Michigan Department of Environmental Quality
Water Bureau
August 2006

Total Maximum Daily Load for *E. coli* for The Grand River Kent 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 in the Grand River, located in Kent County, Michigan (Figure 1).

PROBLEM STATEMENT

The TMDL reach for the Grand River appears on the 2006 Section 303(d) list as:

GRAND RIVER WBID#: 082806A
County: Kent Size: 5 M
Location: Johnson Park, vicinity of Walker. T6N, R12W, Sec. 7
HUC: 4050006 RF3RchID: 4050006 9
Problem: CSO, pathogens (Rule 100).
TMDL YEAR(s): 2006

The Grand River 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* (Wolf and Wuycheck, 2004). Monitoring data collected by the Michigan Department of Environmental Quality (MDEQ) in 2004 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 (Figures 2 and 3, Tables 1 and 2). Similar elevated results were observed by the Grand Rapids Wastewater Treatment Plant (WWTP) staff during their river monitoring at multiple locations on the Grand River (City of Grand Rapids, 2004).

The original listed reach for the Grand River was approximately one mile near Johnson Park, in the vicinity of Walker. Based on the 2004 data collected, the listed TMDL reach extended upstream approximately an additional four miles to the Fulton Street crossing, including the unnamed tributary at Vets Drive in Johnson Park. This modification was reflected in the 2006 Section 303(d) list.

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. This is assumed because *E. coli* are a subset of fecal coliform (American Public Health Association, 1995). Fecal coliform concentrations are substantially higher than *E. coli* concentrations when the wastewater of concern is sewage (Whitman, 2001). Therefore, it can reasonably 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 2004 monitoring data indicated exceedances of WQS at all locations sampled.

DATA DISCUSSION

The Grand River and one unnamed tributary were sampled at six locations in the vicinity of Grand Rapids to address this TMDL listing (Figure 1). Ann Street (GR01) was the only location to meet the 30-day geometric mean the entire season. All other stations on the Grand River exceeded the 30-day geometric mean WQS on multiple occasions (Figure 2, Table 1). Thirty-day geometric mean *E. coli* concentrations in the Grand River ranged from 31 *E. coli* per 100 ml in September at Ann Street (GR01) to 264 *E. coli* per 100 ml in August at the Kent Trail Bridge station (GR03) (Figure 2, Table 1). The daily geometric mean was exceeded at all sampling locations on the Grand River. Daily geometric mean concentrations ranged from 18 *E. coli* per 100 ml in September at Ann Street (GR01) to 2,536 *E. coli* per 100 ml in August at the Kent Trail Bridge station (GR03) (Table 1). Data from the M-11 station (GR06) indicate WQS exceedances of the 30-day geometric mean for the entire sampling season.

One unnamed tributary to the Grand River was also sampled (GR04). Thirty-day geometric mean *E. coli* concentrations ranged from 331 *E. coli* per 100 ml in September to 1,261 *E. coli*

per 100 ml in August. Daily geometric means ranged from 72 *E. coli* per 100 ml in June to 11,093 *E. coli* per 100 ml in May (Table 2, Figure 3). Daily geometric mean concentrations of *E. coli* were above 1,000 per 100 ml on four occasions throughout the sampling season.

SOURCE ASSESSMENT

The municipalities making up the largest portion of the TMDL watershed include the cities of Grand Rapids and Walker. The municipalities in the TMDL watershed are represented by the shaded area in Figure 1. Table 3 shows the distribution of land for each municipality.

The land use in the Lower Grand River watershed, upstream of the listed reach, is primarily agriculture (49%), forest land (23%), and urban developed (10%) (Fishbeck et al., 2004). The TMDL reach is located entirely in the urbanized area of the city of Grand Rapids. Possible sources of *E. coli* include Combined Sewer Overflows (CSOs), Sanitary Sewer Overflows (SSOs), illicit connections, contributions from tributaries (i.e., Plaster Creek), and wildlife inputs from parks or other recreational areas where animals and waterfowl may congregate.

The city of Grand Rapids has ten permitted CSO discharges to the Grand River under permit MI0026069. Multiple overflows occurred during the 2004 recreational season due to above average precipitation events that occurred during the spring of that year. Approximately 157 million gallons of partially treated sewage (partial treatment consists of primary settling and disinfection) was released to the Grand River via direct or retention basin discharges. During that same time period, approximately 13 million gallons of diluted raw sewage was discharged to Plaster Creek and Coldbrook Creek, both tributaries of the Grand River (MDEQ, 2006). Sampling stations GR02, GR03, GR05, and GR06 are downstream of CSO discharge locations (Figure 4). The exceedances noted on June 22, 2004 (Table 1), could be attributed in part to CSO discharges that occurred the day before. Noteworthy exceedances were also observed throughout the season at GR06 possibly because this location is downstream of all the CSO outfalls and several tributaries that are also likely contributing *E. coli* to the Grand River. In addition to discharge from the CSOs, the Grand Rapids WWTP had four SSOs to tributaries of the Grand River during the recreational season releasing less than 0.03 million gallons of raw and/or partially treated sewage. The MDEQ is working on a settlement with the city of Grand Rapids to resolve the SSOs.

Tributaries to the Grand River are another possible source of *E. coli* to the Grand River. *E. coli* data collected by the MDEQ in 2001 indicate substantial exceedances in Plaster Creek and a TMDL was subsequently developed (Thelen, 2002). Follow-up *E. coli* data from Plaster Creek in 2002 and 2004, indicate continued WQS exceedances (MDEQ, 2004). The unnamed tributary to the Grand River near the Vets Drive Boat Ramp in Johnson Park (GR04) exhibited exceedances of both the daily and monthly geometric mean WQS for nearly all of the 2004 sampling season.

There are 387 NPDES permitted discharges to the Grand River or its tributaries in the TMDL reach (Table 4, Figure 5), including 8 individual NPDES permits, 139 certificates of coverage (COCs) under 4 general NPDES permits, and 238 notices of coverage under 2 permits-by-rule. Table 5 contains information on each of the general permits and the permits-by-rule. Two individual permits, the Grand Rapids WWTP and the Wyoming WWTP, are permitted to discharge treated human waste. Each facility has limits for fecal coliform and when the WWTPs are meeting their fecal coliform permit limits, it is assumed the WQS for *E. coli* will be met in the discharge. The remaining three individual permits, MacDonalds Ind. – Oak Industrial, Delphi Automotive, and GM - NAO Grand Rapids, contain discharges typical of industrial activities and are not believed to be a source of *E. coli* to the TMDL reach (i.e., noncontact cooling water, storm water from industrial activities, etc.). The two individual Municipal Separate Storm Sewer (MS4) permittees, the city of Grand Rapids and the Michigan Department of Transportation

(MDOT) – statewide permit, are prohibited from discharges that may cause or contribute to a violation of WQS. The individual ground water permit for Forest Hills PS – Secondary Building (GW164100203) authorizes the discharge of sanitary waste to ground water via a constructed wetland. It is a possible source of *E. coli* to the Grand River. The Northwoods Boarding Kennel groundwater permit may be another possible source of *E. coli*; however, it's proximity to the Grand River (greater than 1,000 feet) does not make it a probable source of *E. coli* to the river. The remaining groundwater permit, Coit Avenue Gravel Company, is for gravel mining and is not believed to be a source of *E. coli*. Likewise, the general NPDES permit discharges are not considered to contain treated or untreated human sewage or animal waste; therefore, they are not deemed a significant source of *E. coli* to the Grand River TMDL watershed. The permits-by-rule involve earthwork in the TMDL watershed, and are not considered a significant source of *E. coli*. There are three Concentrated Animal Feeding Operations located in Kent County; however, they are located in subwatersheds many miles upstream of the Grand River TMDL reach and not anticipated to negatively effect the water quality in the TMDL reach (as indicated by the data at GR01).

