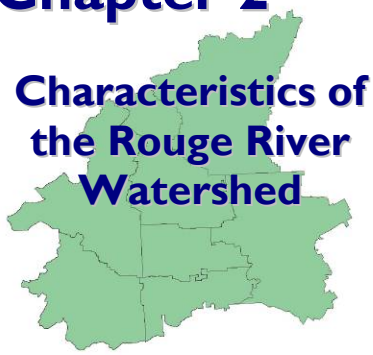
Chapter 2



Characteristics of the Rouge River Watershed

Introduction

The Rouge River is a small, coastal river in southeastern Michigan. Its watershed drains 466 square miles and is located within three counties and 48 communities. The Rouge River has four separate branches (Main, Upper, Middle and Lower) and stretches more than 126 miles in length before emptying into the lower 20 miles of Detroit River at Zug Island (Figure 2-1). More than 50 miles of the Rouge River flows through public parklands, making the Rouge River one of the most publicly accessible rivers in Michigan. There are over 400 lakes, impoundments, and ponds in the watershed.

The watershed is further split into seven storm water management areas, also referred to as subwatersheds: Lower 1, Lower 2, Middle 1, Middle 3, Upper, Main 1-2, and Main 3-4. Each subwatershed has multiple hydrologic unit codes (HUC) based on the reach (See Figure 2-2). HUCs are important because they assign each reach and tributary of the Rouge River a unique ID.

Due to its location, the Rouge River Watershed has unique challenges as it contains the most heavily populated and industrialized area within southeastern Michigan. These challenges are directly tied to the ranges in land use and land cover across the watershed. The watershed's three counties: Oakland, Wayne and Washtenaw, and 48 communities encompass land uses ranging from the highly urbanized areas of Detroit, Livonia and Southfield to the developing areas of Troy, Canton Township and Novi, to the rural areas of Salem, Superior and Van Buren townships.

HUCs are important because they assign each reach and tributary of the Rouge River a unique ID . . . These codes are referenced when applying for various funding sources through the State of Michigan.

Climate

Michigan's climate is a product of its latitude, its position on the North American continent, and its position relative to the Great Lakes. Average temperatures within the watershed range from 17.8°F at night during the coldest month of January to 83.4°F in July during the day (Catalfio et al., 2006). The Rouge River Watershed receives an average of 32 inches of precipitation annually and snow contributes roughly 10% to 15% of the total. There are 26 rain gages throughout the Rouge River Watershed that have collected continuous readings since 1994. Specific information from these rain gages may be found on the Rouge River National Wet Weather Demonstration Project (Rouge Project) website under the Watershed Monitoring Database Query Tool (www.rougeriver.com).

Lower Rouge Recreation Trail in Canton

Geology & Soils

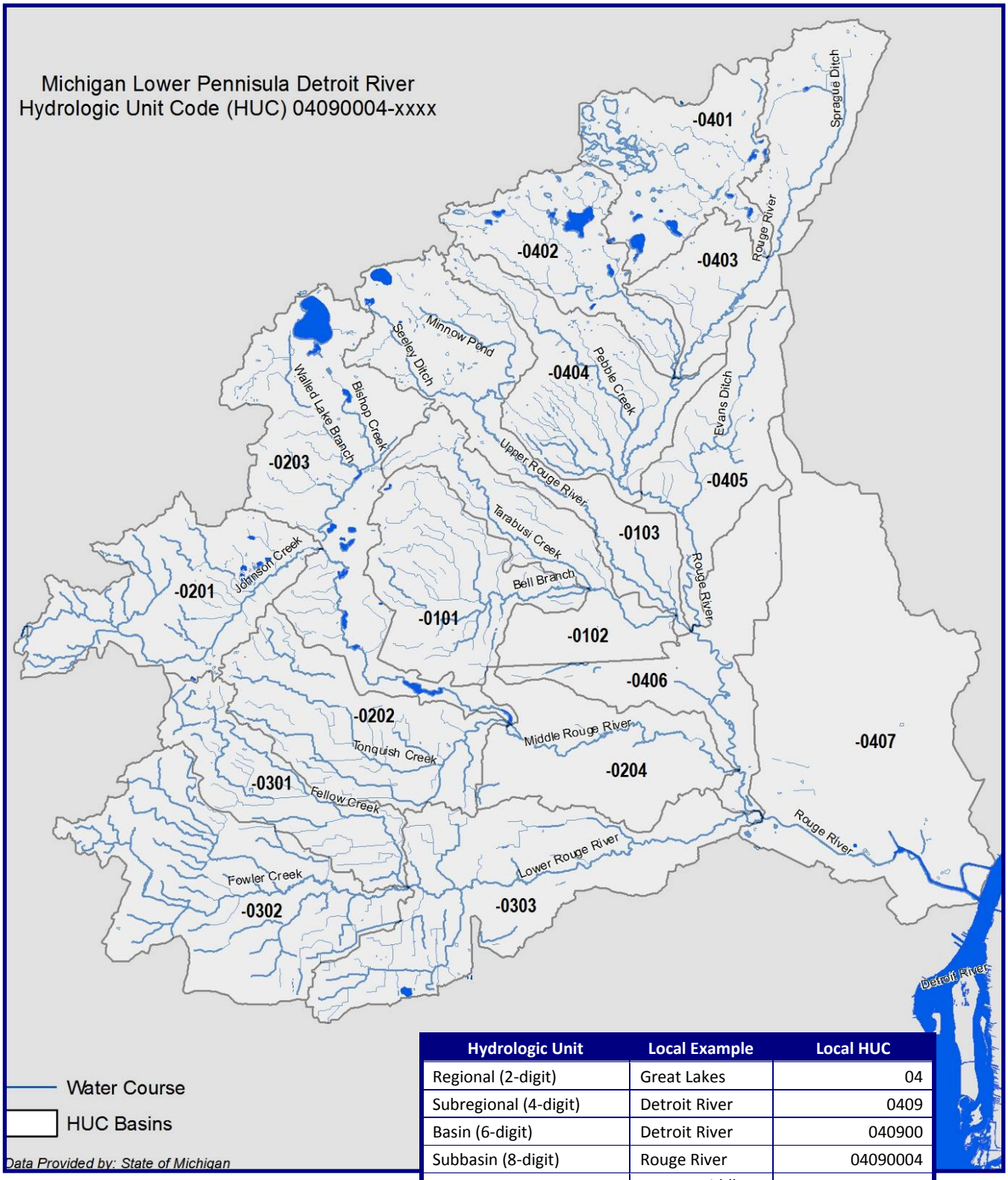
The soils of the Rouge River Watershed range from sands that allow rapid infiltration to tight clays that allow almost no infiltration. As a result of this variation, storm water best management practices must be chosen that are effective given the site specific geology.

