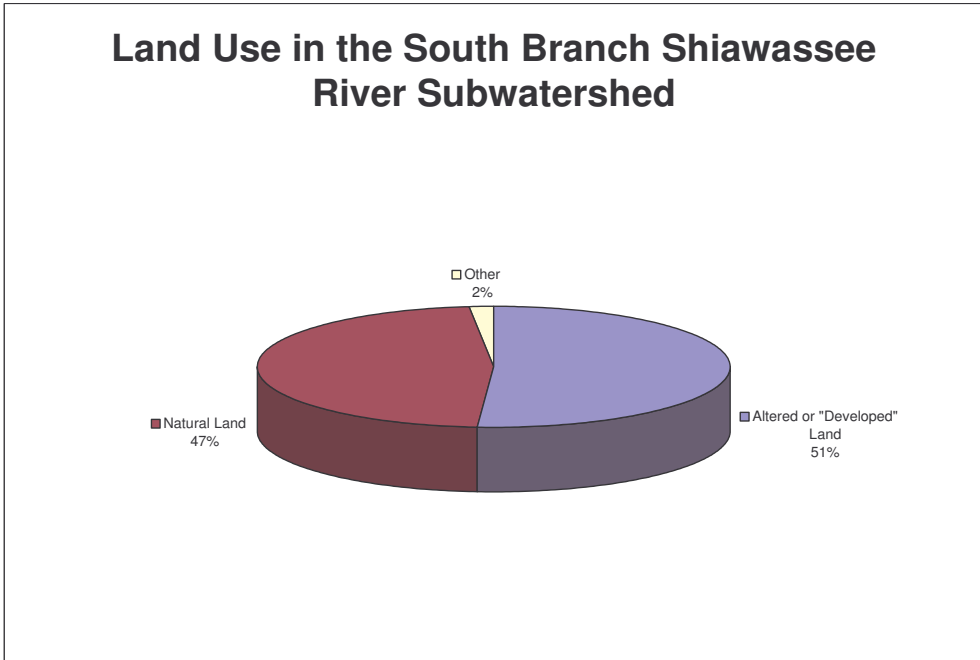


Watershed Survey Site Observations

Overall Watershed Condition:

Land Use: The entire South Branch Shiawassee River watershed is divided almost equally to being “developed” or altered land, and being “natural” land. The breakdown is as follows:

“Developed” or Altered Land:	51.2%
Agriculture:	28.3%
Under Development:	1.1%
Commercial/Office:	0.6%
Extractive:	0.3%
Industrial:	0.5%
Institutional:	0.4%
Transportation:	0.8%
Residential:	19.2%
Natural Land:	47.0%
Water:	2.9%
Wetlands/Woodlands:	24.8%
Grassland:	19.3%
Other:	
Cultural/Recreational:	1.8%



Values taken from GIS Mapping of SEMCOG 2000 Data

In general, it was noted that at many road/stream crossings, water runoff created small gullies down the road banks to the stream where water runs off from the roadways. In addition, given that most roads in the watershed are unimproved, there is a much greater chance that excessive sedimentation is occurring in the waterways.

South Branch Shiawassee River

Land Use: This subwatershed is predominately natural lands at 46.4%, which are comprised of water (1.5%), grassland and shrub (17.0%), woodland and wetland (26.9%) and cultural/recreational (1.0%). The next highest land use category falls into active agriculture at 32.6%. The majority of the remaining subwatershed land use is made up of 17.4% single-family residential. As with most of Livingston County, the subwatershed setting is very rural, with residential areas occurring in low-densities.

Community Involvement: This subwatershed touches into a total of eight communities. They are as follows:

- Small SW portion of Genoa Township
- Part of the eastern half of Marion Township
- Most of the City of Howell
- Over half of Howell Township
- Over half of Cohoctah Township
- Very NW corner of Deerfield Township
- Lower SE corner of Burns Township, Shiawassee County
- Lower SW corner of Argentine Township, Genesee County

General Observations: The watershed is quite large, covering 56.32 square miles (almost 34,000 acres) and drains 26.2% of the watershed. Most of the river corridor is flanked by wetlands or agriculture, with little riparian landownership along its length. There were six survey sites located throughout the watershed from the headwaters area to the boundary of Livingston and Genesee County. Of those six sites, two were sampled for *E. coli* and Total Phosphorus, and all sites were analyzed for Dissolved Oxygen Content (DO), pH, Temperature, Turbidity and Conductivity using a *Hydrolab* apparatus. The bacteria and phosphorus samples were analyzed at the Howell Township Waste Water Treatment Plant (WWTP). The results are shown in Table X below.