LINKAGE ANALYSIS

Determining the link between the *E. coli* concentrations in the Grand River and the potential sources is necessary to develop the TMDL. This link provides the basis for estimating the total assimilative capacity of the water body and any needed load reductions. For this TMDL, the loading of pathogens appears to enter the Grand River during all weather conditions (i.e., wet and dry weather events). Potential sources include CSOs, SSOs, tributary inputs, wildlife, and illicit connections.

To further investigate the potential sources mentioned above, a load duration curve analysis was developed for each sampling station as outlined in a paper by Cleland (2002). A load duration curve is a relatively new method utilized in TMDL development and considers how flow conditions relate to a variety of pollutant sources (point and nonpoint sources).

The load duration curves for each station sampled on the Grand River and the unnamed tributary are included in Appendix A. The United States Geological Survey gage used to determine the load duration curves discussed here is located on the Grand River, approximately 500 feet upstream from the Fulton Street Bridge, and 1.7 miles upstream of the Plaster Creek confluence (gage number 04119000). The data indicate that exceedances of the WQS are observed during both wet and dry weather events. Note that dots above the curve on the left side of the figure are indicative of WQS exceedances during wet weather conditions (higher flows) and dots above the curve to the middle and right side of the figure indicate WQS exceedances during dry weather conditions (lower flows). The *E. coli* WQS exceedances at the two upstream stations, Ann Street (GR01) and Fulton Street (GR02), appear to be influenced by mid to higher flow events while downstream stations experience WQS exceedances under all flow conditions (Appendices A-1 through A-5). Wet weather exceedances downstream are likely due to CSO events upstream. The load duration curve at the Vet Drive Boat launch (GR04) suggests the greatest number of exceedances of the *E. coli* daily WQS occur during mid to low flow events (Appendix A-6). Sources could be from illicit connections upstream in the tributary or animal and waterfowl populations in the park.

The guiding water quality management principle used to develop the TMDL was that compliance with the numeric pathogen target in the Grand River depends on the control of *E. coli* from wet and dry weather sources. If the *E. coli* inputs can be controlled to meet the numeric standards, then total body contact recreation in the Grand River will be restored and protected.

TMDL DEVELOPMENT

The TMDL 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, TMDL development also defines the environmental conditions that will be used when defining allowable levels. Many TMDLs are designed around the concept of a "critical condition." The "critical condition" is defined as the set of environmental conditions that, if controls are designed to protect, will ensure attainment of objectives for all other conditions. For example, the critical conditions for the control of point sources in Michigan are given in R 323.1082 (Mixing Zones) and R 323.1090 (Applicability of WQS). In general, the lowest monthly 95 percent exceedance flow for streams is used as a design condition for point source discharges. However, for pathogens in point source discharges of treated or untreated human sewage, 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. In addition, sources of pathogens to the Grand River arise from a mixture of wet and dry weather-driven sources. For these sources, there are a number of different allowable loads that will ensure compliance, as long as they are distributed properly throughout the watershed.

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.

ALLOCATIONS

TMDLs are 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 TMDL 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:

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

The term TMDL represents the maximum loading that can be assimilated by the receiving water while still achieving WQS. 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 4 outlines the permitted point source discharges to the listed reach of the Grand River or its tributaries. The discharges include 8 individual NPDES permits, 139 COCs under 4 general NPDES permits, and 238 notices of coverage under 2 permits-by-rule. The WLA for the above mentioned permits is equal to 130 *E. coli* per 100 ml as a 30-day average and 300 *E. coli* per 100 ml as a daily average during the recreational season between May 1 and October 31.

LAs

Because this TMDL is concentration based, the LA is equal to 130 *E. coli* per 100 ml based on a 30-day geometric mean. 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 11 municipalities (Table 3). The municipalities making up the largest portion of the watershed are the cities of Grand Rapids (40 percent) and Walker (17 percent).

There are three state-issued ground water discharge permits in the Grand River TMDL reach. These permits are potential nonpoint sources of *E. coli* to the Grand River.

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 a greater protection of water quality. The MDEQ has determined that the use of the WQS of 130 *E. coli* per 100 ml 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. There is no total body contact during the remainder of the year primarily due to cold weather. In addition, because this is a concentration-based TMDL, WQS will be met regardless of flow conditions in the applicable season.

MONITORING

Pathogens were monitored weekly at five stations on the Grand River and one unnamed tributary from May through October 2004. Future monitoring will take place as part of the five-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 30-day geometric mean value of 130 *E. coli* per 100 ml and 300 *E. coli* per 100 ml as a daily maximum are being met.

REASONABLE ASSURANCE ACTIVITIES

The Grand Rapids WWTP and the Wyoming WWTP are responsible for meeting their NPDES permit limits for fecal coliform. Compliance is determined based on review of Discharge Monitoring Report data by the MDEQ. Both WWTPs are presently meeting their permit limits for fecal coliform. The city of Grand Rapids is in the process of a sewer separation project which

will eliminate the remaining CSOs by 2019. CSO Outfalls 124 and 125 (Figure 4) are scheduled for separation in 2006, which will eliminate a considerable source of *E. coli* (diluted raw sewage) to the Grand River. The MDEQ is currently negotiating a settlement for the SSO discharges with the city of Grand Rapids.

The industrial storm water permits identified in Table 4 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 city of Grand Rapids is under a Phase I Storm Water Permit. A Phase I storm water permit is issued when an individual community's MS4 serves a population greater than 100,000. This permit contains multiple requirements that have a positive impact on water quality such as: education and outreach programs regarding storm water impacts, the development and implementation of an illicit discharge elimination program, the development and implementation of a program to address storm water from new and redevelopment projects, and the development of good housekeeping practices at municipal facilities. The city of Grand Rapids recently received MDEQ approval to conduct their storm water program under the Phase II permits rules. This will allow them to participate in the watershed-based permit with the other communities in the Lower Grand River Watershed. The MDOT is also under a Phase I Storm Water permit. This is a statewide permit that requires the permittee to reduce the discharge of pollutants to the maximum extent practicable and employ BMPs to comply with TMDL requirements.

A Section 319 grant was awarded to the Grand Valley Metropolitan Council to write a Watershed Management Plan for the Lower Grand River. The plan provides a holistic approach to managing the watershed and serves as a clearinghouse for activities that will improve water quality and foster stakeholder involvement. A product of the grant included a *Lower Grand River Watershed Project Information and Education Guidebook*, which was developed to motivate stakeholders and decision makers in the watershed to protect water quality. The guidebook includes a summary of activities and products for improving water quality, how to start a successful outreach program, investigating strategy targets, how to make things happen, and how to evaluate the strategy. The following Web site offers helpful information and important links to other groups and information on the Lower Grand River: www.lowergrandriver.org.

