Recreation and Cemetery Land Use from 1995 to 2000

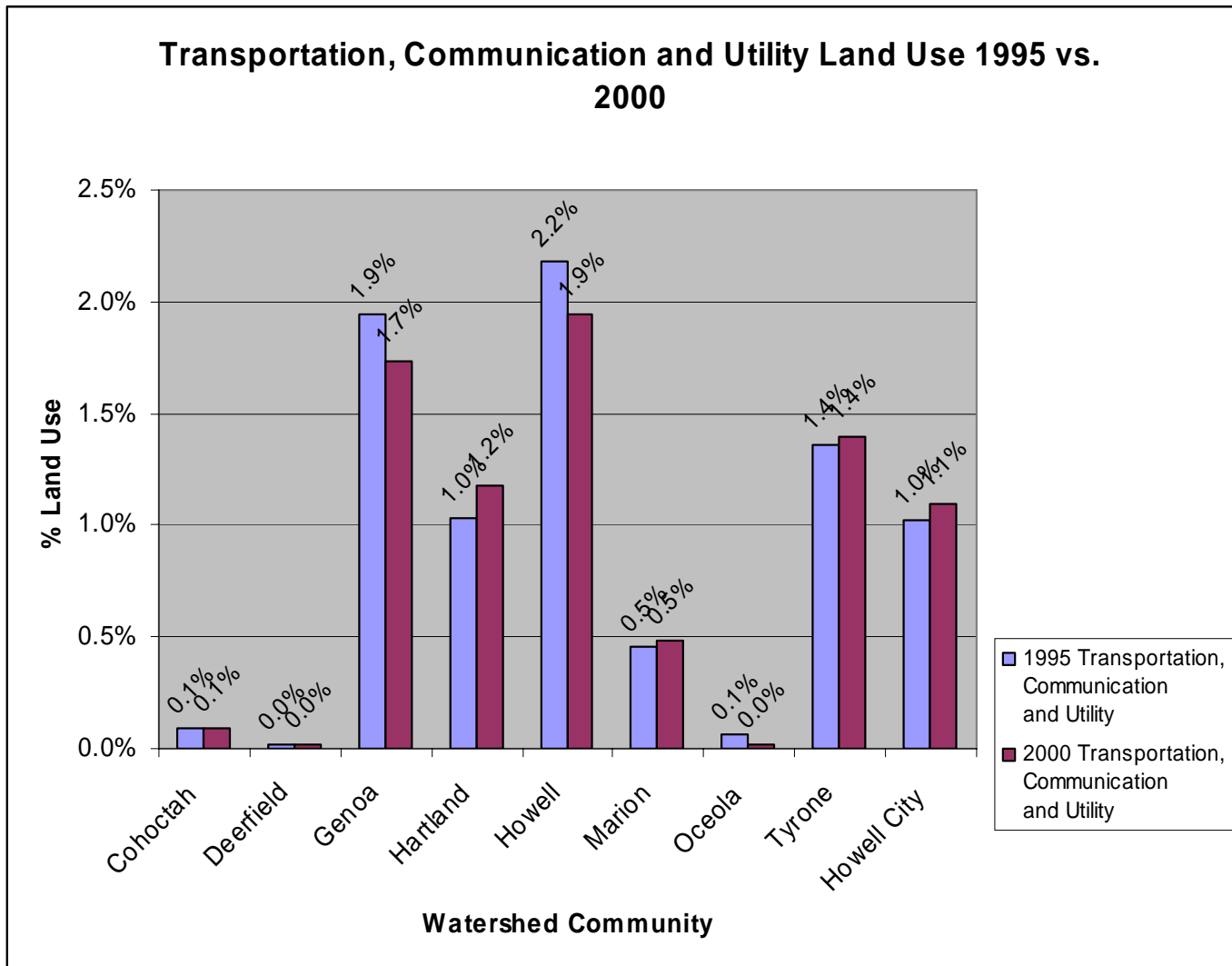


Figure 2.7 Change in Transportation, Communication and Utility Land Use from 1995 to 2000

