

**Michigan Department of Environmental Quality
Water Bureau
June 2007**

**Total Maximum Daily Load for *E. coli* for
Lake Erie Luna Pier Beach
Monroe County**

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 [CFR], 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 nonpoint 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 at Luna Pier Beach, Lake Erie, located in Monroe County, Michigan.

PROBLEM STATEMENT

The TMDL reach for Lake Erie Luna Pier Beach appears on the Section 303(d) list as:

LAKE ERIE LUNA PIER BEACH

County: MONROE

Location: City of Luna Pier Beach, Lake Erie.

NHD Reach Code: 04100001001145

Problem Summary: Pathogens (Rule 100).

TMDL Year(s): 2007

WBID#: **060101D**

SIZE: 1 M

Lake Erie Luna Pier Beach was placed on the Section 303(d) list due to impairment of recreational uses as indicated by the presence of elevated levels of *E. coli* (Edly and Wuycheck, 2006). Monitoring data collected by the Michigan Department of Environmental Quality (MDEQ) in 2005 documented exceedances of the WQS for *E. coli* at all sampling locations during the total body contact recreational season of May 1 through October 31 (Table 1).

NUMERIC TARGET

The impaired designated use addressed by this TMDL is total 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 be protected for total body contact recreation from May 1 to October 31. 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 (ml), as a 30-day geometric mean. Compliance shall be based on the geometric mean of all individual samples taken during five or more sampling events representatively spread over a 30-day period. Each sampling event shall consist of three or more samples taken at 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 ml. Compliance shall be based on the geometric mean of three 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 ml, based on the geometric mean of all of five or more samples taken over a 30-day period, nor more than 400 fecal coliform bacteria per 100 ml, based on the geometric mean of all of three or more samples taken during any period of discharge not to exceed seven 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 ml if their National Pollutant Discharge Elimination System (NPDES) permit limit of 200 fecal coliform per 100 ml as a monthly average is met. Therefore, typically it can be assumed that there are less 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.

For this TMDL, the WQS of 130 *E. coli* per 100 ml as a 30-day geometric mean and 300 *E. coli* per 100 ml as a daily geometric mean are the target levels for the TMDL reach from May 1 to October 31. As previously stated, the 2005 monitoring data indicated exceedances of WQS at all stations sampled.

DATA DISCUSSION

Lake Erie Luna Pier Beach was sampled for pathogens weekly at five stations from May through September 2005 (See Figure 1 for sampling locations). Precipitation data for the two days prior to each MDEQ sampling event were obtained from a weather station near the Toledo Metcalf Airport, Ohio (Table 1; Weather Underground, 2006). Thirty-day geometric mean *E. coli* concentrations ranged from 70 *E. coli* per 100 ml (Station 4) to 595 *E. coli* per 100 ml (Station 1) (Table 1). The 30-day geometric mean WQS was exceeded the majority of the sampling season at all five stations. Daily maximum concentrations ranged from <20 *E. coli* per 100 ml in September (Station 3) to 5005 *E. coli* per 100 ml in July (Station 2) (Table 1).

SOURCE ASSESSMENT

For the purposes of this TMDL, sources of *E. coli* to Lake Erie Luna Pier Beach fall into two categories: local sources within the immediate watershed and remote sources carried to the TMDL reach by the currents of the western basin of Lake Erie. Potential point sources of *E. coli* in the local watershed of the Lake Erie Luna Pier Beach are listed in Table 2, and illustrated in Figure 2. Another potential local source of *E. coli* contamination are the on-site septic systems, which service many homes in the Luna Pier Beach watershed. The MCHD does not maintain records of septic inspection failure rates, so the extent of this contamination

source is undocumented. Illicit discharge inspections were conducted by the Monroe County Drain Commissioner on Sulphur Creek and resulted in the identification of eight potential illicit drain connections, but none yet confirmed. Other potential local sources of *E. coli* include wildlife, primarily birds, which may be attracted by the accumulated zebra mussel shells in the swash zone of Luna Pier Beach.

