Michigan Department of Environmental Quality

Water Bureau

Total Maximum Daily Load for *E. coli* for the Detroit River

Wayne, Oakland and Washtenaw County, Michigan

Public Notice Draft
June 20, 2008

1.0 INTRODUCTION

Section 303(d) of the federal Clean Water Act and the United States Environmental Protection Agency's (USEPA's) Water Quality Planning and Management Regulations (Title 40 of the Code of Federal Regulations, Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies that are not meeting water quality standards (WQS). The TMDL process establishes the allowable loadings of pollutants for a water body based on the relationship between pollution sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reductions necessary from both point and non-point sources to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify the allowable levels of *E. coli* that will result in the attainment of the applicable WQS in the Detroit River, located in Wayne County, Michigan.

The Detroit River is a unique water body in that it is a connecting channel between two of the Great Lakes (Huron and Erie) and is an international water body. Its watershed consists of United States (U.S.) and Canadian lands and its water surface is divided by the international boundary. As an important ecological and navigational waterway, the management of the Detroit River is accomplished with guidance from a Bi-national Agreement that is coordinated by the International Joint Commission.

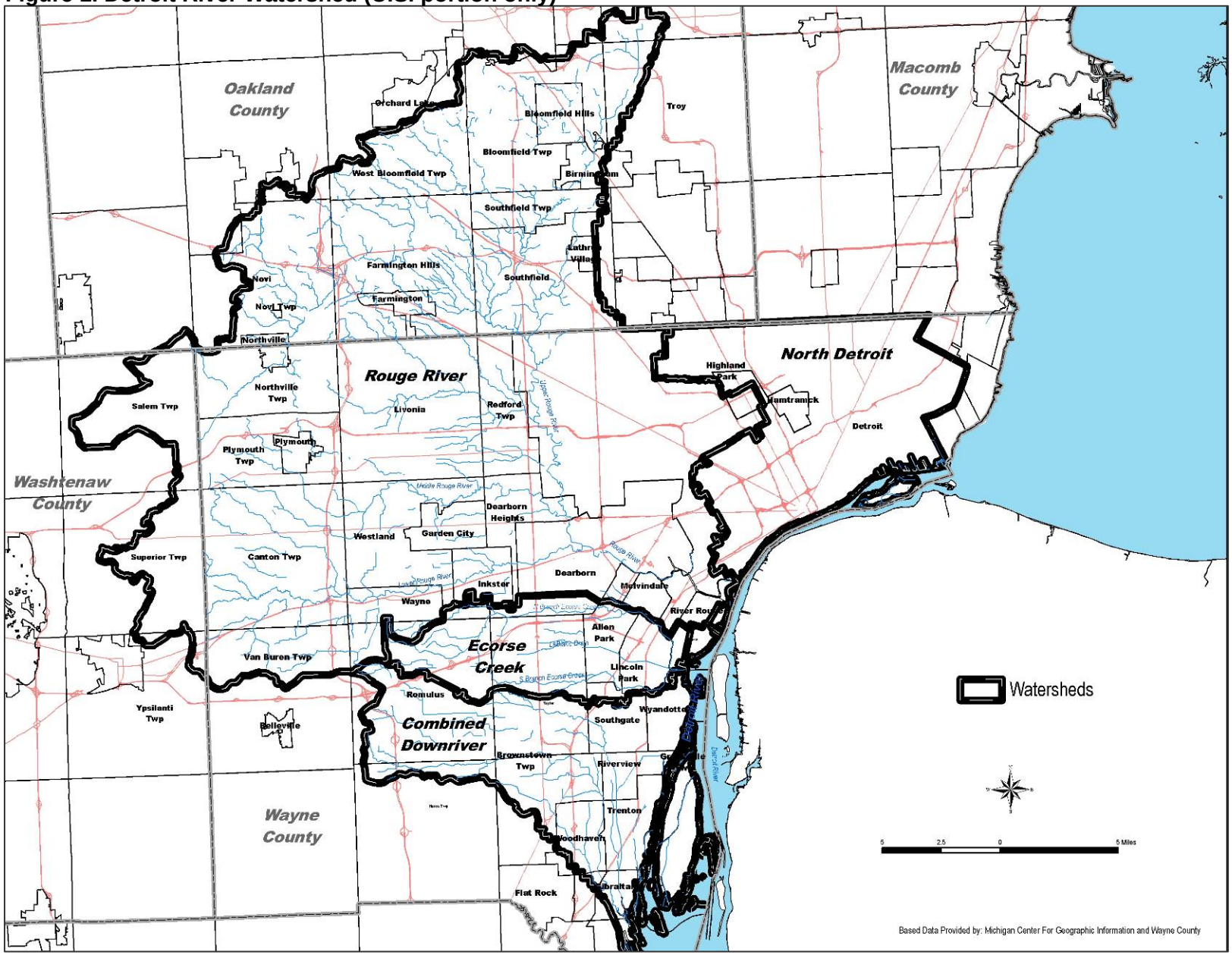
This U.S. *E. coli* TMDL does not apply to sources of *E. coli* within the Canadian portion of the Detroit River watershed, although those sources contribute to the measured water quality impairments. Consequently, it is necessary to proportion the Detroit River flow to calculate a loading capacity that accounts for, and allocates, U.S. loads only. This TMDL acknowledges that achieving water quality standards will require continued cooperation between the U.S. and Canada under the Bi-national Agreement in addition to successful implementation of this TMDL by U.S. agencies and stakeholders.

The U.S. side of the Detroit River watershed includes portions of Oakland, Wayne, and Washtenaw counties in southeast Michigan. Portions of Ontario, Canada, also drain to the Detroit River. There are four subwatersheds in the U.S. portion of the watershed: Rouge River, Ecorse River, North Detroit, and Combined Downriver (See Figure 1). The Rouge River is the largest subwatershed comprising 69% of the Detroit River watershed in the U.S. The Ecorse River subwatershed makes up another 6% of the watershed. The MDEQ developed, and the USEPA approved, an *E. coli* TMDL for the Rouge River in 2007 (MDEQ 2007). The Ecorse River *E. coli* TMDL is currently under development. Together, these two TMDLs address sources of *E. coli* in 75% of the U.S. Detroit River watershed.

The Detroit River *E. coli* TMDL has been developed consistent with the allocations provided in the draft and final *E. coli* TMDLs for the Ecorse and Rouge rivers, respectively, and does not attempt to further address *E. coli* sources in those watersheds. Implementation of the Ecorse River and Rouge River *E. coli* TMDLs will result in attainment of the total and partial body contact designated use at their confluence with the Detroit River. Implementation of the Detroit River *E. coli* TMDL relies on concurrent implementation of the of *E. coli* TMDLs for the Rouge and Ecorse rivers.

The remaining drainage areas in the Detroit River watershed are comprised of the Combined Downriver and North Detroit subwatersheds. Both subwatersheds are located entirely within Wayne County. The Combined Downriver area is drained by the Frank and Poet Drain, Brownstown Creek and Blakely Drain.

Figure 1. Detroit River Watershed (U.S. portion only)



The Combined Downriver area comprises 13% of the U.S. Detroit River watershed. Approximately 31% of the Combined Downriver subwatershed drains directly to the Detroit River via overland flow and sewers, including a combined sewer system in Wyandotte and a portion of Southgate. Grosse Ile, an island in the Detroit River, is part of the Combined Downriver subwatershed.

The North Detroit subwatershed comprises 12% of the U.S. Detroit River watershed. The City of Detroit represents most of the land area in this subwatershed. The City of Detroit is almost entirely drained by a combined sewer system, which includes 46 outfalls along the Detroit River shoreline. The remainder is drained by separate storm sewers, which discharge directly to the Detroit River. The communities of Hamtramck, Highland Park, River Rouge, and Ecorse are fully or partially located in the North Detroit subwatershed.

2.0 PROBLEM STATEMENT

The TMDL reach for the Detroit River appears on the Section 303(d) list as:

Water Body Name: Detroit River **AUID:** 040900040001-01

Impaired Designated Use: Partial Body and Total Body Contact Recreation

Cause: *Escherichia coli* **Size:** 23.73 miles

Location: Lake Erie u/s to Lake St. Clair. Excludes 2 miles of Critical Assessment Zones of Detroit River drinking water intakes.

TMDL Year: 2008

The Detroit River was placed on the Section 303(d) list due to the presence of combined sewer overflows and *E. coli* levels exceeding Michigan's water quality standard (WQS) for total and partial body contact recreation. Monitoring data collected by the Michigan Department of Environmental Quality (MDEQ) in 2007 documented exceedences of the WQS for *E. coli* during the total body contact recreational season of May 1 through October 31. Elevated *E. coli* levels have been observed through the years in sampling conducted on this water body by the City of Detroit.

3.0 NUMERIC TARGET

The impaired designated uses addressed by this TMDL are total and partial body contact recreation. The designated use rule (R 323.1100 of the Part 4 rules, WQS, promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended) states that this water body is to be protected for total body contact recreation from May 1 to October 31 and partial body contact recreation year-round. The target levels for this designated use are the ambient *E. coli* standards established in Rule 62 of the WQS as follows:

R 323.1062 Microorganisms. Rule 62. (1) All waters of the state protected for total body contact recreation shall not contain more than 130 E. coli per 100 milliliters, as a 30-day geometric mean. Compliance shall be based on the geometric mean of all individual samples taken during 5 or more sampling events representatively spread over a 30-day period. Each sampling event shall consist of 3 or more samples taken at 2 representative locations within a defined sampling

area. At no time shall the waters of the state protected for total body contact recreation contain more than a maximum of 300 E. coli per 100 milliliters. Compliance shall be based on the geometric mean of 3 or more samples taken during the same sampling event at representative locations within a defined sampling area. (2) All surface waters of the state protected for partial body contact recreation shall not contain more than a maximum of 1,000 E. coli per 100 milliliters. Compliance shall be based on the geometric mean of 3 or more samples, taken during the same sampling event, at representative locations within a defined sampling area.

The target for sanitary wastewater discharges is:

Rule 62. (3) Discharges containing treated or untreated human sewage shall not contain more than 200 fecal coliform bacteria per 100 milliliters, based on the geometric mean of all of 5 or more samples taken over a 30-day period, nor more than 400 fecal coliform bacteria per 100 milliliters, based on the geometric mean of all of 3 or more samples taken during any period of discharge not to exceed 7 days. Other indicators of adequate disinfection may be utilized where approved by the department.

Sanitary wastewater discharges are considered in compliance with the WQS of 130 *E. coli* per 100 milliliters (mL) if their National Pollutant Discharge Elimination System (NPDES) permit limit of 200 fecal coliform per 100 mL as a monthly average is met. This is assumed because *E. coli* are a subset of fecal coliform (APHA, 1995). Fecal coliform concentrations are substantially higher than *E. coli* concentrations alone when the wastewater of concern is sewage (Whitman, 2001). Therefore, it can reasonably be assumed that there are fewer than 130 *E. coli* per 100 mL in the effluent when the point source discharge is meeting its limit of 200 fecal coliform per 100 mL.

The target for this TMDL is 300 *E. coli* per 100 mL expressed as a daily maximum load and concentration from May 1 to October 31 (i.e., daily target) and 130 *E. coli* per 100 mL as a 30-day geometric mean, expressed as a concentration (i.e., monthly target). An additional target is the partial body contact standard of 1,000 *E. coli* per 100 mL as a daily maximum year round. Achievement of the total body contact daily maximum target is expected to result in attainment of the partial body contact standard.

3.1 LINKAGE ANALYSIS

Determining the link between the *E. coli* concentrations in the Detroit River and the potential sources is necessary to develop the TMDL. TMDLs must be established at a level necessary to attain and maintain the applicable WQS. In Michigan, the applicable total body contact recreation WQS for *E. coli* consists of 2 criteria values: a daily maximum of 300 *E. coli* colony forming units (cfu) per 100 mL (daily target) and a 30-day geometric mean of 130 *E. coli* cfu per 100 mL (monthly target). A partial body contact WQS of 1,000 *E. coli* cfu per 100 mL applies year-round. Because the waste load allocations (WLA) - the loading associated with point source discharges - provided herein are based on the daily target, a linkage analysis is needed to demonstrate these allocations also assure attainment of the monthly target.

The USEPA's development of ambient water quality criteria for bacteria, as contained in the "Ambient Water Quality Criteria for Bacteria – 1986" (USEPA, 1986), defines the statistical relationship between the daily maximum and 30-day geometric mean criteria values. The assumption used to develop the 30-day geometric mean of 126 cfu per 100 mL (rounded to 130 cfu per 100 mL as the Michigan criterion) is a log-normal distribution using a log standard

deviation of 0.4. Using this assumption and a comparable recurrence interval (e.g., 30 days), a daily maximum projected from the 30-day geometric mean would be 713 cfu per 100 mL. Conversely, the Michigan daily maximum criterion of 300 cfu per 100 mL is comparable to a 30-day geometric mean of approximately 55 cfu per 100 mL. This relationship provides the basis for demonstrating that attaining the daily target in the TMDL will also achieve the monthly target. A further conservative assumption is the log standard deviation of 0.4. The log standard deviation observed in most riverine systems is generally at least 0.3, and often quite larger (Cleland, 2006). The greater the variability, the more protective the daily maximum is relative to the monthly target.

Michigan regulates discharges containing treated or untreated human waste (i.e., sanitary wastewater) using fecal coliform. Sanitary wastewater discharges are required to meet 200 fecal coliform per 100 mL as a monthly average and 400 fecal coliform per 100 mL as a maximum. The MDEQ believes the sanitary wastewater discharges are in compliance with the daily and monthly targets and the allocations associated with the daily target, if their NPDES permit limits for fecal coliform are met. The *E. coli* criteria contained in the 1986 document were derived to approximate the degree of protection (i.e., 8 illnesses per 1,000 swimmers) provided by the fecal coliform indicator level of 200 cfu per 100 mL recommended by the USEPA prior to the adoption of the 1986 criteria. All wastewater treatment plants (WWTPs) provide year-round disinfection, providing another level of confidence that these sources will not contribute to *E. coli* WQS exceedences in the receiving waters.

4.0 DATA DISCUSSION

This portion of the document is divided into two main sections: hydrologic data and *E. coli* data. The hydrology section describes the available flow data and how flow estimates were made for the River. The *E. coli* section presents and summarizes the ambient *E. coli* data that were collected during 2007. Further information on the *E. coli* data collection effort can be found in the document *Detroit River and Ecorse River E. coli Monitoring to Support TMDL Development Final Report*, which is included as Attachment A.

4.1 Hydrology Data

The St. Clair – Detroit River waterway is a major water resource shared by the United States and Canada. The United States and Canada measured flow in the Detroit River independently up until 1953 when the Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data (Coordinating Committee) was established to unify flow measurement and reporting between the two nations. The Coordinating Committee serves in an advisory capacity to the agencies of the United States and Canada who are charged with the responsibility for collecting and compiling the Great Lakes hydraulic and hydrologic data. In the United States, the Detroit District of the Army Corps of Engineers (USACE) is the lead agency for this data collection effort.

Since the Detroit River is a connecting channel between Lake St. Clair and Lake Erie, its hydrology is quite different from a typical river. Daily flow in the Detroit River is highly variable and transient due to prevailing wind and water levels in the St. Clair-Detroit River waterway. Wind and lake level conditions can change throughout a single 24-hour period, preventing steady flows from developing in the Detroit River before one or more of the variables (i.e.: wind direction, wind speed, river velocity, etc.) change (Holtschlag and Koschik, 2001). Although the Detroit River flow is technically unstable, it is treated as stable for the purpose of estimating its

discharge. This is necessary due to the limited data and numerical methods available for the Detroit River (Koschik, 2008).