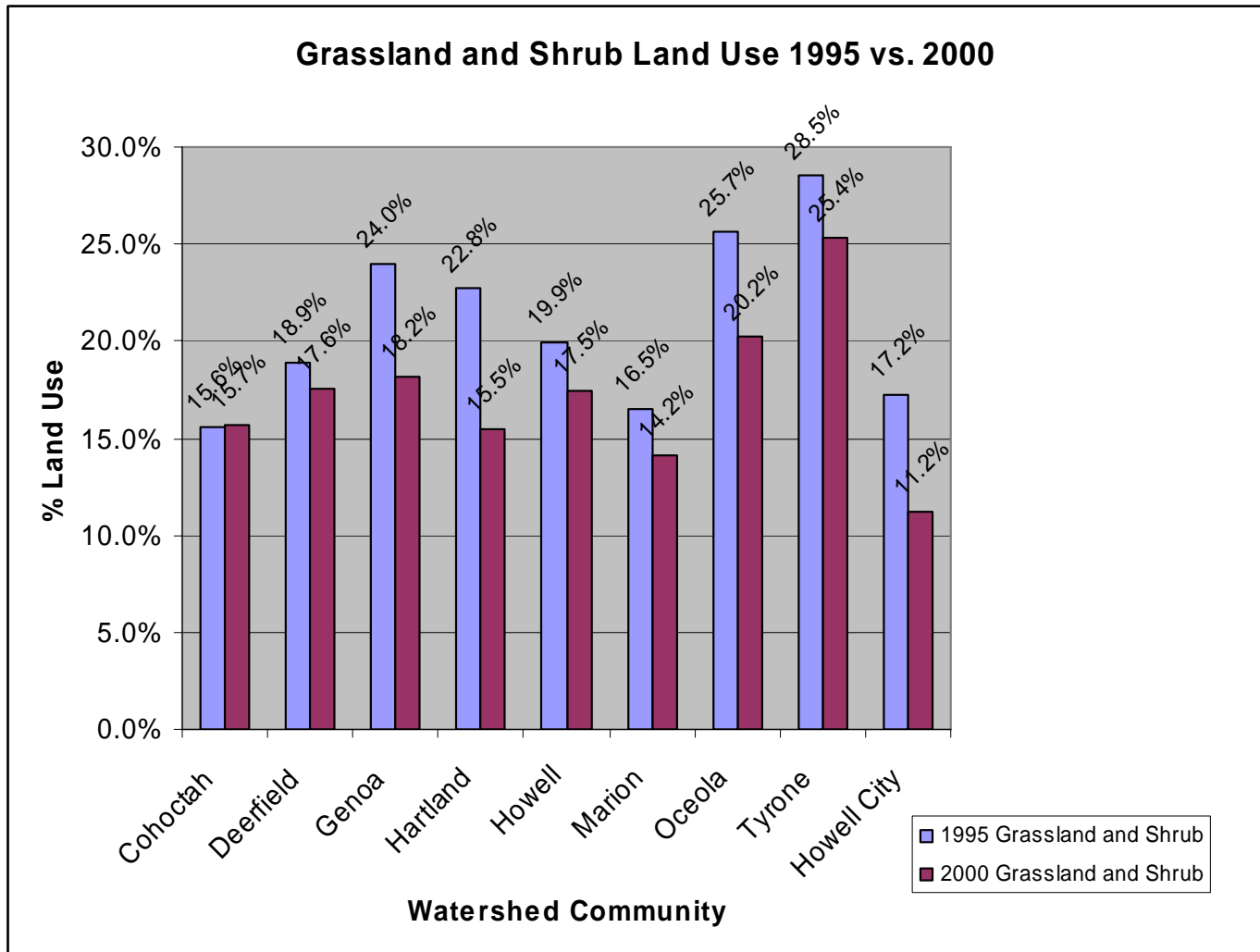


Figure 2.8 Change in Grassland and Shrub Land Use from 1995 to 2000

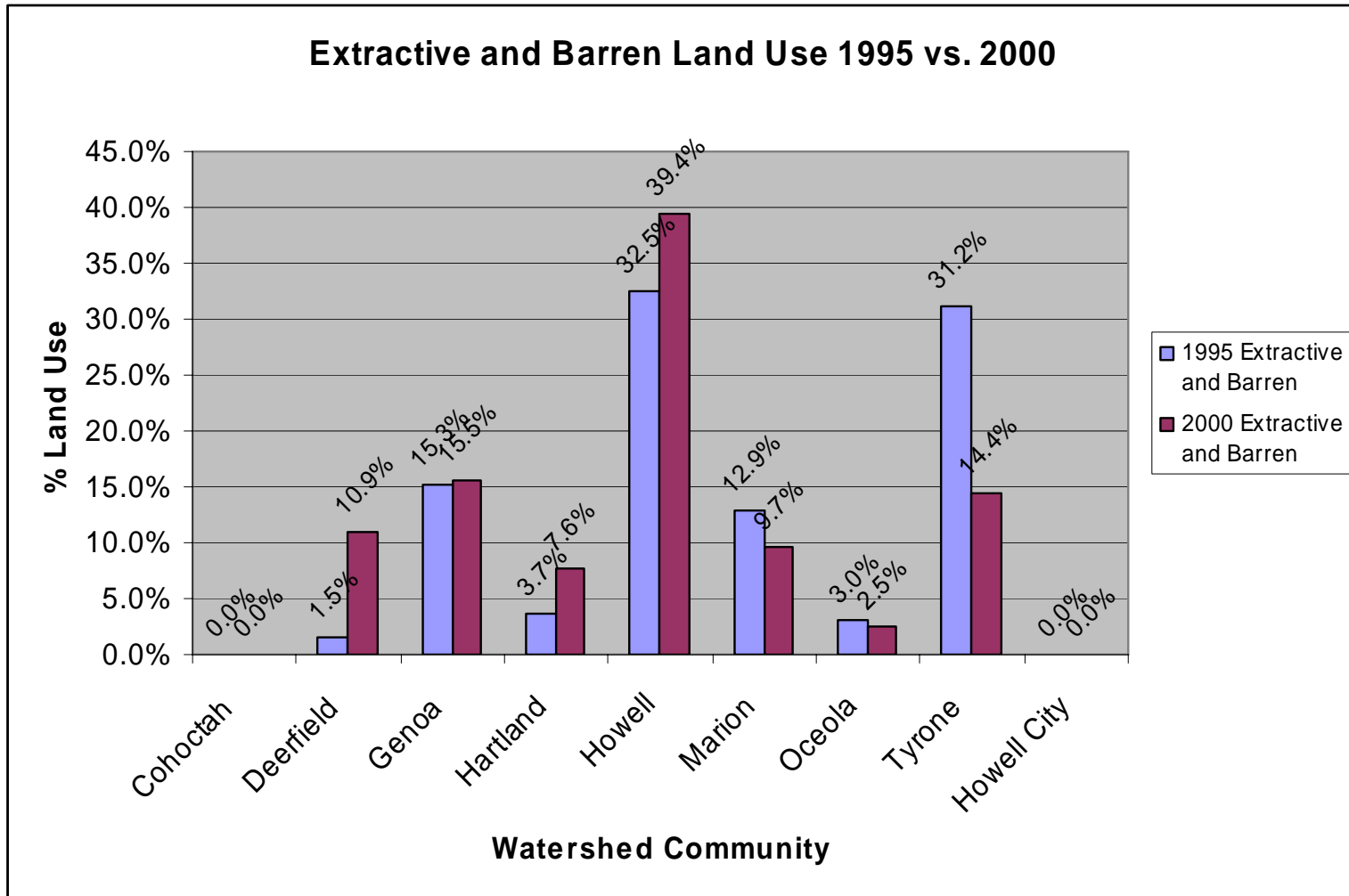


Figure 2.9 Change in Extractive and Barren Land Use from 1995 to 2000

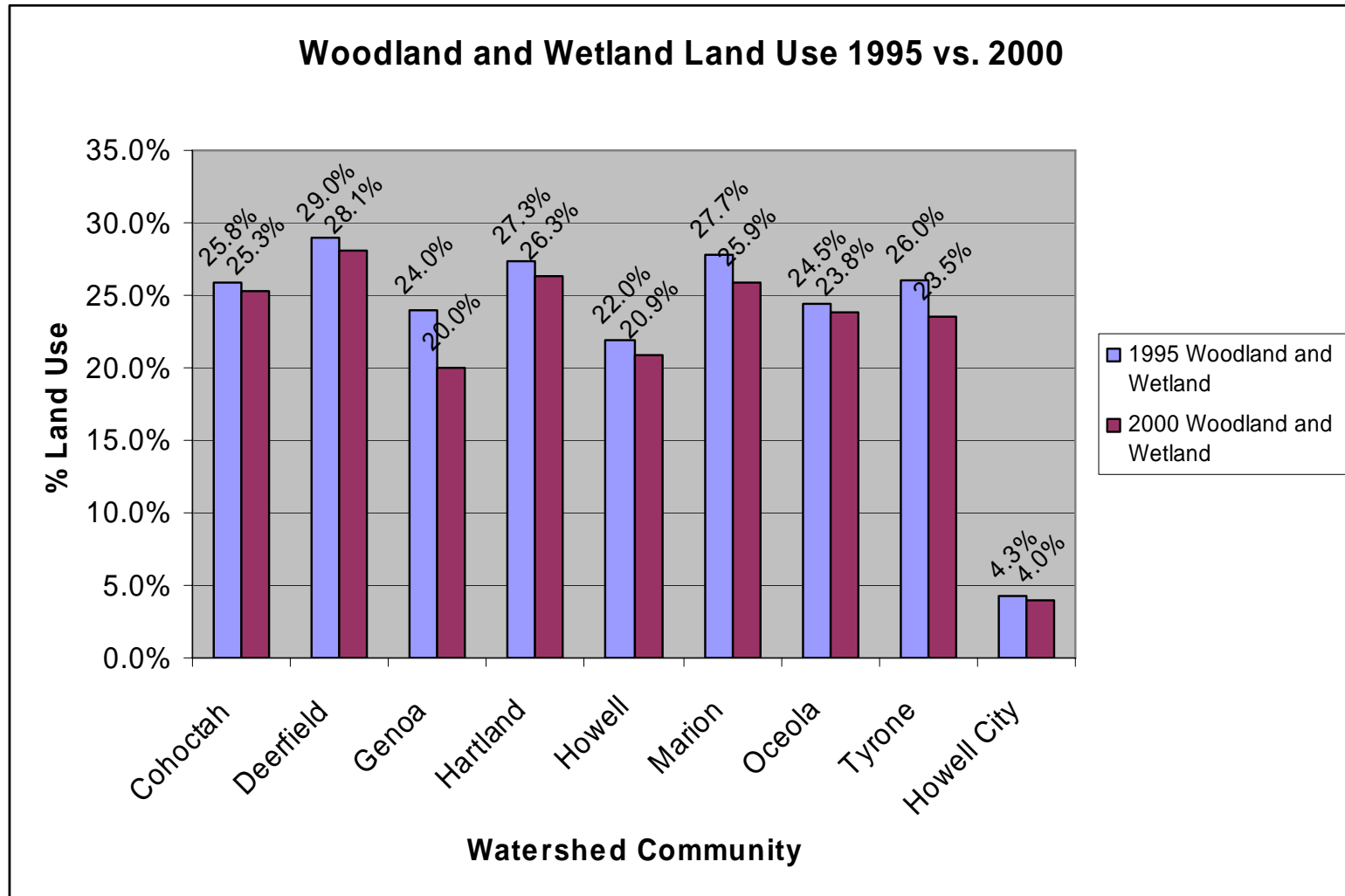


Figure 2.10 Change in Woodland and Wetland Land Use from 1995 to 2000

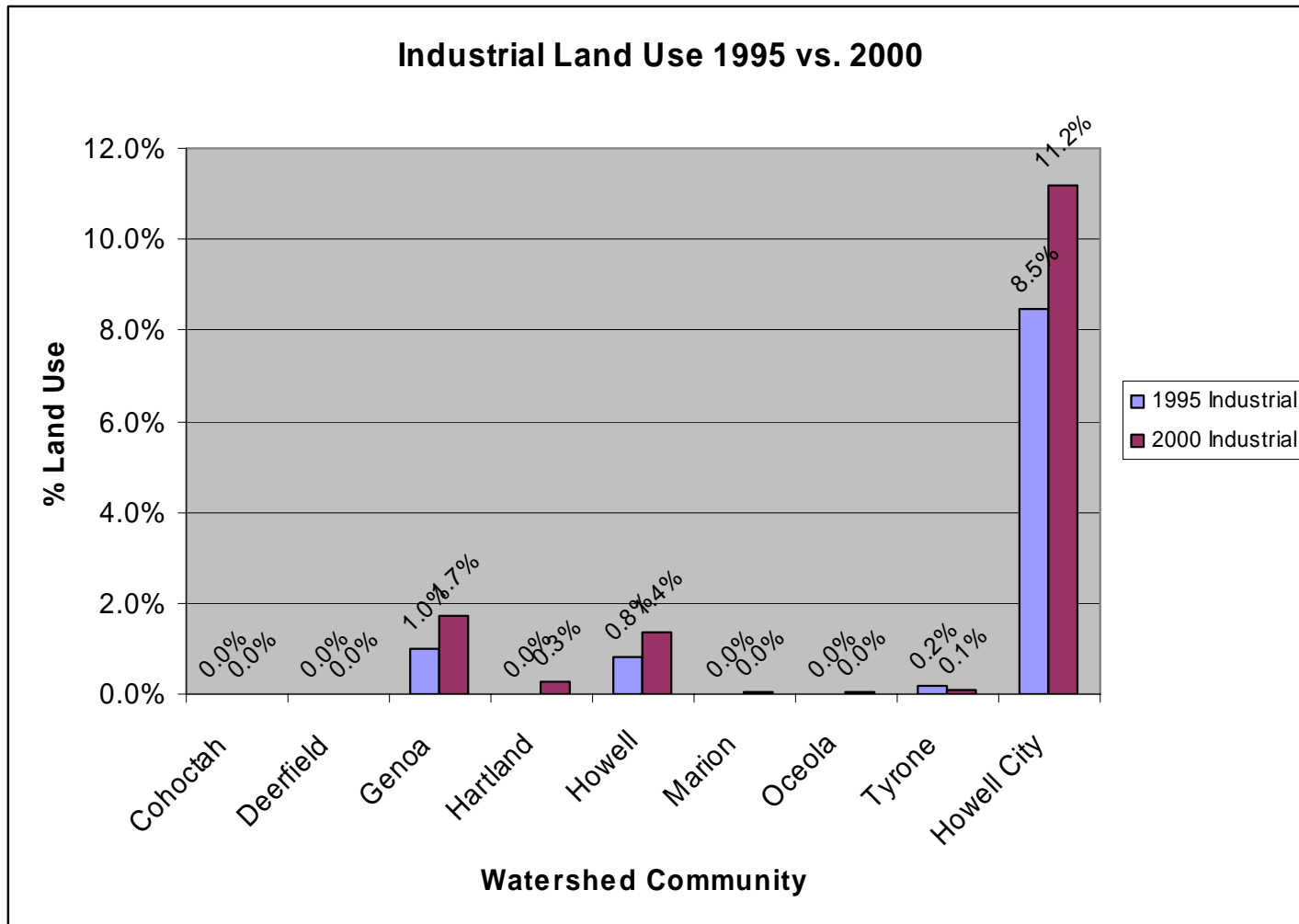


Figure 2.11 Change in Industrial Land Use from 1995 to 2000

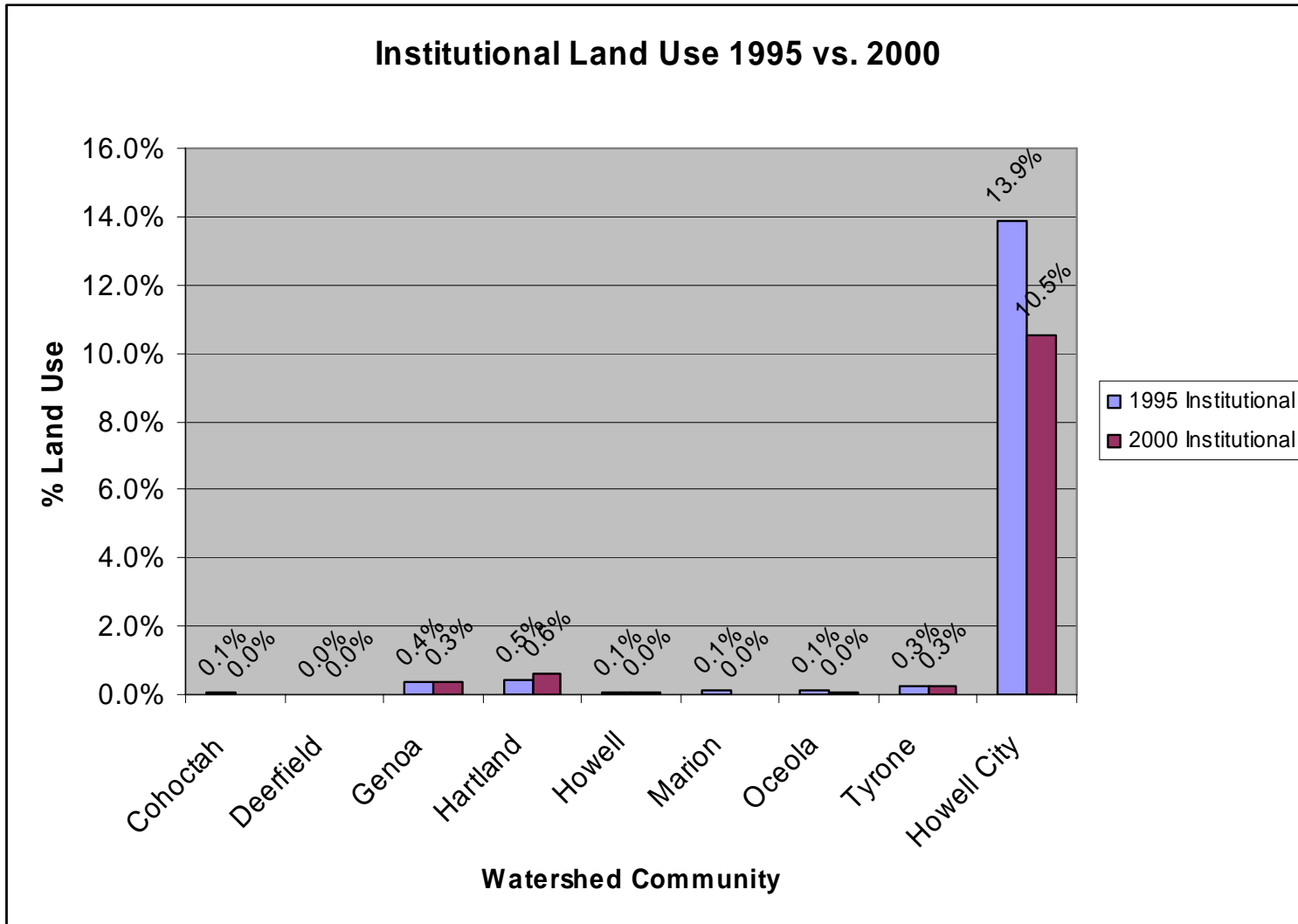


Figure 2.12 Change in Institutional Land Use from 1995 to 2000

2.5.1 Loss of Agricultural Land

Overall, loss of agricultural land in southeast Michigan has decreased by 13% from 1990-2000. In Livingston County, 13,200 acres have been lost—an 11% decrease. In the USR watershed, only 2.5% has been lost over the past five years. These losses have been primarily due to development, but some of the cause is due to economic loss in the farming industry, as well. The development in Livingston County has been occurring on both previously agricultural land and other undeveloped land at roughly the same amount.

In the time from 1992 to 1997, the USDA reported that in Livingston County, the following changes in farm land and use occurred:

- Full-time farms fell 11% from 312 to 278;
- Market value of agricultural products fell 3% to \$28,455,000 in 1997;
- Crop sales accounted for 65% of the market value in 1997;
- Livestock sales accounted for 35% of the market value in 1997;
- The market value of agricultural products sold, as an average per farm, went up 5% from \$42,736 to \$44,671.

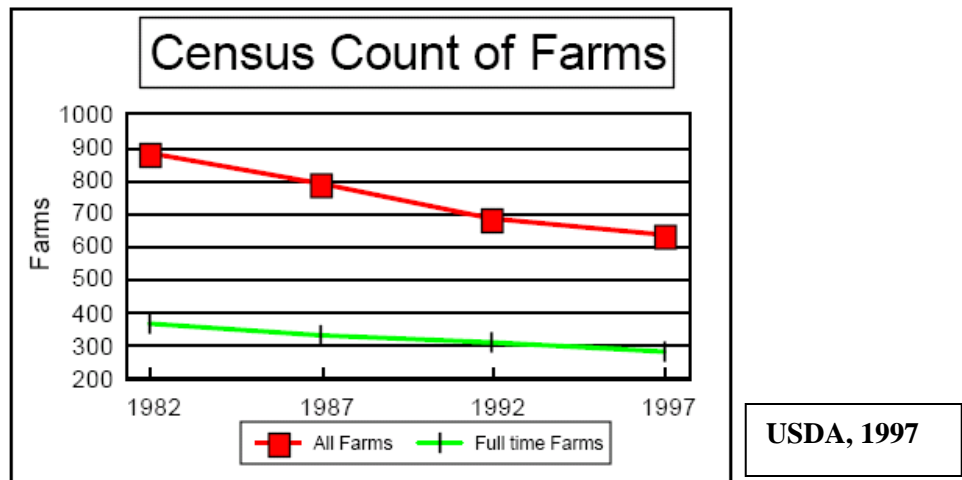


Figure 2.13 Loss in Number of Farms in Livingston County

Figure 2.14 shows the current agricultural lands that exist throughout the county (based on 1995 figures).

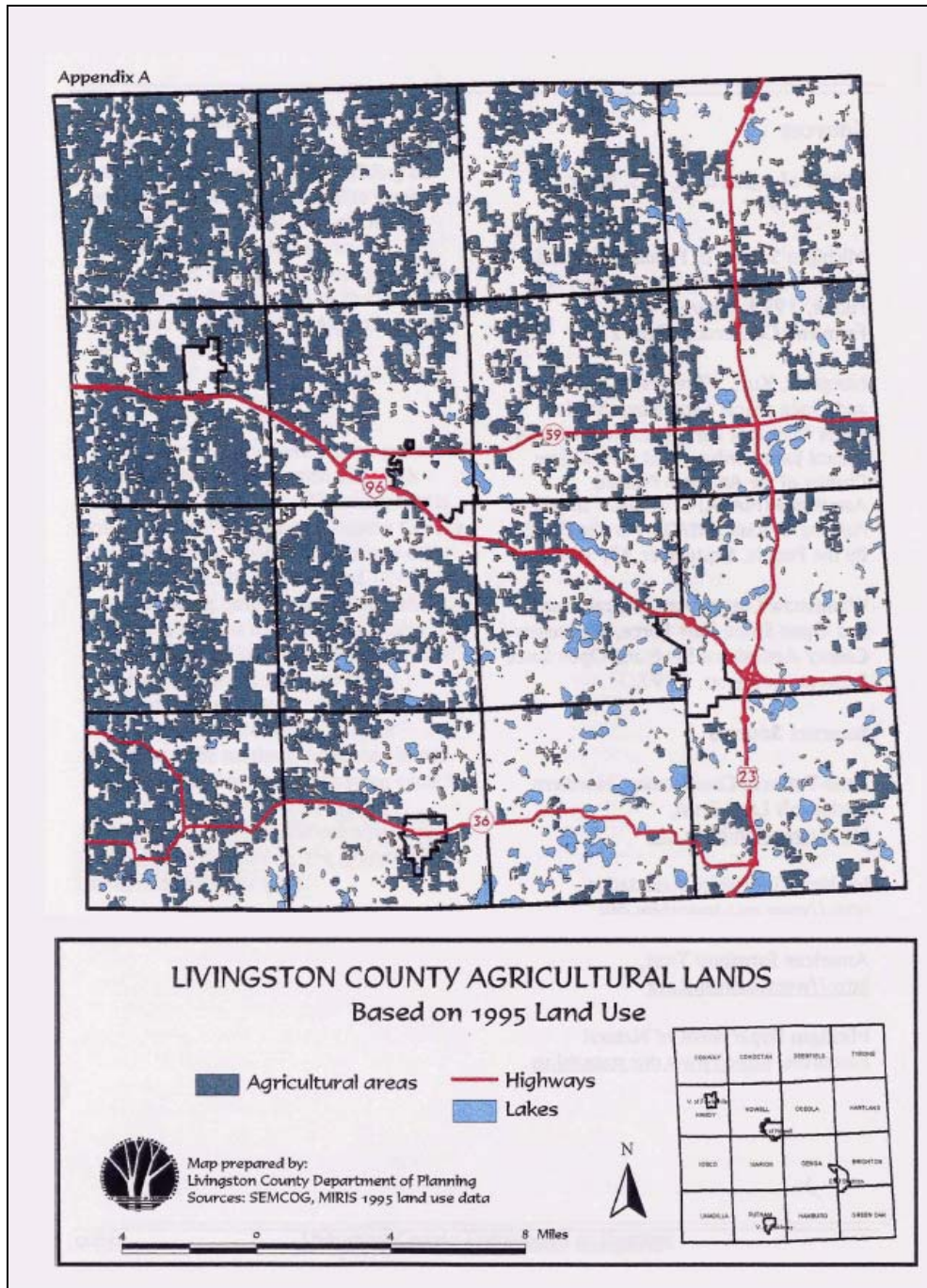


Figure 2.14 Agricultural Lands in Livingston County

Evaluating the loss of agricultural land on a county-wide basis is useful because it provides insight into the possible future changes of agriculture uses in the USR watershed. Given that agricultural land use significantly preserves the rural character of the area, future preservation of agricultural land will be a key component in maintaining this character. Plans are in place in the county to help protect these lands. At this time, there are a number of farms that have farmland preservation contracts (via the P.A. 116

Program) in place. Continuation of this program is recommended in order to help protect the rural character of the area.