The River Rouge Watershed is characterized by hilly or moderately undulating topography to the north and west and by relatively flat land to the southeast.

More than 50 miles of the Rouge River flows through public parklands, making the Rouge River one of the most publicly accessible rivers in Michigan.

Figure 2-1: Rouge River Watershed

Figure 2-2: Hydrologic Unit Code (HUC)



Hydrologic Unit	Local Example	Local HUC
Regional (2-digit)	Great Lakes	04
Subregional (4-digit)	Detroit River	0409
Basin (6-digit)	Detroit River	040900
Subbasin (8-digit)	Rouge River	04090004
Watershed (10-digit)	Upper, Middle, Lower, Main	04090004-01 to 04
Subwatershed (12-digit)	Figure 2-2	04090004-xxxx

Bedrock geology and soil conditions are important characteristics to evaluate when selecting storm water best management practices.

Most of the watershed was covered by waters of former glacial lakes. Sands and clays laid down in glacial lakes make up the surface deposits in the southeastern two-thirds of the watershed. Areas to the northwest are principally morainal deposits of retreating glaciers. These sandy areas allow fairly rapid infiltration of storm water. Altitudes in the morainal areas range from 900 to more than 1,000 feet above sea level. Altitudes gradually lessen toward the southeast to about 600 feet above sea level and down to 574 feet at the mouth of the Rouge River (Beam & Braunscheidel, 1998). Figure 2-3 shows the bedrock geology of the Rouge River Watershed.

The surficial geology (soil) of the Rouge River Watershed is primarily clay, a factor that the earliest settlers quickly discovered and put to use in making bricks. The first brickyard was established in 1799 by John Askin. Figure 2-4 shows the soil distribution throughout the Rouge River Watershed.

Almost 95% of the watershed contains silt loam or smaller particles. Heavier soils such as these have low permeability and do not lend themselves to percolation of rainwater into the ground and later slow release to the stream. Rather, they function as relatively impermeable surfaces which shunt surface water over contours into the lowest point -- the stream. (Beam & Braunscheidel, 1998).

Bedrock Geology groups:

- Antrim Shale,
- Bedford Shale,
- Berea Sandstone,
- Coldwater Shale,
- Detroit River Group
- Dundee Limestone
- Sunbury Shale
- Traverse Group

The soils within the Rouge River Watershed are categorized into hydrologic soil groups (see Figure 2-5), which is a description of their runoff-producing or infiltration characteristics. Topography along with vegetative cover is not considered in the classification of hydrologic soil groupings. Group A soils are well-drained sandy or gravelly materials with a high infiltration rate and low runoff potential. Group D soils, on the other hand, are soils having a very slow infiltration rate and thus a high runoff potential and are generally characterized as having a clay pan or clay lay near the surface. High water tables are also characteristic of these types of soils. Soils classified as Group B or C have characteristics intermediate of those soils in Groups A and D.

Groups A and B soil areas are generally suitable for storm water best management practices that promote infiltration.

Groups C and D soils dominate the watershed with interspersed areas of very sandy areas and low-permeable clay areas.

Hydrology

Surface Hydrology

There are four main branches within the Rouge River system. Three main tributary branches (Upper, Middle, Lower) flow into the Main Branch of the Rouge River and ultimately empty into the Detroit River. The Main Branch is approximately 44 miles long and originates at the Sprague Drain in Troy. Moving upstream from the mouth of the Rouge River four miles of the Main Branch from Michigan Avenue to the Turning Basin, were converted to a concrete channel in the 1970s to alleviate flooding in Dearborn, Dearborn Heights and Melvindale. The Lower Branch of the Rouge River joins the Main Branch in Dearborn, at Michigan Avenue and Evergreen (river mile 7.5). This branch is approximately 27 miles long and drains from the morains in Washtenaw County, across glacial lake plain, which results in a higher number of tributaries streams (Beam & Braunscheidel, 1998).