To date, empirical stage-fall-discharge relationships have been determined to be the best predictors of flow in the Detroit River (Koschik, 2008; Quinn, 1079). The USACE and the National Oceanic and Atmospheric Administration (NOAA) maintain four gaging stations that record Detroit River water levels from Lake St. Clair to Lake Erie. Ontario maintains two gaging stations in addition to the U.S. stations. The USACE estimates a single flow each day for the Detroit River using the stage-fall-discharge regression equations and stage data collected at the four gaging stations (Quinn, 1979). These data are then used to develop monthly mean flows (Koschik, 2007). In practice, this means that the flow is the same at any given cross-section along the river from Lake St. Clair to Lake Erie at any given point in time. Flows entering the Detroit River from Lake St. Clair and exiting the Detroit River to Lake Erie are essentially the same; incoming flows from tributaries such as the Rouge and Ecorse rivers are considered to be negligible by the USACE (Koschik, 2008). The average flow of the Detroit River is approximately 187,000 ft^3/s (Holtschlag and Koschik, 2001).

Estimated daily mean flow data were obtained from the USACE, Detroit District (Koschik, 2007) for the period 1977 to 2007, providing 30 years of flow record for developing flow duration curves. The 30-year record represents a range of prevailing climatic conditions and long-term cyclical water levels in the Great Lakes, and therefore is deemed an adequate record of flow for use in this TMDL. Attachment B contains plots of the flow time series and duration curve.

Because the Detroit River is influenced to a much greater degree by lake levels than precipitation, the flow duration curve reflects long-term Great Lakes water levels more so than annual precipitation variability. Therefore, the range of discharges occurring in any given year may fall within a small portion of the long-term flow duration curve as compared to more typical rivers. For example, during 2007 the flow in the Detroit River ranged from 116,821 to 196,703 cubic feet per second (cfs). These minimum and maximum values represent the 99th and 54th percentiles on the flow duration curve respectively. In 1985 the discharge ranged from 192,000 to 254,000 cfs. These values represent the 61st and 1st percentiles on the flow duration curve respectively. In addition, the Detroit River flow duration curve tends to be very flat compared to typical rivers. The highest estimated daily discharge over the last 30 years (259,580 cfs) is only four times greater than the lowest estimated daily discharge (64,000 cfs). In contrast, the maximum recorded Ecorse River flow for the period of record is more than 4,000 times greater than the minimum recorded flow.

Because this Detroit River *E. coli* TMDL only applies to U.S waters, it is necessary to portion flow between U.S. and Canadian waters for the purpose of calculating the loading capacity and load allocations (see Section 7). The USGS and USACE collected Acoustic Doppler Current Profiler (ADCP) data in 2002 (Holtschlag and Koschik, 2003). The ADCP data provide depth and velocity data across numerous cross-sections in the Detroit River between Lake St. Clair and Lake Erie, including cross-sections near six of the *E. coli* monitoring transects (DR-1, DR-2, DR-3, DR-4, DR-6, and DR-8) discussed in Section 4.2.1. The ADCP data in closest proximity to the six transects were obtained from the USACE, Detroit District (Koschik, 2007) and analyzed with WinRiver 10.06 software, which calculates flow using the ADCP data. Using ADCP data from locations nearest to the U.S. shoreline and international boundary, the flow for the U.S. portion of the Detroit River was determined at the six transects. The flow proportion at those six transects ranged from 45.5% at transect DR-8 to 68.4% at DR-1 with a mean value of 52.3%. The mean percentage was used to determine the U.S portion of the Detroit River flow.

4.2 *E. coli* Data

4.2.1 Study Design

Nine monitoring transects were established on the Detroit River. Transects were roughly evenly spaced over the course of the River, with one each placed at the most upstream and downstream ends of the River. There were multiple sampling sites associated with each transect. The number of sampling sites was based on the width of the river. Three to nine sampling sites were roughly evenly spaced across the river in both U.S. and Canadian waters. The left and right most sites were generally within 50 feet of the shorelines. Sampling site "A" always corresponds to the left most sample nearest to the U.S. mainland. The sampling transects and their corresponding sampling sites are described in Table 1 and depicted in Figures 2a and 2b.

Table 1. Detroit River Transect Descriptions (listed upstream to downstream)

Transect	Sampling Sites	Transect Description
DR0	A – E	Outlet of Lake St. Clair and upstream end of Windmill Pointe Park and upstream of Peche Island
DR1	A – E	Upstream of Belle Isle and downstream of Little River
DR2	A – C	Scott Middle Ground near the Detroit Boat Club, north side of Belle Isle
DR2	D – F	Fleming Channel, south side of Belle Isle
DR3	A – E	Downstream of the GM Renaissance Center
DR4	A – E	At Fort Wayne
DR5	A – E	Downstream of the Rouge River cut-off channel and Zug Island
DR6	A – E	Downstream of the Ecorse River
DR6	F – H	North end of Fighting Island to the downstream of Turkey Creek
DR7	A – C	Trenton Channel near Elizabeth Park
DR7	D – I	Grosse Ile to downstream of the Canard River
DR8	A	Near Brownstown Creek outlet
DR8	B – I	Upstream of Lake Erie and downstream of Celeron Island to the Canadian mainland

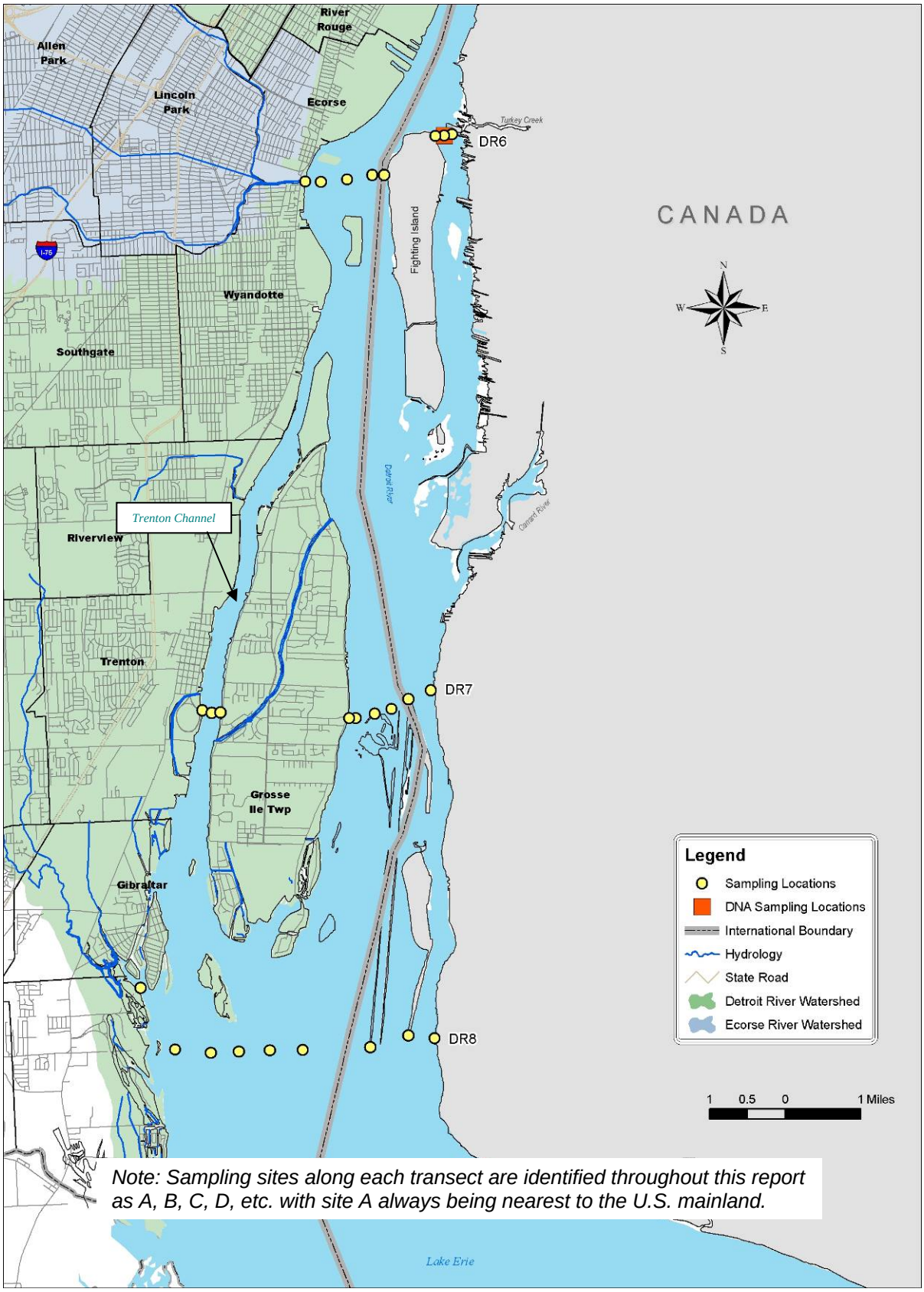
All monitoring sites were sampled for *E. coli* for 23 weeks, from May 1, 2007 through October 2, 2007. One sample was collected at each site for a total of 1,300 samples over the 23 week study period. In conformance with Rule 62, a single sample result is represented by the geometric mean of the three discrete samples collected in a defined location. Compliance with the daily maximum WQS is determined by comparison of any single sample result with the daily maximum WQS.

For the purpose of calculating geometric mean values, results for the Detroit River transects were divided into two or three groups based on the location of various land masses within the River and by the location of the international boundary. This resulted in separate geometric means for samples collected in U.S. and Canadian waters. A minimum of three *E. coli* values were used for the geometric mean calculation per the Michigan WQSs. For transects that only had two samples, a third value was obtained by interpolating between the nearest two samples. For instance, at transect DR0 only two samples, A and B, were collected in U.S. waters (See Figure 2a). A third value was estimated by interpolating between sampling site B and C. These three values were used to calculate the geometric mean for the U.S. portion of the transect.

Figure 2a. Upper Detroit River Monitoring Locations

Note: Sampling sites along each transect are identified throughout this report as A, B, C, D, etc. with site A always being nearest to the U.S. mainland.

Figure 2b. Lower Detroit River Monitoring Locations



At the transect along Grosse Ile, three daily geometric means were calculated: one for the Trenton Channel on the west side of Grosse Ile, one for the east side of Grosse Ile in U.S. waters and one for east side of Grosse Ile in Canadian waters. Upstream of Lake Erie along transect DR8, sample A was handled separately because it was located away from the rest of the samples, near the outlet of Brownstown Creek.

4.2.2 *E. coli* Results

The *E. coli* analytical data is presented in a variety of manners. Summary statistics are provided in tables and graphs displaying the measure of central tendency (number of samples, median and range) for each monitoring site. The distribution of the data is graphically displayed by weather condition in pie charts that are overlaid on the project maps. Spatial variation from location to location was also considered. The frequency of WQS exceedences is also calculated and displayed. All raw *E. coli* data and the corresponding daily and monthly geometric means are included in Appendix C of Attachment A.

The minimum, maximum, median and average *E. coli* values for each transect are shown in Table 2. Based on the average values, the highest *E. coli* concentrations are found near the outlet of Brownstown Creek (DR8) and in the Trenton Channel (DR7). Elevated maximum values (above 1,000 cfu/100mL) were detected along the Canadian side of Rouge River transect (DR5) downstream to the U.S. side of the Lake Erie transect (DR8).

Table 2. Detroit River *E. coli* Statistics (based on 23 values per transect)

Transect	Sampling Site Groupings†	Country	*E. coli* Results (cfu/100mL)			
			Minimum	Maximum	Median	Average
DR0 – Outlet of Lake St. Clair	A, B, B/C	US	10	30	10	14
	C – E	CA	10	49	10	14
DR1 – u/s of Belle Isle	A – C	US	10	97	10	16
	C/D, D, E	CA	10	56	14	18
DR2 – Belle Isle	A – C	US	10	107	13	23
	D/E, E, F	CA	10	37	13	16
DR3 – Renaissance Center	A – C	US	10	125	10	22
	C/D, D, E	CA	10	119	28	31
DR4 – Fort Wayne	A – C	US	10	130	10	20
	C/D, D, E	CA	10	190	31	46
DR5 – d/s Rouge River	A, B, B/C	US	13	391	23	60
	C – E	CA	16	1,015	37	159
DR6 – d/s Ecorse River DR6 – d/s Turkey Creek	A – E	US	11	2,125	29	151
	F – H	CA	10	1,745	71	231
DR7 – Trenton Channel DR7 – west side of Grosse Ile DR7 – d/s Canard River	A – C	US	10	7,027	19	366
	D – G	US	10	2,584	10	130
	G/H, H, I	CA	10	516	17	75
DR8 – near Brownstown Creek DR8 – u/s of Lake Erie DR8 – u/s of Lake Erie	A*	US	10*	3,000*	80*	403*
	B – F	US	10	6,312	12	264
	G – I	CA	10	87	14	23

*Based on single discrete samples.

†Sampling sites listed as "B/C", "C/D" or "G/H" indicates that *E. coli* values were interpolated between the two sites.

The *E. coli* results were further evaluated based on weather conditions. Wet weather conditions were defined by events with rainfall volumes of 0.2" or more over the 30 hour period that preceded the start of a sampling event as measured at Detroit Metro Airport. Seven wet weather events were sampled during the 23 weeks of sampling.

The distribution of the *E. coli* values for dry and wet weather conditions are depicted in Figures 3a & 3b. From this analysis it is apparent that elevated *E. coli* levels generally occurred during wet conditions.

Next, the daily and 30-day geometric means for each transect were compared to the Michigan WQSs for *E. coli*. This comparison was made for samples taken in U.S. waters only. Of the 230 daily geometric means calculated, the daily target of 300 cfu/100 mL was exceeded seven times. These exceedences occurred at the Rouge River, Ecorse Creek, Trenton Channel, Grosse Ile and Lake Erie transects as shown in Table 3. All seven exceedences were associated with two rain events that measured 2.4" and 0.8" on August 21st and October 2nd, respectively.

The Detroit River 30-day geometric means exceeded the monthly target of 130 cfu/100 mL two of 190 times. These exceedences occurred in the Trenton Channel (DR7).

Table 3. Detroit River Water Quality Exceedences (U.S. Waters only)

Transect	Sampling Site Groupings	Daily Geometric Mean			30-Day Geometric Means		
		No. of Values	Exceedences (>300 cfu/100mL)		No. of Values	Exceedences (>130 cfu/100mL)	
			Number	Percent		Number	Percent
DR0 – Outlet of Lake St. Clair	A, B, B/C	23	0	0%	19	0	0%
DR1 – u/s of Belle Isle	A – C	23	0	0%	19	0	0%
DR2 – Belle Isle	A – C	23	0	0%	19	0	0%
DR3 – Renaissance Center	A – C	23	0	0%	19	0	0%
DR4 – Fort Wayne	A – C	23	0	0%	19	0	0%
DR5 – d/s Rouge River	A, B, B/C	23	1	4%	19	0	0%
DR6 – d/s Ecorse Creek	A – E	23	2	9%	19	0	0%
DR7 – Trenton Channel	A – C	23	2	9%	19	2	9%
DR7 – west side of Grosse Ile	D – G	23	1	4%	19	0	0%
DR8 – u/s of Lake Erie	B – F	23	1	4%	19	0	0%
Totals		**230**	**7**	**3%**	**190**	**2**	**1%**

Lastly, a spatial comparison of the Detroit River *E. coli* data was made (See Figure 4a & 4b). For this comparison, the average *E. coli* concentration was calculated at each sampling site for the entire 23 week sampling period. This comparison shows that the highest *E. coli* concentrations were located along the shorelines (both U.S. and Canadian); while the mid-river flows generally had very low *E. coli* concentrations. This is most apparent downstream of the Rouge and Ecorse rivers (DR5 & DR6, respectively). With the exception of the shoreline sites, which tend to have higher *E. coli* concentrations, there was little variation of *E. coli* concentrations across the transects. Two exceptions to this occur at the outlet of Lake St. Clair (DR0) and across the Trenton Channel (DR7). The River appears to be fairly well mixed horizontally at these transects.