Table 2.4 summarizes the total acreage for each Township that has agricultural land participating in the P.A. 116 Program (Farmland and Open Space Preservation Unit, 2000).

Table 2.4 Total Acreage of Farmland Preservation under Contract by Township in 2000

Township	Total Acreage	Average Acreage per Contract	Total Number of Contracts per Township
Cohoctah	4217	105	40
Deerfield	1855	74	25
Hartland	827	92	9
Howell	612	61	10
Oceola	428	54	8
Tyrone	557	93	6

Note: The acreage represented does reflect the contracts throughout the Township’s total area, and may extend outside of the Upper-2 Shiawassee River watershed boundaries.

Preservation of prime agricultural land throughout the county is a high priority land use initiative. Figure 2.15 shows the prime farmland areas that have been identified throughout the county, and the farmland that could exist if the areas were drained.

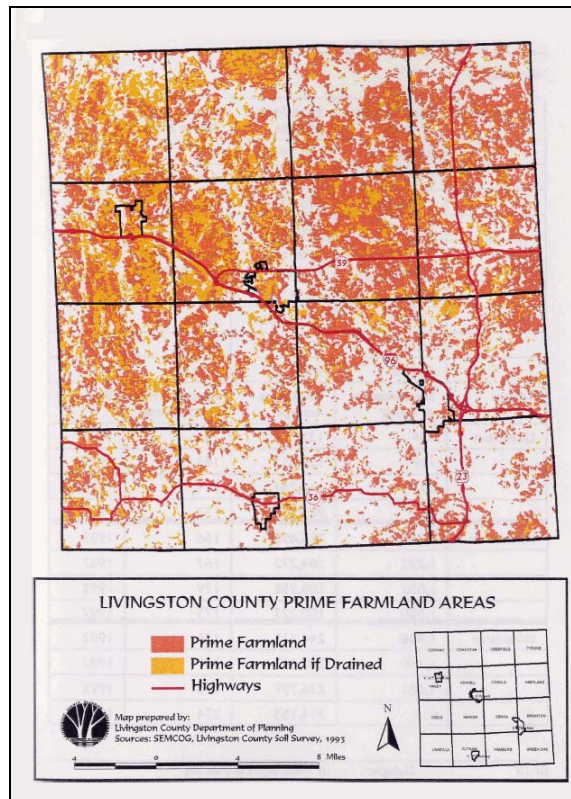


Figure 2.15 Prime Farmland Areas Identified in Livingston County

2.6 Watershed Community Profiles: Land Use and Growth Trends

Given that only 2.1% of the USR watershed area is in parts of Genesee and Shiawassee Counties, and less than 10% touches into each of Rose and Highland Township's of Oakland County, and on the basis that the majority of the watershed is in Livingston County, each contributing community within Livingston County alone will be discussed herein. Overall, approximately 45% of Livingston County's water resources are contained within the communities discussed herein; however, in many instances, close to 50% of some communities land area contributes to other watersheds and that should be kept in mind when assessing the numbers presented for each community. The land use descriptions described for each community are based on year 2000 data from SEMCOG.

2.6.1 Cohoctah Township

Located in the northwest quadrant of Livingston County, Cohoctah Township is very rural in nature and is predominately a farming community. The only population centers are Oak Grove, Cohoctah and Cohoctah Center. Sixty-four percent of Cohoctah Township's acreage is included in the USR watershed. The other 36% of Cohoctah's land area drains into the "main branch" Shiawassee River watershed.

Land use in Cohoctah Township is primarily agricultural (47%), woodland and wetland (25.3%), and grassland and shrub (15.7%). A small percentage is single-family residential (9.7%); there is very little commercial or industrial land use. A small portion (1.3%) of Livingston County's water resources are within Cohoctah's boundaries (Figures 2.16 and 2.17). The South Branch Shiawassee River runs along the perimeter of the southeast quadrant of the Township, and the Bogue Creek joins the South Branch Shiawassee River in the southeast corner of the Township, as well (Figure 1.4).

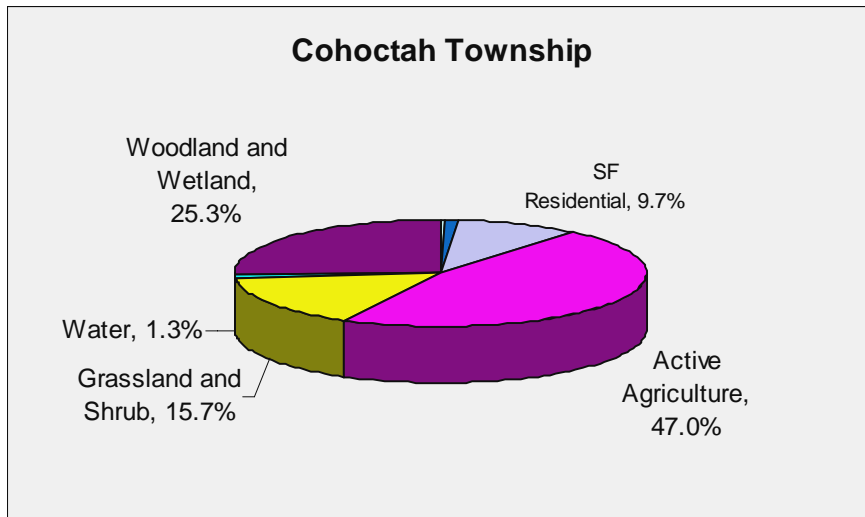


Figure 2.16 Pie Graph of Land Use in Cohoctah Township

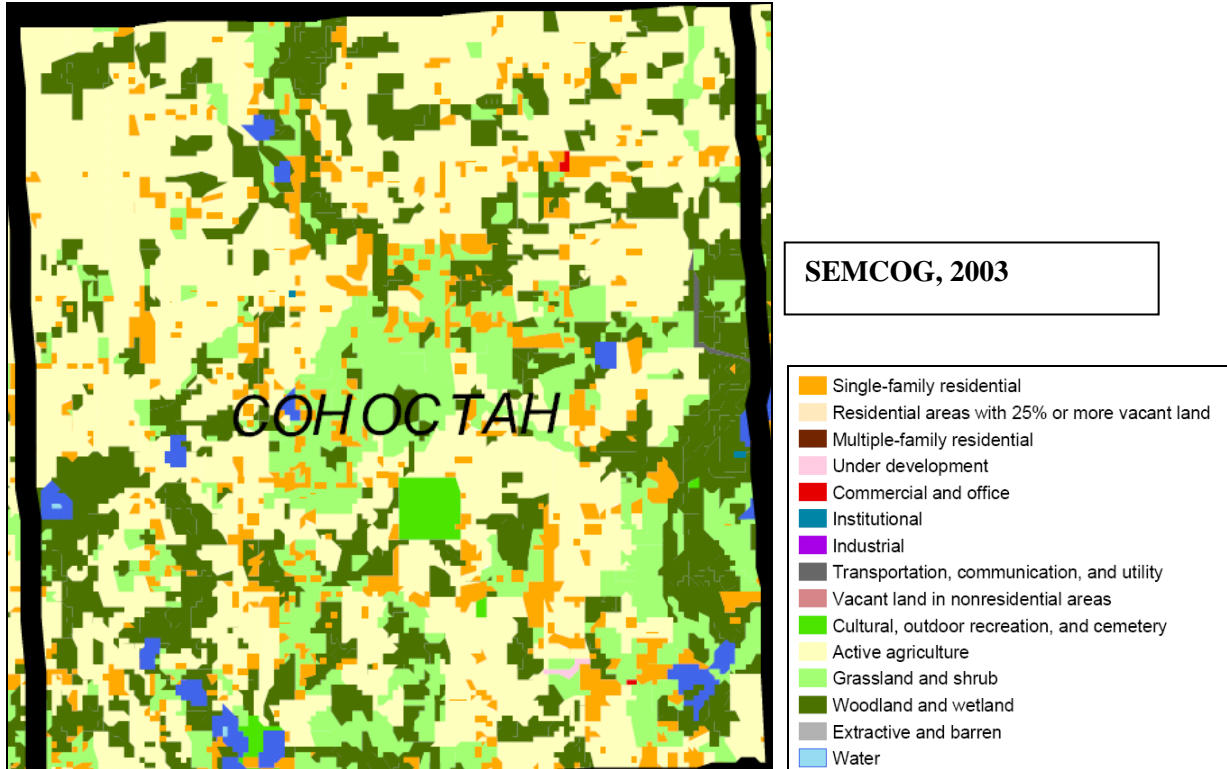


Figure 2.17 Current Land Use in Cohoctah Township

The Township is currently working on a 40-acre park near Allen and Preston Roads. It will be a recreational park with an archery area, nature trails and picnicking areas. In the southeastern portion of the township is the Oak Grove State Game Area located in Sections 24 and 25 of Cohoctah Township, and portions of Section 19 and 30 of Deerfield Township. The MDEQ is responsible for maintaining its habitat and the area is home to excellent deer hunting and fishing. Hosley Pond is set within the State Game Area and the western edge of the State Game Area borders the east side of the Bogue Creek upstream of its confluence with the South Branch Shiawassee River.

As of December 2003, the total population of Cohoctah Township was 3,592 and is forecasted to reach 5,317 by 2030 (a 32% increase). A build-out analysis conducted in 2000 projected a build-out population of 43,087 people. This large population is due in large part to the agricultural district, which allows single family homes on one acre (per the 1986 Master Plan, Table 2.5). The housing will be predominately low-density with 92% of the buildable lots between one (1) and five (5) acres. The Township's future land use map allows an additional 12,780 housing units and 39,717 people. As the Township is not expected to reach its build-out population any time soon, its growth will be steady. The area's urbanization is expected to occur in the southeast corner of the Township (Figure D in Executive Summary).

Table 2.5 Profile of Residential Lots in Cohoctah Township

Lot Size	% of Buildable Lots
5 + acres	4%
1 to < 5 acres	92%
½ to < 1 acre	< 1%
Under ½ acre	4%

2.6.2 Deerfield Township

Located in the north central portion of Livingston County, much of the Township is comprised of countryside, dairy farms, woods and fields. The Township is home to portions of the Oak Grove State Game Area which is located in parts of Sections 19 and 30. Deerfield Township also has a 400-acre park that is comprised of rolling hills, primitive nature trails and public access to Indian Lake for onshore fishing. Motor vehicles are prohibited in the park, and the Township would like to incorporate horseback riding to the park activities.

Land use in Deerfield Township is primarily agricultural (36.0%), woodland and wetland (27.1%), and grassland and shrub (16.9%). A small percentage is single-family residential (11.4%); there is very little to no commercial or industrial land use (Figures 2.18 and 2.19). A good deal of Livingston County’s water resources flow through Deerfield Township (7.9%) Every watercourse, except for the Denton Creek, in the watershed passes through Deerfield Township (Figure 1.4).

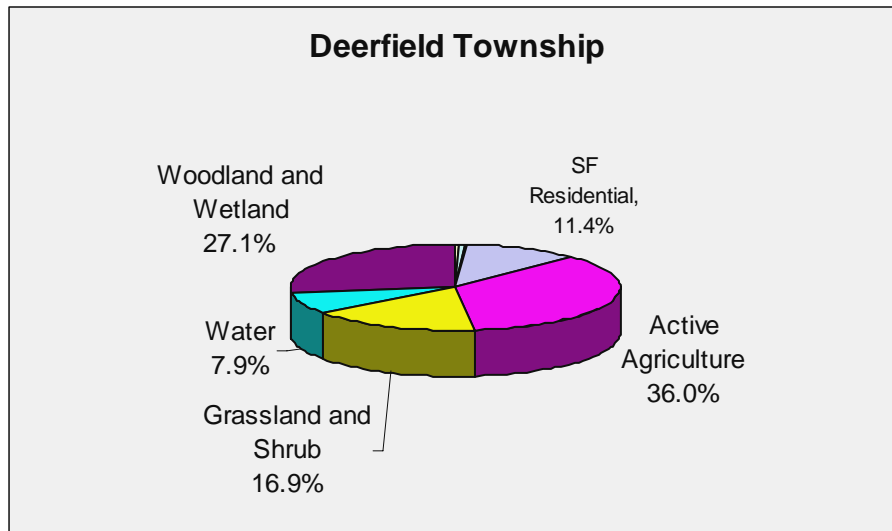


Figure 2.18 Pie Graph of Land Use in Deerfield Township

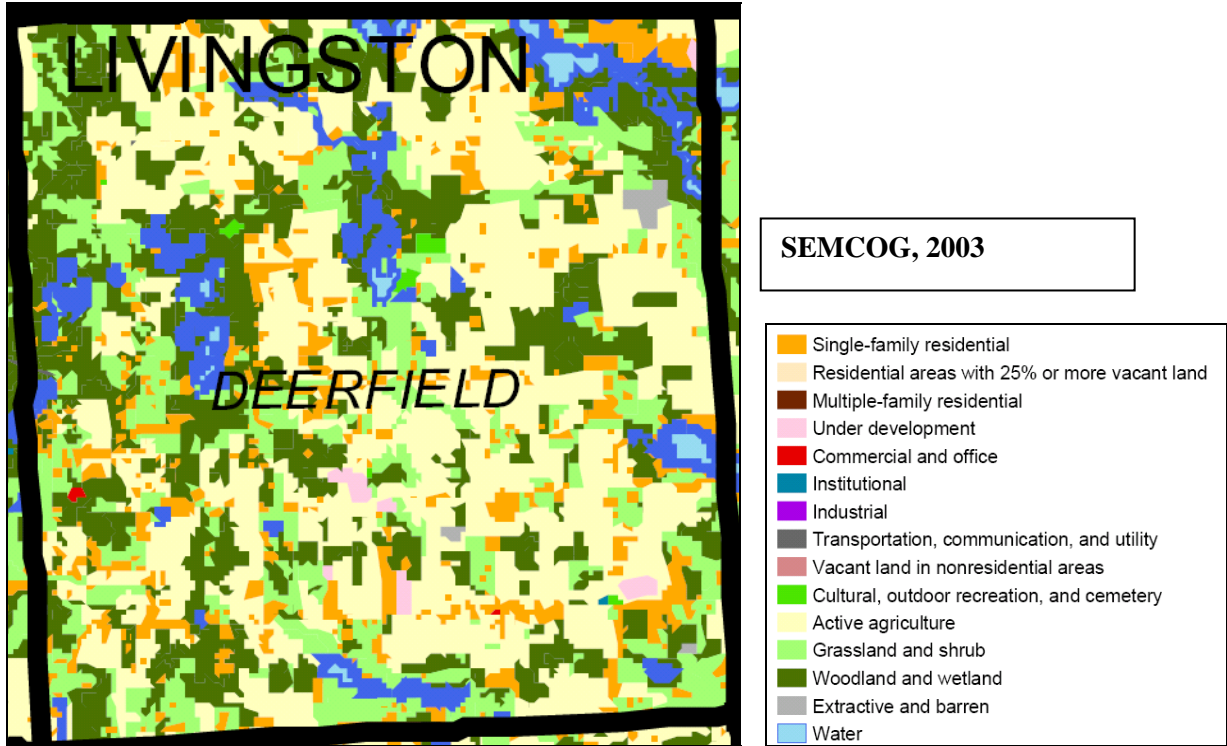


Figure 2.19 Current Land Use in Deerfield Township

As of December 2003, the total population of Deerfield Township was 4,335 and is forecasted to reach 6,915 by 2030 (a 37% increase). A build-out analysis conducted in 2000 projected a build-out population of 23,424 people. The Township’s future land use map allows an additional 6,527 housing units and 19,693 people. More than 65% of the Township’s buildable units fall within the agricultural/rural residential district, which has a minimum lot size of 2 acres. As such, the housing in the township is predominately low-density. Deerfield’s future land use map has a significant proportion (30%) of lots under one acre which supports relatively compact future growth in the area (Table 2.6). The most urbanized areas in this township will occur in the northeastern and central eastern portions of the Township (Figure D in Executive Summary).