Figure 2-3: Bedrock Geology

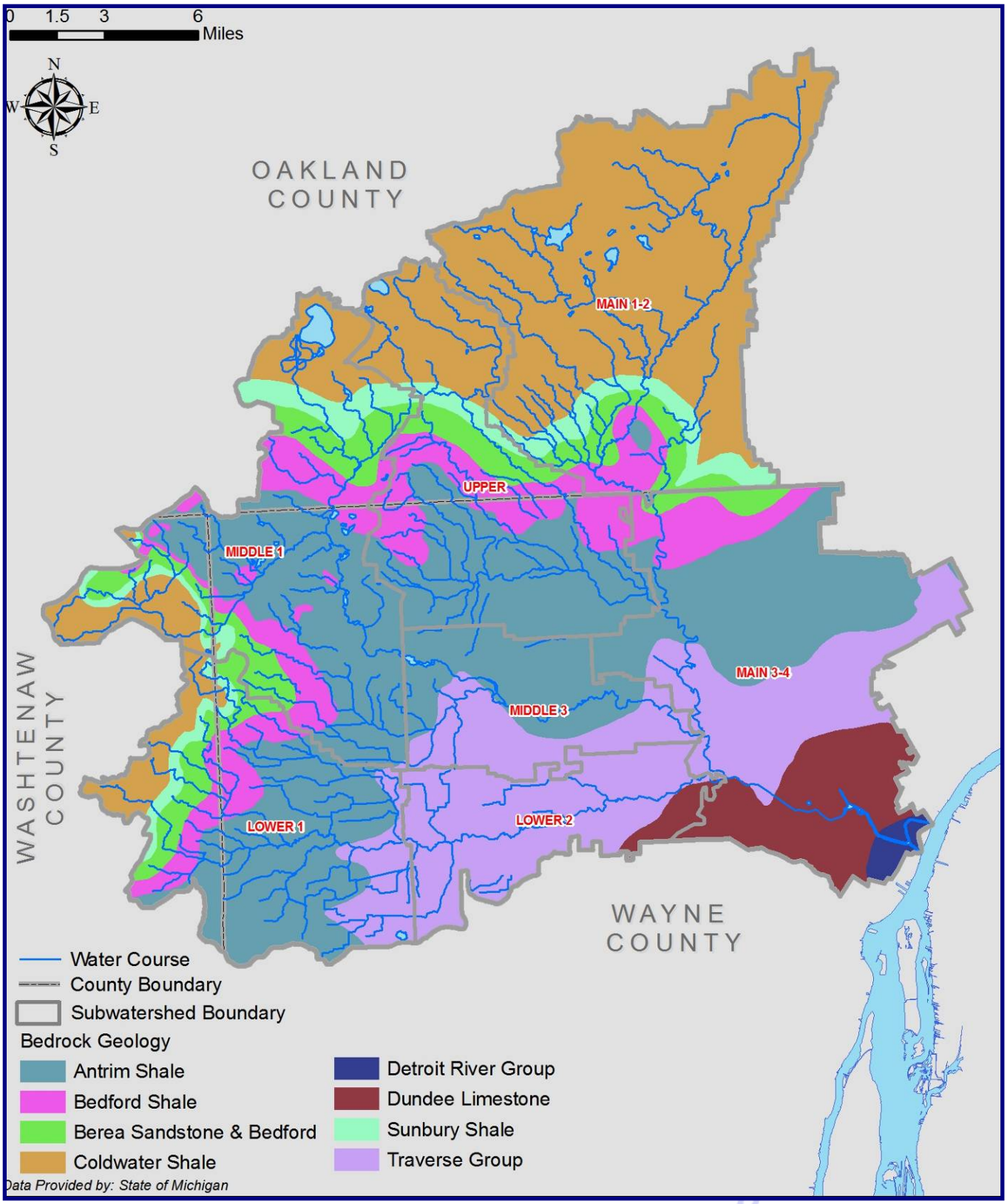


Figure 2-4: Soils