Figure 3a. Detroit River *E. coli* Frequency Distribution – Dry Conditions

Figure 3b. Detroit River Daily *E. coli* Frequency Distribution – Wet Conditions

Figure 4a. Spatial Distribution of Average *E. coli* Concentrations across the Upper Detroit River

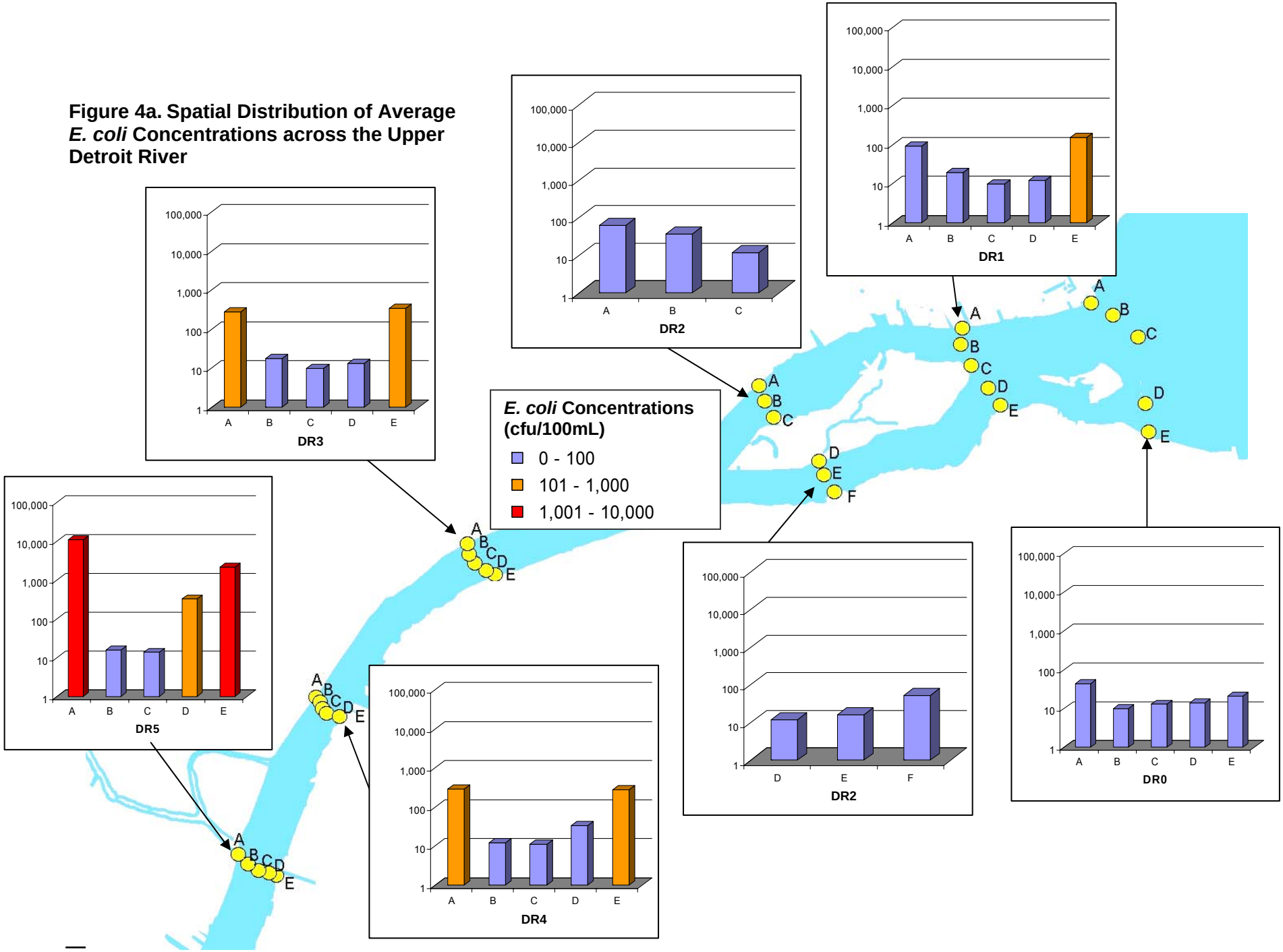
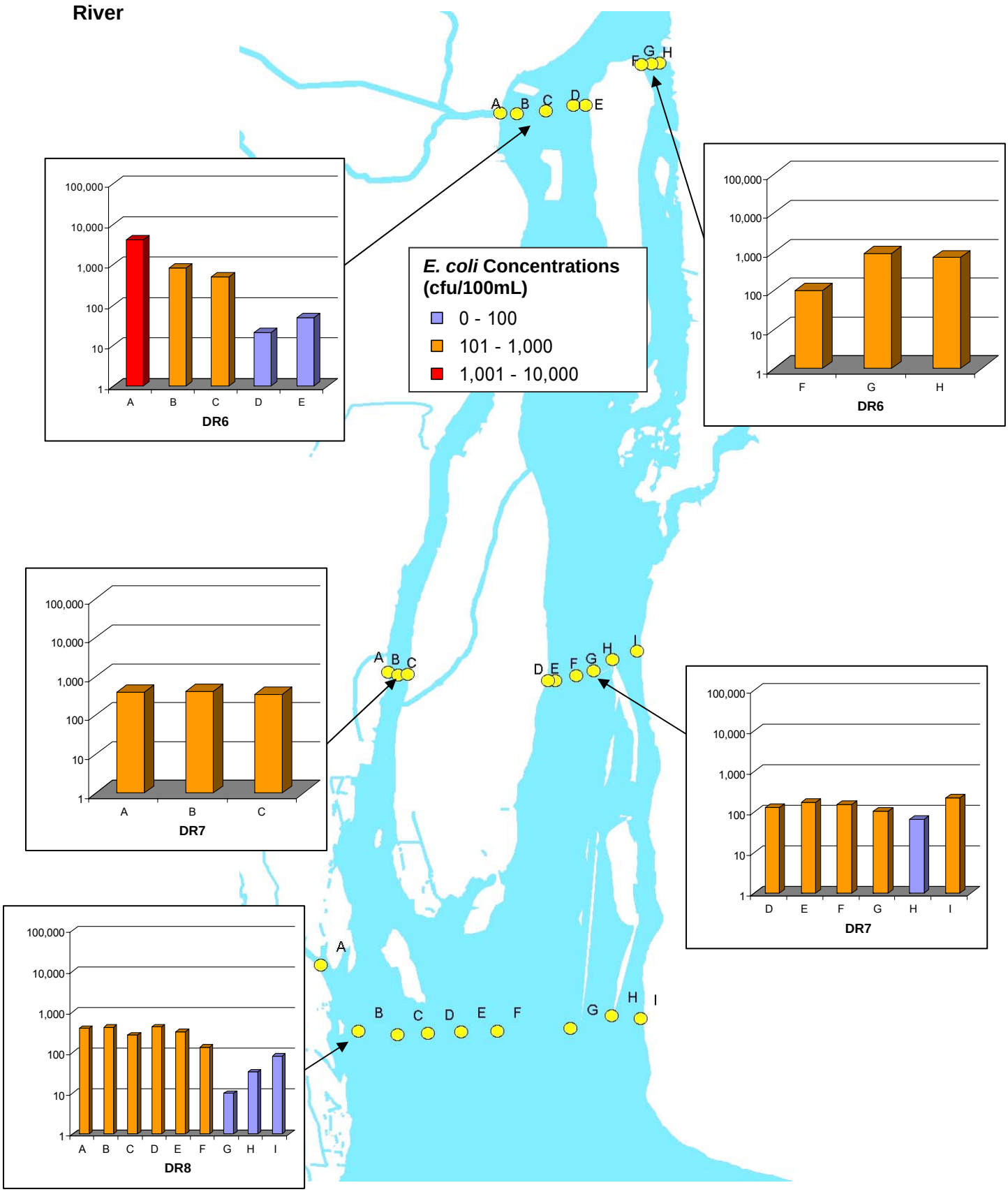


Figure 4b. Spatial Distribution of Average *E. coli* Concentrations across the Lower Detroit River



5.0 SOURCE ASSESSMENT

As mentioned earlier, the Rouge River subwatershed already has an *E. coli* TMDL established, and the Ecorse River subwatershed's *E. coli* TMDL is under development. Therefore, this Section doesn't explicitly address those two subwatersheds. However, it should be noted that each of these tributaries are a substantial source of *E. coli* to the Detroit River based on MDEQ-collected data in those subwatersheds and in preparation for the Detroit River TMDL.

Table 4 shows the land use distribution summarized by subwatershed based on 2000 data obtained from the Southeast Michigan Council of Governments (SEMCOG 2003).

Table 4. Land Use Distribution within the Detroit River Watershed*

Land Use Category	Combined Downriver		North Detroit	
	Acres	%	Acres	%
Active Agriculture	3,120	5.8	0	0.0
Commercial Office	2,641	4.9	5,253	9.7
Extractive	971	1.8	96	0.2
Grassland	6,213	11.5	360	0.7
Industrial	3,983	7.3	5,818	10.8
Institutional	1,900	3.5	3,686	6.8
Multiple Family	1,273	2.3	3,820	7.1
Outdoor	2,408	4.4	3,540	6.6
Residential With Vacant	0	0.0	13,567	25.1
Single Family	14,519	26.8	12,389	23.0
Transportation	5,972	11.0	3,285	6.1
Under Development	1,027	1.9	0	0.0
Vacant Land	0	0.0	1,834	3.4
Water	395	0.7	35	0.1
Woodland-grassland	9,814	18.1	264	0.5
Total Drainage Area	**54,236**		**53,947**	

*The Ecorse and Rouge river sources of *E. coli* are addressed in separate existing and planned *E. coli* TMDLs for those water bodies.

The Detroit River watershed is largely urbanized. Potential sources of *E. coli* associated with urban land uses are combined sewer overflows, sanitary sewer overflows, sanitary sewer exfiltration, failing on-site sewage disposal systems, illicit connections and discharges to storm sewers, domestic pets and wildlife.

5.1 NPDES Permits

There are 104 NPDES-permitted discharges in the North Detroit and Combined Downriver watersheds. NPDES permitted discharges to the Ecorse and Rouge River subwatersheds can be found in their respective TMDL reports. The discharge permits include 22 individual permits and 82 certificates of coverage under eight general permits (Attachment C). Many of the NPDES permits authorize the direct discharge of storm water to the Detroit River or tributaries thereof. Storm water collection systems often concentrate numerous sources of *E. coli* from

overland runoff and from illegal connections to the storm sewer system. Some permits address multiple outfalls including sanitary sewer, combined sewer, industrial pretreatment and storm water discharges. A map of the NPDES discharges is also included in Attachment C.

5.2 Wastewater Treatment Plants

Five wastewater treatment plants (WWTP) discharge treated sewage effluent directly to the Detroit River: Detroit WWTP, Wayne County Downriver WWTP, Trenton WWTP, Grosse Ile Township WWTP and the South Huron Valley Utility Authority WWTP. WWTP discharges are considered in compliance with the WQS of 130 *E. coli* per 100 mL if their NPDES permit limit of 200 fecal coliform per 100 mL as a monthly average is met. All five plants are substantially in compliance with the fecal coliform limits in their NPDES permits (note that for the Detroit WWTP a second effluent outfall to the Detroit River is under construction that will allow for disinfection of all excess flows during wet weather once completed).

The most significant wet weather overflows that drain directly to the Detroit River occur as combined sewer overflows (CSOs). CSO discharges contain raw, diluted, or partially treated sewage containing *E. coli*, among other pathogens. CSOs are wet weather discharges from combined sewer systems that are designed to carry a mixture of sewage and storm water runoff. During wet weather, the flow in combined sewers may exceed the capacity of pipes or the treatment plant. Once system capacity is reached, raw sewage bypasses treatment at the WWTP, or is discharged from points in the collection system, and is discharged directly to a receiving water body. CSOs are permitted discharges that can only exist in sewer systems with combined storm water and sanitary sewers, and are also under approved Long-term CSO Control Programs to either be eliminated or provided with treatment to meet water quality standards at times of discharge. A map of the CSO outfall locations to the Detroit River is provided in Figure 6.

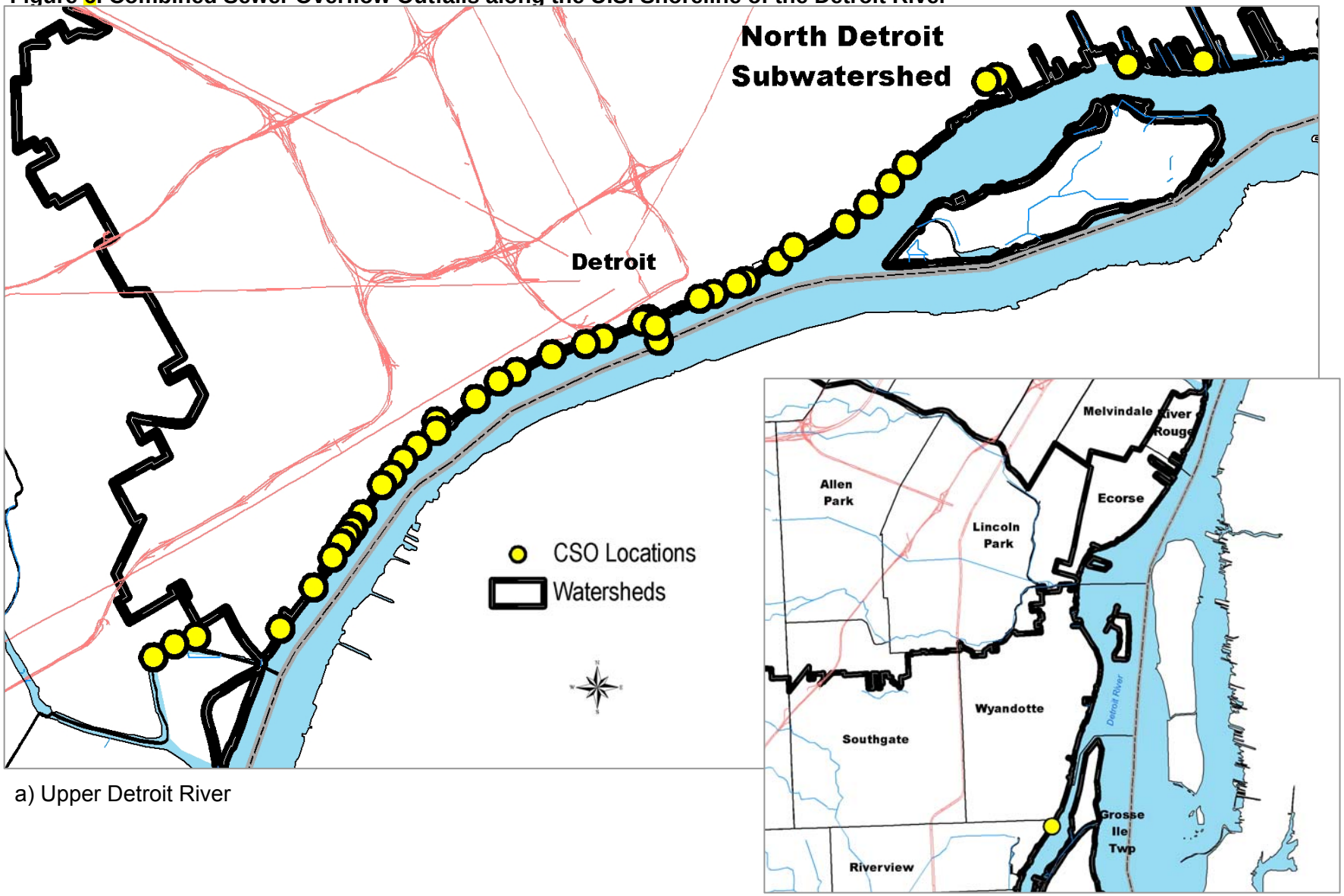
SSOs are wet weather discharges from sanitary sewer systems that contain raw or inadequately treated sewage and some unintended storm water inflow and/or ground water infiltration into the sanitary sewer system. SSOs occur when the capacity of a sanitary sewer system is exceeded. SSOs are illegal events and can occur in any sanitary sewer system served by a wastewater treatment plant.