Table 2.6 Profile of Residential Lots in Deerfield Township

Lot Size	% of Buildable Lots
5 + acres	3%
1 to < 5 acres	67%
½ to < 1 acre	30%
Under ½ acre	0%

2.6.3 Genoa Township

This Township is located in the south central portion of Livingston County. Grand River Avenue bisects the community on an angle and connects the two cities of Howell and Brighton.

Land use in Genoa Township is divided almost equally among woodland and wetland and grassland and shrub at 20% and 18.2%, respectively. Agriculture comprises 14.8% of the land. A good portion of land use is made up of single-family residential at 28.9%, the highest amount of residential area in all of the Townships in the watershed (Figures 2.20 and 2.21). From 1995 to 2000, Genoa Township grew in single-family residential by 9.4%, from 19.5%, and continues to be one of the most rapidly growing Township's in the watershed. There is very little commercial or industrial land use. Twelve percent of Livingston County's water resources are within the limits of Genoa Township, being home to many shallow lakes that are used for recreational purposes; however, most of these lakes are part of the Huron River Chain of Lakes watershed (54% of Genoa's land area, see Figure 1.1). Genoa Township is a headwater's area for both the USR watershed and the Huron Chain of Lakes watershed. Forty-five percent of Genoa Township is included in the USR watershed, and the Marion and Genoa Drain, as well as the headwaters of the Bogue Creek flow within this portion of the watershed (Figure 1.4). There is one major lake in this portion of the watershed: Lake Chemung—a 321-acre, all sports lake with public access and availability to fish for warmwater species such as Pan fish and Pike.

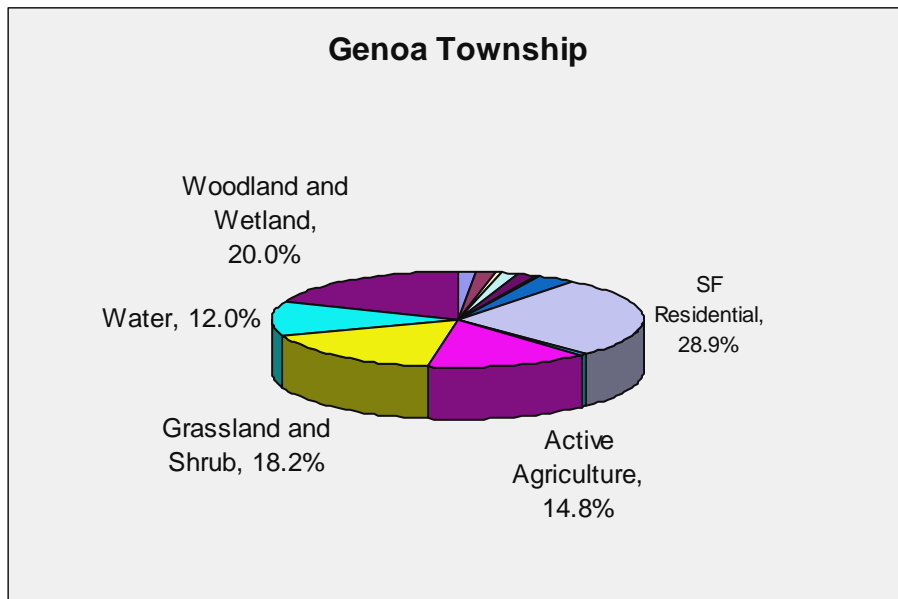


Figure 2.20 Pie Graph of Land Use in Genoa Township

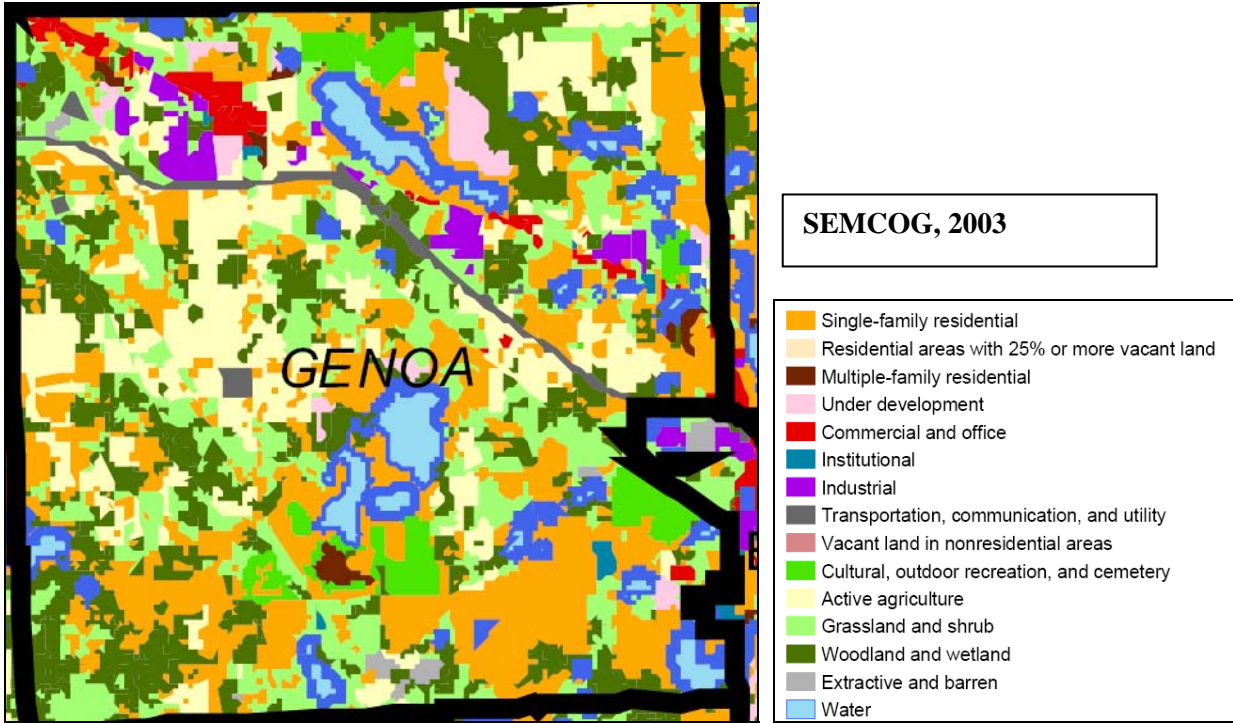


Figure 2.21 Current Land Use in Genoa Township

As of December 2003, the total population of Genoa Township was 19,387 and is forecasted to reach 29,083 by 2030 (a 33% increase). A build-out analysis conducted in 2000 projected a build-out population of 50,463 people. The Township’s future land use map allows an additional 11,840 housing units and 34,640 people. Almost half of the Township’s possible buildable lots fall into the Small Lot Single Family Residential district which has a minimum lot size of ¼ of an acre (Table 2.7). As such, the housing in this community is predominately high-density. The most urbanized areas in the USR watershed will be in the northwest quadrant of the Township (Figure D in Executive Summary).

Table 2.7 Profile of Residential Lots in Genoa Township

Lot Size	% of Buildable Lots
5 + acres	5%
1 to < 5 acres	23%
½ to < 1 acre	0%
Under ½ acre	72%

The large percent of small residential lots helps account for the second largest build-out population in the County (Hartland Township has the highest build-out population with just over 51,000 people). As such, public sewer and water service will likely be needed to serve those lots under ½ acre. This analysis implies that significant public infrastructure will be necessary to service these lots if Genoa develops according to its current land use plan.

2.6.4 Hartland Township

Hartland Township is located in the eastern central portion of Livingston County. It is bisected by two major thoroughfares: north/south by US-23 and east/west by M-59. As such, a substantial number of vehicles travel through this area from both Oakland and Genesee Counties. Land use in Hartland Township is divided up somewhat equally between woodland and wetland (26.3%), agriculture (22.3%), and single-family residential (22.6%). Grassland and shrub land constitutes a significant amount, as well (15.5%). There is very little commercial or industrial land use (Figures 2.22 and 2.23). Seventy-three percent of Hartland Township falls within the USR watershed boundary. Approximately 7.4% of the water resources in all of Livingston County are located in Hartland Township. The North Ore Creek begins in the Township formed by many headwater streams, and a small portion of the headwaters of the Cranberry Creek originate at the northwestern-most corner of Hartland (Figure 1.4). The other 27% of Hartland's land area drains to the Huron River Chain of Lakes watershed (Figure 1.1).

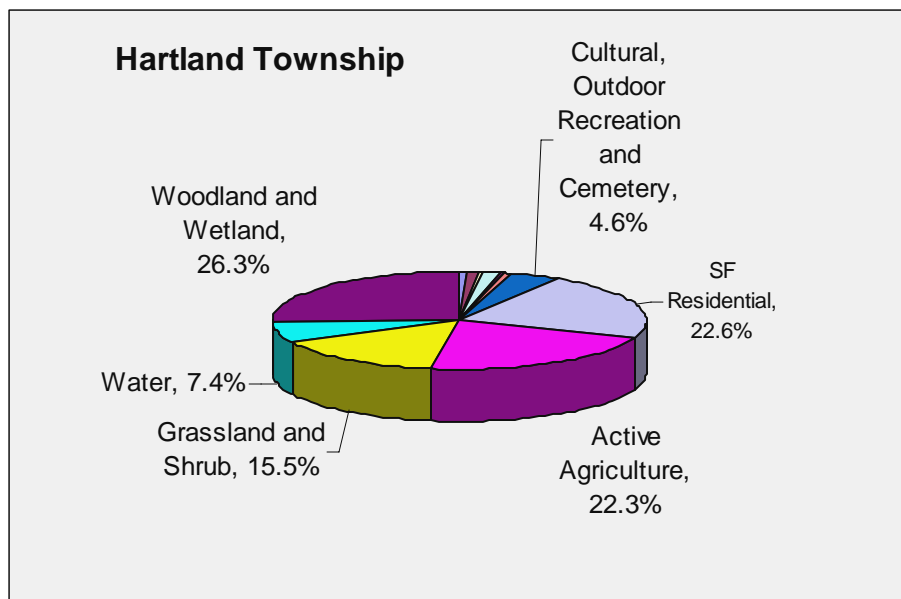


Figure 2.22 Pie Graph of Land Use in Hartland Township

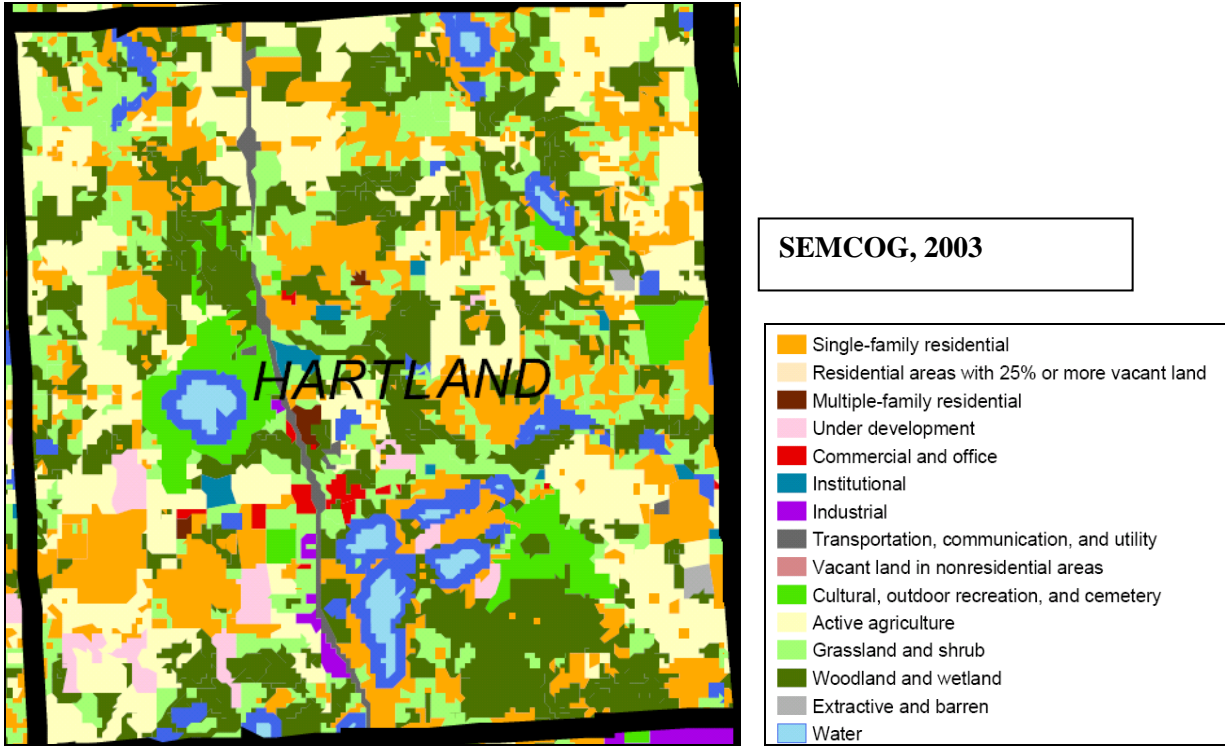


Figure 2.23 Current Land Use in Hartland Township

As of December 2003, the total population of Hartland Township was 13,546 and is forecasted to reach 19,734 by 2030 (31% increase). A build-out analysis conducted in 2000 projected a build-out population of 51,611 people. The Township’s future land use map allows an additional 13,760 housing units and 41,636 people. Seventy-five percent of the Township’s possible buildable residential area is planned to have ½ acre lots or smaller (Table 2.8). As such, the housing density will be midway between low and high-density.