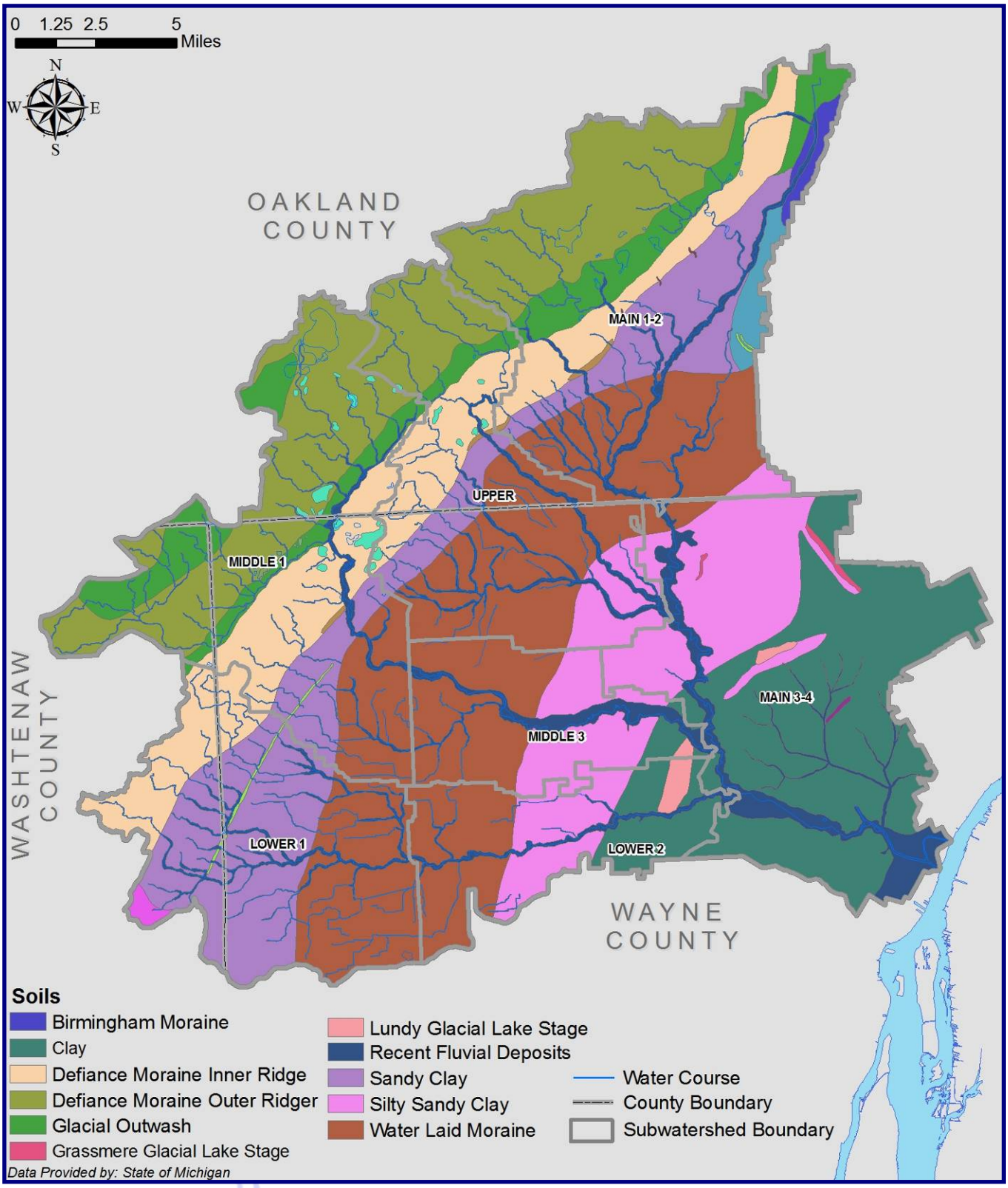
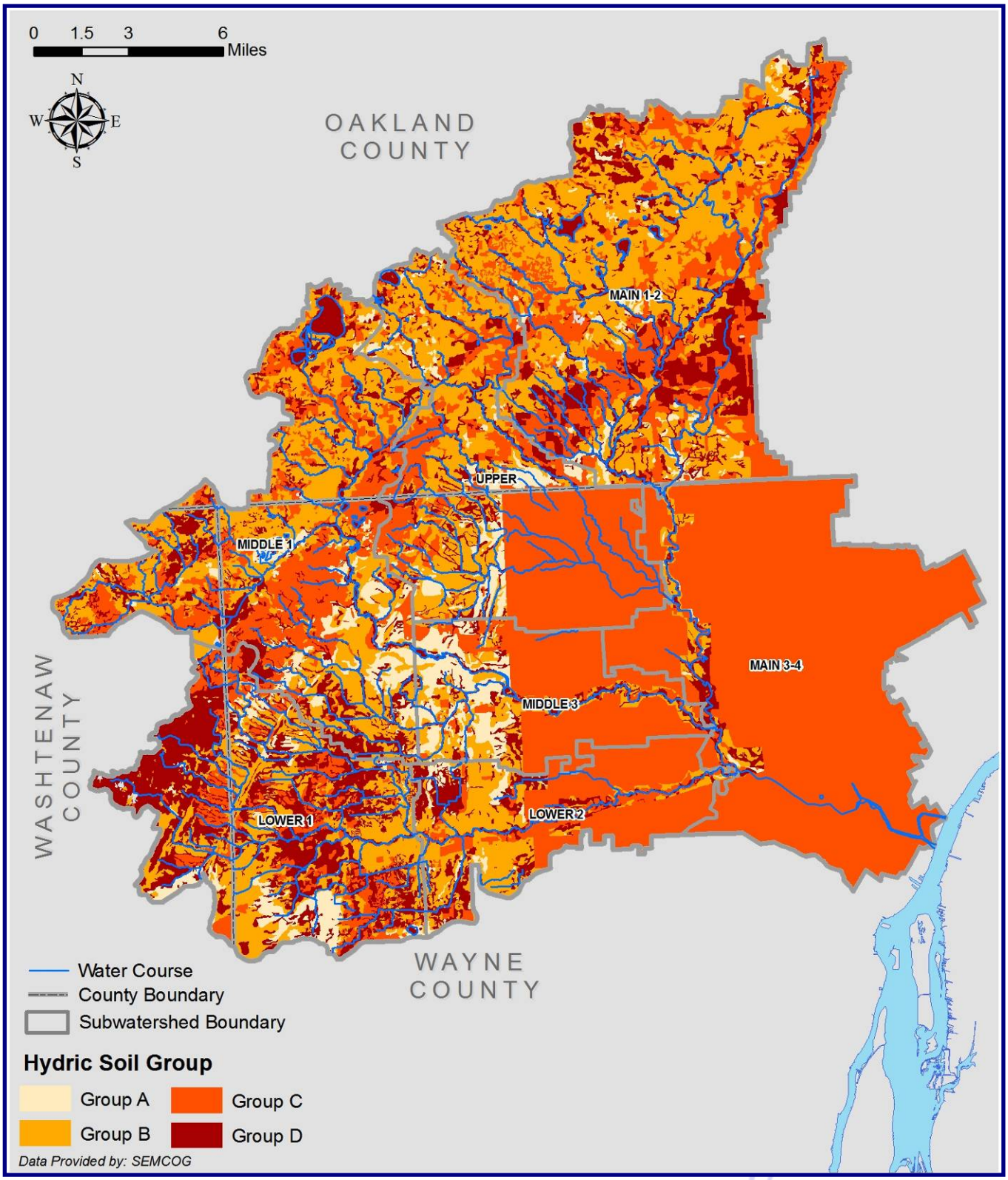