Table X South Branch Shiawassee River Water Quality Results									
Date	Site ID	DO (mg/L)	pH	Temp. (°F)	Turbidity	TDS	Conductivity (µmhos/cm)	Fecal coliform (organisms/100mL water)	P_{Total} (mg/L)
6.3.04	SB-07	9.50	8.07	62.3	9.5	444	695	169****	.083****
6.3.04	SB-13	10.86	8.10	62.8	7.3	466	729	n/s	n/s
6.3.04	SB-14	11.02	8.18	62.1	11.0	580	906	n/s	n/s
6.3.04	SB-15	12.59	8.28	64.3	0	540	848	n/s	n/s
6.3.04	SB-19	11.26	8.11	63.0	0	368	575	n/s	n/s
6.3.04	SB-20	12.04	8.01	65.7	0	341	533	18**	.021**

*** Sampled: 06/16/04

** Sampled: 06/21/04

Many of the surface streets throughout the watershed are unimproved, dirt roads.

Water Quality Impairments: The South Branch Shiawassee River was subjected to a significant contamination event of PCBs from 1969-1974 from the then Cast Forge Company, now known as Hayes-Lemmerz, Inc., located on the north side of M-59 along the east side of the South Branch Shiawassee River. As it stands now, the major threat to human health from the PCB contamination lies in the consumption of fish from the river—hence, there has been a Fish Consumption Advisory (FCA) for any and all fish in the river since 1977. The PCBs mostly reside in the sediments of both the river bed and its floodplain areas. The chemical is not suspended in the water column, as it is not readily water soluble. Remediation efforts have been conducted two times in the past, with more to come in the future. The design document for the remediation efforts has been scheduled to be complete on May 17th, 2004, and the work has been scheduled for July, 2004.

From studies completed by the MDEQ, Surface Water Quality Division, in 1995 and 2000, the data shows that there is a general decrease in both macroinvertebrate and habitat ratings--it is also known that the Marion and Genoa Drain is contributing significant nutrient loads (Total P), as well as high concentrations of Hexavalent Chromium to the South Branch. The South Branch has 2002 TMDLs for both poor fish and macroinvertebrate communities, as well as a 2009 TMDL for FCA-PCBs. It has been noted that from a point north of Chase Lake Road on the South Branch, nonpoint source loads on the watercourse are significant. Total Dissolved Solid (TDS) concentrations are also documented as exceeding Water Quality Standards (WQS) along this whole reach. There is evidence of eroding stream banks from unstable, flashy flows during rain events. Macroinvertebrate communities surveyed in 2000 were comprised of pollution-tolerant taxa and scored in the lower-half of the acceptable range. Total P concentrations downstream of the Marion and Genoa Drain continue to be elevated--all the way up to Chase Lake Road (before the bend where the Bogue Creek comes in); DO monitored at Mason and Byron Roads was found to average 7.1-7.2 mg/L; temperature average was 17.6 and 17.5 deg. C; average TDS was 550 and 545 mg/L, respectively. Water chemistry results showed levels of conventional pollutants to be lower than those observed in a similar study done in 1974. 1995 reports suggest that, with the exception of historical releases of PCBs to the South Branch, the discharge of toxicants does not represent a significant threat to the ecological health of the watershed. The primary impairment to the biological communities in this watercourse is related to physical habitat loss associated with drainage projects.

Marion and Genoa Drain

Land Use: This subwatershed is predominately natural lands, including water (0.1%) grassland and shrub (21.0%), woodland and wetland (20.8%) and cultural/recreational (2.2%) which adds up to 44.1% of the watershed's land use. The next highest land use

category falls into active agriculture at 25.6%. The remaining majority is made up of 18.8% single-family residential. As with most of Livingston County, the watershed setting is very rural, with residential areas in low-densities.