Using information generated by the Section 319 project, a Watershed Interactive Tool (WIT) was developed for the Lower Grand River Watershed (LGRW) by the Grand Valley Metropolitan Council and their partners. The WIT is a watershed-based interactive tool for local decision makers, educators, students, and residents of the LGRW. The tool includes information on the natural history of the LGRW, interactive maps of the LGRW, general watershed concepts, lesson plans for watershed education, and information on how everyday activities can affect water quality in the LGRW. The WIT can also help local units of government and nonprofit entities in writing their own nonpoint source management plan. Additional information can be found at the following Web site: https://www.gvsu.edu/wri/isc/lower-grand-watershed-interactive-tool-wit-57.htm.

The Grand Valley Metropolitan Council was awarded a Section 319 Grant for the Lower Grand River Implementation Project in 2004. The goals of this project will benefit water quality in the Grand River by performing additional *E. coli* source identification sampling in Plaster Creek and implementing BMPs. As previously discussed, Plaster Creek is a major source of *E. coli* to the Grand River and an *E. coli* TMDL for this water body was approved by the USEPA in 2002. This project involves sampling 14 stations that will isolate pollution sources and differentiate wet and dry weather sources of *E. coli*, the use of aerial imagery to evaluate potential sources, and

the installation of demonstration BMPs. The project will use the Water Quality Modeling and TMDL Development Toolbox developed by the USEPA Region 4 to develop a watershed characterization system for the Plaster Creek watershed. This model will integrate existing watershed data to describe current and historical water quality conditions from both regional and local sources and will provide a decision support system for monitoring site selection and stakeholder decisions.

Kent County has been an active participant in the LGRW activities. They have developed a web page that contains information for homeowners to help them properly manage on-site septic systems and therefore reduce the potential for transport of pathogens to surface waters. The information can be found at the following Web site: www.gvsu.edu/wri/isc. The Kent County Health Department conducted *E. coli* monitoring on surface waters from 2000-2003. This sampling aided in prioritizing additional follow-up activities for the illicit connection identification and elimination program mentioned above. In addition, the Grand Rapids WWTP collects *E*. *coli* data from six locations on the Grand River as part of their routine monitoring. This data can be found at the following website: *The link provided was broken. This online document was revised 7/3/2017.*.

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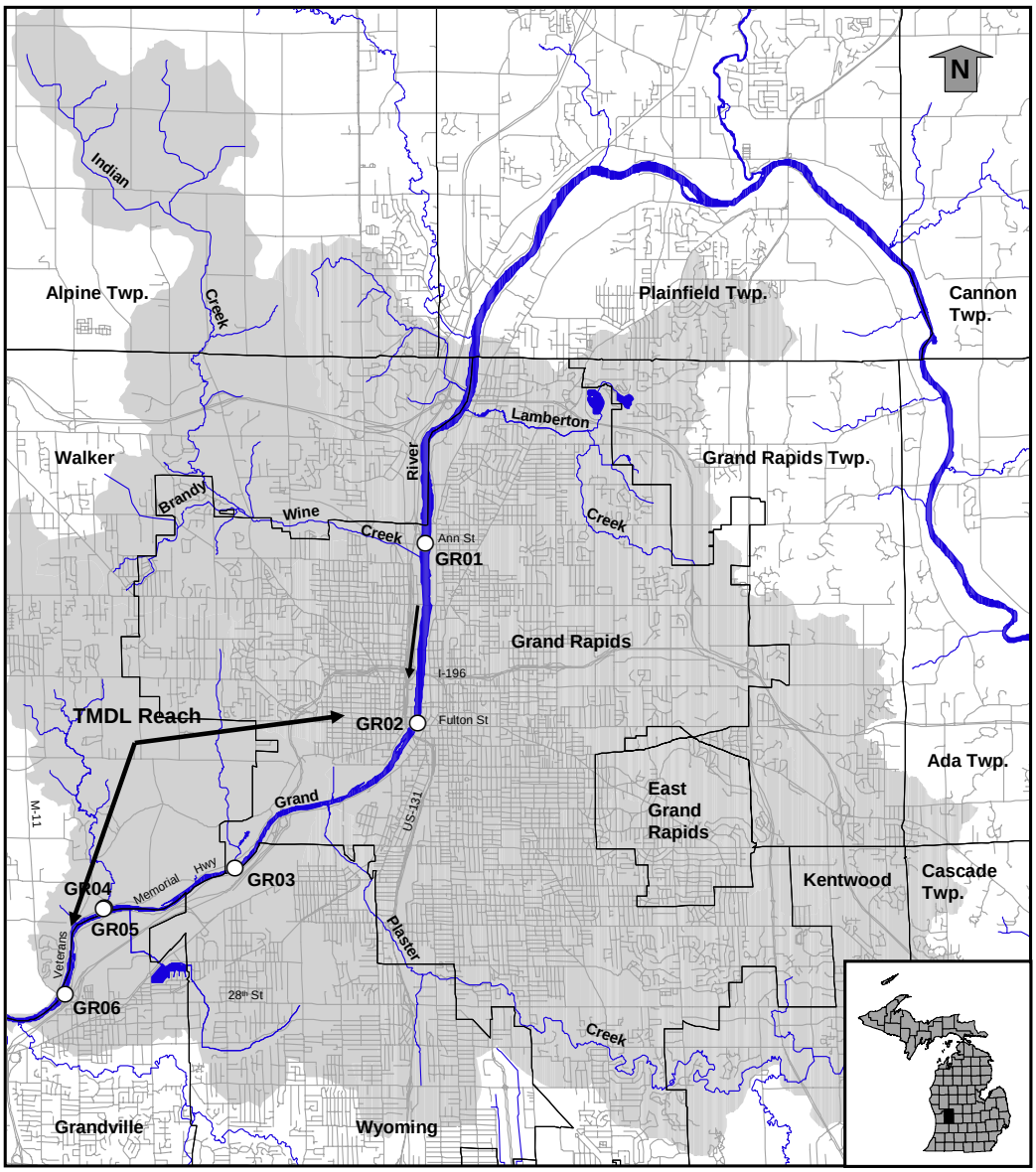


Figure 1. Grand River *E. coli* sampling locations, including the unnamed tributary, in the vicinity of Grand Rapids, Kent County, Michigan, 2004.