Figure 2-5: Hydrologic Soil Groups



The Middle Branch joins the Main Branch in Dearborn Heights, near Henry Ford Community College at Ann Arbor Trail and Outer Drive, (river mile 9.5). This branch is approximately 30 miles long and begins with two main tributaries: Bishop Creek and Walled Lake. The Walled Lake tributary contains Johnson Creek, the Rouge River's only cold water stream (MDEQ, 2007). The Upper Branch joins the Main Branch near the Redford Township/Detroit border, in Detroit's Eliza Howell Park (river mile 17). This branch is approximately 21 miles long and originates in wetlands from Novi and Farmington Hills (Beam & Braunscheidel, 1998).

Flooding along the Rouge River

The Rouge River has over 570 miles of rivers, streams and creeks. Approximately 17% of these are within public recreation areas. There are also over 400 lakes, impoundments, and naturally occurring ponds in the Rouge River Watershed ranging in size from less than an acre to 670 acres (Walled Lake). Most of the lakes and impoundments are located in the northern and western region (Beam & Braunscheidel, 1998).

A floodplain is an area next to a river, stream, or creek that may be covered with water following heavy rainstorms. The 100-year floodplain is land adjacent to a river, lake or stream that will be inundated by water during a flood which has a 1% chance of occurring in any given year. The floodplain holds the excess water allowing it to be slowly released into the river system and seep into groundwater aquifers. Floodplains also allow time for sediment to settle out of floodwaters, thereby keeping it out of water bodies.

Floodplains

Flooding has affected the development of the Rouge River Watershed throughout its history. The large number of parks adjacent to the Rouge River was initially established to prevent the recurring property damage from the frequent floods. As the development continued and the frequency and duration of the floods increased, the river was straightened and "smoothed" to allow the floods to pass quickly.

Flooding occurs when too much rainfall is quickly delivered to the river channels at a rate that exceeds the river's ability to transport the water away. Even before the Rouge River Watershed experienced extensive development, the areas adjacent to the river would flood regularly due to the predominant clay soils and the drainage pattern. As a result, there remains an extensive park system along most of the Rouge River. With increasing development and the loss of natural areas, the land has lost the ability to soak up storm water. Therefore, areas that were once effective sponges storing precipitation are now being replaced by buildings and pavement that have made the land increasingly impervious. As a result, floods have become more frequent.

Groundwater Hydrology

Groundwater hydrology contributes to streamflow in the watershed.

Small to moderate quantities of groundwater are available nearly everywhere in the Rouge River basin from aquifers in the glacial drift or bedrock. The glacial drift is composed of clay, silt, sand, gravel, and stones deposited by glaciers and glacial melt waters. The relative proportions, degree of sorting, and thickness of these materials control the availability of water from the drift aquifers. Sands and gravels will generally yield larger quantities of water than deposits of clays, silts, or fine sand. The more favorable water-bearing rocks in the glacial drift are not extensive and therefore limit the aquifer as a source of abundant water supply. It is for this reason that the majority of watershed communities are served by the Detroit Water & Sewerage Department, which obtains its water from the Detroit River and Lake Huron (Beam & Braunscheidel, 1998).

Dams

Historically dams have been constructed across the watershed for a variety of reasons including hydropower, recreational impoundments, flood control, etc. The Rouge River is highly fragmented by 62 dams: 26 are on the Main Branch and its headwater tributaries; 12 are in the Upper Branch; 18 are in the Middle Branch, and six are in the Lower Branch. Only nine of the 62 dams allow fish to pass. Additionally, two dams are especially problematic because they isolate the watershed from the Detroit River and Lake Erie ecosystem. These are at Wayne Road in the City of Wayne on the Lower Rouge River and at the Henry Ford Estate in Dearborn on the Main Branch (Beam & Braunscheidel, 1998).

Dams hinder fish passage from the Detroit River to headwater areas. Modifications to allow fish passage are crucial to long-term fish population improvements.

The Wayne Road dam is located on the Lower Rouge River, has a three-foot head, and blocks all but the largest salmonids from upstream passage. The Henry Ford Estate Dam is a hydroelectric dam which has a 12-foot head and effectively bars all fish passage upstream to the Upper, Middle and Main branches of the Rouge River.

Henry Ford Estate, Dearborn

Significant Natural Features

Natural features consist of ecological resources such as stream, lakes, wetlands, vegetation, and woodlands, but also include steep or unique slopes and rock formations. Other natural features may have one or more of the following characteristics: vital to the surrounding ecosystem; support other rare features or animals; vital to maintaining water quality; prevent erosion or add beauty to the surrounding area.

Pre-Settlement Natural Features

During the pre-settlement era, the Rouge River Watershed was comprised of abundant wetlands and permeable soil that worked to reduce the frequency and severity of flooding caused by snowmelts and rainstorms. Although the river has always been subject to flooding in the lower portions due to soil types and a relatively low gradient, the headwater areas historically have had stable flows and clear, cool waters. This is evidenced by the presence of a federal whitefish and trout hatchery in Northville in the late 1800s. During pre-settlement times, tributaries flowed through a complex system of upland forests, meadows, and various types of wetlands providing food, shelter, and breeding places to a variety of plants and animals. It has been estimated that prior to European settlement, 80 percent of the watershed was forested. From the pre-1800s to 1978 vegetative data has changed significantly with the largest proportion of land changing into urban or agricultural uses.