Both uncontrolled CSO and SSO discharges are considered the primary source of *E. coli* to the Detroit River watershed (please see the Ecorse River TMDL and Rouge River TMDL for sources that are not direct to the Detroit River). Needed CSO/SSO corrections are organized as follows by the associated wastewater treatment plant.

5.2.1 Detroit Water and Sewerage Department

The Detroit Water and Sewerage Department (DWSD) operates one of the largest WWTPs in the United States with a daily flow of approximately 750 million gallons per day (MGD). It serves approximately three million people in 77 communities that contain both separate sanitary sewer systems and combined sewer systems. The City of Detroit is served almost entirely by a combined sewer system with an estimated service area of 97,240 acres (DWSD 2007). Prior to the implementation of the Long-term CSO Control Plan (LTCP), DWSD had 46 and 32 uncontrolled CSO outfalls along the Detroit and Rouge rivers, respectively, with an estimated annual discharge totaling 20 billion gallons. Seven previously untreated CSOs are now controlled by four treatment facilities located along the Detroit River (See Attachment D).

Figure 6. Combined Sewer Overflow Outfalls along the U.S. Shoreline of the Detroit River



a) Upper Detroit River

b) Lower Detroit River

During the May 1, to October 2, 2007, *E. coli* monitoring period, the Detroit River watershed received 9.9 billion gallons of mostly CSO and some SSO effluent. Approximately 42% (4.4 billion gallons) of that volume was discharged directly to the Detroit River, the rest discharged to the Rouge River. Of the 4.4 billion gallons, approximately 76% of that volume received partial treatment (i.e. skimming, settling and disinfection) prior to discharge to the Detroit River.

The Detroit Water and Sewerage Department conducted shoreline surveys, river transect surveys, and dye studies in 1999 and 2000 to collect data for updating its LTCP (DWSD, 2001). The formerly untreated CSO discharges to Conner Creek are an example of the impact untreated CSOs can have on a receiving water. This discharge was actually from three CSOs to Conner Creek near the upstream area of the Detroit River. Sampling revealed *E. coli* numbers within Conner Creek of 100,000 cfu/100 mL during one wet weather event as a result of CSO discharges. Dye studies were conducted to evaluate the impact of the Conner Creek CSO discharge on Detroit River water quality. Maximum *E. coli* numbers within the Conner Creek CSO discharge plume routinely exceeded the partial body contact WQS of 1,000 cfu/100 mL. However, *E. coli* numbers decreased by approximately one-half within 100 feet downstream of the Conner Creek confluence due to mixing with the Detroit River (from 18,000 to 950 cfu/100 mL). The Conner Creek CSO discharge plume was generally confined to within 200 to 300 feet of the shoreline near the outfall, but expanded to 500 feet two to three miles downstream of the outfall. Although the Conner Creek outfall is now controlled, this demonstrates how uncontrolled CSO discharges can impact the *E. coli* levels in the Detroit River.

5.2.2 Wayne County Downriver WWTP

The Downriver collection system serves thirteen communities and consists of major interceptors, retention basins and the Wayne County Downriver WWTP. The Downriver WWTP treats an average flow of 60 MGD, but can treat up to 225 MGD during wet weather. All effluent is disinfected using ultraviolet (UV) light. In the recent past, major wet weather correction projects were completed at the WWTP and in the collection system under a federal consent decree.

There are eight remaining emergency bypass points within the Downriver WWTP collection system: one at the WWTP discharging to the Detroit River and seven within the collection system discharging to the Ecorse River subwatershed. These points are prohibited to discharge.

The Southgate-Wyandotte Retention Basin (RTB) serves a portion of the combined sewer area within the Downriver system. The disinfection system for the main outfall (001) at the RTB has recently been rehabilitated. The other outfall in this system, outfall 002, is a wet weather discharge from the Pine Street Pump Station. This outfall is being evaluated under the current NPDES permit as to its ability to comply with all water quality standards at times of discharge.

During dry weather or low flow events, storm water from the combined portions of Wyandotte and Southgate go to the Wayne County Wyandotte WWTP. During moderate events, flow drains to Pump Station No. 5, receives primary treatment and retention, with stored flow discharged back to the WWTP. During heavy events, excess flows from these areas drain to the Pine Street Pump Station with CSO potentially discharged to the Detroit River.

5.2.3 Grosse Ile Township WWTP

An ACO was entered between the MDEQ and Grosse Ile in 2001 that called for correction of bypassing at the WWTP to meet state and federal requirements. All corrective actions have been completed except for a portion of the redundant interceptor system that is planned for completion by 2009. Once this interceptor is completed, Grosse Ile will have additional designed capacity in their sanitary sewer system and at the WWTP to meet state and federal SSO requirements (once positively certified by the State).

5.3 Agricultural Practices

There are no Concentrated Animal Feeding Operations (CAFO) in the North Detroit and Combined Downriver subwatersheds. Furthermore, there is no agriculture in the North Detroit subwatershed.

The Combined Downriver subwatershed contains over 3,000 acres of land (5.8%) in agricultural production. Most of the agricultural production is concentrated on the upper Blakely Drain, south of the Wayne County Detroit Metropolitan Airport. Land application of manure, livestock access to streams, and pasture and feed lot runoff can be sources of *E. coli*, but the extent of these agricultural practices is not known for this subwatershed. Regardless, due to the relatively small amount of agricultural land in the Combined Downriver area, agricultural practices are most likely only a minor source of *E. coli* to the Detroit River.

Agricultural land is a potential *E. coli* source in the Rouge River subwatershed and is addressed accordingly in the Rouge River *E. coli* TMDL.

5.4 Illicit Connections and Discharges

The following are key illicit discharge terms and their definitions in the Watershed-Based Storm Water General Permits issued in 1999 and 2002 (MDEQ, 2006):

> *Illicit discharge*: Any discharge (or seepage) to the separate storm water drainage system that is not composed entirely of storm water or uncontaminated groundwater.
>
> *Illicit connection*: A physical connection to the separate storm water drainage system that 1) primarily conveys illicit discharges into the system and/or 2) is not authorized or permitted by the local authority (where a local authority requires such authorization or permit).

Illicit connections to storm sewers can result in the discharge of sanitary wastewater to separated sewer systems and surface waters within the Detroit River watershed. In some cases, an illicit discharge may be a direct discharge of sanitary wastewater from a sanitary sewer improperly discharging to a water body. In other cases wastewater many infiltrate to a storm sewer from a dilapidated sanitary sewer. Illicit discharges of sanitary wastewater are a dry weather source of *E. coli*.

5.4.1 Wayne County Department of Environment (WCDOE)

WCDOE has conducted an extensive illicit connection program under its Illicit Discharge Elimination Plan (IDEP). A total of 1,971 illicit connections and discharges have been identified since 1987. The results of Wayne County's illicit connection detection efforts were evaluated and reported by the Alliance of Rouge Communities in 2007 (ARC 2007). Wayne County identified 44 illicit connections and 222 illicit discharges through investigation of 6,055 complaints between 1999 and 2005. Wayne County identified an additional 1,486 illicit

connections and seventeen illicit discharges via dye testing of 3,336 facilities (a 45% failure rate) over a ten year period (1996-2006). Wayne County's IDEP activities have revealed that illicit connections and discharges are a widespread problem in the Wayne County portion of the watershed.

5.4.2 Combined Downriver Subwatershed

The Combined Downriver Subwatershed Inter-Municipality Committee completed a WMP in 2005 that included the results of field inventories at 78 locations on 28 different drains in the Combined Downriver subwatershed. The WMP noted possible illicit connections at some of those field inventory locations (CDWIC 2005).

5.4.3 City of Detroit

The City of Detroit operates a small separate sewer system that primarily serves Belle Isle. Since the majority of the island is comprised of parkland and there are very few commercial and no residential buildings on the island, there is a very low probability that illicit connections exist in Detroit's separate sewer system (DWSD 2007).

Illicit connections have been documented in the Rouge and Ecorse river subwatersheds, and may be present in the Combined Downriver and North Detroit subwatersheds. Therefore, illicit connections are considered a source of *E. coli* in the subwatershed.

5.5 On-Site Sewage Disposal Systems (OSDSs)

Failing OSDSs can lead to *E. coli* delivery to the Detroit River when the OSDS is located adjacent to a water body, is seeping into a storm sewer, or has been intentionally or unintentionally connected to a storm sewer. There are no accurate records of the current number of active OSDSs in the Detroit River watershed; however, the Wayne County Health Department estimates that there are approximately 10,000 OSDSs in the County (WCDOE 2007).

The active OSDSs in Wayne County are concentrated in Huron, Sumpter, and Van Buren Townships which are primarily outside of the Detroit River watershed. Active OSDSs are present to a lesser degree in Rouge River subwatershed in the communities of Canton, Northville, and Plymouth Townships. Some active systems are scattered throughout unsewered areas of Romulus (Downriver, Ecorse and Rouge watersheds), Taylor (Ecorse and Downriver watersheds), Redford and Livonia (Rouge subwatershed), and Brownstown Township (Downriver subwatershed). No active OSDSs are suspected to be located in the North Detroit subwatershed.

Since the number of OSDSs in the Combined Downriver and North Detroit subwatersheds is likely very small, failing OSDSs are probably only a minor source of *E. coli* in the watershed.

6.0 LOADING CAPACITY DEVELOPMENT

The loading capacity (LC) represents the maximum daily loading that can be assimilated by the water body while still achieving WQS. Calculation of the loading capacity and allocations in the Detroit River are complicated by the fact that the international boundary between the United States and Canada runs down the middle of the river, and the two countries use different criteria for their water quality standards. A U.S. TMDL cannot control *E. coli* sources located in Canada; therefore, for the purpose of this TMDL, a loading capacity will only be developed for the U.S. portion of the Detroit River.

The total flow was portioned between U.S. and Canadian waters using Acoustic Doppler Current Profiler data obtained from the U.S. Army Corps of Engineers, Detroit District. Those data provide the cross-sectional area and flow velocity on the U.S. side of the International Boundary at six of the *E. coli* monitoring transects. The analysis of ADCP data resulted in portioning of 52.3% of the total Detroit River flow to U.S. waters, which is the average of the six monitoring transects (see Section 4.0 for further discussion of flow portioning).

Flows along a gradient of 0% to 100% were partitioned into three flow zones: high, moderate and low (see Attachment B, Figure B1). The three flow zones are represented by their median flow duration interval and value (e.g., 15% is the midpoint of the high flow zone). Three flow zones are used to be protective throughout the entire range of flows without being overly protective. For example, the median flow value of the Moderate flow category is overly protective for flows in the High flow category but under protective for flows in the Low flow category.

As indicated in the Numeric Target section, the targets for this TMDL are the daily maximum of 300 cfu/100 mL and the 30-day geometric mean of 130 cfu/100mL during the total body contact recreation season and 1000 cfu/100 mL, year-round, based on Michigan's WQSs. The daily maximum of 300 cfu/100mL expressed as a daily load will be used in the development of the loading capacity for U.S. portion of the Detroit River.

Concurrent with the selection of numerical limits, development of the LC requires identification of the critical conditions. The critical conditions are the set of environmental conditions (e.g., flow) used in developing the TMDL that have an acceptably low frequency of occurrence. The total daily load allocations must be less than the LC during the occurrence of the critical conditions. The critical conditions for the applicability of the WQSs in Michigan are given in Rule 323.1090 (Applicability of WQS). Rule 323.1090 requires that the WQS apply at all flows equal to or exceeding the water body design flow. In general, the lowest monthly 95% exceedence flow is used as the design condition for developing pollutant loadings.

As described further in Section 7.0, this TMDL provides allowable *E. coli* loadings under three flow conditions: high, moderate and low. The low flow category includes the 95% exceedence flow condition.

For the Detroit River, the loading capacity for the U.S. waters is calculated using the following equation.

The LC is equal to:

Criteria x Flow x Y

Where:

Criteria = WQS ($\frac{300cfu}{100mL}$) for U.S. waters

Flow for U.S. waters = total River discharge as shown in Table 11 ($\frac{ft^3}{\sec}$) x 52.3%

Y = conversion factor ($\frac{28{,}317 mL}{ft^3} \times \frac{86{,}400 \sec}{day}$)

The resultant LC is presented in Table 11.

6.1 Margin of Safety

The margin of safety (MOS) is a required element of the TMDL and accounts for uncertainty in the relation between pollutant loads and the quality of the receiving water body. The approach to assigning WLAs and LAs in this TMDL uses daily flow and the numeric WQS criteria of 300 cfu/100 mL, the TMDL target. Allocations are based on the assumption that ambient *E. coli* concentrations in the Detroit River will be below the TMDL target and WQS attainment will occur when all regulated NPDES sources of *E. coli* meet the target of 300 cfu/100 mL. This is a conservative approach as explained below. The primary source of uncertainty in this TMDL is estimation of CSO and Detroit River discharge volumes and therefore, the *E. coli* loadings associated with these discharges.

The MOS can be incorporated into the TMDL calculation either implicitly within the WLA or LA, or explicitly. For this TMDL, an explicit MOS was calculated as the difference between the median flow exceedence interval value and minimum flow exceedence interval value for each flow category using the approach developed by Cleland (2006) as shown in Table 5. The MOS was calculated using the U.S. daily criteria of 300 cfu/100 mL for the U.S. portion of the flow only (52.3% of the total flow). The explicit MOS approach ensures that allocations will not exceed the load associated with the minimum flow in each flow category. Therefore, the allocations are protective for the full range of flows in each flow category.

Table 5. Calculation of the Margin of Safety (MOS)

Flow Condition	Median Flow Value (cfs)	Lower Flow Value (cfs)	Median Load (cfu/day)	Lower Load (cfu/day)	MOS (cfu/day)
High	112,960	108,261	8.29E+14	7.95E+14	3.45E+13
Medium	103,637	96,947	7.61E+14	7.12E+14	4.91E+13
Low	91,923	70,423*	6.75E+14	5.17E+14	1.58E+14

*The 95% exceedence flow value was used for the Low flow condition

The MOS for the high, medium, and low flow categories represent 4.2%, 6.5%, and 23.4% of the median loads respectively. The most critical flow category is the low flow category when the volume of water in the Detroit River that is available for mixing is lowest. *E. coli* loads occurring during flows within the low flow category have the largest impact on *E. coli* concentrations in the Detroit River. The explicit MOS approach described above provides a 23.4% MOS for the low flow category.