The Luna Pier Wastewater Treatment Plant (WWTP) (NPDES Permit #MIG570026) discharge contains treated sanitary wastewater and the sanitary collection system has no reported combined sewer overflow (CSO) outfall locations or sanitary sewer overflows (SSOs). A summary of averaged fecal coliform data from Luna Pier WWTP Discharge Monitoring Reports (DMRs) from January 2003 through December 2006, is presented in Table 3. During this timeframe, Luna Pier WWTP exceeded their monthly geometric mean effluent limitation on one occasion in August 2006. The Luna Pier WWTP discharge is generally in compliance with the NPDES fecal coliform final effluent limitations, but the effluent fecal coliform data suggest that the discharge is a possible minor source of *E. coli* to Luna Pier Beach. The Mason Consolidated Schools WWTP (NPDES Permit #MI0047201), with a design flow of 0.035 million gallons per day (MGD), is permitted to continuously discharge treated sanitary wastewater from outfall 001 to Lapointe Drain located in Section 4, T8S, R8E, Erie Township, Monroe County. Mason Consolidated Schools WWTP is not likely contributing to the water quality exceedances at Luna Pier Beach considering the low monthly geometric means of fecal coliform (Table 3), the small design flow (0.035 MGD) of the discharge, and that this facility is discharging well upstream of Lake Erie. Lapointe Drain confluences with Lake Erie 0.6 miles south of Luna Pier Beach.

The LaSalle Mobile Home Park (MHP) (NPDES Permit #MI0056022) with a design flow of 0.0996 MGD is permitted to continuously discharge treated sanitary wastewater from outfall 001 to the North Branch Wenrick and Cousino Drain located in Section 33, T7S, R8E, LaSalle Township, Monroe County. The North Branch Wenrick and Cousino Drain is a tributary to Lapointe Drain. The Waterford Condominium Development (NPDES Permit #MIG570027) is permitted to discharge 0.075 MGD of treated sanitary wastewater to Lake Erie. To date, neither the LaSalle MHP nor Waterford Condominium Development have been constructed or discharged any effluent.

These local sources are minor in significance when compared with permitted sanitary wastewater discharges and CSOs from the larger urban areas, which line the western basin of Lake Erie, including the metropolitan areas of Detroit, Michigan; Monroe, Michigan; and Toledo, Ohio (Figure 3). To illustrate the possible geographic extent of potential contamination sources, a study tracking the movement of an accidental salt spill in the mouth of the River Rouge (Detroit, Michigan) demonstrated that contaminants from that river can travel as far south as the Maumee River, Toledo, Ohio (Kovacik, 1972). The direction of Lake Erie surface currents is highly variable on a day-to-day basis, and is driven by a combination of factors, primarily wind direction. The Great Lakes Coastal Forecasting System (GLCFS) was developed by the National Oceanic and Atmospheric Administration (NOAA) and the Great Lakes Environmental Research Laboratory to forecast a variety of physical parameters for Lake Erie. The GLCFS utilizes real-time wind direction, air temperature, and water temperature from weather stations along with geologic characteristics of the lake basin to predict the direction of water circulation throughout the entire Lake Erie. The GLCFS model accuracy is monitored 24 hours a day. According to this model, the prevailing direction of surface water currents in the vicinity of Luna Pier Beach is to the northeast, with currents traveling in that direction 34 percent of the summer recreation season, and currents traveling to the southwest 19 percent of the season (GLCFS, Unpublished) (Table 4). Currents travel

directly west only 6 percent of the total body contact recreation season. This implies that sources to the north and to the south of Luna Pier Beach are possibly contributing to the *E. coli* exceedances, while it is less likely that sources to the east are contributing.

Possible remote *E. coli* sources to the north include the Detroit WWTP (34 miles) and Monroe Metro WWTP (9 miles). Monroe Metro WWTP does not have CSO outfalls, nor has that facility exceeded their fecal coliform effluent limit in the recent past (May 2003-January 2007). Three SSOs have been reported by Monroe Metro WWTP since 2003, with only one incident occurring during the total body contact recreation season (August 14, 2003) (MDEQ, 2006). However, the Detroit WWTP discharges CSOs to the Detroit River, the Rouge River, Conner Creek, Fox Creek, and O'Brien Drain. Before work began in 1992 to remedy CSOs in the Detroit Metropolitan Area, 20 percent of the River Rouge watershed was serviced by CSOs and a total of 168 CSOs were identified in the watershed. Detroit WWTP treated discharge has generally been in compliance with its fecal coliform final effluent limitation. An *E. coli* TMDL is under development for the majority of the River Rouge watershed for fecal coliform exceedances [Edly and Wuycheck, 2006; Alexander, 2007 (draft)].

The main possible source of *E. coli* contamination from the south is the WWTP for the city of Toledo, Ohio. The city of Toledo has 69 CSOs, which discharge to the Ottawa and Maumee Rivers before entering Lake Erie approximately 5 miles south of Luna Pier Beach (Toledo Waterways Initiative). Prevailing surface currents may then carry contaminants from untreated overflows northeast to Luna Pier Beach.