Community Involvement: There are three communities in all that are part of this subwatershed. They are as follows:

- NW half of Genoa Township
- NE corner of Marion Township
- Very small portion of the southern-most part of the City of Howell

General Observations: The subwatershed covers 11.85 square miles (just under 7,600 acres) and drains 5.1% of the watershed. The Marion and Genoa drain is one of three tributaries to the South Branch Shiawassee River and it joins the South Branch at Norton Road. The drain corridor is primarily flanked by wetlands, woodlands, agriculture, and industrial land uses. There is little riparian landownership. There were three survey sites located throughout the subwatershed from the headwaters area to its confluence with the South Branch Shiawassee River. Of those three sites, two were sampled for *E. coli* and Total Phosphorus, and all sites were analyzed for DO, pH, Temperature, Turbidity and Conductivity using a *Hydrolab*. The bacteria and phosphorus samples were analyzed at the Howell Waste Water Treatment Plant (WWTP). The results are shown in Table X below.

Table X Marion and Genoa Drain Water Quality Results

Date	Site ID	DO (mg/L)	pH	Temp. (°F)	Turbidity	TDS	Conductivity (µmhos/cm)	Fecal coliform (organisms/100mL water)	P _{Total} (mg/L)
6.3.04	MG-16	11.42	7.90	59.7	3.5	670	980	48**	.052**
6.3.04	MG-17	13.72	7.96	60.8	0	811	1262	n/s	n/s
6.3.04	MG-18	11.14	8.14	55.8	0	n/s	682	228**	.045**

** Sampled: 06/21/04

Many of the surface streets throughout the watershed are unimproved, dirt roads.

Water Quality Impairments: There is a 2007 TMDL established in the Marion and Genoa Drain for Hexavalent Chromium which has been detected in the drain in amounts that have exceeded WQS. It was found to be discharging from a storm sewer outfall just upstream of the Howell WWTP's effluent discharge pipe. It has been linked to the waste water discharge coming from Diamond Chrome Plating, Inc.

Previous sampling by the MDEQ in the year 2000 showed poor macroinvertebrate communities, and, in addition, the drain is suspected of contributing significant nutrient loads to the south branch of the Shiawassee River. The drain was also noted for having excessive algal growths during the summer months in 2000.

Bogue Creek

Land Use: Natural lands make up 50.0% of the subwatershed, comprised of 3.2% water, 24.3% woodland and wetland, 20.7% grassland and 1.8% cultural/recreational. Active agriculture is the next highest land use at 24.9%. Single-family residential comprises 20.6% of the subwatershed.

Community Involvement: The Bogue Creek subwatershed touches into five communities. They are as follows:

- a small, north-central portion of Genoa Township
- most of the western half of Oceola Township
- a very small portion of the City of Howell and Howell Township
- small portions of southwest Deerfield Township and southeast Cohoctah Township

General Observations: This subwatershed covers 40.48 square miles, almost 26,000 acres, and drains 17.3% of the watershed. It is the second of three tributaries to the South Branch Shiawassee River and meets the south branch at north of Jones Road, between Preston and Fisher Road. It runs throughout a very rural setting. There are two very large lakes that lie within the subwatershed—Lake Chemung in Genoa Township and Thompson Lake in the City of Howell and Oceola Township. Both of these lakes have a large number of riparian landowners and should be a good target for public education opportunities. There were five survey sites located throughout the subwatershed from the headwaters area to its confluence with the South Branch Shiawassee River. Of those five sites, three were sampled for *E. coli* and Total Phosphorus, and all sites were analyzed for DO, pH, Temperature, Turbidity and Conductivity using a *Hydrolab*. The bacteria and phosphorus samples were analyzed at the Howell Waste Water Treatment Plant (WWTP). The results are shown in Table X below.