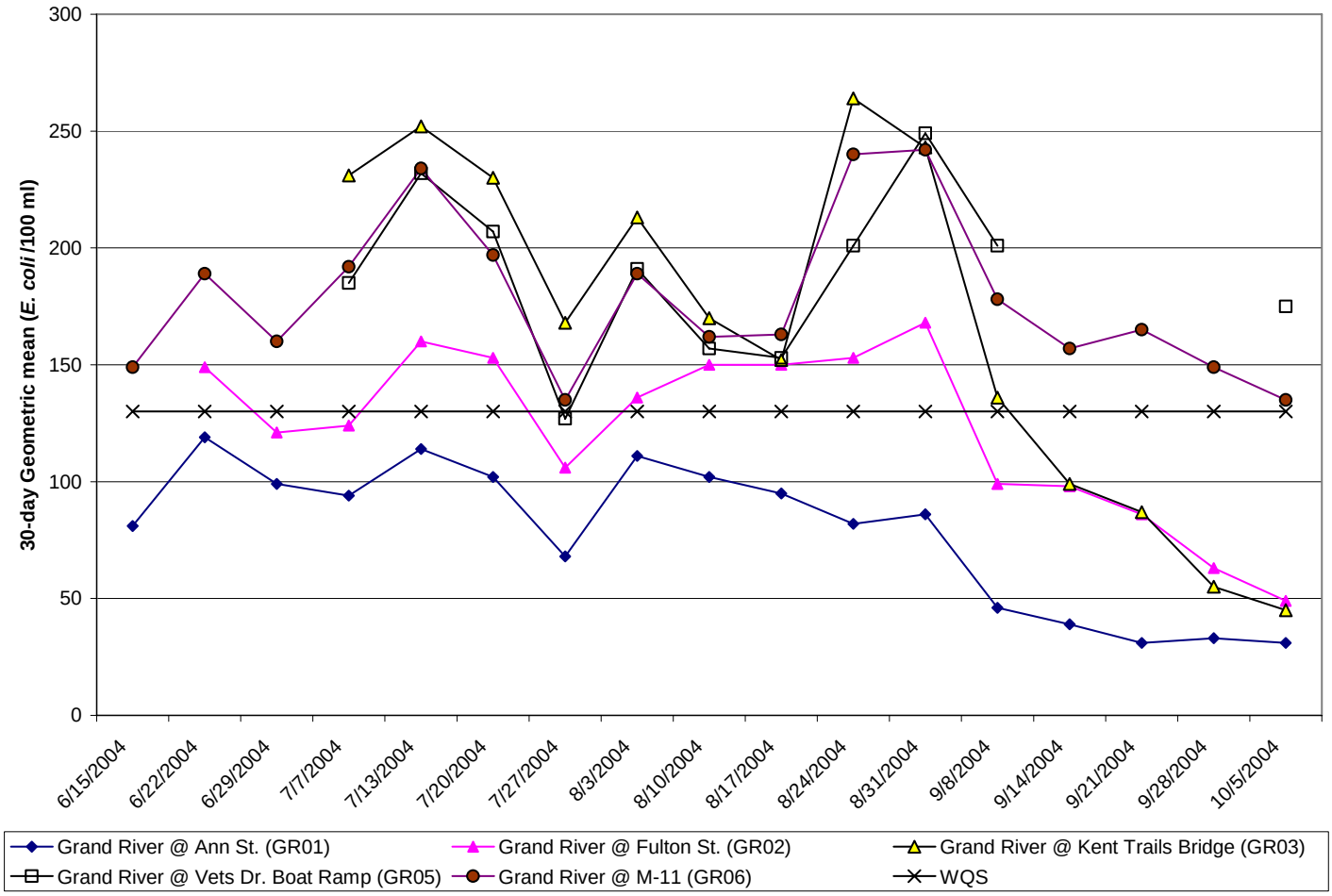


Figure 2. Thirty-day geometric mean for *E. coli* in the Grand River, vicinity of Grand Rapids, Kent County, Michigan, 2004.

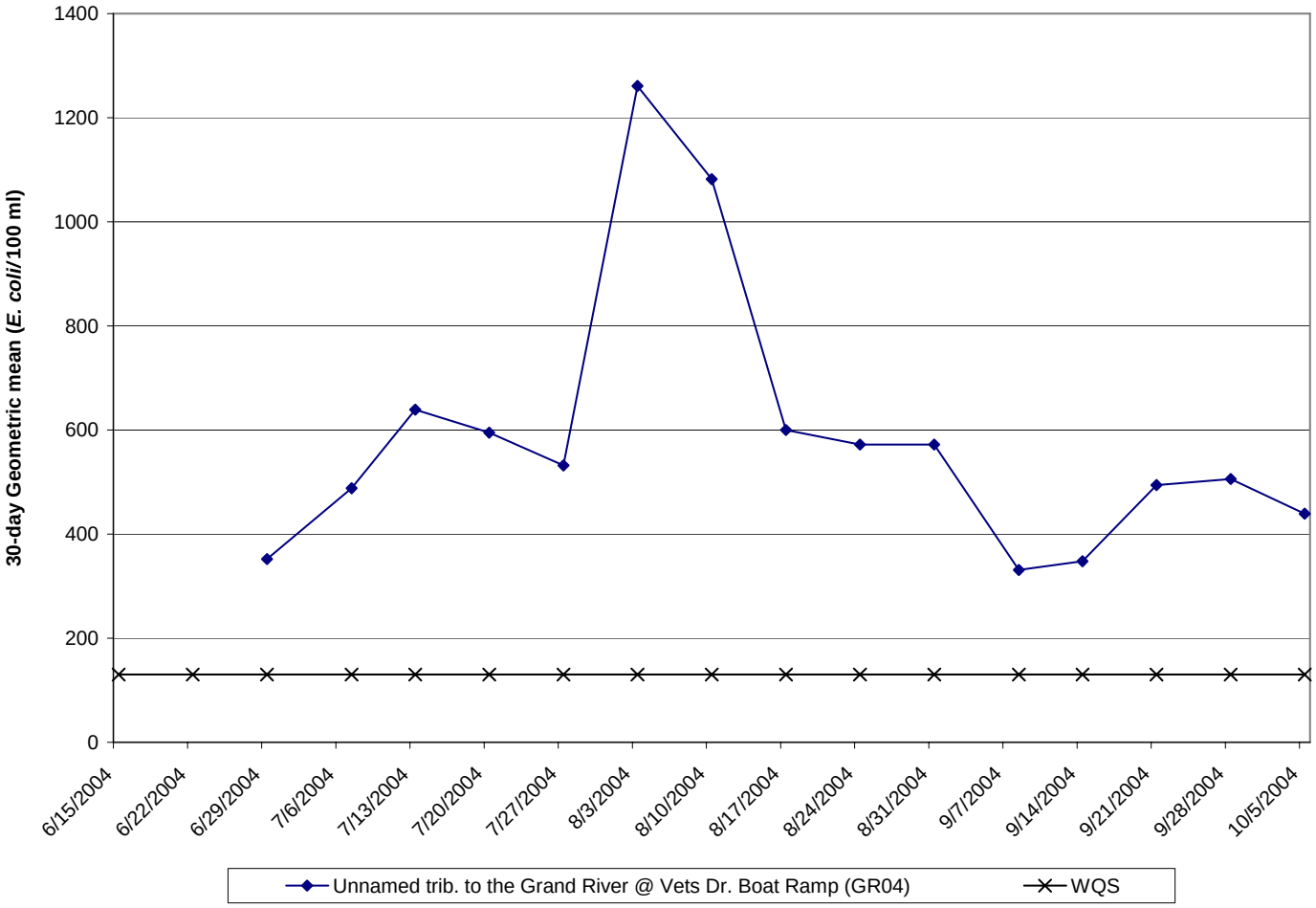


Figure 3. Thirty-day geometric mean for *E. coli* in an unnamed tributary of the Grand River, vicinity of Grandville, Kent County, Michigan, 2004.