LOADING CAPACITY (LC) DEVELOPMENT

The LC represents the maximum loading that can be assimilated by the water body while still achieving WQS. As indicated in the Numeric Target section, the targets for this pathogen TMDL are the 30-day geometric mean WQS of 130 *E. coli* per 100 ml and daily geometric mean of 300 *E. coli* per 100 ml. Concurrent with the selection of a numeric concentration endpoint, development of the LC requires identification of the critical condition. The "critical condition" is defined as the set of environmental conditions (e.g., flow) used in development of the TMDL that results in attaining WQS and has an acceptably low frequency of occurrence. The critical conditions for the applicability of WQS in Michigan are given in R 323.1090 (Applicability of WQS), which requires that the WQS apply at all flows equal to or exceeding the water body design flow, generally the lowest of the 12 monthly 95 percent exceedance flows. The 95 percent exceedance flow is the stream flow equal to or exceeded 95 percent of the time. However, for point source discharges of treated human sewage, pathogen levels are restricted to a monthly average limit of 200 fecal coliform per 100 ml regardless of stream flow. Therefore, the design stream flow is not a critical condition for determining the allowable loading of pathogen for WWTPs.

For most pollutants, TMDLs are expressed on a mass loading basis (e.g., pounds per day). For *E. coli*, however, mass is not an appropriate measure, and the USEPA allows pathogen TMDLs to be expressed in terms of organism counts (or resulting concentration) (USEPA, 2001). Therefore, this pathogen TMDL is concentration based, consistent with R 323.1062, and the TMDL is equal to the target concentration of 130 *E. coli* per 100 ml as a 30-day geometric mean and daily geometric mean of 300 *E. coli* per 100 ml in all portions of the TMDL reach for each month of the recreational season (May through October). Expressing the TMDL as a concentration equal to the WQS ensures that the WQS will be met under all flow and loading conditions; therefore, a critical condition is not applicable for this TMDL.

LOADING CAPACITY

The LC is comprised of the sum of individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the LC must include a margin of safety (MOS), either implicitly within the WLA or LA, or explicitly, that accounts for uncertainty in the relation between pollutant loads and the quality of the receiving water body. Conceptually, this definition is denoted by the equation:

$$LC = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS}$$

The LC represents the maximum loading that can be assimilated by the receiving water while still achieving WQS. Because this TMDL is concentration-based, the total loading for this TMDL is equal to the WQS of 130 *E. coli* per 100 ml as a 30-day geometric mean and 300 *E. coli* per 100 ml as a daily geometric mean (or daily maximum) during the recreation season. This pathogen TMDL will not be expressed on a mass loading basis and is concentration-based, consistent with USEPA regulations in 40 CFR, Section 130.2(i).

WLAs

Table 2 as well as Figure 2 outline the 11 permitted point source discharges to the watershed surrounding Lake Erie Luna Pier Beach. The discharges include four individual permits, six Certificate of Coverages under four NPDES general permits, and one Notice of Coverage under one Permit-by-rule.

The discharges authorized under NPDES general permits for Industrial Storm Water, the MDOT statewide permit and Swimming Pool Wastewater are not considered significant sources of *E. coli* to the Lake Erie Luna Pier Beach due to the nature of the effluent. The Notice of Coverages under Permits-by-Rule involve earthwork in the watershed and, due to the nature of the permit, are not considered a significant source of *E. coli* to the TMDL watershed. There are no municipalities with Separate Storm Sewer Systems (MS4s) or concentrated animal feeding operations in the watershed surrounding Luna Pier Beach. The WLA for the permits in Table 2 is equal to 130 *E. coli* per 100 ml as a 30-day geometric mean and 300 *E. coli* per 100 ml as a daily maximum during the recreational season between May 1 and October 31.

LAs

Because this TMDL is concentration-based, the LA is also equal to 130 *E. coli* per 100 ml as a 30-day geometric mean and 300 *E. coli* per 100 ml as a daily maximum. This LA is based on the assumption that all land, regardless of use, will be required to meet the WQS. Therefore, the relative responsibility for achieving the necessary reductions of bacteria and maintaining acceptable conditions will be determined by the amount of land under the jurisdiction of the local unit of government in the watershed. This TMDL reach is located in four municipalities within one county. The township of LaSalle makes up the largest percent of the watershed (57 percent), followed by Erie Township (27 percent), the city of Luna Pier (9 percent) and Ida Township (7 percent).