The TMDL also incorporates a conservative approach that adds an implicit MOS not accounted for in the explicit MOS calculation above. *E. coli* survive for a relatively short time in the environment, depending on environmental conditions. However, the load allocation approach assumes no *E. coli* die-off and that the entire allocated load contributes to Detroit River *E. coli* concentrations.

6.2 Tributary Loads

Tributary loads for the Rouge River and Ecorse River are expressed as their respective loading capacities. An *E. coli* TMDL has been finalized for the Rouge River and an *E. coli* TMDL is currently under development for the Ecorse River. Loading capacities for the mouth of the two tributaries have been calculated for their respective TMDLs using flow duration curves and the numeric criteria (300 cfu/100 mL) for the total body contact recreation WQS. Those flow duration curves have been used to calculate loading capacities for the flow categories used in this TMDL. The resultant loading capacities correspond to the tributary load allocations that are shown in Table 11.

7.0 ALLOCATIONS

The overall LC is subsequently allocated into waste load allocations (WLA) for point sources, load allocations (LA) for non-point sources and the margin of safety (MOS), which was discussed in Section 6.1. The allocations described herein refer only to the Combined Downriver and North Detroit subwatersheds. The allocations for the Rouge and Ecorse River subwatersheds can be found in there respective TMDL reports.

The LC is the sum of individual WLAs, LAs, and the MOS. Conceptually, this definition is denoted by the following equation.

$$LC = \sum WLAs + \sum LAs + MOS$$

Where $\sum$ = sum of

E. coli allocations are divided into two categories: 1) waste load allocations and 2) load allocations. Waste load allocations cover *E. coli* loads from permitted point sources including wastewater treatment plant discharges, runoff from industrial sites and discharges from municipal separate storm sewer systems (MS4s). Load allocations include *E. coli* loads from non-point sources not covered under individual or general discharge permits. Runoff from agricultural land is also included in load allocation category. A detailed description of each allocation follows along with the rationale behind each allocation. The resultant numeric loads and a summary of the rationale can be found in Tables 11 and 12.

7.1 Waste Load Allocation

Waste load allocations (WLA) were assigned to sanitary wastewater, industrial storm water, and municipal storm water discharges permitted by an individual NPDES permit or general NPDES permit as described in the sections below. A complete list of NPDES permits addressed in this TMDL is included in Attachment C.

7.1.1 Sanitary Wastewater NPDES Permits

There are six NPDES permits that received a WLA for the discharge of sanitary wastewater as shown in Table 6. Five of these permits are for WWTPs that discharge directly to the Detroit River. WLAs have been assigned to the individual WWTP permits using the NPDES plant design flow rates and the WQS of 300 cfu/100 mL. NPDES design flow rates are noted in Table 11.

Table 6. Facilities with WLA for Sanitary Wastewater

Permit/ Certificate of Coverage Number	Facility Name
Individual Permits (for Discharge of Sanitary Wastewater)	
MI0021156	Wayne Co-Downriver WWTP
MI0021164	Trenton WWTP
MI0022802	Detroit WWTP
MI0026191	Grosse Ile Twp WWTP
MI0036072	Southgate/Wyandotte CSO RTF
MI0043800	S Huron Valley UA WWTP

Numerous CSOs also discharge directly to the Detroit River and receive WLAs under two individual permits. The CSOs permitted under the Detroit WWTP individual permit received a WLA based on output from a hydrodynamic model developed and applied by the City of Detroit as part of its CSO long-term control plan. This was the best method for determining the flow at all 46 Detroit WWTP CSOs in lieu of actual discharge data.

The total flow volume was obtained for the model run for the one year rainfall event (1 inch in 1 hour). The flow produced by this rainfall event is frequent enough, while not being too frequent, and of sufficient magnitude to produce WLAs protective under most conditions. Larger rainfall events may result in a higher *E. coli* load to the Detroit River, but the events are too rare to be protective of the WQS on a daily basis. Smaller rainfall events occur more frequently during the total body contact recreation season, but the total CSO volume and *E. coli* load are fairly low for those smaller events. Consequently, those smaller rainfall events may under-emphasize the impact of CSOs on the total body contact recreation WQS.

The Southgate/Wyandotte CSO retention and treatment facility (RTF) received a WLA based on the maximum recorded event discharge volume recorded between March 1, 2003 and April 1, 2008. The maximum recorded event was used to be most protective of the River. The reported precipitation total associated with this CSO event was 1.59 inches. The event occurred between February 5th and 12th of 2008.

7.1.2 Industrial Storm Water NPDES Permits

The WLA for industrial storm water permits was assigned based on the anticipated *E. coli* loading from storm water runoff associated with the industrial areas under various flow conditions. The Long Term Hydrologic Impact Analysis (LTHIA) web application developed by Purdue University, available through the Local Government Environmental Assistance Network, was used to approximate *E. coli* loadings associated with industrial storm water runoff. LTHIA is a curve number-based model that uses land use and hydrologic soil group data to predict long term runoff volumes and non-point source pollution from watersheds. Each land use and hydrologic soil combination is assigned an average curve number. The model uses precipitation data to estimate Antecedent Moisture Conditions (AMC) in the soil and the curve number is adjusted according the AMC conditions. Long-term daily precipitation data is used to predict average annual runoff for each curve number assigned to the various land use/soil group combinations. Dust and dirt accumulation in urban areas and its wash off are used to estimate non-point source pollution, including fecal coliform.

With land use, hydrologic soil information and site location information provided by the user and long-term daily precipitation data queried from an Oracle® database, LTHIA generates runoff volumes and non-point source pollution output in tabular and graphical forms. Non-point source

pollution is indicated as an average annual load in tabular form and as a function of percent exceedence of the rainfall in graphical form. The user is able to extract the estimated non-point source pollution loading associated with any given rainfall event based on percent exceedence.

The total industrial land use for the Detroit River watershed (minus the Rouge and Ecorse river watersheds) was determined using the 2000 SEMCOG land use data. The existing available soil information (obtained from the Michigan Center for Geographic Information) was identified for all of the industrial land use area using GIS. LTHIA outputs an annual load in million of fecal coliform (MFC) units per year. A conversion factor as shown in the following formula was applied to calculate daily *E. coli* loads from annual fecal coliform loads predicted by LTHIA.

$$E.coli(\frac{cfu}{day}) = \frac{MFC}{year} \times \frac{1year}{365days} \times \frac{1{,}000{,}000FC}{MFC} \times 0.77\frac{E.coli}{FC}$$

The annual fecal coliform load associated with the 30% rainfall exceedance was obtained from the LTHIA output and converted to a daily *E. coli* load as summarized in Table 7.

Table 7. Modeled *E. coli* Loadings from Industrial Land Uses by Soil Type

Model Input		Model Output	
Soil Type*	**Area (ac)****	**Annual Fecal Coliform (M FC/year)**	**Annual *E. coli* (cfu/day)**
Soil Group A	171.6	56,053	1.18E+08
Soil Group B	736.5	508,293	1.07E+09
Soil Group C	8,574.4	8,147,354	1.72E+10
Soil Group D	312.8	378,191	7.98E+08
TOTAL	**9,795.3**	**9,089,891**	**1.92E+10**

*As defined by the Natural Resource Conservation Service (NRCS 2008)
** Excluding the Rouge River and Ecorse River sub-watersheds

The WLA for industrial storm water includes facilities with a general industrial storm water permit and facilities with an individual permit that authorizes the discharge of industrial storm water to the Detroit River or its tributaries (See Table 8).

Table 8. Facilities with WLA under the Industrial Storm Water Permit Category

Permit/ Certificate of Coverage Number	Facility Name
Individual Permits (with authorized Storm Water Discharges)	
MI0000540	BASF-Wyandotte
MI0001724	DECO-River Rouge Plt
MI0026786	US Steel-GL-Zug Island
MI0001791	DECO-Trenton Plt
MI0036846	Detroit Metro Wayne Co Airport
MI0002313	US Steel-GL-Ecorse
MI0002381	Taminco-Riverview
MI0057359	Ford-Woodhaven Stamping Pt
General Permit MIS210000 - Storm Water from Industrial Activities (2-Yr Cycle Watersheds)	
MIS210782	Levy-Brennan Street Dock
MIS210878	Great Lakes Agg-Highland Park

Permit/ Certificate of Coverage Number	Facility Name
MIS210886	Dolphin Manufacturing
MIS210888	Superior Materials Plt 2
MIS210900	Alken Ziegler-Taylor
MIS210905	Oakwood Custom Coating
MIS210906	Oakwood Metal Fabricating
MIS210910	Jamison Industries Inc
General Permit MIS310000 - Storm Water from Industrial Activities (3-Yr Cycle Watersheds)	
MIS310018	Group B Industries Inc
MIS310040	Control Manufacturing
MIS310041	Best Concrete & Supply
MIS310042	Solutia Inc-Trenton-Plant 2
MIS310050	Hawkins Steel Cartage
MIS310051	Humbug Marina-Gibraltar
MIS310086	Chrysler LLC-Trenton
MIS310090	Levy-Ecorse-Plt 3
MIS310091	Taylor Auto Salvage Inc
MIS310094	Summit Industries-Taylor
MIS310095	Saint-Gobain Abrasives Inc
MIS310143	G & J Cartage Co-Taylor
MIS310146	Fritz Enterprises-Taylor
MIS310147	Fritz Enterprises-Brownstown
MIS310183	FPT Hi-Way
MIS310186	Mich ARNG-Taylor Armory OMS8
MIS310189	Phils Auto Parts-Southgate
MIS310209	Suburban Industries-Gibraltar
MIS310210	Trenton Auto Parts
MIS310211	Levy-Penn Landfill
MIS310212	Ash Stevens-Riverview
MIS310216	Doan Companies-Brownstown Plt
MIS310217	Big 4 Auto Parts
MIS310221	Riverview-Land Preserve
MIS310224	Gregory Boat Company-No 1
MIS310225	Gregory Boat Company-No 2
MIS310238	ET US Holdings LLC
MIS310239	Johnson Controls-Taylor
MIS310273	Kreher Wire Processing-Romulus
MIS310276	Ford-Woodhaven Forging Plt
MIS310284	Elkins Machine & Tool-Romulus
MIS310289	Industrial Fab Inc-Rockwood
MIS310292	Waste Mgt of Mi-Area Disposal
MIS310293	Harbor Hill Marina-Detroit
MIS310294	Trenton Forging Co-Trenton
MIS310315	Millcraft SMS Services-Taylor
MIS310316	Contract Freighters-Taylor
MIS310319	Systrand Manufacturing-Trenton
MIS310387	Aztec Manufacturing-Romulus
MIS310419	Landis Machine Shop-Romulus
MIS310428	Detroit Marine-Detroit River
MIS310470	Federal Screw Works-Romulus

Permit/ Certificate of Coverage Number	Facility Name
MIS310476	Keans Detroit Yacht Harbor
MIS310508	CTS Engineering-Taylor
MIS310510	UPS-Taylor
MIS310518	Apollo Plating Inc-Taylor
MIS310553	CL Rieckhoff Co Inc
MIS310555	Bucks Oil Co Inc
MIS310569	Huron Valley Steel Corp
MIS310599	Prime Industries
General Permit MIS410000 - Storm Water from Industrial Activities (4-Yr Cycle Watersheds)	
MIS410395	Barrett Paving-Romulus
MIS410413	Oakite Products-Romulus
MIS410554	Johnson Controls Inc-Rockwood
General Permit MIS320000 - Storm Water Discharges with Required Monitoring	
MIS320014	Grosse Ile Municipal Airport
MIS320020	Buckeye Terminals-Woodhaven

7.1.3 Individual or General Permits not authorizing Storm Water

After review of the NPDES permits that do not authorize the discharge of storm water as shown in Table 9, the MDEQ determined that the sites covered under these permits are not likely to contain *E. coli* in their discharges. Therefore, the WLA for these discharges is zero.

Table 9. Facilities not authorized to Discharge Storm Water

Permit/ Certificate of Coverage Number	Facility Name
Individual Permits	
MI0002399	DSC-Trenton Plant
MI0003310	Praxair Inc
MI0001953	DECO-Sibley Quarry
MI0038105	Wyandotte Electric Plant & WFP
MI0001775	DECO-Conners Creek Plt
MI0056243	Steel Rolling Holdings LLC
MI0057709	US Steel-GLW-River Basins
General Permit MIG640000 - Wastewater Discharge from Municipal Potable Water Supply	
MIG640222	DWSD-Water Works Park II WTP
General Permit MIG670000 - Hydrostatic Pressure Test Water	
MIG670085	Buckeye Terminals-Woodhaven

7.1.4 Municipal Storm Water NPDES Permits

All Phase I and Phase II MS4 communities and the Michigan Department of Transportation, listed in Table 10, receive a combined WLA. This combined municipal storm water WLA is equal to the balance of the LC after deducting the MOS and all other WLA.

Table 10. Agencies with WLA under the Municipal Storm Water Permit Category

Permit/ Certificate of Coverage Number	Facility Name
Individual Permits	
MI0057364	MDOT State-wide MS4
General Permit MIG619000 - Municipal Separate Storm Sewer System (Watershed-Based)	
MIG610017	Romulus MS4-Wayne
MIG610040	Wayne Co MS4
MIG610344	Grosse Ile Twp MS4-Wayne
MIG610345	Riverview MS4-Wayne
MIG610346	Gibraltar MS4-Wayne
MIG610347	Southgate MS4-Wayne
MIG610348	Taylor MS4-Wayne
MIG610349	Wyandotte MS4-Wayne
MIG610352	Ecorse MS-4 Wayne
MIG610353	Huron Charter Twp MS4-Wayne
MIG610354	Woodhaven MS4-Wayne
MIG610355	Sumpter Twp MS4-Wayne
MIG610356	Brownstown Twp MS4-Wayne
MIG610359	Woodhaven-Brownstown PS MS4-Wayne
General Permit MIS040000 - Municipal Separate Storm Sewer System (Six Min. Measures)	
MIS040066	Detroit MS4-Wayne
MIS040073	River Rouge MS4-Wayne
MIS040038	Trenton MS4-Wayne

7.2 Load Allocation

Non-point sources receive a separate Load Allocation (LA) in a TMDL. For the Detroit River watershed, all drainage areas are considered to be covered under a NPDES permit including the MS4 general storm water permits; therefore the load allocation is zero.