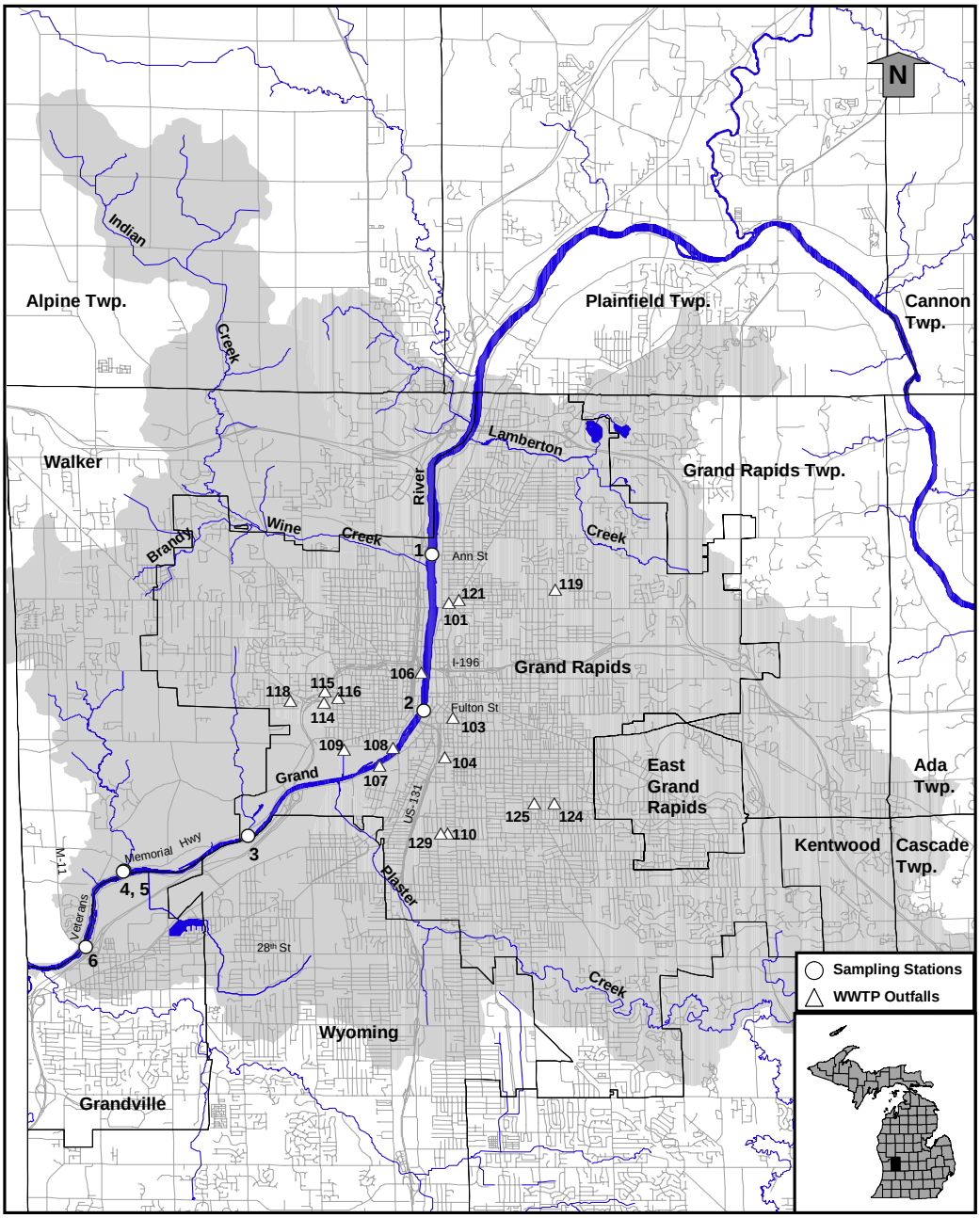


Figure 4. City of Grand Rapids Combined Sewer Outfall locations, located in the vicinity of Grand Rapids, Kent County, Michigan, 2004.

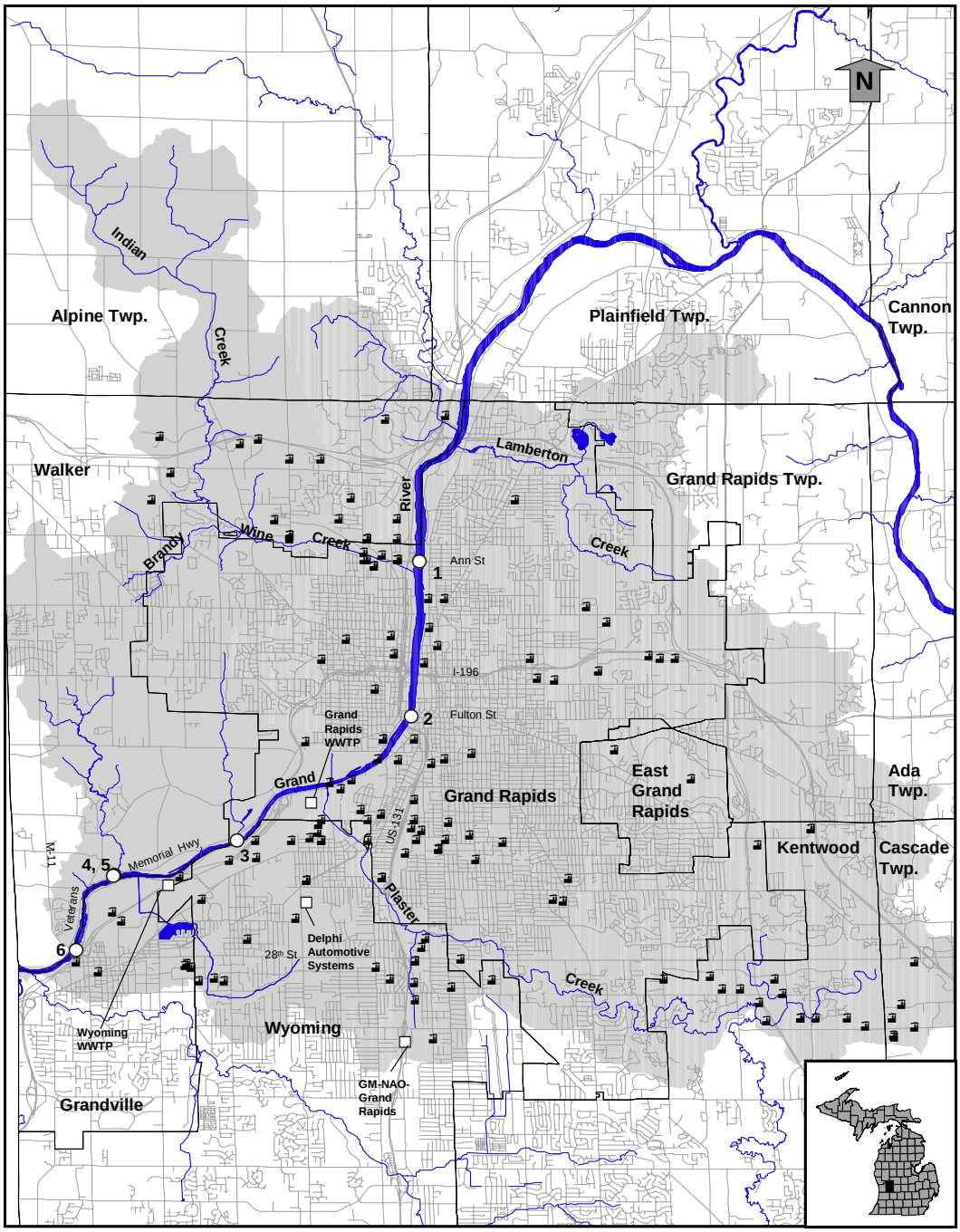


Figure 5. NPDES permitted discharges to the Grand River TMDL reach, Kent County, Michigan, 2004. (Note: figure does not contain MS4 permits or permits-by-rule).

Table 1. MDEQ 2004 *E. coli* monitoring data (*E. coli*/100 ml) for the Grand River in the vicinity of Grand Rapids. Shaded areas indicate exceedances of the WQS. Data are presented upstream to downstream. Note: precipitation is noted if occurring within 24 hours preceding sampling.