MOS

This section addresses the incorporation of an MOS in the TMDL analysis. The MOS accounts for any uncertainty or lack of knowledge concerning the relationship between pollutant loading and water quality, including the pollutant decay rate if applicable. The MOS can be either implicit (i.e., incorporated into the WLA or LA through conservative assumptions) or explicit (i.e., expressed in the TMDL as a portion of the loadings). This TMDL uses an implicit MOS because no rate of decay was used. Pathogen organisms ordinarily have a limited capability of surviving outside of their hosts and a rate of decay could be developed. However, applying a rate of decay could result in an allocation that would be greater than the WQS, thus no rate of decay is applied to provide for greater water quality protection. The MDEQ has determined that the use of the WQS of 130 *E. coli* per 100 ml as a 30-day geometric mean and 300 *E. coli* per 100 ml as a daily maximum for the WLA and LA is a more conservative approach than developing an explicit MOS and accounts for the uncertainty in the relationship between pollutant loading and water quality, based on available data and the assumption to not use a rate of decay. Applying the WQS to be met under all flow conditions also adds to the assurance that an explicit MOS is unnecessary.

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 no total body contact during the remainder of the year due to cold weather; however, there is a separate WQS maximum of 1000 *E. coli* per 100 ml for the partial body contact season. Because this is a concentration-based TMDL, WQS must be met regardless of flow conditions in the applicable season.

REASONABLE ASSURANCE ACTIVITIES

The municipal wastewater treatment facilities listed in Table 2 are responsible for maintaining compliance with their respective NPDES permit limitations for fecal coliform, and shall continue to monitor their effluent according to their permit requirements. Compliance is determined based on review of DMR data by the MDEQ. The Luna Pier WWTP has exceeded its monthly fecal coliform limit once over the past several years. This exceedance of effluent limitations occurred following a rain event during which 2.8 inches of rain fell (August 28, 2006, Weather Underground). The plant is at capacity and the MDEQ is currently working with the facility to draft a compliance agreement and develop a schedule for upgrading the WWTP.

The general industrial storm water permits identified in Table 2 (MIS210000 and MIS510000) require that if there is a TMDL established by the MDEQ 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 shall be determined.

The Michigan Department of Transportation (MDOT) statewide MS4 permit requires the permittee to reduce the discharge of pollutants to the maximum extent practicable and to employ best management practices to comply with TMDL requirements.

The city of Toledo was sued by the USEPA in 1991 under violations of Section 309(e) of the federal Clean Water Act. In 2002, Toledo entered into a consent decree. The city of Toledo

was required to develop a Long-Term Control Plan, which would insure that their sewage collection system complies with the NPDES permit, the Clean Water Act, and the objectives of the USEPA's "Combined Sewer Overflow (CSO) Policy" (Toledo Waterways Initiative, 2006). At the end of 2006, 20 percent of the city of Toledo was still served by combined sewers but significant progress is being made. The consent decree states that full implementation of the Long-Term Control Plan must be completed by August 31, 2016.

The USEPA appropriated money to Wayne County, Michigan, for the creation of the Rouge River National Wet Weather Demonstration Project (Rouge Project) in 1992. The Rouge Project successfully eliminated 19 CSOs, including Michigan's largest CSO outfall. The Rouge Project was successful in cutting CSO pollutant loads to the River Rouge by 90 to 100 percent in affected communities during most wet weather events (Rouge Project, 2005). Detroit WWTP submitted a WWTP Wet Weather Operational Plan to the MDEQ in 2004, to maximize treatment in the interim before completion of the Long-Term CSO Control Program. Detroit WWTP is scheduled to eliminate the last of the CSO discharges to the Detroit River in 2010, and to the Rouge in 2012 (NPDES Permit #MI0022802).

The MCHD will continue to sample Lake Erie Luna Pier Beach weekly during the total body contact season using federal Beaches Environmental Assessment and Coastal Health Act funds, and has applied for additional funding through NOAA. The MCHD reviews the data and will post total body contact recreation warnings when appropriate. The data reported by the MCHD will be reviewed by the MDEQ and published on the MDEQ Beach Monitoring Database Web site.

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Table 1. Weekly *E. coli* sampling results (counts per 100 mL) from Luna Pier sampling stations 1-5, May 1-October 31, 2005. Exceedances of the daily maximum and monthly geometric mean WQS are shaded gray.