Table X Bogue Creek Water Quality Results

Date	Site ID	DO (mg/L)	pH	Temp. (°F)	Turbidity	TDS	Conductivity (µmhos/cm)	Fecal coliform (organisms/100mL water)	P _{Total} (mg/L)
6.18.04	BC-08	8.72	8.19	70.2	17.5	317	620	147.5***	.062***
6.18.04	BC-09	9.06	8.14	68.8	16.4	405	631	218***	.073***
6.18.04	BC-10	6.38	7.85	68.9	0	310	501	n/s	n/s
6.18.04	BC-11	5.69	7.97	72.3	1.0	337	526	n/s	n/s
6.18.04	BC-12	9.28	8.15	69.8	0.9	396	618	135.5***	.055***

*** Sampled: 06/16/04

Water Quality Impairments: In a 1995 study, it was noted that there were no modifications to the stream. There is evidence of bank erosion on most bends due to extreme flow fluctuations, and fish communities contained low species diversity and abundance due to inadequate pool depth and lack of instream debris—not as a result of

water quality impairment. There is a 2009 TMDL for Thompson Lake for PCB-contaminated lake sediments—a fish consumption advisory is in effect for this lake, as well. There was a very comprehensive study done called the “Bogue Creek, A High Quality Natural Area in Livingston County” conducted by area residents and college professors. Of note, there were three identified immediate threats to the Bogue Creek. A former owner of land that bordered the west side of the creek in Section 19 of Oceola Township mined the land in preparation for development of a macro-subdivision. It is now owned by the Operating Engineers Local 324 who plan to maintain the parcel as a limited work area and it is hoped they’ll maintain the land in a way to prevent further runoff into the stream. The second threat comes from a land-application septage site along the east side of the stream in Section 19 of Oceola Township. It has been cited that improper dumping practices have occurred—in fact, there was an observation of sewage that had been dumped on the bank sloping down to the creek. The LCDPH was notified of the situation, and they are monitoring it. The LCDPH said they were closing down the site, but this will need to be verified. The third threat comes from a closed landfill on Fisher and Barron Roads in Section 13 of Howell Township. It is known to be leaching into surrounding groundwater and may be entering into the stream. Water testing in the stream should indicate if toxics are entering the stream from this source. Church Lake is a site that is monitored by the MDEQ for *E. coli* and it was reported to have exceeded WQS limits at one time. There aren’t any septage sites nearby, but there is a closed landfill. There isn’t any riparian landownership in the area either. The entire lake is surrounded by woodlands and wetlands.

Yellow River Drain

Land Use: The Yellow River Drain subwatershed is comprised of 48.7% natural lands—water at 2.6%, woodland/wetland at 30.2%, grassland at 15.8% and cultural/recreational at 0.1%. The second most used land use is active agriculture at 37.8%. Single-family residential comes in at 12.3%.

Community Involvement: This subwatershed touches into three communities:

- Very north-central portion of Oceola Township
- Bisects the western half of Deerfield Township
- Extends into the southwest corner of Argentine Township, Genesee County

General Observations: This watershed is roughly 15 square miles (about 9,500 acres) and drains 7.4% of the watershed. The Yellow River Drain is the third tributary to the south branch, meeting it up in Genesee County. There were three survey sites located throughout the subwatershed from the headwaters area to its confluence with the South Branch Shiawassee River. Of those three sites, two were sampled for *E. coli* and Total Phosphorus, and all sites were analyzed for DO, pH, Temperature, Turbidity and Conductivity using a *Hydrolab*. The bacteria and phosphorus samples were analyzed at the Howell Waste Water Treatment Plant (WWTP). The results are shown in Table X below.

Table X Yellow River Drain Water Quality Results

Date	Site ID	DO (mg/L)	pH	Temp. (°F)	Turbidity	TDS	Conductivity (µmhos/cm)	Fecal coliform (organisms/100mL water)	P _{Total} (mg/L)
6.18.04	YR-01	6.27	8.05	73.2	1.0	331	517	205.5***	.058***
6.18.04	YR-05	7.64	8.10	74.9	0	301	470	n/s	n/s
6.18.04	YR-06	8.62	8.07	68.1	0	332	515	153.5***	.026***

*** Sampled: 06/16/04

Water Quality Impairments: The MDEQ has monitored stations representing previously modified channels (dredged and straightened) that have all undergone some degree of recovery; results from 2000 survey showed that all water chemistry parameters were within expected ranges (Lundgren, 1994). The majority of the drain corridor is flanked by wetlands, woodlands and agriculture. Both Indian Lake and Faussett Lake are part of the subwatershed. Faussett Lake was studied in 2003 by WQI, Inc. and it was found to have problems with algal blooms, low dissolved oxygen and high total phosphorus content. Conductivity in the lake was found to be normal, so over-use of salt on the roads is likely not a problem in this area. The investigators suggested that lake residents use fertilizers without nitrogen or phosphorus. The researchers indicated that excess nutrient levels might also be coming from streams flowing into the lake. This drainage area makes up what would be considered the headwaters area of this subwatershed. Overall, the investigators noted that the lake suffers from poor water quality from time to time, likely from spring and fall-mixing (Fusilier, 2003).