Table 11. Loading Capacity and Allocation for the Detroit River (excluding the Ecorse and Rouge River Subwatersheds)

	NPDES Permit (if applicable)	Flow Condition		
		High (0% - 30%)	Moderate (30% - 70%)	Low (70% - 100%)
Median Flow Exceedence Frequency		15%	50%	85%
Total River Flow (cfs)		215,986	198,158	175,761
United States Flow Portion - 52.3% of Total River Flow (cfs)		112,960	103,637	91,923
		Daily Load of *E. coli* (cfu/day)		
Loading Capacity (LC) for United States Waters		8.29E+14	7.61E+14	6.75E+14
Margin of Safety (MOS)		3.45E+13	4.91E+13	1.58E+14
Tributary Loads				
Rouge River		4.25E+12	1.66E+12	8.46E+11
Ecorse River		3.27E+11	4.48E+10	1.17E+10
Available LC		7.89E+14	7.10E+14	5.16E+14
Waste Load Allocations (WLA) –				
WLA – Sanitary Wastewater				
Wayne County Downriver WWTP (125 MGD; 193 cfs)	MI0021156	1.42E+12	1.42E+12	1.42E+12
Trenton WWTP (6.5 MGD; 10 cfs)	MI0021164	7.38E+10	7.38E+10	7.38E+10
Detroit WWTP (930 MGD; 1,439 cfs)	MI0022802	1.06E+13	1.06E+13	1.06E+13
Detroit CSOs (46 outfalls)	MI0022802	6.06E+12	6.06E+12	6.06E+12
Grosse Ile Twp WWTP (2.25 MGD; 3 cfs)	MI0026191	2.56E+10	2.56E+10	2.56E+10
Southgate/Wyandotte CSO RTF (1 outfall)	MI0036072	3.07E+11	3.07E+11	3.07E+11
S Huron Valley UA WWTP (24 MGD; 37 cfs)	MI0043800	2.73E+11	2.73E+11	2.73E+11
WLA – Industrial Storm Water	MIS210000 MIS310000 MIS410000 MIS320000	1.92E+10	1.92E+10	1.92E+10
WLA – Municipal Storm Water	MIG619000 MIS040000 MI0057364	7.71E+14	6.91E+14	4.97E+14
WLA – Individual or general permits not authorizing storm water excluding WWTPs	MIG640000 MIG670000	0+00E+00	0+00E+00	0+00E+00
Load Allocation (LA) (non-point sources)	None	0+00E+00	0+00E+00	0+00E+00

Table 12. Allocation Rationale Table for the Detroit River *E. coli* TMDL

Allocation	Rationale
Margin of Safety (MOS)	Explicit: Difference between median flow exceedence interval value and minimum flow exceedence interval value for each flow category; MOS calculated using U.S. daily criteria of 300 cfu/100 mL for U.S. portion of flow (52.3% of total flow) Implicit: Conservative approach
Rouge River	Discharge flow at mouth of river times daily maximum WQS
Ecorse River	Discharge flow at mouth of river times daily maximum WQS
Waste Load Allocations (WLA)	
WLA – Sanitary Wastewater	Detroit CSO WLA is based on the 1-year storm event modeled by the City of Detroit (1-inch in 1-hour). Southgate/Wyandotte CSO WLA is based on maximum recorded discharge volume between March 1, 2003 and April 1, 2008. NPDES design flows used for WWTPs.
WLA – Industrial Storm Water	Long Term Hydrologic Impact Analysis (LTHIA) web application was used to approximate *E. coli* loadings associated with industrial storm water runoff. Web-based application developed by Purdue University: http://cobweb.ecn.purdue.edu/~sprawl/LTHIA7/lthianew/tool.htm
WLA – Municipal Storm Water	Available LC from Table 11 minus allocations for individual permits for sanitary wastewater and CSOs, and general industrial storm water permits and individual permits authorizing storm water.
WLA – Individual or general permits not authorizing storm water excluding WWTPs	No allocation – these permits are not considered a source of *E. coli*
Load Allocation (LA) (non-point sources)	No allocation – although agricultural areas exists, they all discharge to areas covered under municipal or industrial NPDES permits

8.0 SEASONALITY

Seasonality in the TMDL is addressed by expressing the TMDL in terms of a total body contact recreation season that is defined as May 1 through October 31 by R 323.1100 of the WQS. It is expected that there is minimal total body contact during the remainder of the year due to cold weather; however, there is a separate WQS maximum of 1,000 *E. coli* per 100 mL for the partial body contact season, which applies year-round. *E. coli* allocations developed to protect during the total body contact season are also expected to assure attainment of the partial body contact standard.

9.0 MONITORING

E. coli was monitored weekly at nine river transects and 56 stations on the Detroit River from May 1 through October 2, 2007. Future monitoring will take place as part of the 5-year rotating basin monitoring as resources allow, and when corrective actions have occurred to suggest that WQS may be met. When these results indicate that the water body may be meeting WQS, sampling will be conducted at the appropriate frequency (as defined in the Numeric Target section) to determine if the targets are being met.

10.0 REASONABLE ASSURANCE ACTIVITIES

As mentioned earlier, the Rouge River subwatershed already has an *E. coli* TMDL established, and the Ecorse River subwatershed's *E. coli* TMDL is under development. As such, reasonable assurance activities for meeting the WQS in those two subwatersheds are not explicitly discussed herein, as they are described in their respective TMDLs.

The MDEQ regulates point sources of *E. coli* to the Detroit River and its tributaries through the issuance of individual permits or certificates-of-coverage (COC) for general permits under the NPDES. The daily maximum and monthly geometric mean WQS concentration levels for *E. coli* presented in the numeric target section (e.g., 300 and 130 cfu/100 mL, respectively), or alternative endpoints that assure attainment of the *E. coli* standards (e.g., best management practices, fecal coliform limitations) will be used to establish any necessary NPDES permit requirements that are consistent with this TMDL.

Point source discharges are the most prevalent source type for *E. coli* in the Detroit River watershed, including municipal storm sewers, industrial storm water outfalls, and combined sewers. Therefore, water quality attainment can be achieved solely through the regulation of point sources.

The following existing organizational structures and activities demonstrate the ability to eliminate or reduce many of the *E. coli* sources in the Detroit River watershed, particularly wet weather sources, through NPDES permitting and cooperative watershed-based efforts.

10.1 Industrial Storm Water

Federal regulations require certain industries to apply for an NPDES permit if storm water associated with industrial activity at the facility discharges into a separate storm sewer system or directly into surface water. A storm water permit is not required if storm water does not discharge from the facility or is discharged into a sewer system that leads to a WWTP. The general industrial storm water permits identified in Attachment C (MIS210000, MIS310000, MIS320000 and MIS410000) require that if there is a TMDL established by the MDEQ for the receiving water that restricts a material that could impair or degrade water quality, then the required storm water pollution prevention plan shall identify the level of control for those materials necessary to comply with the TMDL and an estimate of the current annual load of those materials via storm water discharges to the receiving stream.

The State of Michigan began issuing industrial storm water permit coverage in 1994. There are three types of permits available in Michigan: a generic baseline general permit, a generic general permit with monitoring requirements, or a site-specific individual permit. There are approximately 4,000 facilities statewide with storm water discharge authorization, with approximately 265 within the U.S. Detroit River watershed. Michigan's storm water permit authorization requires facilities to obtain a certified operator who will have supervision and control over the control structures at the facility, eliminate any unauthorized non-storm water discharges, and develop and implement a storm water pollution prevention plan for their facility that includes structural and nonstructural control measures. Prior to obtaining permit coverage, applicants must certify that they do not have any unauthorized discharges.

MDEQ staff conducts inspections of a percentage of permitted industrial facilities annually. Inspections are utilized to ensure that facilities comply with the regulations, and they result in a

further reduction in unauthorized discharges and illicit connections. Additionally, as additional facilities obtain industrial storm water permits, more illicit discharges will be eliminated.

General permits for wastewater discharges from municipal potable water supplies (MIG640000) and hydrostatic pressure test waters (MIG670000) require that Michigan's WQS are not violated as a result of the discharge. The MDEQ may require the permittee to provide additional sampling or monitoring as deemed necessary to assure adequate operation of the treatment system.

10.2 Municipal Storm Water

The USEPA's Storm Water Phase II Rules require that all municipalities operating MS4s within urbanized areas obtain municipal storm water permits, unless this requirement is waived by the NPDES permitting authority. Municipal storm water is regulated in Michigan under either one of two general permits: watershed based (MIG619000) or six minimum measures (MIS040000). MS4 communities can elect to apply for coverage under either general permit.

Under both newly revised permits, if a water body has a TMDL established by the MDEQ for a particular pollutant, the MS4 permittee must complete actions to reduce the pollutant in storm water discharges. Permittees that discharge into water bodies with an approved *E. coli* TMDL are required to take at least one representative sample of a storm water discharge from at least 50% of discharge pipes or open conveyances measuring 36 inches or more at the widest cross section, within the portion of the TMDL watershed in the urbanized area. Results must be reported to the MDEQ.

10.2.1 Watershed Based Storm Water Permit (MIG619000)

The USEPA and most water resource professionals advocate holistic and adaptive watershed management approaches for the protection and restoration of aquatic ecosystems by encouraging pollution control strategies that are developed through collaborative partnerships within a hydrologic boundary. Michigan was one of the first states to embrace and help develop the concept of watershed-based general storm water permitting.

The Combined Downriver and North Detroit subwatersheds encompass 12 MS4 communities that have obtained coverage under the Phase II Watershed Based Storm Water General Permit (MIG619000, Table 13). Per the requirements of the watershed-based permit, Combined Downriver Subwatershed Inter-Municipality Committee (CDWIC) prepared a watershed management plan in 2006 that establishes storm water management goals and actions (CDWIC 2006).

Table 13. Combined Downriver and North Detroit Subwatershed Communities covered under the Watershed-based Permit

Brownstown Twp.	Riverview	Taylor
Ecorse	Romulus	Woodhaven
Gibraltar	Southgate	Wyandotte
Grosse Ile Twp.	Sumpter Twp.	Wayne County
Huron Twp.		

There are numerous county drains in the Combined Downriver subwatershed under the jurisdiction of the WCDOE. Wayne County's coverage under the General Permit applies to its operations, facilities, and functions throughout the approximately 626 square mile county (WCDOE 2004). The Watershed Management Division coordinates Wayne County General Permit activities with watershed communities, counties, agencies, subwatershed advisory groups, and other interested parties.

The communities and other stakeholders in the Ecorse River, Combined Downriver, and Lower Huron River subwatersheds have been working together for several years to manage the area's water resources on a watershed basis and to comply with federal regulations regarding the discharge of storm water. The communities have formed a permanent watershed organization established under the Watershed Alliance legislation (Public Act 517 of the Public Laws of 2004). The Alliance of Downriver Watersheds (ADW) provides services to its members and to the existing Advisory Group for each subwatershed in order to facilitate implementation of the Combined Downriver and Ecorse River watershed management plans.

10.2.2 Six Minimum Measures Storm Water Permit (MIS040000)

The Cities of Detroit, River Rouge, and Trenton have obtained Certificates of Coverage under Michigan's Six Minimum Measures general storm water permit (MIS040000) for MS4 communities. The cities of Detroit and River Rouge are located in the north Detroit subwatershed, while Trenton is located in the Combined Downriver subwatershed. The Six minimum measures general MS4 storm water permit requires permittees to develop and implement a Storm Water Management Program Plan (SWMPP) to reduce the discharge of pollutants from the drainage area to the maximum extent practicable to protect the designated uses of the waters of the state, to protect water quality, and to satisfy appropriate water quality requirements of the federal and state statutes.

The City of Detroit last updated its SWMPP in April of 2007 (DWSD 2007). Detroit's SWMPP provides a framework for implementation of several pollution prevention BMPs covering the areas of illicit discharge elimination, OSDS operation, public education, public involvement and construction site runoff under its on-going Long Term CSO Control Plan. The City identified 50 municipally-owned storm sewers including 22 outfalls to the Detroit River and its tributaries during a comprehensive investigation (DWSD 2007). All but one of those outfalls is located on Belle Isle and the Belle Isle Bridge. The other is located on the Detroit River shoreline just south of the Belle Isle Bridge. The majority of the City's storm sewers drain parklands and/or roads.

The City of Detroit developed its SWMPP through a coordinated multi-agency effort by representatives from several city departments. Storm water management in the City of Detroit involves many entities including the Water and Sewerage Department, the Recreation Department, the Planning and Development Department, the Department of Public Works, the Building and Safety Engineering Department, the Department of Environmental Affairs, the Detroit Economic Growth Corporation, the Greater Detroit Resource Recovery Authority, the General Services Department and Corporation Counsel. Management and control of storm water discharge will be achieved consistent with the City's efforts to control wet weather discharges from its combined sewer system. Completion of the Long Term CSO Control Plan and SWMPP implementation will minimize water quality impacts to the Detroit River to the maximum extent possible (DWSD 2007).

The City of Trenton has had permit coverage since October 31, 2003. The City of River Rouge has had permit coverage since March 22, 2007, and is thus beginning to implement planned

programs. Only about two percent of the City of River Rouge is served by separate storm sewers.

10.2.3 Illicit Discharge Elimination

Under municipal storm water permits, permittees are required to develop and implement illicit discharge elimination plans (IDEPs) to prohibit and effectively eliminate illicit discharges (including discharges of sanitary wastewater) to municipal separate storm water drainage systems (MS4s). Communities throughout the watershed have responded to this permit requirement by implementing various activities including:

- Inspection of storm water outfalls and screening storm water discharges for signs of pollution;
- Enacting a report-a-polluter hotline at the county-level to field pollution complaints;
- Training municipal staff at the county and local level on how to detect illicit discharges; and
- Conducting dye testing of various businesses to ensure they are properly connected to the sanitary sewer system.

The Combined Downriver Watershed Management Plan contains a subwatershed action plan section that details planned activities of the communities participating in the Downriver Watershed Alliance, including the Wayne County Airport Authority and Woodhaven-Brownstown School District. Most of those entities are implementing IDEP activities.

The City of Detroit has planned several IDEP BMPs in its SWMPP including staff training, dry weather outfall screening, outfall inventory, dry weather flow sampling, and correction.

The City of Trenton partially fulfills the IDEP requirements of the Six Minimum Measures permit by conducting dry weather screening of their point source discharges. Half of Trenton's outfalls were inspected in 2006, and no illicit discharges were observed. Trenton is in the process of developing a storm sewer database to more readily track illicit discharges.

The City of River Rouge staff will visually inspect and sample the one known storm water discharge point at least once every five years, and eliminate any illicit discharges or connections found.

The City of Trenton has developed and River Rouge is developing geographic information system (GIS) coverage of their respective storm water drainage systems. These GIS coverages include the location of each known stormwater outfall and the respective receiving water or drainage system.

10.2.4 On-Site Sewage Disposal System (OSDS) Management

Under the MS4 permits, municipalities are required to minimize seepage from OSDSs into their storm water drainage systems. OSDS investigations are conducted within Wayne County at the time a home is sold and in response to complaints from the public. Over the past four to five years, Wayne County has identified between 80 and 100 failing on-site septic systems each year through its inspection program of which 90% to 95% are corrected each year (WCDOE 2007). Between 1999 and 2006, Wayne County inspected 1,007 OSDSs county-wide, identifying 239 failed systems and confirming 225 corrections (ARC 2007).

Trenton and River Rouge have sanitary sewer service for every home and business. Within these cities it is a violation of City Building Code and City Ordinance to develop or use property without connecting to City sanitary sewer. Septic systems are not permitted within either City.

10.2.5 Public Education & Involvement

Under the MS4 permits, municipalities are required to develop a public education plan for the purpose of encouraging the public to reduce the discharge of pollutants in storm water to the maximum extent practicable. In response to the MS4 regulations, Wayne County has instituted a 24-hour pollution complaint telephone line to encourage the public to report illegal dumping and water quality problems. Wayne County has also trained many of their field staff on how to identify illicit discharges in storm sewers. Programs like these help reduce the number of water quality problems in the watershed.

10.3 CSO/SSO Control

CSOs can be corrected by either elimination through sewer separation projects or by providing adequate treatment to meet Michigan WQS at times of discharge. Under the long term control plans, it is acceptable to treat CSOs to meet federal and state requirements that include, as one significant goal, protecting public health. CSO treatment often involves solids settling, skimming floatable materials and disinfection. CSO discharges are not required to meet federal secondary treatment requirements as they apply to WWTPs, but must still comply with all state water quality standards.

SSOs must be eliminated in accordance with the MDEQ SSO Policy and Clarification Statement.