DATE	Luna Pier Station 1			Luna Pier Station 2			Luna Pier Station 3			Luna Pier Station 4			Luna Pier Station 5			Prior 2-Day Precipitation in inches
	SAMPLE RESULTS	DAILY MAX	30-day G. MEAN	SAMPLE RESULTS	DAILY MAX	30-day G. MEAN	SAMPLE RESULTS	DAILY MAX	30-day G. MEAN	SAMPLE RESULTS	DAILY MAX	30-day G. MEAN	SAMPLE RESULTS	DAILY MAX	30-day G. MEAN	
5/11/2005	40 40 <20	32	---	200 30 100	84	---	40 100 40	54	---	20 40 60	36	---	40 40 80	50	---	0.02
5/18/2005	120 200 100	134	---	220 200 800	328	---	840 1800 1100	1185	---	800 900 1000	896	---	500 760 260	462	---	0
5/25/2005	800 600 80	337	---	80 100 60	78	---	400 400 40	186	---	40 60 100	62	---	200 200 80	147	---	0.15
6/1/2005	100 800 1400	482	---	320 220 120	204	---	5000 2000 1200	2289	---	1200 1200 980	1122	---	1200 2600 200	855	---	0
6/8/2005	220 260 40	132	156	60 40 40	46	115	180 20 <20	60	309	20 20 20	20	135	40 240 260	136	209	0
6/15/2005	1540 1060 1120	1223	323	<20 <20 <20	20	86	<20 <20 20	20	380	20 40 280	61	150	20 <20 100	34	193	0.02
6/22/2005	20 60 20	29	238	600 1,000 1,000	843	104	1,340 800 1,400	1145	377	180 120 220	168	107	200 200 400	252	171	0.13
6/29/2005	400 400 120	268	227	60 80 140	88	107	200 220 20	96	320	40 40 20	32	94	40 200 600	169	176	0.26
7/6/2005	2000 3600 1000	1931	299	4400 5000 5700	5005	202	260 200 380	270	187	180 220 400	251	70	800 800 600	727	170	0.01
7/13/2005	1400 1600 400	964	446	40 40 7000	224	278	5600 1600 6200	3816	448	8000 10400 60	1709	169	40 80 160	80	153	1.01
7/20/2005	200 60 600	193	308	120 80 <20	58	343	120 200 140	150	442	240 20 180	95	185	200 180 120	163	209	0.54

Table 1 continued.

DATE	Luna Pier Station 1			Luna Pier Station 2			Luna Pier Station 3			Luna Pier Station 4			Luna Pier Station 5			Prior 2-Day Precipitation in inches
	SAMPLE RESULTS	DAILY MAX	30-day G. MEAN	SAMPLE RESULTS	DAILY MAX	30-day G. MEAN	SAMPLE RESULTS	DAILY MAX	30-day G. MEAN	SAMPLE RESULTS	DAILY MAX	30-day G. MEAN	SAMPLE RESULTS	DAILY MAX	30-day G. MEAN	
7/27/2005	600 2800 280	778	595	2200 2400 3400	2618	431	160 100 200	147	294	80 180 240	151	181	340 400 220	310	218	1.27
8/3/2005	120 240 140	159	537	280 40 400	165	489	300 280 260	280	364	200 100 40	93	225	80 20 40	40	164	0
8/10/2005	140 600 800	407	393	120 80 60	83	215	40 20 80	40	248	100 140 60	94	185	40 <20 120	46	94	0.1
8/17/2005	120 60 80	83	241	20 200 60	62	167	80 60 100	78	114	120 60 <20	85	103	60 80 200	99	98	0
8/24/2005	1000 1200 400	783	319	400 1200 220	473	254	400 200 200	252	127	200 200 80	147	113	200 200 600	288	110	0
8/31/2005	200 800 200	317	266	2000 800 600	986	209	1800 200 800	660	171	1600 200 1000	684	156	800 600 800	727	131	0.03
9/7/2005	400 400 200	317	306	400 200 200	252	227	200 400 400	317	175	400 400 200	317	203	200 200 400	252	189	0
9/14/2005	480 100 540	296	287	820 120 660	402	312	280 560 340	376	274	220 140 120	155	225	60 280 120	126	231	0.05
9/21/2005	20 20 <20	20	216	40 <20 80	40	285	<20 <20 <20	<20	376	20 <20 20	20	183	20 40 20	25	176	0
9/28/2005	100 80 180	113	146	60 40 100	62	190	20 20 <20	20	246	40 80 60	58	150	80 120 120	105	144	0.55

Table 2. Locations and receiving waters of potential point sources in the TMDL reach watershed.
 Source: MDEQ, Water Bureau's NPDES Permit Management System.