Historical Vegetation Included:

- Beech Sugar Maple Forest
- Oak Hickory Forest
- Mixed Oak Savanna
- Mixed Hardwood Swamp
- Wet Prairie
- Cedar Swamp
- Black Ash Swamp
- Muskeg/Bog
- Mixed Oak Forest
- Shrub Swamp/Emergent Marsh
- Mixed Conifer Swamp

Current Land Cover

The Rouge River Watershed is one of the most urbanized watersheds within the State of Michigan with a large percentage of natural features having been altered or removed. Green infrastructure such as wetlands, woodlands, open space, and grasslands are vital to the health of the watershed and Table 2-1 shows the 2002 land cover in the Rouge River Watershed.

Measuring current land cover conditions and how they are changing is achieved through a land cover classification, which quantifies the current land cover in a series of thematic categories. Using remotely sensed imagery and semi-automated classification methods provides a cost-effective and accurate means to derive this information.

For this project, Sanborn acquired and utilized the United State Geologic Survey (USGS) leaf-off imagery with four bands of data, including near infra-red (IR). This imagery was collected in the spring of 2008 by the USGS. Sanborn used semi-automated land classification techniques to classify the imagery into a five-category land cover dataset (Level 1) that includes an impervious category. More can be learned about his land cover dataset at the following link from the Sanborn website: http://www.sanborn.com/2009_REVISE/products/LCMenhanced.htm.

While land use has been utilized for storm water planning efforts, land cover provides a more representative picture of watershed characteristics.

In 2009, the ARC contracted with the Sanborn Map Company of Ann Arbor, Michigan to acquire a land cover classification for the Rouge River Watershed. This dataset provides the ARC communities with a current inventory of its land cover and a means of monitoring change over time to ensure responsible watershed and land use management and planning.

Level 1 Land Cover Classification Scheme:
1 – Impervious
2 – Woody Land Cover
3 – Non Woody Land Cover
4 – Water
5 – Barren

The land cover dataset will be delivered in a format that is compatible for use in geographic information system (GIS) software. It is compatible for display and analysis using ArcGIS produced by the Environmental Systems Research Institute (ESRI) and CityGreen©, a software tool developed by American Forests that helps to evaluate and quantify the storm water and cost savings value of trees and other green infrastructure in the local environment.

Rouge Green Corridor workshop

The ARC believes that land cover is a better metric for monitoring and assessing environmental conditions than land use because land classifications are based on actual land cover conditions in a given area rather than on zoning designations and land parcel ownership data.

Green Infrastructure

One of the cornerstones of the Rouge River Watershed restoration is the enhancement of greenways, recreational opportunities and wildlife habitat to connect people to the Rouge River. Within the Rouge River Watershed there are over 300 parks, 33 public golf courses, 27 nature preserves and 20,000+ acres of parkland, which include 50 miles of riparian corridor. Recreational opportunities within the Rouge River Watershed extend from local community parks to golf courses to hiking and bike paths. These opportunities exist from the Middle Rouge River's Bennett Arboretum and its impoundments, such as Newburgh Lake, to the river's riparian corridors along Wayne County's Hines Parkway. The Lower Rouge boasts the Lower Rouge Recreational Trail in Canton, the Lower Rouge Parkway in Inkster and Ford Field in Dearborn. The Rouge River's Main Branch winds through the Rouge Green Corridor of Birmingham, Beverly Hills and Southfield then through Rouge Park, the City of Detroit's largest park and finally through the restored oxbow at The Henry Ford before it finds its way to the Detroit River.

Land Use

Existing

According to SEMCOG's 2000 Land Use data the Rouge River Watershed consists primarily of medium density residential, however this varies from community to community. Table 2-1 shows the 2000 Land Use breakdown per subwatershed.

Table 2-1: 2000 Land Use Breakdown

Rouge Subwatershed	Drainage Area (square miles)	Forest/Rural Open	Urban Open	Agricultural/ Pasture	Medium Density Residential	High Density Residential	Commercial	Industrial	Highways	Water/ Wetlands
Main 1-2	103 m^2	6%	5%	<1%	63%	5%	12%	2%	2%	5%
Main 3-4	91 m^2	2%	7%	0%	52%	4%	16%	14%	4%	1%
Upper	64 m^2	8%	7%	<1%	54%	5%	14%	4%	3%	4%
Middle 1	77 m^2	20%	6%	10%	32%	4%	7%	9%	3%	11%
Middle 3	36 m^2	6%	5%	<1%	49%	5%	14%	12%	1%	7%
Lower 1	62 m^2	20%	5%	25%	23%	1%	3%	9%	2%	12%
Lower 2	33 m^2	4%	6%	2%	51%	3%	13%	9%	1%	10%

Political Jurisdictions

The influence of human activities and development across the landscape are major driving forces in modifying the natural environment within this watershed, as all watersheds. This section summarizes the demographics that impact the environment.

Community Profiles

The Native Americans were the first to settle in the Rouge River Watershed followed by the French and the British. Because the Rouge River supplied them with food, water, and a mode of transportation, all these early settlers depended upon the river for their survival. In 1701, the first European settlement of Fort Pontchartrain in Detroit marked the beginning of 300+ years of development and population growth. The first known population data in the region indicates that there were approximately 500 people in the City of Detroit. In 1840, the first U.S. Census population data for the region indicated there were 103,064 people in southeast Michigan. Today, it is estimated that 1.35 million people live in the Rouge River Watershed.