To date, there has been a great deal of work on CSO control and SSO correction projects that have reduced the volume of untreated wet weather discharge into the Detroit River. Previous and on-going work toward eliminating SSOs and controlling CSOs is summarized below by sewer area.

10.3.1 Detroit Long-term CSO Control Program

The Detroit Water and Sewerage Department (DWSD) continues to make significant progress implementing its Long-term CSO Control Plan (LTCP) that was submitted in 1996, with approved elements first embodied in its 1997 NPDES permit. Revisions to LTCP projects were made and further included in the 2003 NPDES permit and again in the 2007 NPDES permit. Detroit's LTCP has initially focused on 1) bringing as much wet weather flow to the WWTP as possible during events and treating it to NPDES required primary levels (some treated through full secondary treatment as required by the Environmental Protection Agency CSO policy), 2) using in-system storage in the combined collection system (large flat sewers are available for storage), and 3) by storing/treating priority CSOs on the collection system using retention and treatment basins (RTBs).

The Detroit WWTP (MI0022802) requires that an updated LTCP be submitted by December 1, 2008, that defines the correction projects and associated schedules for the remaining uncontrolled CSOs. The updated LTCP is separated into two parts; one that affects the Detroit River and the other that affects the Rouge River. The specific correction projects and associated schedules will be incorporated into the NPDES permit once approved (either through modification or at the next reissuance). The MDEQ requires that all CSOs be controlled to provide adequate treatment to meet all water quality standards at times of discharge. The State of Michigan does not use less restrictive wet weather water quality standards nor are permittees

allowed the option of use-attainability analyses to downgrade designated uses of receiving waters. MDEQ District staff is participating with DWSD staff during its current LTCP update efforts.

Improvements made by the City of Detroit include the following:

- Four CSO Storage/Treatment Facilities along the Detroit River. These include the Conner Creek RTB (30 MG), the Leib Screening & Disinfection Facility (screens and disinfects all CSO flow), the St. Aubin Screening & Disinfection Facility (screens and disinfects) and the 0.3 MG Belle Isle CSO RTB (controls one CSO);

- Eleven storage devices within the collection system. These are inflatable dams in large sewers;

- Additional facilities at the WWTP (i.e. two 180 MGD primary clarifiers, an additional influent pump in PS 2) that have increased its ability to treat combined wet weather flows to primary treatment levels as required by the NPDES permit (capacity now 1.7 billion gallons per day (BGD) as compared to 1.2 BGD prior to submittal of the LTCP);

- Rehabilitation of pump stations and regulators along the Detroit River;

- Completion of the instrumentation/control system that determines CSO flows and discharge times for the remaining untreated CSOs; and

- Completion of, and several revisions to, the collection system hydraulic model used for LTCP planning and specific project design.

The four CSO retention and treatment facilities along the Detroit River shoreline control the following City of Detroit CSO outfalls:

- 104A Conner Creek Retention Treatment Basin (RTB);
- 108A Belle Isle RTB;
- 105A Lieb Screening/Disinfection Facility; and
- 106A St. Aubin Screening/Disinfection Facility.

These facilities have demonstrated the ability to provide adequate disinfection to protect public health and meet Rule 62 across the range of events monitored when properly operated. Attachment D contains a list of uncontrolled CSO outfalls on the Detroit River that are part of the Detroit WWTP combined sewer system.

The MDEQ estimates that the controls implemented to date have resulted in adequate treatment of 85% of the previously discharged untreated CSO volume (annual average of about 20 billion gallons per year – Detroit and Rouge CSOs combined) though only twelve of the 78 outfalls are currently controlled. The City of Detroit, in consultation with the MDEQ, has intentionally addressed the worst CSOs first. Established correction projects will eliminate two untreated CSOs once construction currently underway is completed, seventeen untreated CSOs once the Upper Rouge Tunnel project is completed (plans now in-house for final construction permitting), and an additional five untreated CSOs (for a total of 36 of the 78 CSOs) by the year 2014. It is estimated that the cost of LTCP through 2014 will be approximately 1.1 billion dollars (or more).

10.3.2 Wayne County Downriver WWTP Collection System

As a result of an enforcement action that was brought against Wayne County and the thirteen Downriver Communities, a federal Consent Decree was entered on February 11, 1994. The Consent Decree included a compliance program for sewer rehabilitation and elimination of excess flow, a flow monitoring program, and a schedule for upgrading the WWTP to meet effluent limits. The projects included a regional storage-transport system and relief sewer facilities with sufficient capacity such that the sewage would be transported for treatment in compliance with the requirements of the applicable NPDES permits. The Consent Decree was terminated in 2005 as compliance was achieved.

The following are projects that constitute the various improvements carried out by the communities, the regional system and the wastewater treatment plant.

- Relief Sewers from the Pelham Basin to Jackson Road Pumping Station
- Upper Tunnel & Allen Park Spur
- Eureka Road Relief Sewer
- Lower Tunnel
- Main Tunnel Sewer Allen Road, I-75 to Champaign Road
- Main Tunnel Sewer Pennsylvania Road, Grange Road to Allen Road and Allen Road, Pennsylvania Road to I-75
- Tunnel Pump Station
- Eureka Road Relief Sewer Extension Beech Daly to Middlebelt Road
- Eureka Road Relief Extension Middle Belt to Wahrman Road
- Low Lift Pump Station
- UV Disinfection and Outfall
- Chemically Enhanced Primary Treatment
- Preliminary Treatment: Screening, Grit removal, Disinfection (UV Facility and new outfall)
- Tunnel Dewatering Pump Station
- Southgate-Wyandotte drainage District # 5 Flow Control chamber
- Downriver Storage & Transport Project - System Monitoring Project

There are eight remaining emergency bypass points within the Downriver system (one at the WWTP to the Detroit River, and seven on the collection system in the Ecorse Creek subwatershed). These are prohibited from discharging. The storm conditions necessary prior to emergency bypass were originally established in the Consent Order.

The Southgate-Wyandotte RTB serves the remaining combined sewer areas within the Downriver system. The existing disinfection system at the RTB Outfall 001 has recently been rehabilitated to provide more effective disinfection. The other outfall in this system is a wet weather discharge from the Pine Street Pump Station (outfall 002). This outfall is being evaluated under the current NPDES permit as to its ability to comply with all water quality standards at times of discharge.

10.3.3 Trenton WWTP Collection System

An ACO was entered between the MDEQ and the City of Trenton in 1996 that called for correction of SSOs to meet state and federal requirements. Fourteen SSO locations were identified in the ACO. The correction program included three new major interceptors, an additional 10.5 MG equalization basin to increase total retention size to 20.0 MG, five new

chambers built at the WWTP grounds to control/divert flows, and a WWTP headworks upgrade. Thirteen of the fourteen SSO locations have been eliminated since 1996. Outfall 002 is the only remaining untreated outfall that could potentially discharge to the Detroit River. However, it has been designed to the 100 year - 24 hour event (4.7 inches of rain in a 24 hour period). Discharge from this outfall is not authorized by the NPDES permit.

10.3.4 Grosse Ile Township WWTP Collection System

A 2001 ACO required correction of SSOs (bypassing at the WWTP) to meet state and federal requirements. Downspouts, yard drains, and catch basins connected to the sanitary sewer system were removed. Sewers and manholes were rehabilitated. Two major interceptors were built to transport peak flow and a 6.5 MG equalization basin was constructed at the WWTP. In addition, a new influent chamber was built at the WWTP grounds to control/divert wet weather flows. All improvements have been completed except for a portion of the redundant interceptor system that is planned to be completed by 2009.

10.3.5 South Huron Valley Utility Authority WWTP Collection System

A 2004 Court Order required the South Huron Valley Utility Authority (SHVUA) to correct SSOs. Prior to this Court Order, a 15-mile long gravity interceptor was constructed in 1993, all seven participating communities removed excess flow sources to stay below their respective contract capacities, and the Odette pump station was built to remove a bottleneck in the collection system. The 2004 Court Order resulted in the construction of a 6 MG equalization basin (designed so that there would be no bypassing at the WWTP at the 25 year - 24 hour event of 3.9 inches of rain in 24 hours). The basin is expandable to 7 MG, if additional capacity is needed.

11.0 PUBLIC PARTICIPATION

The USEPA and MDEQ sponsored two public meetings prior to the release of the draft TMDL. The first meeting was held prior to the onset of the 2007 sampling on March 22, 2007, in conjunction with a regular meeting of the Alliance of Downriver Communities. The second meeting was held on January 30, 2008 on Belle Isle where the 2007 monitoring data and the TMDL development process was discussed. A one-page fact sheet summarizing the monitoring results was prepared and distributed via email prior to this meeting.

A final public meeting is planned for summer 2008 to discuss the draft TMDL document.

All meeting dates were advertised on the MDEQ's calendar and meeting announcements were sent via email to numerous stakeholders.

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Attachment A
Detroit River & Ecorse River *E. coli* Monitoring to Support TMDL Development
Final Report

Attachment B
Detroit River Flow Duration Curve and Time Series Data

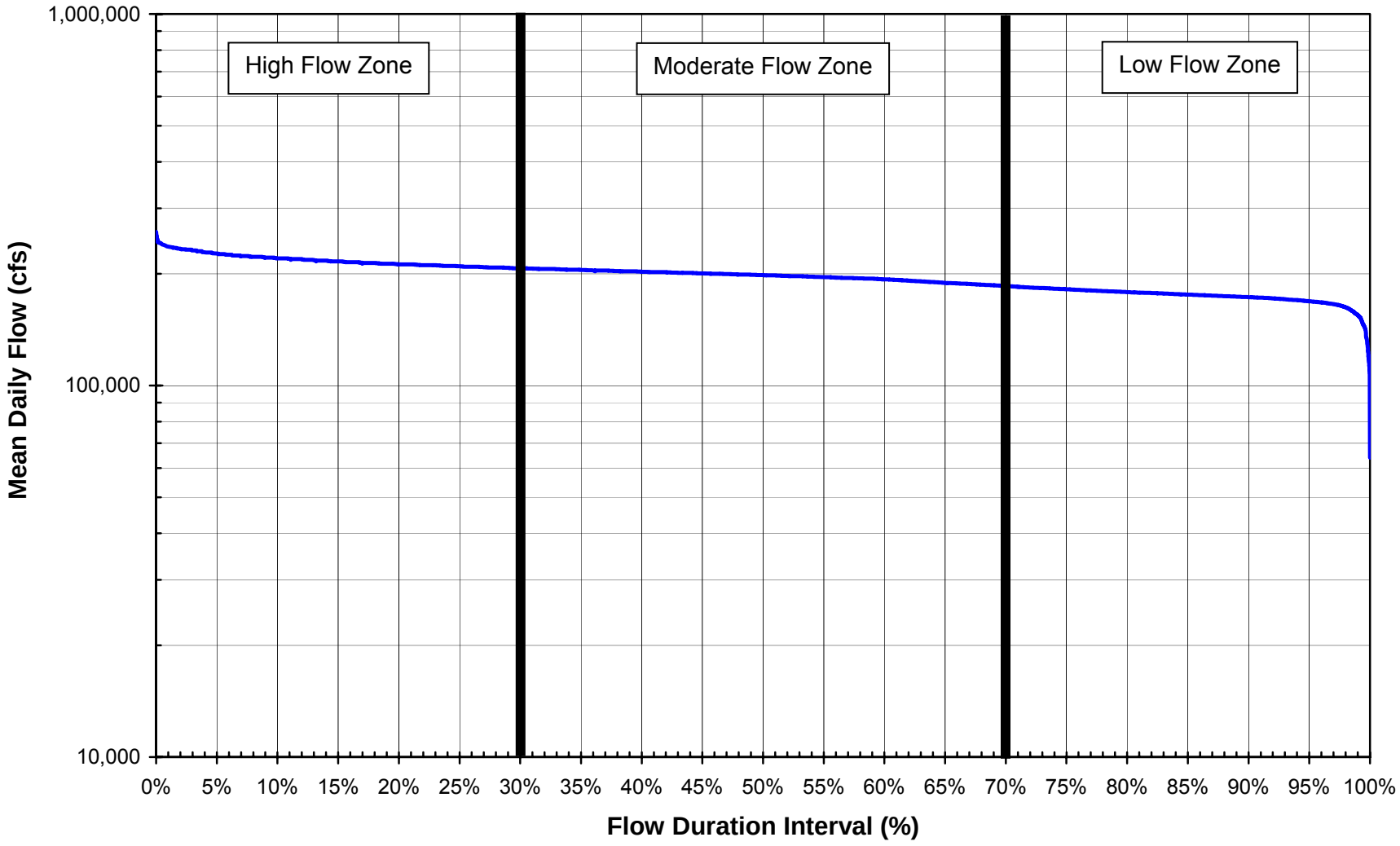


Figure A1. Estimated flow duration curve for the Detroit River. Daily flow estimates obtained from the USACE Detroit District for the period 1/1/1977 to 12/31/2007

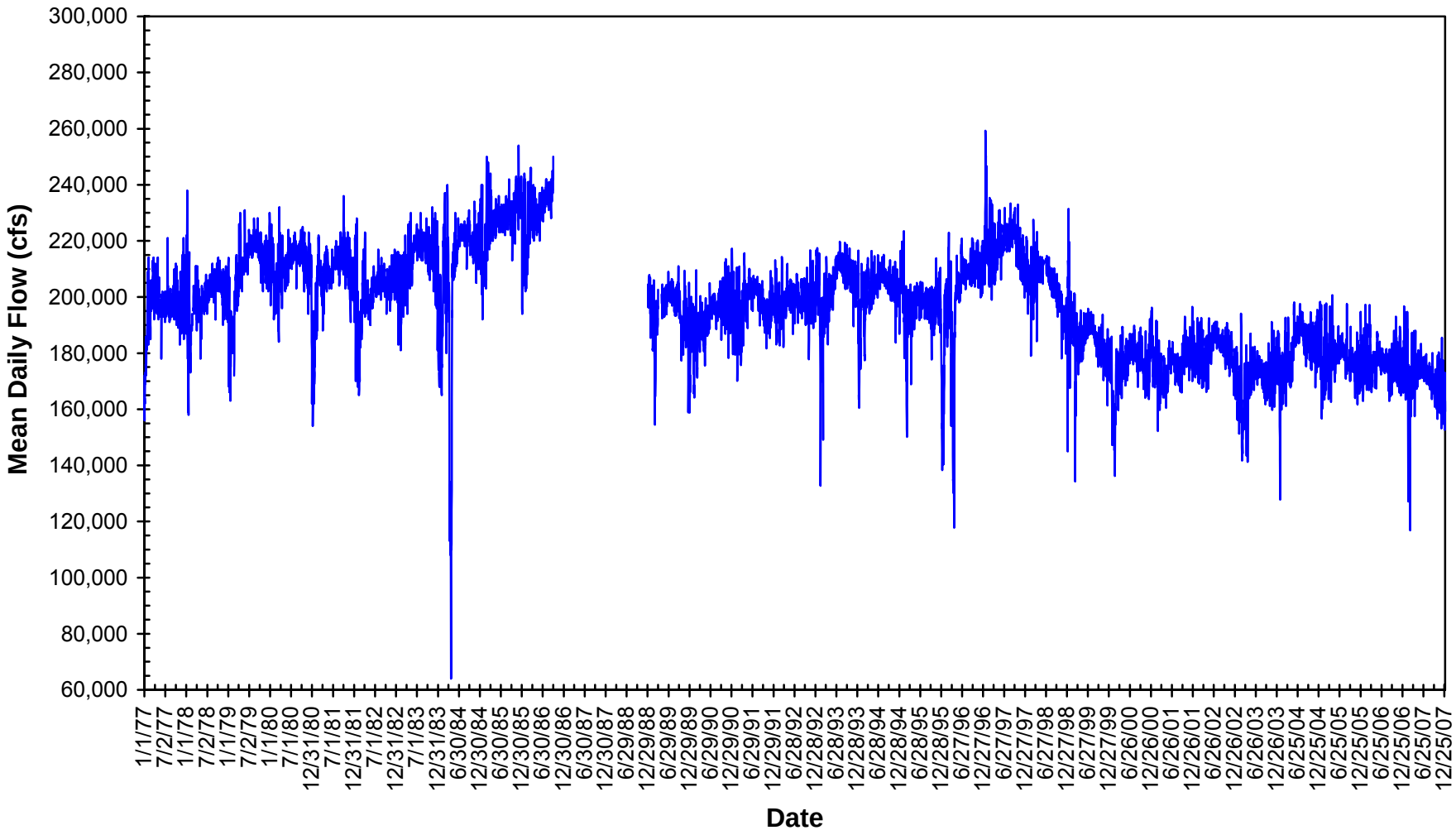


Figure A2. Estimated flow time series for the Detroit River. Daily flow estimates obtained from the USACE Detroit District for the period 1/1/1977 to 12/31/2007