Facility	Number	County	Receiving Water	Latitude	Longitude
Individual Permit					
CECO-J R Whiting Power Plt	MI0001864	Monroe	Lake Erie	41.79667	-83.44778
LaSalle MHP	MI0056022	Monroe	Wenrick and Cousino Drain	41.82528	-83.48611
MDOT MS4	MI0057364	Statewide	Statewide		
Mason Consolidated School WWTP	MI0047201	Monroe	Lapointe Drain	41.80972	-83.49
MIS210000 General Permit - Storm Water from Industrial Activities - Cycle 2 watersheds					
Lost Peninsula Marina	MIS210836	Monroe	Lake Erie - N. Maumee Bay	41.7775	-83.50583
Toledo Beach Marina-Lasalle	MIS210101	Monroe	Lake Erie	41.83861	-83.41611
MIS510000 General Permit - Storm Water from Industrial Activities - Cycle 5 watersheds					
Interstate Truck Parts & Equip	MIS510444	Monroe	Muddy Creek	41.83333	-83.4875
MIG570000 General Permit - Secondary Treatment Wastewater					
Luna Pier WWTP	MIG570026	Monroe	Lapointe Drain	41.81278	-83.44056
Waterford Condominium Development	MIG570027	Monroe	Lake Erie	41.826111	-83.4075
MIG760000 General Permit - Swimming Pool Wastewater					
Toledo Beach Marina-Lasalle	MIG760001	Monroe	Lake Erie	41.83861	-83.41611
Notice of Coverage - Permit by Rule					
Lost Peninsula Marina-Erie	MIR108814	Monroe	not applicable	na	na

Table 3. Monthly average final effluent fecal coliform results for Luna Pier and Mason Consolidated Schools WWTPs as monthly geometric means (counts per 100 mL). Exceedances of permit limitations are shaded.

Date	Luna Pier WWTP	Mason Consolidated Schools
5/31/2003	27	22
6/30/2003	27	21
7/31/2003	0	21
8/31/2003	0	23
9/30/2003	0	21
10/31/2003	0	0
11/30/2003	0	0
12/31/2003	0	0
1/31/2004	0	0
2/29/2004	0	0
3/31/2004	0	0
4/30/2004	0	0
5/31/2004	14	0
6/30/2004	68	0
7/31/2004	57	0
8/31/2004	60	0
9/30/2004	66	0
10/31/2004	47	0
11/30/2004	0	0
12/31/2004	0	0
1/31/2005	0	0
2/28/2005	0	0
3/31/2005	64	0
4/30/2005	not available	0
5/31/2005	0	0
6/30/2005	0	0
7/31/2005	0	0
8/31/2005	0	0
9/30/2005	0	0
10/31/2005	65	0
11/30/2005	44	0
12/31/2005	0	0
1/31/2006	0	0
2/28/2006	42	0
3/31/2006	58	0
4/30/2006	56	0
5/31/2006	73	0
6/30/2006	95	0
7/31/2006	not available	0
8/31/2006	439	21
9/30/2006	60	0
10/31/2006	39	0
11/30/2006	39	0
12/31/2006	76	0

Table 4. Direction of Lake Erie surface currents by percentage of the total body contact recreation (TBCR) season.

Direction of Surface Current Flow	% of TBCR season (May-October 2006)
NE	34%
E	12%
SE	7%
S	6%
SW	19%
W	6%
NW	7%
N	9%