Table 2.8 Profile of Residential Lots in Hartland Township

Lot Size	% of Buildable Lots
5 + acres	0%
1 to < 5 acres	25%
½ to < 1 acre	54%
Under ½ acre	21%

Hartland Township is expected to continue to grow steadily due to its central proximity to the US-23, I-96 and M-59 corridors. It is the fourth fastest growing Township in the watershed (6.3% increase over the past five years). The Township’s 1994 Comprehensive Plan allows for enough housing units for a population of 51,611. The Township is not expected to reach build-out conditions any time soon, but is expected to grow steadily over the next 20 years. Since population densities will be much higher in this area, impervious surfaces will be a significant factor in contributing to stormwater runoff volumes. The entire township is expected to have levels of imperviousness above 11% which could have serious implications on the water quality in the region (Table B and Figure D in Executive Summary). Careful land use planning for this community will be a priority for years to come.

2.6.5 Howell Township

Howell Township is centrally located in Livingston County and has the feel of both the city and the country. It was originally organized in 1836 and contained what is now known as Cohoctah, Conway, Deerfield, Handy and Oceola Townships. The Township is closely affiliated with the City of Howell and is experiencing residential and industrial growth as a result.

Howell Township’s infrastructure includes a new state-of-the-art waste water treatment plant (discharges less than one million gallons of effluent per day to the South Branch Shiawassee River), and their public water supplies are serviced through the Marion, Howell, Oceola, Genoa Water Authority (MHOG). A master plan for sewer and water has been drawn up by the township as a future growth tool. Those properties not on public sewer and water are serviced by private onsite septic disposal systems (OSDS) and groundwater wells (see Figures 2.34 and 2.35 in Section 2.7.1, and Appendix A, for maps of current and future sanitary sewer system infrastructure in the Township).

Both M-59 and I-96 run through the Township, as well as a railroad. The Township has a commercial airport (Livingston County Airport) located just north of the intersection of M-59 and I-96. Given its central location, the Township has a mix of industrial, commercial, residential and agricultural land use. Howell Township is promoting future development in the industrial and commercial areas (currently only 2.0% of its land use). At this time, land use in Howell Township is primarily agricultural (37.2%). Remaining land use is highly devoted to woodland and wetland (20.9%), grassland and shrub (17.5%) and single-family residential land use comes in at 17.5%. A very small amount of Livingston County’s water resources lay within Howell Township’s limits (1%) (Figures 2.24 and 2.25). The South Branch of the Shiawassee River runs through the center of the community from the south to the north, and the Bogue Creek runs through portions of the eastern half of the Township. Sixty-six percent of Howell Township is part of the USR watershed (Figure 1.4). The other 34% of the land area drains into the Red Cedar River watershed (Figure 1.1).

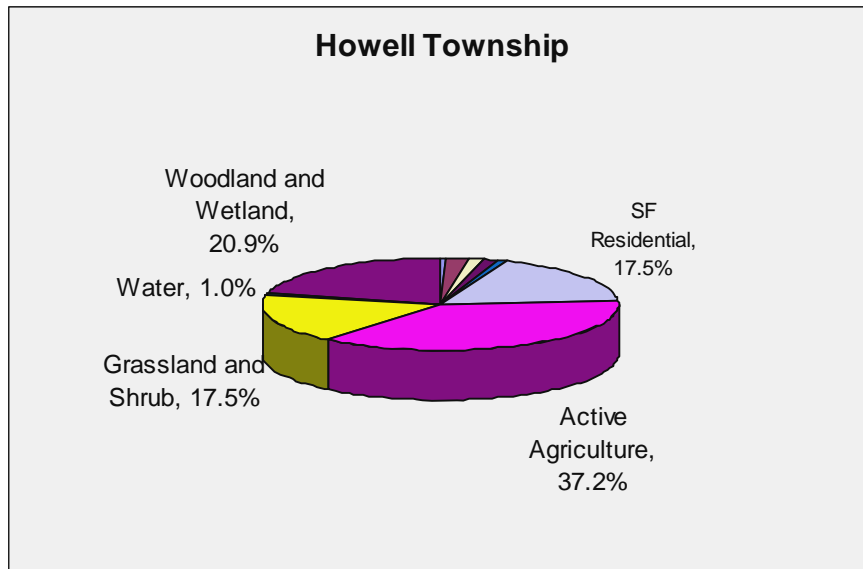


Figure 2.24 Pie Graph of Land Use in Howell Township

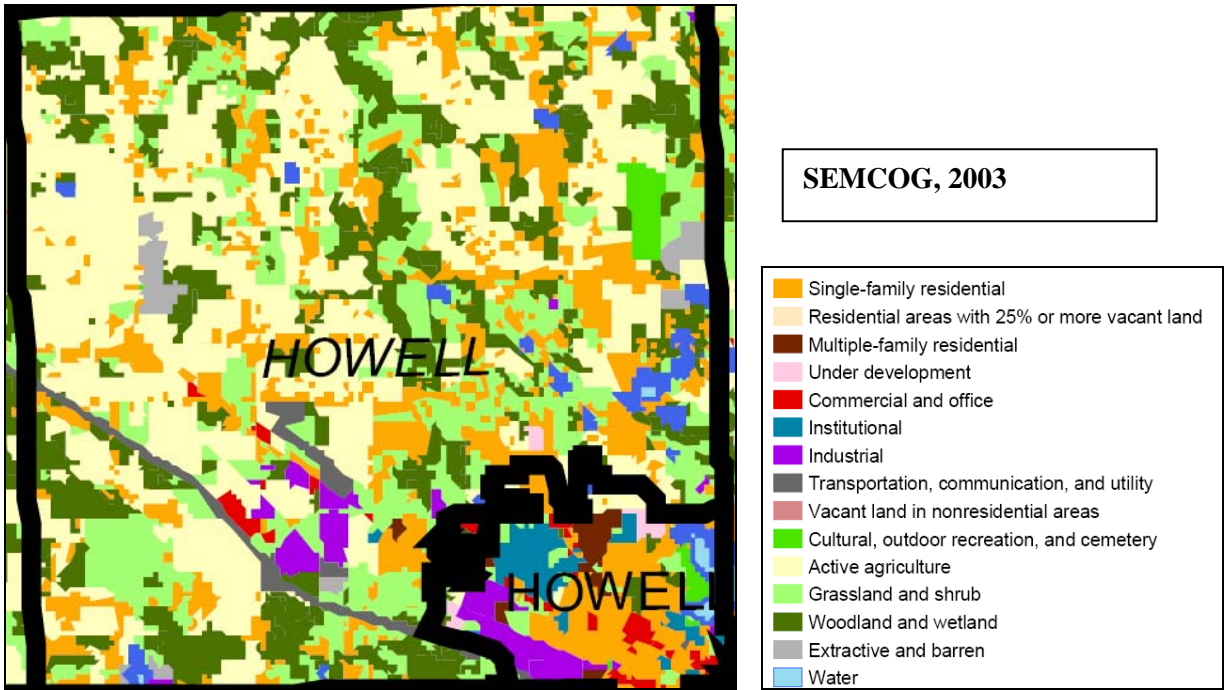


Figure 2.25 Current Land Use in Howell Township

As of December 2003, the total population of Howell Township was 6,374 and is forecasted to reach 13,484 by 2030 (a 53% increase). A build-out analysis conducted in 2000 projected a build-out population of 20,363 people. The Township’s future land use map allows an additional 4,883 housing units and 14,681 people. Over half of the Township’s possible buildable residential area falls into the Single-Family Residential district which has a minimum lot size of 1 acre (Table 2.9). As such, the density of the housing in the area will be relatively low.

Table 2.9 Profile of Residential Lots in Howell Township

Lot Size	% of Buildable Lots
5 + acres	34%
1 to < 5 acres	58%
½ to < 1 acre	0%
Under ½ acre	8%

The Township is forecast to have over 11% impervious surfaces over most of its area, with 50% of this being over 25%. The future land use map does provide for protection along the South Branch Shiawassee River corridor as it will remain less than 11% impervious (Figure D in Executive Summary). The Township’s limited sewer and water availability isn’t likely to inhibit residential development as most lots in the Township are over an acre and would be more than adequate for on-site well and septic systems.

2.6.6 Marion Township

Marion Township is centrally located in Livingston County and was first settled in 1833. It's made up largely of agricultural land used for dairy farms, beef cattle farms, bush fruits, corn, tree nurseries and muck farms. Marion Township has a diverse topography comprised of plains, ridges and small lakes. The land area drains into three different watershed basins: the USR watershed, the Red Cedar River watershed, and the Huron River Chain of Lakes watershed (Figure 1.1). Marion Township is the main geographical source of the water supply that is utilized by the City of Howell.

Land use in Marion Township is primarily agricultural (33.9%), woodland and wetland (25.9%), single-family residential (21%), and also has a fair amount of grassland and shrub (14.2%) area (Figures 2.26 and 2.27). From 1995 to 2000, Marion grew in single-family residential area by 8.8%, from 12.2%, and is the second fastest growing Township in the watershed. Four and a half percent of Livingston County's water resources are within the limits of Marion Township and 40% of this Township is included in the USR watershed. There are two major lakes in this location: Coon Lake (106 acres) and Pardee Lake (81.5 acres). Both have public access and are home to Panfish and Pike, and Coon Lake is enjoyed as an all sports lake. The headwaters of the South Branch Shiawassee River originate here and the Marion and Genoa Drain joins the South Branch in the northeastern corner of the Township (Figure 1.4).

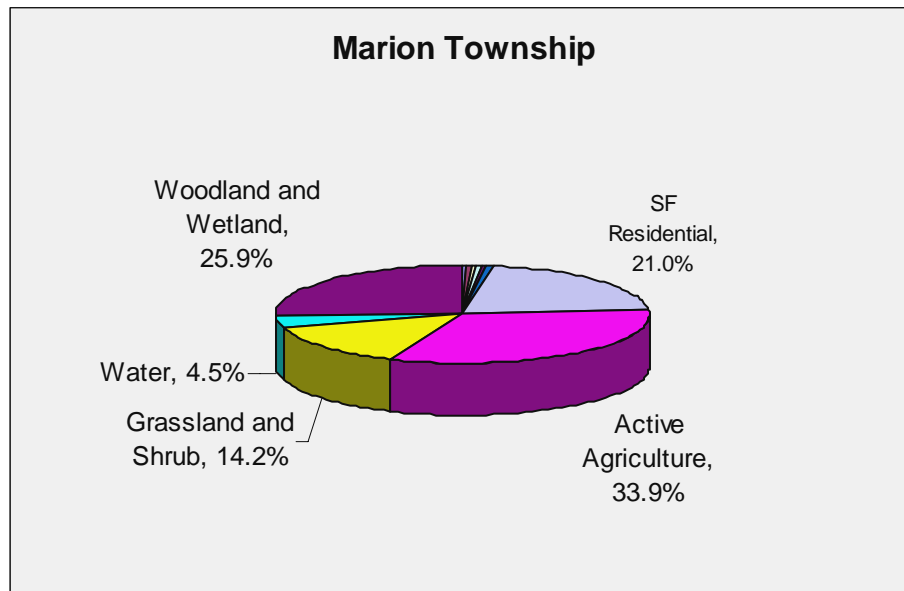


Figure 2.26 Pie Graph of Land Use in Marion Township

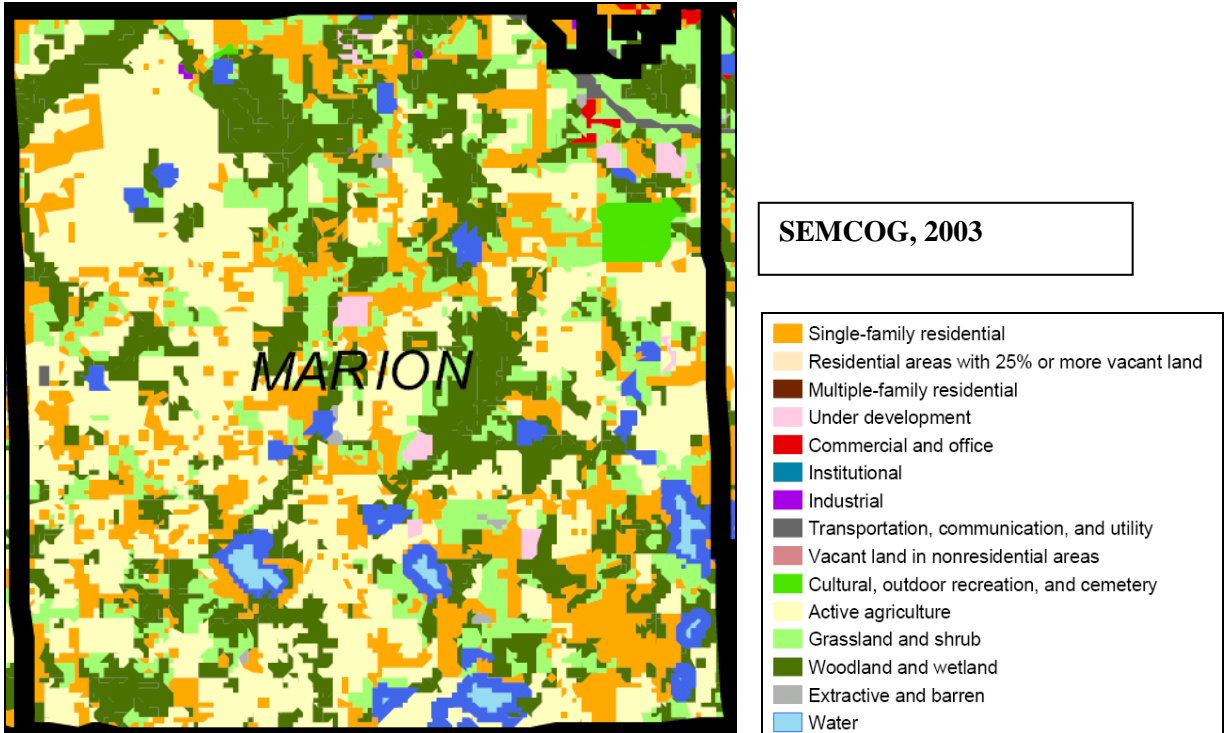


Figure 2.27 Current Land Use in Marion Township

As of December 2003, the total population of Marion Township was 8,272 and is forecasted to reach 13,969 by 2030 (a 41% increase). A build-out analysis conducted in 2000 projected a build-out population of 18,467 people. The Township’s future land use map allows an additional 5,864 housing units and 14,681 people. More than half of the Township’s possible buildable residential area falls into the Mixed Urban Residential district. The land area of this district is relatively small (568 acres or 469 buildable acres), but has a minimum lot size of 0.10 acres. Future sewer service area maps indicated that the development at this density will have adequate sewer, water and other infrastructure, as well as adequate public services, to support it. Seventy-seven percent of the Township’s buildable land area falls in the Open Space Residential district with a density of 5 acres per unit (Table 2.10).