The bridges at many of the road/stream crossings were constructed in the mid '50s, with some being relatively unstable. In addition, there were catch basin inlets constructed in some bridges where sediment was noted to build-up excessively on the bridge and could easily be washed into the river upon a rain-event.

Cranberry Creek

Land Use: The predominant land use in this subwatershed is active agriculture coming in at 46.6%--this is the most agricultural subwatershed out of the six others. Natural lands comprise 41.1% of the land use, followed by single-family residential at 11.2%--the lowest of all the subwatersheds (granted it is also the second smallest subwatershed in the watershed area).

Community Involvement: This subwatershed bisects Deerfield Township and its headwaters touch into small portions of Tyrone, Hartland and Oceola Townships.

General Observations: This subwatershed covers 12.11 square miles, almost 7,800 acres, and drains 5.2 % of the watershed. There have been some problems sited by the LCDPH with elevated *E. coli* levels associated with wet-weather events. It is of note that there are 3 land application septage sites located not too far from the Drain. There were three survey sites located throughout the subwatershed from the headwaters area to its confluence with the Yellow River Drain. All three sites were sampled for *E. coli*, Total

Phosphorus, DO, pH, Temperature, Turbidity and Conductivity using a *Hydrolab*. The bacteria and phosphorus samples were analyzed at the Howell Waste Water Treatment Plant (WWTP). The results are shown in Table X below.

Table X Cranberry Creek Water Quality Results

Date	Site ID	DO (mg/L)	pH	Temp. (°F)	Turbidity	TDS	Conductivity (µmhos/cm)	Fecal coliform (organisms/100mL water)	P _{Total} (mg/L)
6.18.04	CC-02	5.07	8.05	74.1	0	351	548	115***	.067***
6.18.04	CC-03	9.70	8.10	65.6	17.5	459	717	594***	.129***
6.18.04	CC-04	10.13	8.12	70.1	0.5	374	584	34**	.070**

*** Sampled: 06/16/04

** Sampled: 06/21/04

Water Quality Impairments: From 1995 to 2000, MDEQ survey results showed that there was a general decrease in fish and macroinvertebrate community ratings and habitat remained fairly unchanged. Evidence also suggested that upstream reaches of this watercourse are heavily impacted by agriculture. The riparian canopy has been removed and replaced with less than adequate vegetative buffer strips; The station near the center of the Cranberry Creek watershed had the presence of diverse instream cover (e.g. woody debris, undercut banks) which further suggests that water quality at this station is highly likely to be limiting the fish and macroinvertebrate communities. There is a 2007 TMDL for the Cranberry Creek upstream of the confluence with the Yellow River Drain for poor fish communities. Louis Lake is located in this subwatershed and is surrounded by wetlands. There is little riparian landownership along the length of this stream corridor.

North Ore Creek

Land Use: Natural lands comprise 49.4% of the land use, followed almost equally between active agriculture (26.2%) and single-family residential (21.2%).

Community Involvement: This subwatershed touches into the northeast portion of Oceola Township, covers approximately 75% of Hartland Township, touches into the southwest half of Tyrone Township, and covers the northeast quadrant of Deerfield Township.

General Observations: This is the largest subwatershed in the South Branch Shiawassee River watershed. It covers 63.4 square miles (just over 40,500 acres), and drains 27.1% of the watershed. There is a fair amount of riparian landownership along the length of this creek. It also passes through all different kinds of land use—agriculture, wetlands and woodlands. There were six survey sites located throughout the subwatershed from the headwaters area to its confluence with the Shiawassee River. Of those six sites, three were sampled for *E. coli* and Total Phosphorus, and all sites were analyzed for DO, pH, Temperature, Turbidity and Conductivity using a *Hydrolab*. The bacteria and phosphorus samples were analyzed at the Howell Waste Water Treatment Plant (WWTP). The results are shown in Table X below.