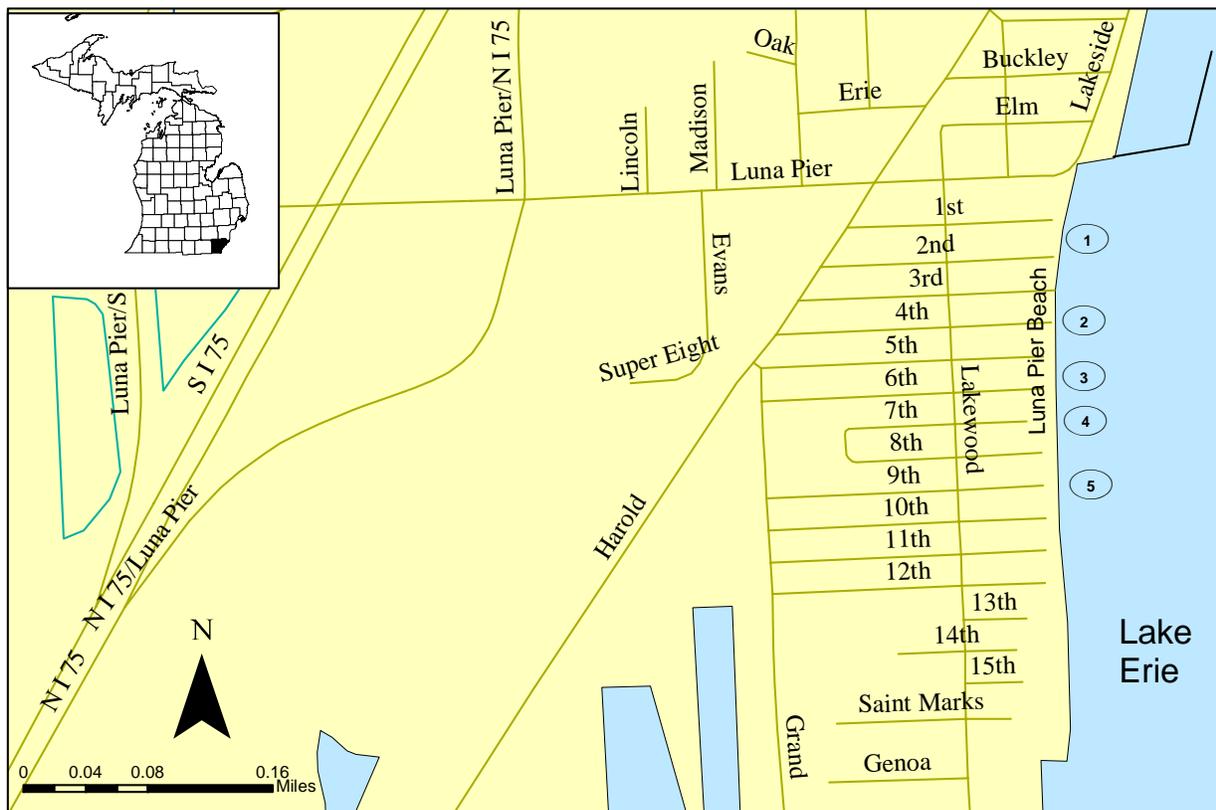


Figure 1. Locations (1-5) of weekly pathogen sampling for Lake Erie- Luna Pier Beach, May 1-October 31, 2005.

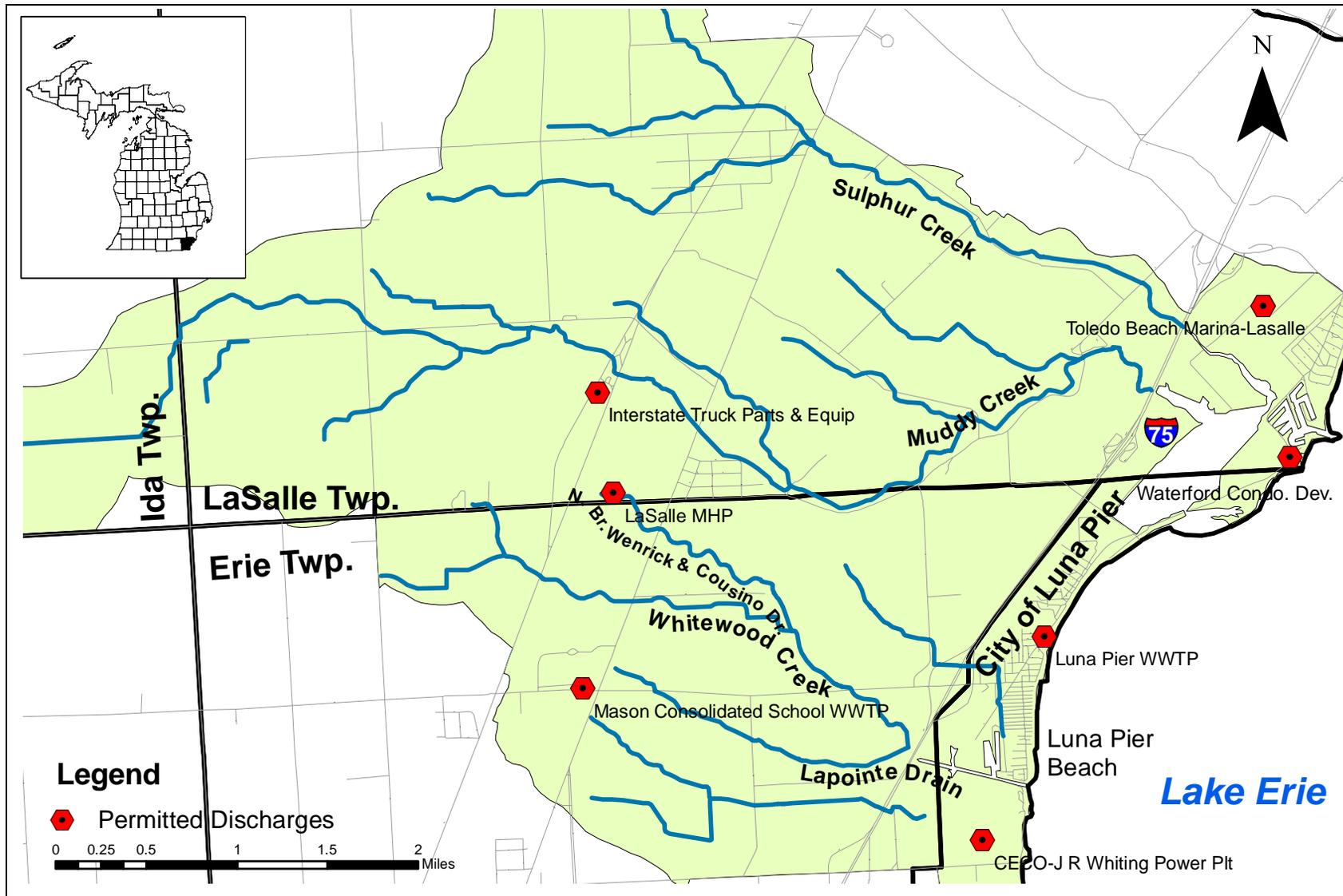


Figure 2. Location of water bodies, municipalities, and point sources within the lakeshore drainage watershed surrounding Luna Pier Beach.