Table 2.10 Profile of Residential Lots in Marion Township

Lot Size	% of Buildable Lots
5 + acres	34%
1 to < 5 acres	9%
½ to < 1 acre	0%
Under ½ acre	57%

Marion Township is forecasted to reach levels of imperviousness that fall between 11 and 25%. Levels of imperviousness above 25% will occur on the outskirts of the City of Howell in the Township (Figure D in Executive Summary). Based on the build-out analysis, housing densities will be relatively high, except for the 34% on lots over 5 acres which will produce low-density housing.

2.6.7 Ocoola Township

Ocoola Township is centrally located in Livingston County and contains substantial expanses of farmland with a topography that is nearly level. More than half of Thompson Lake is located in the southwest corner of this Township and is part of Howell City Park. This is a major recreational area with a public beach. Hundreds of residents live around the perimeter of this 262-acre lake and enjoy it for all water sports. The lake contains both Pan fish and Pike.

In August of 2003, the Livingston Land Conservancy was helping to preserve a 72-acre Centennial Farm located on Curdy Rd, east of Latson Road and west of Listerman Rd. The Conservancy worked with the local landowner to create the H. Clare & Harold Salmon Centennial Farm Conservation Easement. This easement will prevent development, but allow farming—a land use practice that has been in place for over 100 years. The property is made up of a 4-acre woodland of red oak, red maple, southern hardwood trees, and a shrub swamp. The woodland is home to deer and other wildlife. The area has both native plants, as well as some invasive species which volunteers plan to remove in the near future.

Land use in Ocoola Township is primarily agriculture (30.9%); the remaining land use is divided relatively equally among grassland and shrub (20.2%), woodland and wetland (23.8%), and single-family residential (20.6%). There is very little commercial or industrial land use. Just over three percent (3.2%) of Livingston County’s water resources lie within this Township (Figures 2.28 and 2.29). Ninety-seven percent of Ocoola Township is included in the USR watershed while the other 3% drains to the Huron River Chain of Lakes watershed (Figure 1.1). The headwater tributaries of Bogue Creek are spread throughout Ocoola, and the western portions of the North Ore Creek’s headwaters begin in the northeastern quadrant of the Township. The Yellow River Drain and the Cranberry Creek also begin in the northern-most portion of Ocoola (Figure 1.4).

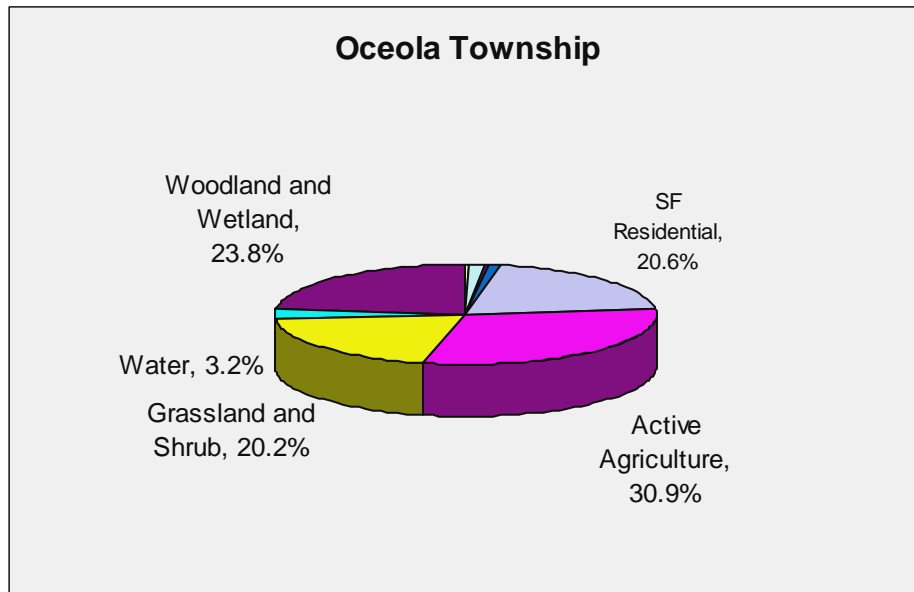


Figure 2.28 Pie Graph of Land Use in Ocoola Township

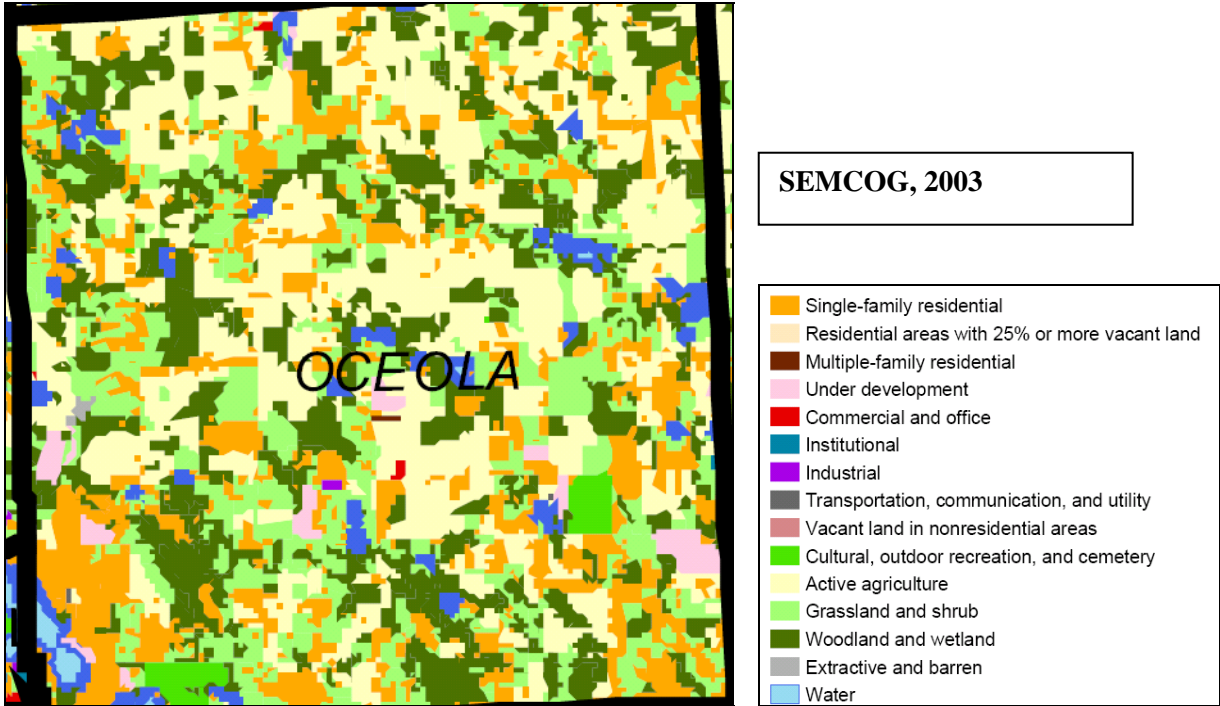


Figure 2.29 Current Land Use in Oceola Township

As of December 2003, the total population of Oceola Township was 10,248 and is forecasted to reach 17,855 by 2030 (a 43% increase). A build-out analysis conducted in 2000 projected a build-out population of 14,112 people. The Township’s future land use map allows an additional 1,768 housing units and 5,681 people. Almost 60% of the Township’s possible buildable residential area falls into the Rural Agriculture district which has a suggested density of no more than 150 lots per 640 acres, or an average of 4.27 acres per unit (Table 2.11). This will result in relatively low-density housing Township-wide. Oceola Township’s build-out population is the second lowest in the County (Putnam Township’s is lower). Coincidentally, Oceola Township is the third fastest growing Township in the watershed (7.8% increase over the past five years).

Table 2.11 Profile of Residential Lots in Oceola Township

Lot Size	% of Buildable Lots
5 + acres	0%
1 to < 5 acres	89%
½ to < 1 acre	0%
Under ½ acre	11%

The Township’s Land Use Plan has not been modified since 1980. Levels of imperviousness throughout the Township will be relatively low, below 11%, except for the southwest quadrant where levels will be between 11 and 25%. There is one small tract of imperviousness that will exceed 25% (Figure D in Executive Summary).

2.6.8 Tyrone Township

Tyrone Township is located in the northeastern-most corner of Livingston County. Land use in Tyrone Township is divided almost equally between grassland and shrub (25.4%), woodland and wetland (23.5%), and single-family residential (24.5%). Agricultural use follows at 18.1%. There is very little commercial or industrial land use. Just over six percent (6.3%) of Livingston County’s water resources reside within this township (Figures 2.30 and 2.31). Ninety-two percent of Tyrone Township is contained in the USR watershed (Figure 1.1). The all-sport lake, Shannon Lake (390 acres), and Runyan Lake (165 acres) are included in the watershed area—neither lake has public access. The other 8% of the Township drains to the main Shiawassee River watershed. A good portion of the North Ore Creek runs through the southwestern portion of the Township and the Denton Creek comprises the drainage area for the northeastern portion of the Township (Figure 1.4).

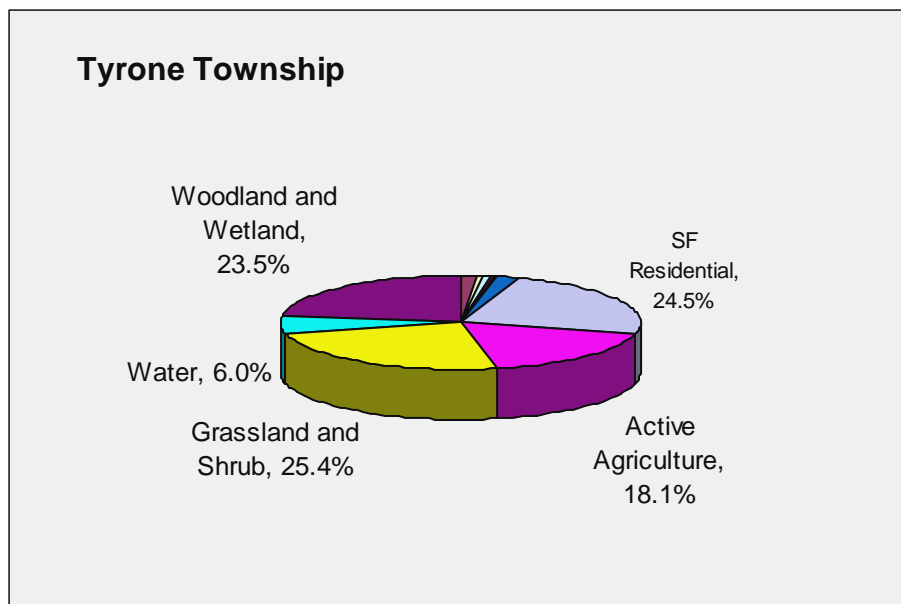


Figure 2.30 Pie Graph of Land Use in Tyrone Township

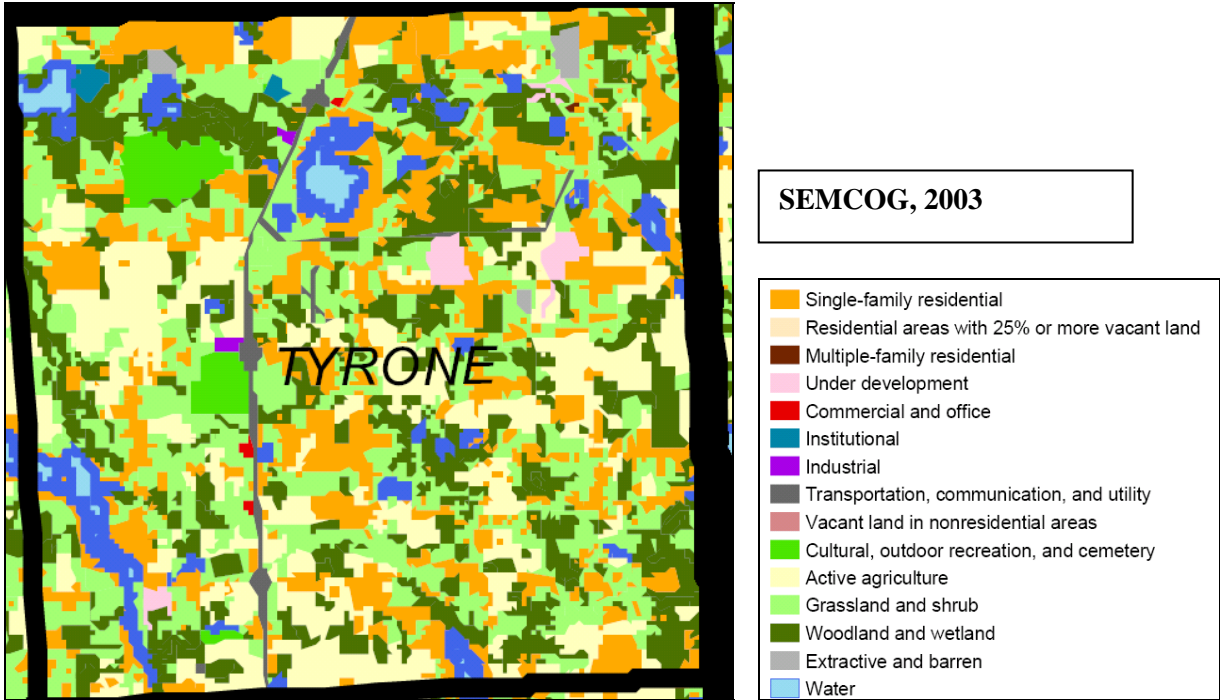


Figure 2.31 Current Land Use in Tyrone Township

As of December 2003, the total population of Tyrone Township was 10,129 and is forecasted to reach 19,732 by 2030 (a 49% increase). A build-out analysis conducted in 2000 projected a build-out population of 17,157 people. The Township’s future land use map allows an additional 2,672 housing units and 8,539 people. When combined, the Suburban Residential and Open Space Residential/Agriculture districts account for more than 85% of the Township’s buildable residential lots (Table 2.12).

Table 2.12 Profile of Residential Lots in Tyrone Township

Lot Size	% of Buildable Lots
5 + acres	48%
1 to < 5 acres	39%
½ to < 1 acre	13%
Under ½ acre	0%

Based on the build-out analysis, housing throughout the Township will be relatively low-density. Levels of imperviousness throughout the Township will be predominately between 11 and 25%. Levels above 25% are concentrated along the US-23 corridor and some of the area lakes (Figure D in Executive Summary).