DATE	Grand River @ Ann St. (GR01)			Grand River @ Fulton St. (GR02)			Grand River @ Kent Trails Bridge (GR03)			Precip. data
	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	
5/18/2004	67	65	---	130	---	---	700	276	---	0.02"
	97			#			150			
	43			260			200			
5/25/2004	160	93	---	280	270	---	*	---	---	0.06"
	30			280			*			
	170			250			*			
6/2/2004	80	95	---	94	80	---	*	---	---	0.04"
	110			90			*			
	98			60			*			
6/8/2004	28	33	---	40	36	---	64	62	---	0.02"
	28			30			50			
	44			40			74			
6/15/2004	120	190	81	160	168	---	130	258	---	0.21"
	190			140			330			
	300			210			400			
6/22/2004	280	426	119	500	553	149	1,400	1169	---	1.0"
	430			380			1,200			
	640			890			950			
6/29/2004	33	38	99	83	97	121	93	116	---	0
	26			110			180			
	62			100			93			
7/7/2004	83	73	94	120	89	124	730	301	231	0.17"
	48			67			220			
	98			87			170			
7/13/2004	60	88	114	140	133	160	160	97	252	0.09"
	120			140			73			
	94			120			78			

Table 1. continued (*E. coli*/100 ml).

DATE	Grand River @ Ann St. (GR01) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Grand River @ Fulton St. (GR02) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Grand River @ Kent Trails Bridge (GR03) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
7/20/2004	93	107	102	170	132	153	230	163	230	0
	87			140			210			
	150			97			90			
7/27/2004	52	58	68	210	90	106	180	239	168	0.04"
	48			66			380			
	78			52			200			
8/3/2004	250	424	111	270	333	136	340	385	213	0
	380			370			620			
	800			370			270			
8/10/2004	54	51	102	80	146	150	130	98	170	0.12"
	46			170			73			
	52			230			100			
8/17/2004	120	57	95	130	132	150	2	56	152	0.32"
	34			70			670			
	46			250			130			
8/24/2004	28	52	82	250	147	153	6600	2536	264	0.03"
	30			90			1300			
	170			140			1900			
8/31/2004	50	75	86	180	141	168	210	160	243	0
	110			130			340			
	78			120			57			
9/8/2004	4	18	46	2	23	99	2	21	136	0
	24			83			72			
	60			77			64			

Table 1. continued (*E. coli*/100 ml).

DATE	Grand River @ Ann St. (GR01) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Grand River @ Fulton St. (GR02) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Grand River @ Kent Trails Bridge (GR03) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
9/14/2004	**40**	23	39	**440**	144	98	**6**	20	99	0
	16			**97**			**30**			
	18			**70**			**42**			
9/21/2004	**22**	18	31	**150**	66	86	**2**	29	87	0
	20			**34**			**160**			
	14			**56**			**77**			
9/28/2004	**52**	74	33	**2**	32	63	**570**	272	55	0.13"
	70			**77**			**220**			
	110			**220**			**160**			
10/5/2004	**30**	55	31	**60**	39	49	**63**	57	45	0
	180			**32**			**67**			
	30			**30**			**43**			

Table 1. continued (*E. coli*/100 ml).

DATE	Grand River @ Vets Drive Boat Ramp (GR05) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Grand River @ M-11 (GR06) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
5/18/2004	830	695	---	230	286	---	0.02"
	900			220			
	450			460			
5/25/2004	*	---	---	240	235	---	0.06"
	*			170			
	*			320			
6/2/2004	*	---	---	130	128	---	0.04"
	*			160			
	*			100			
6/8/2004	60	56	---	16	38	---	0.02"
	67			52			
	43			64			
6/15/2004	190	237	---	210	226	149	0.21"
	260			230			
	270			240			
6/22/2004	650	878	---	800	952	189	1.0”
	800			770			
	1,300			1,400			
6/29/2004	130	75	---	110	103	160	0
	13			140			
	250			70			
7/7/2004	360	252	185	500	314	192	0.17"
	260			230			
	170			270			
7/13/2004	290	171	232	96	102	234	0.09"
	90			92			
	190			120			

Table 1. continued (*E. coli*/100 ml).

DATE	Grand River @ Vets Drive Boat Ramp (GR05) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Grand River @ M-11 (GR06) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
7/20/2004	160	135	207	110	95	197	0
	110			87			
	140			90			
7/27/2004	70	76	127	180	144	135	0.04"
	90			150			
	70			110			
8/3/2004	570	573	191	520	554	189	0
	610			680			
	540			480			
8/10/2004	77	96	157	140	145	162	0.12"
	97			200			
	120			110			
8/17/2004	220	147	153	60	104	163	0.32"
	130			110			
	110			170			
8/24/2004	480	528	201	1000	663	240	0.03"
	750			520			
	410			560			
8/31/2004	350	222	249	310	151	242	0
	240			100			
	130			110			
9/8/2004	120	199	201	40	118	178	0
	200			120			
	330			340			

Table 1. continued (*E. coli*/100 ml).

DATE	Grand River @ Vets Drive Boat Ramp (GR05) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Grand River @ M-11 (GR06) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
9/14/2004	**110**	110	---	**57**	77	157	0
	120			**90**			
	100			**90**			
9/21/2004	**400**	173	---	**130**	134	165	0
	93			**190**			
	140			**97**			
9/28/2004	**550**	755	---	**290**	402	149	0.13"
	1400			**620**			
	560			**360**			
10/5/2004	**50**	58	175	**70**	91	135	0
	83			**110**			
	47			**97**			

sample not analyzed due to laboratory error
* sample not collected due to flooded conditions

Table 2. MDEQ 2004 *E. coli* monitoring data (*E. coli*/100 ml) for an unnamed tributary of the Grand River, in the vicinity of Grandville. Shaded areas indicate exceedances of the WQS. Note: precipitation is noted if occurring within 24 hours preceding sampling.

DATE	Unnamed Trib. To the Grand River @ Vets Dr. Boat Ramp (GR04) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
5/18/2004	7,300 17,000 11,000	11,093	---	0.02"
5/25/2004	* * *	---	---	0.06"
6/2/2004	270 220 120	192	---	0.04"
6/8/2004	370 620 320	419	---	0.02"
6/15/2004	660 2,300 790	1,062	987	0.21"
6/22/2004	170 2,600 1,500	872	523	1.0”
6/29/2004	3 290 430	72	352	0
7/7/2004	760 1,500 840	986	488	0.17"
7/13/2004	1,800 1,400 1,700	1,624	639	0.09"
7/20/2004	620 970 670	739	595	0
7/27/2004	510 750 330	502	532	0.04"
8/3/2004	6,500 8,900 2,700	5,385	1,261	0

Table 2. continued (*E. coli*/100 ml).

DATE	Unnamed Trib. To the Grand River @ Vets Dr. Boat Ramp (GR04) SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
8/10/2004	440	457	1,082	0.12"
	410			
	530			
8/17/2004	560	85	600	0.32"
	370			
	3			
8/24/2004	800	580	572	0.03"
	520			
	470			
8/31/2004	500	503	572	0
	470			
	540			
9/8/2004	68	352	331	0
	770			
	830			
9/14/2004	540	585	348	0
	700			
	530			
9/21/2004	730	489	494	0
	340			
	470			
9/28/2004	700	659	506	0.13"
	560			
	730			
10/5/2004	270	245	439	0
	210			
	260			

* sample not collected due to flooded conditions

Table 3. Distribution of land for each municipality in the Grand River TMDL reach.