Attachment C
Detroit River NPDES Permits

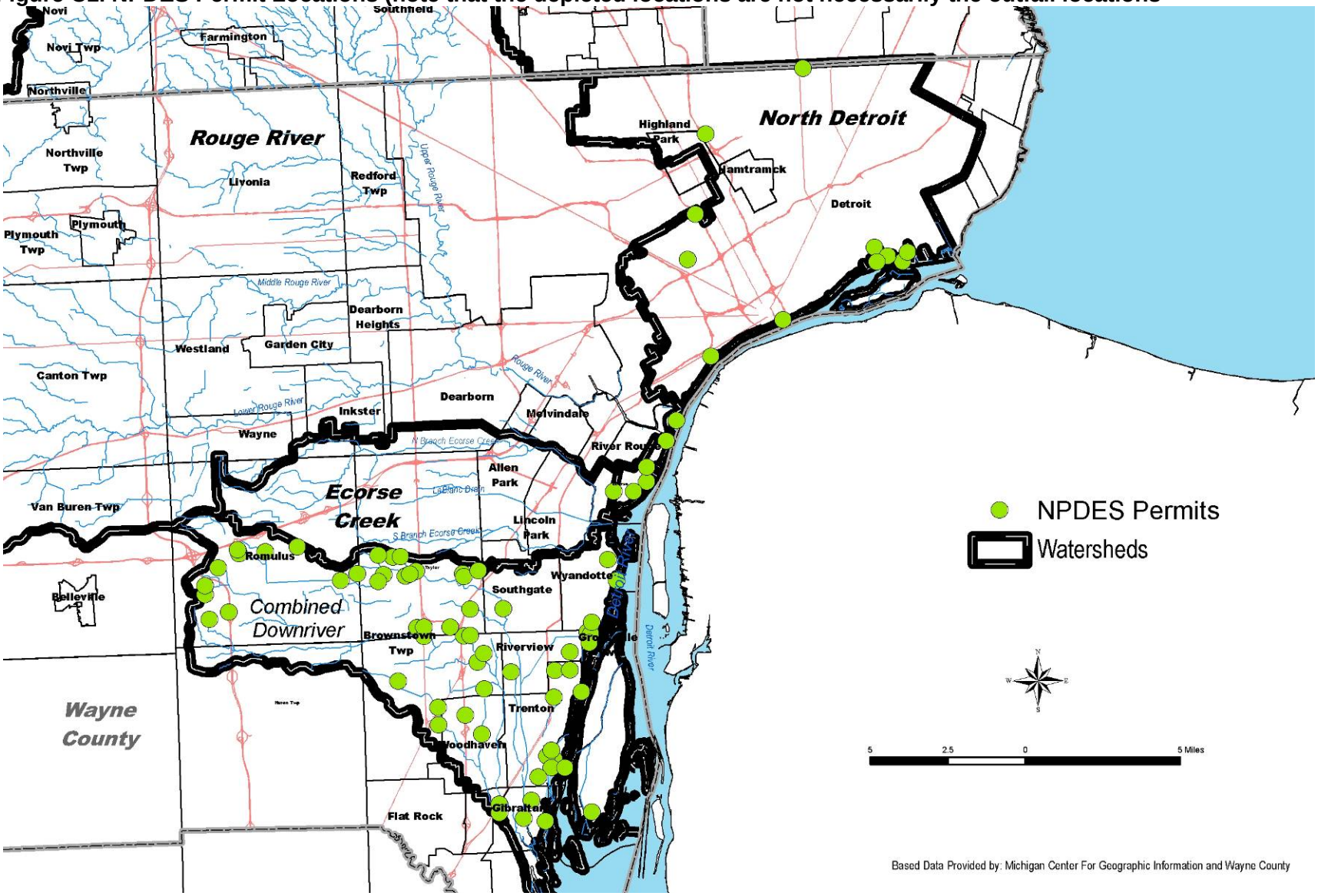
Table C1. NPDES individual permits and Certificates of Coverage in the Combined Downriver and North Detroit portions of the Detroit River Watershed

Permit/ Certificate of Coverage Number	Facility Name
Individual Permits	
MI0000540	BASF-Wyandotte
MI0001724	DECO-River Rouge Plt
MI0001775	DECO-Conners Creek Plt
MI0001791	DECO-Trenton Plt
MI0001953	DECO-Sibley Quarry
MI0002313	US Steel-GL-Ecorse
MI0002381	Taminco-Riverview
MI0002399	DSC-Trenton Plant
MI0003310	Praxair Inc
MI0021156	Wayne Co-Downriver WWTP
MI0021164	Trenton WWTP
MI0022802	Detroit WWTP
MI0026191	Grosse Ile Twp WWTP
MI0026786	US Steel-GL-Zug Island
MI0036072	Southgate/Wyandotte CSO RTF
MI0036846	Detroit Metro Wayne Co Airport
MI0038105	Wyandotte Electric Plant & WFP
MI0043800	S Huron Valley UA WWTP
MI0056243	Steel Rolling Holdings LLC
MI0057359	Ford-Woodhaven Stamping Pt
MI0057364	MDOT State-wide MS4
MI0057709	US Steel-GLW-River Basins
General Permit MIG619000 - Municipal Separate Storm Sewer System (Watershed-Based)	
MIG610017	Romulus MS4-Wayne
MIG610040	Wayne Co MS4
MIG610344	Grosse Ile Twp MS4-Wayne
MIG610345	Riverview MS4-Wayne
MIG610346	Gibraltar MS4-Wayne
MIG610347	Southgate MS4-Wayne
MIG610348	Taylor MS4-Wayne
MIG610349	Wyandotte MS4-Wayne
MIG610352	Ecorse MS-4 Wayne
MIG610353	Huron Charter Twp MS4-Wayne
MIG610354	Woodhaven MS4-Wayne
MIG610355	Sumpter Twp MS4-Wayne
MIG610356	Brownstown Twp MS4-Wayne
MIG610359	Woodhaven-Brownstown PS MS4-Wayne
General Permit MIS040000 - Municipal Separate Storm Sewer System (Six Min. Measures)	
MIS040066	Detroit MS4-Wayne
MIS040073	River Rouge MS4-Wayne
MIS040038	Trenton MS4-Wayne
General Permit MIG640000 - Wastewater Discharge from Municipal Potable Water Supply	
MIG640222	DWSD-Water Works Park II WTP
General Permit MIG670000 - Hydrostatic Pressure Test Water	
MIG670085	Buckeye Terminals-Woodhaven
General Permit MIS210000 - Storm Water from Industrial Activities (2-Yr Cycle Watersheds)	
MIS210782	Levy-Brennan Street Dock
MIS210878	Great Lakes Agg-Highland Park
MIS210886	Dolphin Manufacturing
MIS210888	Superior Materials Plt 2

Permit/ Certificate of Coverage Number	Facility Name
MIS210900	Alken Ziegler-Taylor
MIS210905	Oakwood Custom Coating
MIS210906	Oakwood Metal Fabricating
MIS210910	Jamison Industries Inc
General Permit MIS310000 - Storm Water from Industrial Activities (3-Yr Cycle Watersheds)	
MIS310018	Group B Industries Inc
MIS310040	Control Manufacturing
MIS310041	Best Concrete & Supply
MIS310042	Solutia Inc-Trenton-Plant 2
MIS310050	Hawkins Steel Cartage
MIS310051	Humbug Marina-Gibraltar
MIS310086	Chrysler LLC-Trenton
MIS310090	Levy-Ecorse-Plt 3
MIS310091	Taylor Auto Salvage Inc
MIS310094	Summit Industries-Taylor
MIS310095	Saint-Gobain Abrasives Inc
MIS310143	G & J Cartage Co-Taylor
MIS310146	Fritz Enterprises-Taylor
MIS310147	Fritz Enterprises-Brownstown
MIS310183	FPT Hi-Way
MIS310186	Mich ARNG-Taylor Armory OMS8
MIS310189	Phils Auto Parts-Southgate
MIS310209	Suburban Industries-Gibraltar
MIS310210	Trenton Auto Parts
MIS310211	Levy-Penn Landfill
MIS310212	Ash Stevens-Riverview
MIS310216	Doan Companies-Brownstown Plt
MIS310217	Big 4 Auto Parts
MIS310221	Riverview-Land Preserve
MIS310224	Gregory Boat Company-No 1
MIS310225	Gregory Boat Company-No 2
MIS310238	ET US Holdings LLC
MIS310239	Johnson Controls-Taylor
MIS310273	Kreher Wire Processing-Romulus
MIS310276	Ford-Woodhaven Forging Plt
MIS310284	Elkins Machine & Tool-Romulus
MIS310289	Industrial Fab Inc-Rockwood
MIS310292	Waste Mgt of Mi-Area Disposal
MIS310293	Harbor Hill Marina-Detroit
MIS310294	Trenton Forging Co-Trenton
MIS310315	Millcraft SMS Services-Taylor
MIS310316	Contract Freighters-Taylor
MIS310319	Systrand Manufacturing-Trenton
MIS310387	Aztec Manufacturing-Romulus
MIS310419	Landis Machine Shop-Romulus
MIS310428	Detroit Marine-Detroit River
MIS310470	Federal Screw Works-Romulus
MIS310476	Keans Detroit Yacht Harbor
MIS310508	CTS Engineering-Taylor
MIS310510	UPS-Taylor
MIS310518	Apollo Plating Inc-Taylor
MIS310553	CL Rieckhoff Co Inc
MIS310555	Bucks Oil Co Inc

Permit/ Certificate of Coverage Number	Facility Name
MIS310569	Huron Valley Steel Corp
MIS310599	Prime Industries
General Permit MIS410000 - Storm Water from Industrial Activities (4-Yr Cycle Watersheds)	
MIS410395	Barrett Paving-Romulus
MIS410413	Oakite Products-Romulus
MIS410554	Johnson Controls Inc-Rockwood
General Permit MIS320000 - Storm Water Discharges with Required Monitoring	
MIS320014	Grosse Ile Municipal Airport
MIS320020	Buckeye Terminals-Woodhaven

Figure C1. NPDES Permit Locations (note that the depicted locations are not necessarily the outfall locations



Attachment D
City of Detroit Uncontrolled CSOs Discharging to the Detroit River

Table D1. City of Detroit Uncontrolled CSOs on the Detroit River Shoreline

Outfall Number	Name and Location	Latitude Longitude
080	Fox Creek Backwater Gates (B01) East Jefferson & Fox Creek	42°22'28" 082°56'27"
004	Fairview (DWF) Pump Station (P28 through P31) Parkview & Detroit River - Emergency only	42°21'20" 082°58'01"
005	McClellan (B03) McClellan & Detroit River	42°21'20" 082°58'02"
006	Fischer (B04) Fischer & Detroit River	42°21'16" 082°59'15"
007	Iroquois (B05) Iroquois & Detroit River	42°21'14" 082°59'21"
008	Helen (B06) Helen & Detroit River	42°20'40" 083°00'06"
009	Mt. Elliott (B07) Mt. Elliott & Detroit River	42°20'24" 083°00'28"
011	Adair (B09) Adair & Detroit River	42°20'16" 083°00'41"
012	Joseph Campau (B10) Joseph Campau & Detroit River	42°10'08" 083°01'02"
014	Dubois (B12) Dubois & Detroit River	42°20'01" 083°01'19”
016	Orleans Relief (B15) Orleans (Eastside of) & Detroit River	42°19'54" 083°01'36"
017	Orleans (B14) Orleans (Westside of) & Detroit River	42°19'53" 083°01'37"
018	Riopelle (B16) Riopelle & Detroit River	42°19'52" 083°01'42"
019	Rivard (B17) Rivard & Detroit River	42°19'48" 083°01'55"
020	Hastings (B18) Schweizer Place & Detroit River	42°19'46" 083°02'03"
021	Randolph (B19) Randolph & Detroit River	42°19'29" 083°02'26"
022	Bates (B20) Bates & Detroit River	42°19'38" 083°02'32"
023	Woodward (B21) Woodward & Detroit River	42°19'37" 083°02'35”
024	Griswold (B22) Griswold & Detroit River	42°19'35" 083°02'28"
025	First-Hamilton (B23) First (extended) & Detroit River	42°19'30" 083°02'57"
026	Third St. (B24) Third St. & Detroit River	42°19'28" 083°03'07"
027	Cabacier (B25) Brooklyn (extended) & Detroit River	42°19'24" 083°03'26"
028	Eleventh St. (B26) Eleventh St. & Detroit River	42°19'17" 083°03'46"
029	Rosa Parks (B27) Rosa Parks & Detroit River	42°19'13" 083°03'56"
030	Vermont (B28) Vermont(extended) & Detroit River	42°19'06" 083°04'09"

Outfall Number	Name and Location	Latitude Longitude
031	Eighteenth St. (B29) Eighteenth St. & Detroit River	42°18'57" 083°04'31"
032	Twenty-First St. (B30) Twenty-First St. & Detroit River	42°18'53" 083°04'31"
033	Twenty-Fourth St. (B31) Twenty-Fourth St. & Detroit River	42°18'47" 083°04'42"
034	West Grand Blvd. (B32) West Grand Blvd. & Detroit River	42°18'41" 083°04'50"
035	Swain (B33) Swain & Detroit River	42°18'35" 083°04'56"
036	Scotten (B34) Scotten & Detroit River	42°18'31" 083°05'02"
037	McKinstry (B35) McKinstry & Detroit River	42°18'19" 083°05'13"
038	Summit-Clark (B36) Summit & Detroit River	42°18'14" 083°05'18"
039	Ferdinand (B37) Ferdinand & Detroit River	42°18'13" 083°05'19"
040	Morrell (B38) Morrell & Detroit River	42°18'10" 083°05'22"
041	Junction (B39) Junction & Detroit River	42°18'07" 083°05'25"
042	Campbell (B40) Campbell & Detroit River	42°18'01" 083°05'30"
043	Dragoon (Livernois Relief) (B41) Dragoon (extended) & Detroit	42°17'49" 083°05'41"
044	Schroeder (B42) Schroeder & West Jefferson	42°17'32" 083°06'00"
046	Cary (B44) Cary & Rouge River (Old Channel)	42°17'29" 083°06'47"
047	Dearborn St. (B45) Dearborn St. & Rouge River (Old Channel)	42°17'26" 083°06'59"
048	Pulaski (No monitor) Pulaski & Rouge River (Old Channel)	42°17'21" 083°07'11"