2.6.9 City of Howell

The City of Howell is Livingston County’s county seat and is centrally located in the County. The city was first called Livingston Center. Land use in the City of Howell is very mixed. It is primarily single-family residential (34.2%), followed by a fair amount of grassland and shrub (11.2%), institutional use (10.5%), and industrial use (11.2%). There is also a fair amount of commercial and office (7.6%) use.

Almost six percent (5.7%) of the land area is devoted to agriculture. Just over one percent (1.1%) of Livingston County’s water resources are within the City limits (Figures 2.32 and 2.33). All of the City of Howell is contained in the USR watershed (Figure 1.4). The City’s Waste Water Treatment Plant discharges effluent to the Marion and Genoa Drain and the South Branch Shiawassee River. Thompson Lake also touches into the City (part of Howell City Park) and is utilized for its public beach and its all-sports recreation.

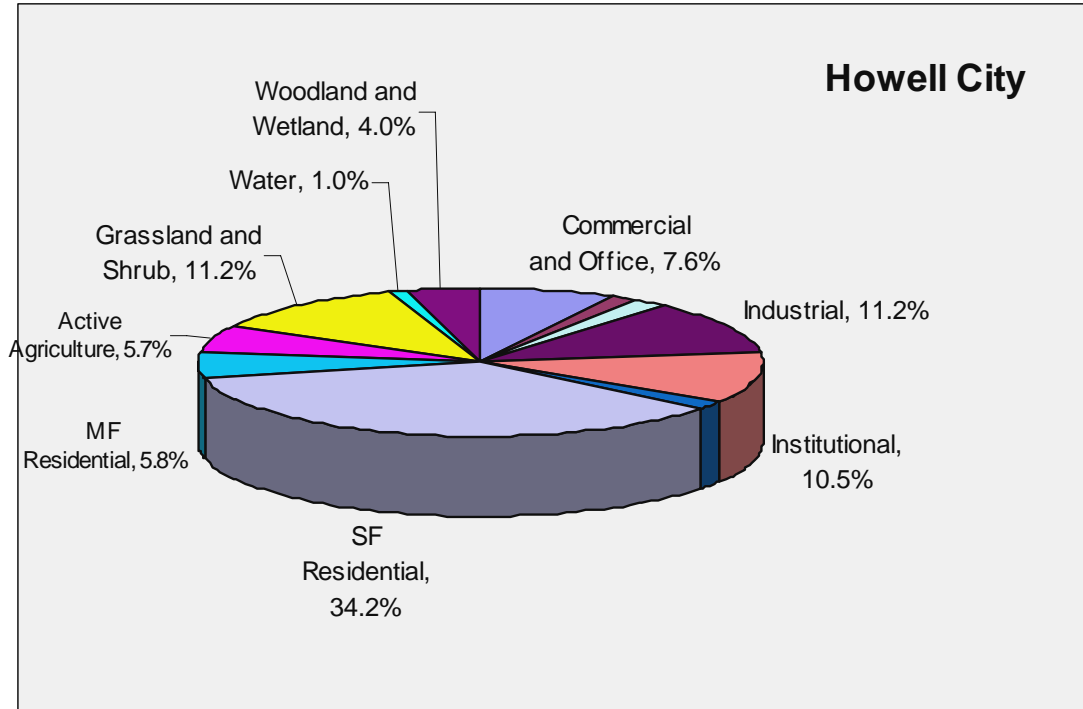


Figure 2.32 Pie Graph of Land Use in the City of Howell

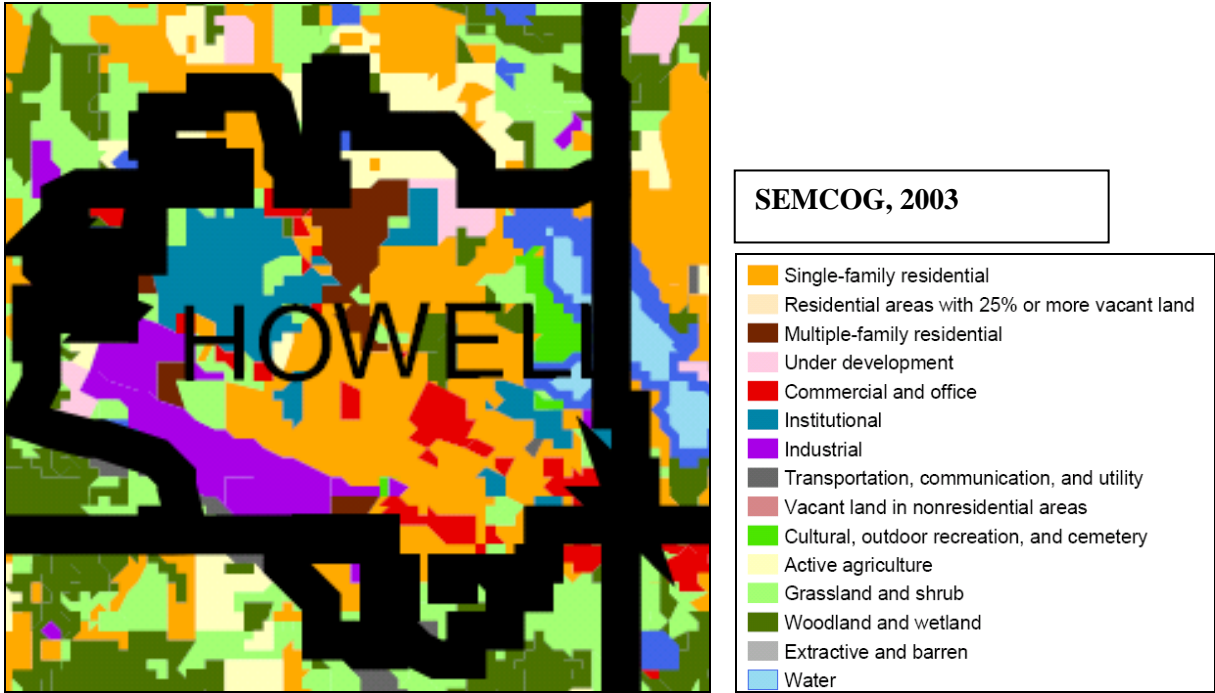


Figure 2.33 Current Land Use in the City of Howell

As of December 2003, the total population of the City of Howell was 9,775 and is forecasted to reach 10,965 by 2030 (an 11% increase). This small increase in population is mostly due to the fact that most of the land area has already been developed. A build-out analysis conducted in 2000 utilizing the City’s current zoning map projected a build-out population of 20,906 people. The Township’s current zoning map allows an additional 5,070 housing units and 11,739 people. All of the buildable residential lots in the City are under ¼ acre in size, which results in a rather large build-out population of over 20,000 people.

Table 2.13 Profile of Residential Lots in the City of Howell

Lot Size	% of Buildable Lots
5 + acres	0%
1 to < 5 acres	0%
½ to < 1 acre	0%
Under ½ acre	100%

It is highly unlikely that the City will reach its build-out population. Many of the residents already feel that it’s nearly built-out. The large discrepancy between current population estimates and the build-out analysis is likely due to the fact that much of the residential land is not developed on lots as small as the minimum lot size. Also, areas that could accommodate multiple family units may not necessarily be developed at these densities. Overall, housing densities are high and levels of imperviousness for the entire City are over 25% (Figure D in Executive Summary).

2.7 Infrastructure

The availability of infrastructure (roads, sanitary and storm sewer systems) or lack thereof will significantly impact land use, growth and water quality in the watershed. For instance, those areas with a sanitary sewer system will have the capability of having higher densities, whereas areas without infrastructure for sanitary waste disposal will need larger lot sizes to accommodate for OSDS. As such, these areas will tend to be lower in density. For those areas that are piped with sanitary sewers, the threats from failing septic systems is eliminated, however the threats from increased water inputs from point source discharges of stormwater from sewer systems will be a factor to consider. Alternatively, in areas that are not serviced by sanitary sewers or water supplies, those areas will require the use of OSDS and groundwater wells if suitable conditions allow those systems to be installed. As such, proper maintenance and operation of the OSDS will be crucial to ensuring water quality protection. In addition, the capacity of roadways, especially gravel roadways, to handle increases in traffic flow will be a significant factor to consider during land use planning. Given that most of the watershed is zoned for low-density and agricultural/rural residential, maintenance of roadways will be one of the most important operational procedures needing attention to ensure water quality protection.

2.7.1 Sanitary Sewer Systems

According to SEMCOG, as of 2003, Figure 2.34 (also in Appendix A) identifies the current and future sanitary sewered areas, as well as the major and minor waste water treatment plant (WWTP) locations in the watershed area. It appears that there will be adequate sanitary sewer infrastructure to handle the future growth anticipated for the watershed (Figure 2.35). The areas without sewer by 2030 are zoned low-density and agricultural/rural residential and will be handled by OSDS.

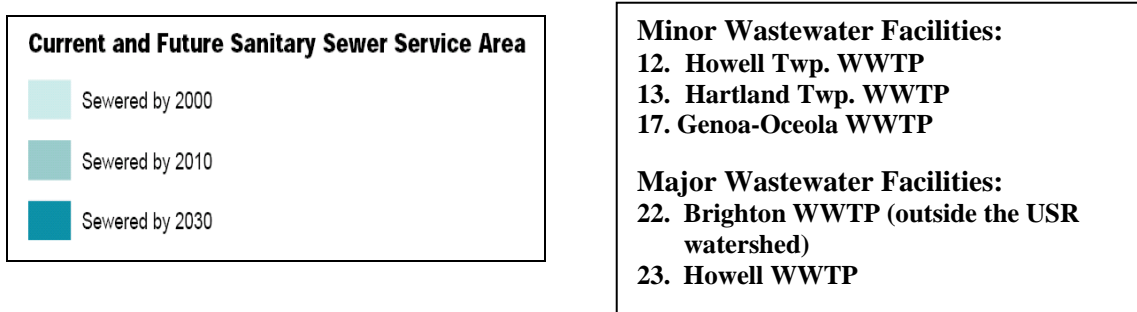
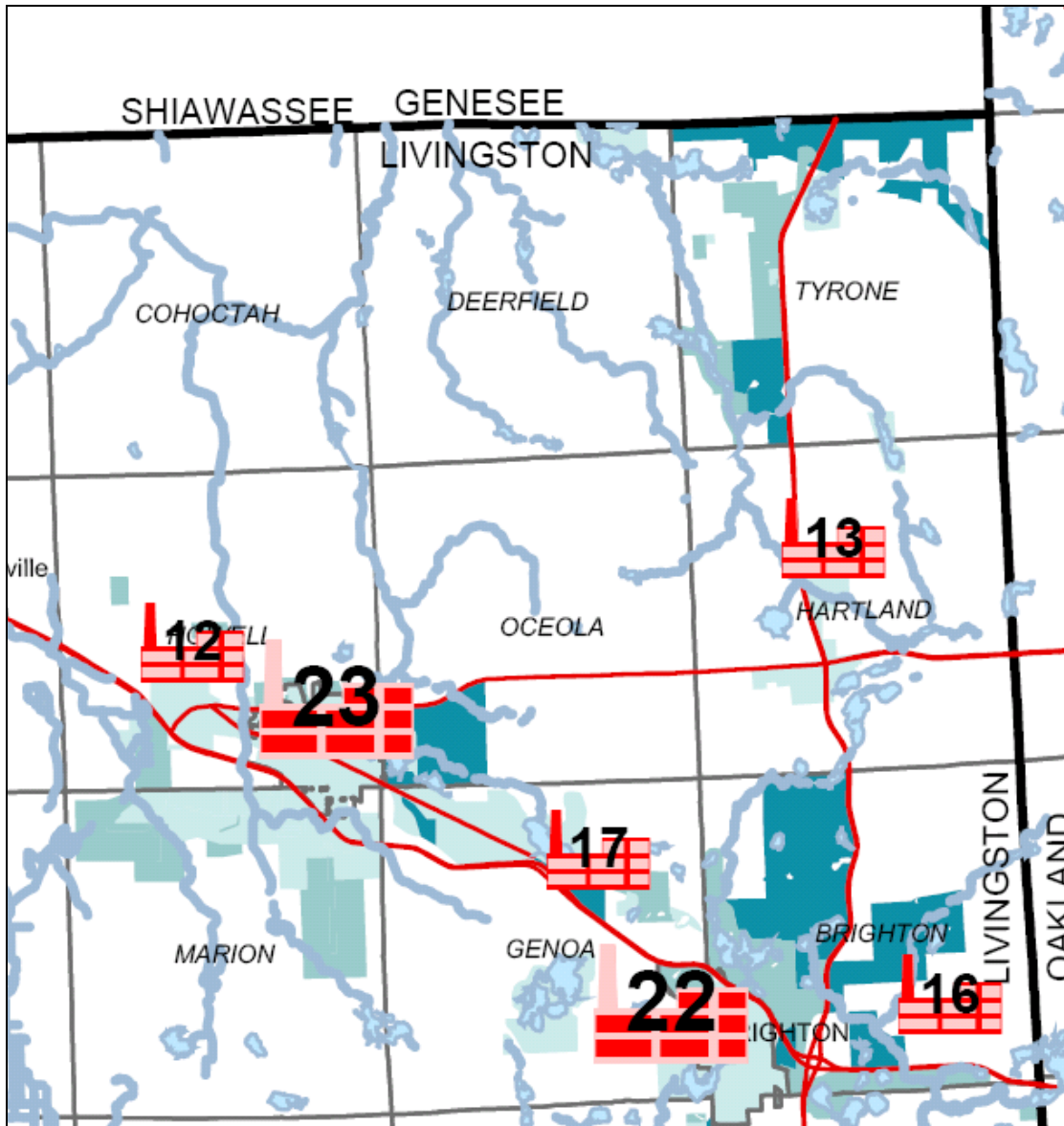


Figure 2.34 Current and Future Sewered Areas and Major and Minor Waste Water Treatment Plants in the Upper-2 Shiawassee River Watershed Area

Figure 2.35 (also in Appendix A) shows another representation of the current and future sewer service areas for the watershed area compared to the future land use plan.