Municipality	Square Miles	Percent
Grand Rapids	43.6	40
Walker	18.7	17
Alpine Township	10.0	9
Wyoming	10.0	9
Grand Rapids Township	7.6	7
Kentwood	6.7	6
East Grand Rapids	3.4	4
Grandville	2.7	3
Cascade Township	2.6	2
Plainfield Township	2.2	2
Ada Township	0.5	1
TOTAL	**108**	**100**

Table 4. Permitted outfalls to the Grand River TMDL watershed. Source: MDEQ, Water Bureau's NPDES Permit Management System.

Facility	Ind. Permit/Certificate of Coverage/Notice of Coverage	Receiving Water	Latitude	Longitude
Forest Hills PS-Secondary Bldg	GW164100203	----	43.00805	-85.64723
MDOT MS4	MI0057364	Statewide	----	----
Grand Rapids MS4	MI0053872	----	42.95528	-85.65944
MacDonalds Ind-Oak Industrial	MI0057568	Grand River	42.97500	-85.60417
Grand Rapids WWTP	MI0026069	Grand River	42.94556	-85.70278
Wyoming WWTP	MI0024392	Grand River	42.92861	-85.74139
Delphi Automotive Systems LLC	MI0001236	Plaster Creek	42.92500	-85.70417
GM NAO – Grand Rapids	MI0043877	Plaster Creek	42.89583	-85.67778
Northwoods Boarding Kennel	GW114101303	----	42.93944	-85.56787
Coit Avenue Gravel Company	GW1510152	----	42.93944	-85.56787
CEMC-E Gr Rapids	MIG080886	Grand River	42.95611	-85.62083
J&H Oil Co-Cherry St	MIG080892	Grand River	42.95833	-85.67500
Icon on Bond LLC	MIG081065	Grand River	42.97417	-85.67194
Keebler Co	MIG250151	Plaster Creek	42.91250	-85.67500
Blackmer-A Dover Resources Co	MIG250152	Plaster Creek	42.92966	-85.68386
Sojourners Trans Living	MIG250159	----	42.93611	-85.58222
Betz Industries	MIG250169	Grand River	43.00083	-85.70833
Yamaha Musical Products	MIG250271	Little Plaster Creek	42.90000	-85.57083
Grand Rapids Printing Ink Co	MIS110033	Grand River	42.93750	-85.70000
Micron Mfg Co	MIS110035	Indian Mill Creek	43.00417	-85.71250
Burton St Recycling-Supply Co	MIS110038	Plaster Creek	42.94278	-85.68389
Imperial Metal Products	MIS110040	Grand River	42.94389	-85.68944
Midwest Bumper Co	MIS110041	Silver Creek	42.93333	-85.65833
Thompson-McCully Co-Market Co	MIS110052	Plaster Creek	42.94944	-85.69778

Table 4. continued.

Facility	Ind. Permit/Certificate of Coverage/Notice of Coverage	Receiving Water	Latitude	Longitude
The DECC Company	MIS110055	Grand River	42.94167	-85.67500
Kentwood Packaging-Powder	MIS110057	Plaster Creek	42.89944	-85.58000
Gelock Transfer Line Inc	MIS110058	Grand River	42.95417	-85.67917
Evans Tempcon Inc	MIS110108	Grand River	42.99583	-85.68750
RailAmerica-GDR Eastern RR	MIS110109	Indian Mill Creek	42.99667	-85.68333
Mitco Inc	MIS110118	Plaster Creek	42.93472	-85.67750
Walker Tool & Die	MIS110119	Indian Mill Creek	43.00833	-85.74583
P & K Steel Service Inc	MIS110129	Plaster Creek	42.93333	-85.72500
Vans Delivery-Turner	MIS110131	Grand River	43.00861	-85.69167
Thierica Inc	MIS110133	Coldbrook Drain	42.98750	-85.66667
Paulstra CRC	MIS110142	Grand River	42.97500	-85.64333
Waste Mgt of MI-Grand Rapids	MIS110284	Grand River	42.92139	-85.70722
Woodland Paving Co	MIS110287	Indian Mill Creek	43.02556	-85.66611
Int Tooling Solution-Gd Rapids	MIS110288	Grand River	42.97611	-85.68028
Cascade Engineering-ATS 33rd	MIS110296	Plaster Creek	42.89833	-85.55333
State Heat Treat-Grand Rapids	MIS110297	Plaster Creek	42.90833	-85.65417
Stagood-Metal Components Inc	MIS110299	Plaster Creek	42.97778	-85.66861
Yellow Freight Sys-Wyoming	MIS110345	Crockery Creek	42.93389	-85.71778
UPS-Wyoming-Clyde Park	MIS110346	Buck Creek	42.95833	-85.68333
Spectrum-GR-Plymouth	MIS110355	Coldbrook Drain	42.97250	-85.62500
Reliance Finishing Co	MIS110487	Plaster Creek	42.93750	-85.70000
Rapid Die & Engineering	MIS110488	Plaster Creek	42.92917	-85.63333
Price Industries Inc	MIS110491	Plaster Creek	42.95000	-85.60000
Packaging Corp Amer-Wyoming	MIS110492	Grand River	42.92917	-85.70417
Covanta Energy-Grand Rapids	MIS110495	Grand River	42.95000	-85.69167
CorrChoice LLC-Mich Packaging	MIS110504	Little Plaster Creek	42.90000	-85.56667
Mich Cert Con-Grand Rapids	MIS110506	Plaster Creek	42.92472	-85.63472
NS Grand Rapids Yard	MIS110508	Plaster Creek	42.94583	-85.67500
Nova Plastics Tech-Grandville	MIS110522	Grand River	42.91167	-85.73722
Louis Padnos-GR-Turner Yard	MIS110525	Grand River	43.00000	-85.67917
Klise Mfg Co	MIS110528	Coldbrook Creek	42.97500	-85.60833
Kamps Pallets Inc	MIS110533	Indian Mill Creek	43.02000	-85.72167
Hansen-Balk Steel Treating Co	MIS110537	Grand River	42.98750	-85.67083
Hager Wood Preserving Inc	MIS110539	Grand River	42.94167	-85.70000
Hekman Furniture Company	MIS110540	Grand River	42.93750	-85.67444
Grand Rapids Auto Parts Inc	MIS110555	Indian Mill Creek	42.99583	-85.67917
Grand Rapids Gravel-Plt 4	MIS110557	Roys Creek	42.92083	-85.75417
Frost Inc	MIS110561	Indian Mill Creek	43.00000	-85.70833
Columbian Distribution Serv	MIS110564	Grand River	42.94167	-85.68750
Crystal Flash	MIS110565	Indian Mill Creek	42.99583	-85.68833
Spectrum-GR-Wealthy	MIS110566	Grand River	42.95417	-85.68472
Electro Chem Finish Co-Remico	MIS110567	Grand River	42.90889	-85.72917
Blackmer-A Dover Resources Co	MIS110569	Plaster Creek	42.92966	-85.68386
Cascade Engineering 5141-36	MIS110570	Little Plaster Creek	42.89806	-85.54000
Haviland Products Company	MIS110571	Indian Mill Creek	42.99583	-85.67889

Table 4. continued.