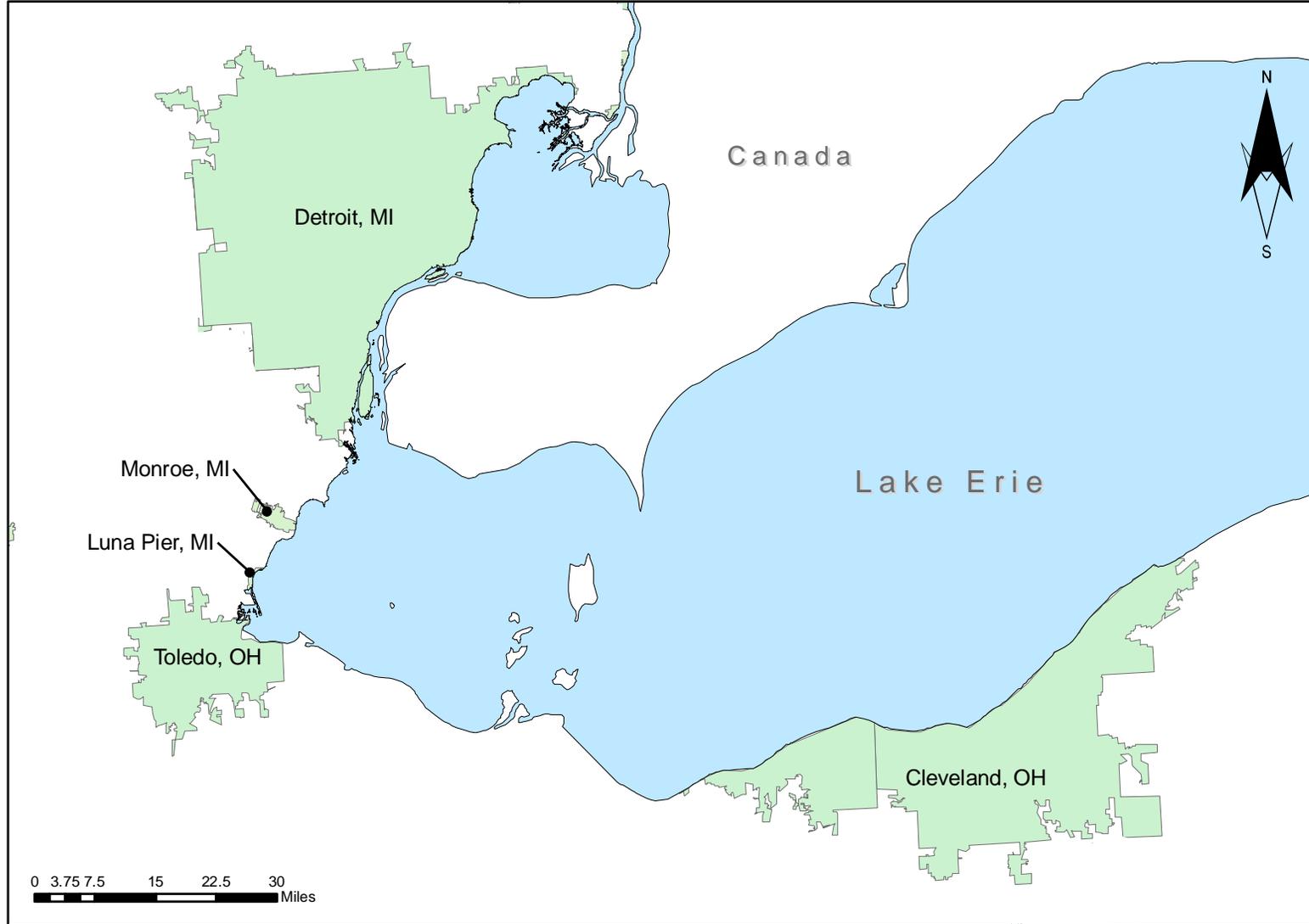


Figure 3. Locations of nearby metropolitan areas which may contribute to *E. coli* contamination of Luna Pier Beach via the surface currents of Lake Erie.