The watershed population is expected to continue to increase by nearly 3.4% by 2035. Table 2-2 shows the land and population of each local unit of government in the Rouge River Watershed.

Alliance of Rouge Communities
OURS TO PROTECT
Working together, restoring the river

The Alliance of Rouge Communities (ARC) is a voluntary public watershed entity comprised of 40 municipal governments, tree counties and the Wayne County Airport Authority

Table 2-2: Land Area and Population for Rouge River Watershed Communities

Community	Acres in Watershed	Square miles in Watershed	Percent within the Watershed	Population within the Watershed
Allen Park	892	1.39	20%	5,434
Auburn Hills	192	0.30	2%	377
Beverly Hills	2,381	3.72	100%	10,202
Bingham Farms	783	1.22	100%	1,009
Birmingham	1,978	3.09	100%	19,556
Bloomfield Hills	3,196	4.99	100%	3,735
Bloomfield Twp.	16,304	25.47	99%	41,255
Canton Twp.	23,037	36.00	100%	84,037
Commerce Twp.	606	0.95	3%	1,153
Dearborn	15,650	24.45	100%	99,307
Dearborn Heights	5,302	8.28	71%	39,033
Detroit	38,546	60.23	44%	366,511
Farmington	1,707	2.67	100%	10,364
Farmington Hills	21,303	33.29	100%	80,419
Franklin	1,680	2.63	100%	3,059
Garden City	3,752	5.86	100%	27,588
Highland Park	886	1.38	47%	7,393
Inkster	3,695	5.77	92%	26,658
Lathrup Village	966	1.51	100%	4,087
Livonia	22,934	35.83	100%	94,733
Lyon Township	468	0.73	2%	310
Melvindale	1,772	2.77	100%	10,636
Northville	664	1.04	52%	3,231
Northville Twp.	10,629	16.61	100%	26,533
Novi	15,211	23.77	76%	41,566
Novi Twp.	86	0.13	100%	NA
Oak Park	80	0.12	2%	780
Orchard Lake Village	158	0.25	6%	140
Plymouth	1,431	2.24	100%	8,641
Plymouth Twp.	10,212	15.96	100%	26,634
Pontiac	449	0.70	3%	2,371
Redford Twp.	7,185	11.23	100%	48,267
River Rouge	1,376	2.15	77%	7,267
Rochester Hills	1,977	3.09	9%	6,502
Romulus	2,458	3.84	11%	2,581
Salem Twp.	10,235	15.99	47%	3,140
Southfield	14,983	23.41	89%	69,856
Southfield Twp.	102	0.16	2%	NA
Superior Twp.	10,130	15.83	45%	5,853
Troy	3,835	5.99	18%	14,531

Community	Acres in Watershed	Square miles in Watershed	Percent within the Watershed	Population within the Watershed
Van Buren Twp.	8,421	13.16	37%	10,234
Walled Lake	585	0.91	37%	2,579
Wayne	3,851	6.02	100%	17,956
West Bloomfield Twp.	11,081	17.31	56%	36,631
Westland	13,093	20.46	100%	81,882
Wixom	548	0.86	9%	1,306
Ypsilanti Twp.	1,097	1.7	5%	2,890
Total	**297,905**	**466**	**NA**	**1,358,226**