Table X North Ore Creek Water Quality Results

Date	Site ID	DO (mg/L)	pH	Temp. (°F)	Turbidity	TDS	Conductivity (µmhos/cm)	Fecal coliform (organisms/100mL water)	P _{Total} (mg/L)
6.29.04	NO-04	9.34	8.30	64.5	2.5	367	574	13**	.017**
6.28.04	NO-05	11.28	8.30	59.5	4.1	420	657	n/s	n/s
6.28.04	NO-06	8.40*	8.48	69.9	7.0*	411	643	132**	.036**
6.28.04	NO-07	10.80	8.29	64.8	0	434	678	44**	.005**
6.28.04	NO-08	11.18	8.33	59.9	6.2	365	570	91**	.058**
6.28.04	NO-09	10.20	8.34	65.8	7.3	336	526	n/s	n/s
6.28.04	NO-10	9.42	7.85	55.6	0	412	644	n/s	n/s

* Results in table from upstream impoundment. Downstream results instream for DO: 11.7 mg/L and Turbidity: 6.2.

** Sampled 06/21/04

Water Quality Impairments: Overall quality of this creek is good, but there is evidence of sedimentation and flashy flows from a point north of Clyde Rd in Hartland Township. Habitat degradation at Hogan Rd has been noted to be due to the flashy nature of the stream. There are a number of *E. coli* sampling sites along the North Ore that have exceeded WQS for the day, but the numbers aren't necessarily high enough to call for concern—longer sampling events would need to take place to verify that a problem existed. Problems with flooding at Hogan Road and near Bullard Lake along the creeks length have also been observed. In a 2000 MDEQ report, water clarity was noted as diminished from Clyde Rd to Shannon Lake.

Denton Creek

Land Use: This subwatershed is predominately natural lands at 58.8%. The next highest land use is single-family residential at 23.1%, followed by active agriculture at 14.0%—the lowest amount of agriculture out of all the subwatersheds.

Community Involvement: The Denton Creek subwatershed touches into Rose and Highland Townships in Oakland County, covers most of the northeast half of Tyrone Township and touches slightly into Fenton Township in Genesee County.

General Observations: This subwatershed covers 20.69 square miles, just over 13,200 acres, and drains 9.2% of the watershed. It is the third smallest subwatershed in the South Branch Shiawassee River watershed. It is the most densely populated subwatershed and has the least amount of agricultural use—although natural lands still comprise almost 60% of the subwatershed area. There were three survey sites located throughout the subwatershed from the headwaters area to its confluence with the North Ore Creek. Of those three sites, two were sampled for *E. coli* and Total Phosphorus, and all sites were analyzed for DO, pH, Temperature, Turbidity and Conductivity using a *Hydrolab*. The bacteria and phosphorus samples were analyzed at the Howell Waste Water Treatment Plant (WWTP). The results are shown in Table X below.

Table X Denton Creek Water Quality Results

Date	Site ID	DO (mg/L)	pH	Temp. (°F)	Turbidity	TDS	Conductivity (µmhos/cm)	Fecal coliform (organisms/100mL water)	P_{Total} (mg/L)
6.29.04	DC-01	10.28	8.20	68.3	0	342	535	6**	.017**
6.29.04	DC-02	5.92	7.76	62.7	0	275	432	26**	.042**
6.28.04	DC-03	10.48	8.26	68.9	1.2	350	547	n/s	n/s

** Sampled: 06/21/04

Water Quality Impairments: Evidence suggests that overall water quality is good; water quality information is limited to a water chemistry sampling event related to the lakes that receive the drainage from Denton Creek (Cooper, 2000). North Ore Creek is similar in that the information related to the stream is from several water quality studies for Shannon Lake. Goodfellow and Urban Lakes were shown to have nutrient enrichment—likely from nonpoint sources contributing excess Phosphorus levels—and are considered to be eutrophic lakes. Tipisco Lake, Sullivan Lake and Runyan Lake are almost completely flanked by riparian landowners. Much of the stream corridor runs through wetlands, and Hoisington, Urban and Goodfellow Lakes are surrounded by wetlands—no residents live around them.