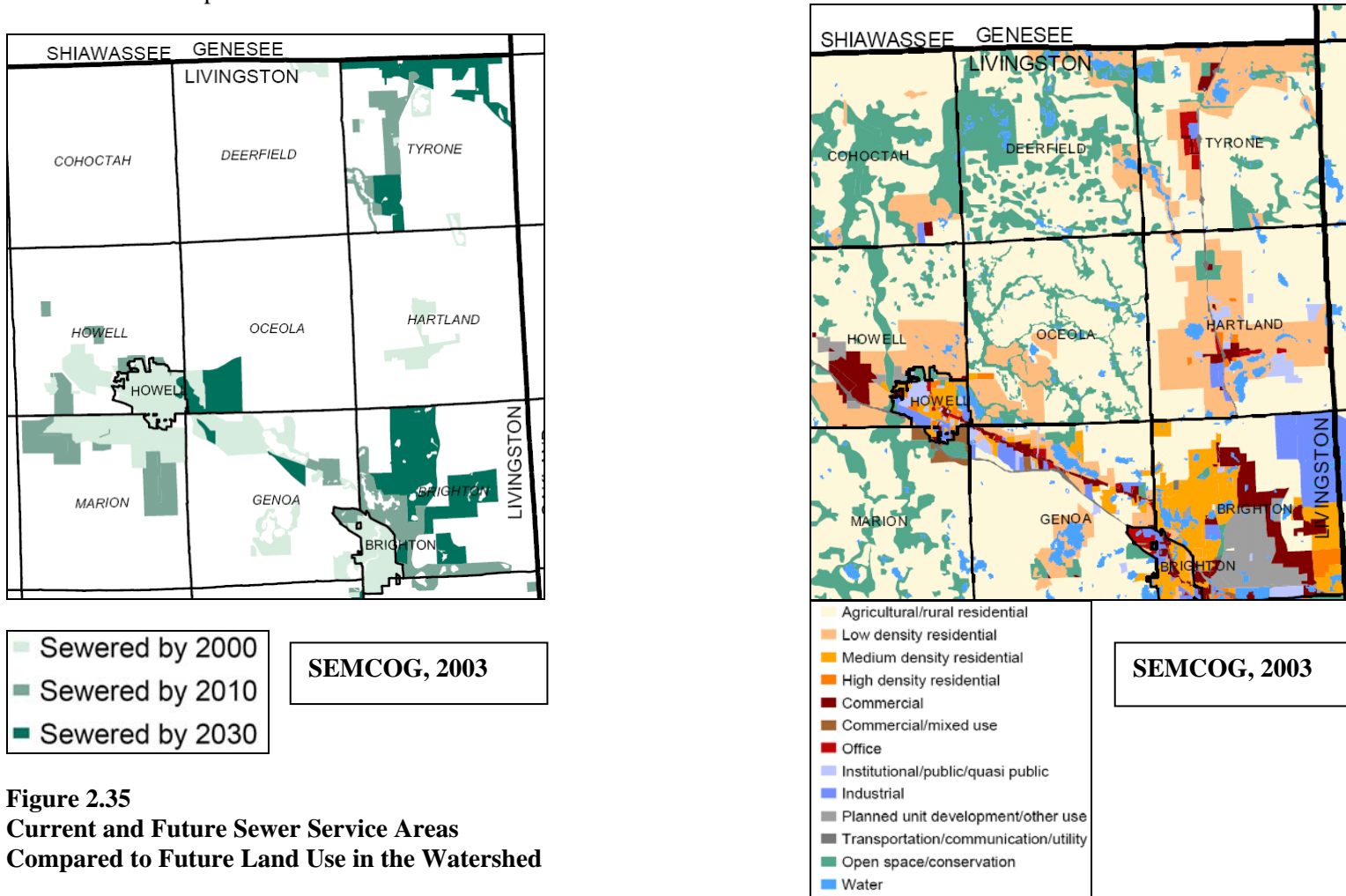


Figure 2.35
Current and Future Sewer Service Areas
Compared to Future Land Use in the Watershed

2.7.2 Onsite Sewage Disposal Systems (OSDS)

Approximately 70% of Livingston County residents utilize OSDS (LCDPH, 2005). It is important that these systems be properly operated and maintained due to the fact that failure of these systems can negatively impact both surface water and groundwater. Fluids may leak and contaminate nearby lakes, streams and groundwater aquifers that provide a source of potable source of drinking water for residents, businesses and schools. The LCDPH has an On-Site Sewage (OSS) Treatment Program. This is a replacement/repair program that aides in identifying failing and/or undersized OSDS and provides effective solutions to meet residential and commercial wastewater needs.

In the LCDPH's, "2004 Annual Report for Replacement of On-Site Sewage Treatment Systems", it was reported that the majority of the repair/replacements completed in 2004 were due to failure. Of the 251 systems evaluated in 2004, 67% of them failed due to age, as opposed to poor operation and maintenance (6%). The highest percentage of failure due to age occurred in systems that were greater than 25 years old (22.3%). The other two most common causes of system failure were due to marginal soils and excessive water usage. Other reasons cited for system failure at lower occurrences include high water table, lack of proper operation and maintenance, surface drainage patterns over the absorption area, undersized system, unsuitable fill material, and/or compacted soils. It is against the law in Livingston County for water softener backwash to discharge into OSDS; however, the LCDPH found that 45% of systems replaced in 2004 were receiving softener backwash.

Currently, the installation of new OSDS's are regulated by the LCDPH Sanitary Code. At this time, an inspection by the Health Officer is required after a new sewage disposal system is installed, but before any portion of the system has been covered or placed in operation. After the OSDS has been properly installed, there is no language in the Sanitary Code that refers to inspections of failing systems, per se. However, if a complaint is received, the Health Officer would inspect the site. The LCDPH website has a host of information on how to detect failing OSDS and how to properly maintain the system.

The sanitary code details the minimum isolation distances of OSDS to prevent a contamination event. Table 2.14 outlines the isolation distances.

Table 2.14 Required Minimum Isolation Distances for Single and Two-Family Dwellings

From	To Septic Tank (Feet)	To Absorption System (Feet)	To Sewer Line (Feet)
Wells	50	75 (a) (drywells 100)	10
Property Lines	10 (b)	10 (b)	10 (b)
Foundation walls	5	10 (drywells 25)	-
Foundation walls without footing drains	5	5	-
Surface waters	50	100	10
Pressurized water lines	10	10	-
Ravines, banks, drop-offs	5	15 (drywells 25)	5
Swimming pools	10	10	10
Designated county drains	50	50	50
Storm drains designed to lower groundwater table	25	50	25
Storm drains not designed to lower groundwater table	25	25	10

- (a) This minimum isolation distance may be decreased to 50 feet if the well construction meets the requirements of Chapter IV Water Supplies, Livingston County Sanitary Code.
- (b) This minimum isolation distance may be decreased to 5 feet at the discretion of the Health Officer.

Penalties for non-compliance with any of the language in Chapter III of the Sanitary Code results in the owner being guilty of a misdemeanor as provided in the Code and/or subject to civil penalties of not more than \$1,000.00 for each violation or day that the violation continues. A copy of the Code is available at: <http://co.livingston.mi.us/health/envirohealth/rr/hydro.html>.

At this point in time, an OSDS inspection ordinance does not exist for Livingston County; however, there are many neighboring counties (Washtenaw, Macomb, Wayne) that have enacted an inspection ordinance that requires point-of-sale inspections. Livingston County can utilize these ordinances as models to develop their own ordinance at some point in the future. Oakland County is going through the process of enacting an OSDS inspection ordinance at this time. In 2002, attempts were made to make changes to the health code that would require a time-of-sale inspection, as well as requiring inspections of OSDS every five years, but the change didn't gain enough public support and was dropped. The biggest issue that arose as a result of the desired change was that the inspection requirements would affect the real estate industry by holding up sales.

On a state level, legislation was introduced in early 2005 which would require MDEQ to create a model ordinance for counties interested in establishing new standards for the design, installation and maintenance of septic systems. The legislation would also require septic inspections to be performed before a property could be transferred or sold. Under Senate Bill 71, the state's proposed model ordinance provisions would require septic inspections conducted by the county, or a person authorized by the county who would be permitted to charge a fee and be required to provide an inspection report to the property owner. All actions recommended in the report would then need to be completed within a year from the inspection date (Elliot, K., *Spinal Column Newsweekly*, February 16, 2005). The bill would also allow the state's Strategic Water Quality Initiative Fund to provide up to \$5 million statewide to counties conducting inspections.

Though there may not be laws that can regulate inspections and maintenance on OSDS systems at this time in Livingston County, it is the hope that with ongoing education to private and public landowners utilizing OSDS that they will recognize any problems that may arise with their systems and correct them before harm is done to the environment.

2.7.3 Storm Sewer Systems

Many of the communities do not have extensive storm sewer system infrastructure at this time. A significant amount of the drainage network is made up of open drains and ditches. The storm sewer systems are more isolated to more built-up areas such as subdivisions and commercial or industrial areas that have curb and gutter. As such, stormwater drainage mainly occurs by overland flow rather than being collected in a catchment system and discharged from a point source discharge. Storm sewer infrastructure currently exists or is planned for developments that typically fall along the Grand River Avenue, US-23, M-59 and I-96 corridors. The LCDC and LCRC own the majority of the storm sewer point source outfalls throughout the watershed. Many of the open channel conveyance systems are privately-owned drains (see Appendix C for maps of the drainage system network for each watershed community).

2.7.3.1 Drain Maintenance

The LCDC is responsible for maintaining hundreds of miles of open and enclosed drains throughout Livingston County. In the USR watershed, the approximate lengths of drains that are required to be maintained by the LCDC are summarized in Table 2.15 below.

Table 2.15 Approximate Drainage Length Maintained in Watershed Communities

Community	Length in Feet	Length in Miles
Cohoctah Township	270,400	51.21
Deerfield Township	117,682	22.29
Genoa Township	42,290	8.01
Hartland Township	73,228	13.87
Howell Township	172,801	32.73
Marion Township	71,538	13.55
Oceola Township	112,350	21.28
Tyrone Township	5,438	1.03
City of Howell	9,600	1.82

The maps in Appendix C also show the wet weather point source discharge locations (storm sewer outfalls) that are owned and operated by the LCDC and LCRC. There are a much greater amount of outfalls owned and operated by the LCRC.

2.7.4 Groundwater Wells

All Livingston County residents get their drinking water from groundwater supplies. As of 2004, approximately 17,000 well logs have been entered into the LCDPH’s database. Annually, the county receives approximately 2000 new well permit applications.

There are programs in place in the County that ensure proper placement of wells that will protect the public health and safety. The LCDPH requires that a hydrogeologic investigation be completed for land division developments. This applies for those properties that would require use of either public or private water supply wells. Before the LCDPH will approve construction of a well, the developer must demonstrate that a “potable, adequate, reliable, and protected on-site water supply can be developed. Go to: <http://co.livingston.mi.us/health/envirohealth/rr/hydro.html> for the full scope of requirements of the mandatory hydrogeologic investigation.

The Sanitary Code outlines the following isolation distances of wells from contaminant sources as shown in Table 2.16.

Table 2.16 Isolation Distances of Wells from Contamination Sources

Isolation Distance*	Contamination Sources
*A well furnishing water for any beneficial use shall be located where it is not subject to contamination.	
At least 300 feet	Major sources such as large scale waste disposal facilities including but not limited to wastewater lagoons, municipal sewage treatment infiltration basins, etc. land application of sanitary wastewater or sludge, landfills and oil and gas well production facilities.
At least 150 feet	Preparation area or storage area of fertilizers, agricultural chemicals petroleum fuels or other chemicals that may result in contamination of the soil or groundwater.
At least 75 feet**	Buried sanitary sewer, sewage pump chamber, pressurized sewer or grease trap, septic tank, subsurface disposal field, dry well, seepage pit, cesspool, animal poultry yard, outhouse, other wastewater handling or disposal unit, liquid waste draining into the soil, chemical storage tank systems with secondary containment, or petroleum fuel or chemical storage tanks located entirely above grade or within an approved basement.

**This isolation distance can be reduced to 50 feet for sources of contamination as indicated provided that the well has been properly grouted and constructed under the requirements of Chapter IV of the Sanitary Code.

Note: Wells serving *public water supplies*, as defined in Act 399, Public Acts of 1976, as amended, shall be isolated from contamination sources in accordance with the requirements specified in the Administrative Rules for that Act.

According to MHOG, there are a number of naturally occurring chemicals and gases that are present in Livingston County’s groundwater. They include:

- Arsenic
- Manganese
- Nitrates
- Methane Gas

Most of these constituents are not harmful at certain concentrations and there are systems that homeowners can install to eliminate some of the unwanted constituents. For a small fee, the LCDPH will accept water quality samples from residents to test for nitrates and other chemical analyses to ensure that the drinking water supply is safe. The county also has a Wellhead Protection Program in place to aid in protecting the groundwater supply. The program focuses prevention programs in areas of the watershed that are at high risk for groundwater contamination. For a more in depth discussion of the constituents found in Livingston County’s groundwater and current programs to protect the drinking water supply, go to Section 4.4.3 in Chapter 4.

2.7.5 Roadways

The LCRC maintains over 500 miles of roadway in the USR watershed. Table 2.17 provides a summary of the miles of improved and unimproved roadways throughout the area.

Table 2.17 Miles of Roadway Maintained by the LCRCC in the Watershed

Road Surface	Miles
Primary Hard Surface Roads	120
Primary Gravel Roads	26
Local Hard Surface Roads	135
Local Gravel Roads	244

This equates to roughly 250 miles of paved surfaces and 270 miles of unpaved, or gravel/dirt surface roads that require regular grading, or around 50% of each type of road surface.

The most common types of nonpoint source pollutants associated with both paved and unpaved (unimproved) road surfaces are:

- Sediment
- Nutrients (attached to the sediment particles)
- Road salt
- Grease/oils
- Metals

One of the most significant water quality concerns identified in the USR watershed with stormwater runoff from roadways is sediment transport from both improved and unimproved roadways into streams and lakes. The predominant sources of the sediment are from:

- Bridge scupper drains provide a direct conduit for runoff carrying sediment to enter streams/drains from bridge surfaces where sediment easily builds up over time;
- lack of stabilized roadside ditches to convey the stormwater;
- lack of adequately designed roadside ditches to convey stormwater runoff without eroding the roadway (too shallow and/or narrow—or even nonexistent);
- erosion at road/stream crossings due to inadequate stabilization of banks and lack of vegetation to filter and slow runoff; and,
- soil erosion and offsite sedimentation from construction projects.

Public input has also indicated that contamination of lakes from road salt in stormwater runoff is impacting their water quality. See Chapter 4, Section 4.4.4.3 for more information on this topic.

A significant portion of the implementation efforts of this WMP will fall into BMP installation and maintenance for the roadways throughout the watershed. The BMPs selected will address:

- Street sweeping
- Catch basin cleaning
- Roadside ditch stabilization
- Stream crossings stabilization
- Bank stabilization
- Grade stabilization
- Sediment Controls & Traps

- Calibration of Road Salt Application Equipment
- Research into alternative road de-icing operations

Refer to Section 7.3 of Chapter 7 for a description of these BMPs. It's important to note that many of the BMPs selected for the unimproved roadways may take longer to implement since the funding for these projects comes only from the county. Projects associated with improved roadways may be able to be implemented more expeditiously considering funding comes from the state, as well. Prioritization for roadway BMP implementation will have to take this fact into account. Implementation projects could also be coordinated with scheduled construction projects.