(***SEMCOG, 2008)***

Sanitary Sewer Service

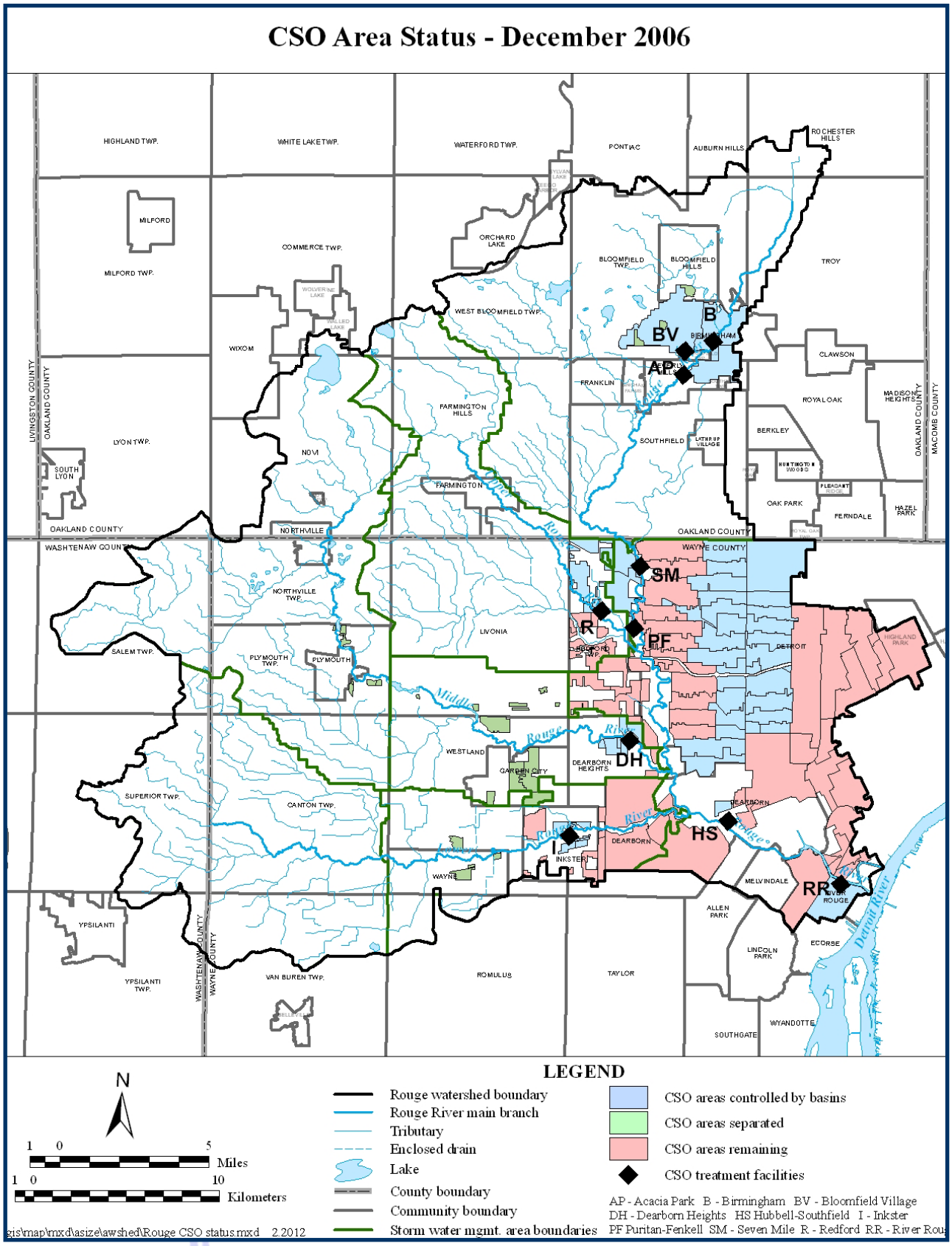
The Rouge River Watershed is served by combined sanitary sewers that carry wastewater and storm water, separate sanitary sewers, and onsite sewage disposal systems (OSDSs) which typical serve residential properties. Combined sewers will overflow to the Rouge River due to the inflow of storm water runoff during heavy rain events. Many of the combined sewer areas are now controlled by various treatment facilities; however, control facilities are still needed to reduce sewer overflows from areas of Dearborn, Dearborn Heights, Detroit, Highland Park, Inkster, and Redford Township as depicted in Figure 2-6.

Sanitary sewer overflows (SSOs) also occur in portions of the watershed. SSOs can occur in separated sanitary sewers that are subject to large amounts of storm water infiltration during heavy rain events, or if a sanitary sewer becomes blocked by an obstruction. SSOs can occur from local wastewater collection systems operated by the watershed communities and from the three interceptor transport systems in the watershed: the Evergreen – Farmington Sanitary Sewer System, the Rouge Valley Sewage Disposal System, and the Western Townships Utilities Authority system.

The Evergreen – Farmington System transports wastewater from portions of Farmington Hills, Beverly Hills, Auburn Hills, West Bloomfield Township, and Troy to the City of Detroit's Wastewater Treatment Plant for treatment and disposal.

The Rouge Valley Sewage Disposal System transports wastewater collected in portions of Canton Township, Dearborn Heights, Garden City, Inkster, Livonia, Northville, Northville Township, Novi, Plymouth, Plymouth Township, Redford Township, Romulus, Van Buren Township, Wayne, and Westland to the City of Detroit's Wastewater Treatment Plant for treatment and disposal.

Figure 2-6: Combined Sewer Drainage Areas



The Western Townships Utility Authority transports wastewater from portions of Canton, Northville and Plymouth townships to the Ypsilanti Community Sewer Authority for treatment and disposal. Improvements to the Evergreen – Farmington Sanitary Sewer System, the Rouge Valley Sewage Disposal System, and numerous community wastewater collection systems are being implemented under Final Orders of Abatement issued by Michigan Department of Environmental Quality (MDEQ) to reduce the frequency of SSOs from the respective sanitary sewer systems.

There are over 10,000 septic systems within the watershed which provide sewage treatment for individual properties. The communities with the most septic systems are Bloomfield Township, Farmington Hills, Franklin, Southfield and West Bloomfield Township as shown in Table 2-3. These communities are all located within the Upper and/or Main 1-2 Subwatersheds. The number of septic systems was estimated based on the best information available to the community. Some communities had more detail information than others.

Table 2-3: Number of Septic Systems by Community

Community	Estimated Number of Septic Systems*
Allen Park	0
Auburn Hills	0
Beverly Hills	1
Bingham Farms	0
Birmingham	3
Bloomfield Hills	12
Bloomfield Twp.	3,106
Canton Twp.	350
Commerce Twp.	X
Dearborn	70
Dearborn Heights	0
Detroit	75
Farmington	2
Farmington Hills	2,000
Franklin	900
Garden City	12
Highland Park	0
Inkster	0
Lathrup Village	0
Livonia	144
Lyon Township	X
Melvindale	2
Northville	16
Northville Twp.	905

Community	Estimated Number of Septic Systems*
Novi	496
Novi Twp.	X
Oak Park	0
Orchard Lake Village	0
Plymouth	0
Plymouth Twp.	306
Pontiac	0
Redford Twp.	50
River Rouge	19
Rochester Hills	0
Romulus	N/A
Salem Twp.	987(est.)
Southfield	1,536
Southfield Twp.	0
Superior Twp.	1,485 (est.)
Troy	0
Van Buren Twp.	X
Walled Lake	7
Wayne	0
West Bloomfield Twp.	2,750
Westland	28
Wixom	0
Ypsilanti Twp.	325 (est.)

*X = Septics present, but quantity unknown.