Facility	Ind. Permit/Certificate of Coverage/Notice of Coverage	Receiving Water	Latitude	Longitude
Country Fresh Inc	MIS110573	Plaster Creek	42.91528	-85.67333
Dyna Plate Inc	MIS110574	Plaster Creek	42.91694	-85.67222
Imperial Sheet Metal	MIS110578	Plaster Creek	42.91694	-85.72028
Imperial Graphics Inc	MIS110579	Indian Mill Creek	43.02083	-85.71667
Louis Padnos-GR-Front Street	MIS110580	Grand River	42.95833	-85.68333
Keebler Co	MIS110581	Plaster Creek	42.91250	-85.67500
Coca-Cola	MIS110582	Grand River	42.95778	-85.70417
Consumers Concrete-15	MIS110585	Plaster Creek	42.90333	-85.58194
CSX Transport-Wyoming Yard	MIS110586	Plaster Creek	42.94806	-85.69472
Roadway Express-GR-Federal	MIS110589	Grand River	42.93806	-85.70333
Rapistan Systems-GR	MIS110590	----	42.98583	-85.62806
Haworth Inc-Kentwood	MIS110599	Whiskey Creek	42.90528	-85.57556
Meridian Auto-GR-Plt 2	MIS110600	Grand River	42.95333	-85.67028
Meridian Auto-GR-Plt 1	MIS110601	Plaster Creek	42.90611	-85.58694
Meridian Auto-GR-Plt 4 & 5	MIS110602	Plaster Creek	42.90833	-85.60778
Meridian Auto-GR-Plt 7	MIS110603	Plaster Creek	42.90611	-85.59194
Bauer Products	MIS110606	Grand River	42.93694	-85.65111
Bell Packaging Corp	MIS110610	Grand River	42.92917	-85.70417
Bissell Inc	MIS110611	Indian Mill Creek	42.97917	-85.69333
Adac Plastics Inc-GR	MIS110616	Plaster Creek	42.90833	-85.57778
Advance Plating & Finishing	MIS110617	Grand River	42.93750	-85.66667
Advance Packaging Corp	MIS110621	Plaster Creek	42.90000	-85.55833
American Seating Co	MIS110623	Grand River	42.97972	-85.68111
Amerikam	MIS110626	Plaster Creek	42.93917	-85.70111
Packaging Corp of Amer-Grand	MIS110666	Grand River	42.93750	-85.68750
Spectrum-GR-McConnell	MIS110672	Grand River	42.95417	-85.66667
Monarch Hydraulics Inc	MIS110705	Grand River	42.97056	-85.63694
Burke E Porter Machinery Co	MIS110745	Coldbrook Creek	42.98264	-85.62264
Plastech	MIS110747	Grand River	42.91111	-85.73556
Northwest Tool & Die	MIS110748	Indian Mill Creek	43.01389	-85.74056
Weller Auto Parts Inc	MIS110749	Grand River	42.93750	-85.71806
Reliance Plastisol Coating Co	MIS110778	Plaster Creek	42.94083	-85.70083
G R Central Iron & Steel Corp	MIS110812	Indian Mill Creek	42.99444	-85.68556
Autodie International Inc	MIS110813	Grand River	42.98167	-85.67056
Knape & Vogt Mfg Co	MIS110816	Maryland Creek storm sewer	42.97556	-85.61139
Pitsch-Concrete Crushing	MIS110819	York Creek	43.02472	-85.68250
Rowe International Inc	MIS110824	Grand River	42.94111	-85.66583
BorgWarner Automotive	MIS110826	Grand River	43.00417	-85.69500
Cook Composites and Polymers	MIS110828	Grand River	42.94000	-85.67583
Yamaha Musical Products	MIS110829	Little Plaster Creek	42.90000	-85.57083
M & E Manufacturing	MIS110840	Plaster Creek	42.90667	-85.66500
Betz Industries	MIS110841	Grand River	43.00083	-85.70833
Miller Products	MIS110842	Grand River	42.96889	-85.68556
Pitsch Salvage	MIS110844	Indian Mill Creek	42.99444	-85.68556
Pinnacle LLC	MIS110849	Grand River	42.93833	-85.66000

Table 4. continued.

Facility	Ind. Permit/Certificate of Coverage/Notice of Coverage	County	Receiving Water	Latitude	Longitude
Williams Distributing	MIS110857	----	Indian Mill Creek	42.91111	-85.68556
Light Metals Corp	MIS110859	----	Roys Creek	42.90833	-85.73333
Proos Mfg Co	MIS110863	----	Coldbrook Creek	42.97083	-85.64167
Harlo Products Corp-Ferry St	MIS110868	----	Grand River	42.91194	-85.73667
American Metal & Plastics	MIS110894	----	Plaster Creek	42.90417	-85.67500
Master Finish Company	MIS110945	----	Plaster Creek	42.92500	-85.63750
Pridgeon & Clay Inc	MIS110976	----	Grand River	42.93528	-85.66861
Apex Rack & Coating Co	MIS110980	----	Grand River	42.92263	-85.75658
Dielink-GR	MIS111018	----	Indian Mill Creek	43.01667	-85.70833
Magic Finishing Company	MIS111028	----	Plaster Creek	42.90861	-85.68167
Accuform Industries Inc	MIS111042	----	Grand River	42.99583	-85.67917
Hme Inc	MIS111047	----	Grand River	42.93000	-85.73833
Bishop Distributing Co	MIS111048	----	Plaster Creek	42.90278	-85.54361
G R Wilbert Burial Vault Co	MIS111049	----	Indian Mill Creek	43.01667	-85.70000
Vi-Chem Corp	MIS111050	----	Grand River	42.93556	-85.66861
Equity Transportation Co	MIS111051	----	Indian Mill Creek	43.02167	-85.74333
MacDonalds Indust Prod	MIS111056	----	Indian Mill Creek	43.00000	-85.68750
Mol Belting Company	MIS111057	----	Indian Mill Creek	42.97500	-85.69972
Consumers Concrete-230-Wyoming	MIS111059	----	Grand River	42.93750	-85.70833
Robinson Cartage Co	MIS111062	----	Luvis Lake	42.92528	-85.73250
Baker Auto-2201 Turner	MIS111066	----	Grand River	43.00417	-85.67917
Baker Auto-1981 Alpine	MIS111067	----	Grand River	43.00000	-85.68750
Baker Auto-1907 Alpine	MIS111068	----	Grand River	43.00000	-85.68750
Davidson Plyforms Inc	MIS111080	----	Plaster Creek	42.91167	-85.54000
Cascade Engineering 4950-37	MIS111106	----	Little Plaster Creek	42.89583	-85.54556
Enterprise Tool & Die Inc	MIS111135	----	Grand River	42.91250	-85.76667
Michigan Wheel Corp	MIS111137	----	Plaster Creek	42.93944	-85.67306
Future Tool & Die	MIS111146	----	Grand River	42.90833	-85.72667
Noble Polymers-Grand Rapids	MIS111298	----	Little Plaster Creek	42.89630	-85.54588
FedEx Freight East-Wyoming	MIS111316	----	Cole Drain	42.89611	-85.67000
Meridian Auto Sys-Kentwood	MIS111336	----	Plaster Creek	42.90889	-85.59528
Lacks Wheel Div-Kraft Assembly	MIS111354	----	Grand River	42.89991	-85.54606
Grocers Baking Company	MIS111369	----	Plaster Creek	42.91250	-85.66250
Louis Padnos-Alpine	MIS111371	----	Indian Mill Creek	42.99721	-85.68838
GRP-Woodpointe Crossings	MIR109069	----	----	----	----
Jarr-Misty Ridge Estates Ph 3	MIR104160	----	----	----	----
Redstone-Southbridge Condo	MIR106623	Kent	----	----	----
Eastbrook Dev-Arbor Hills Ph 3	MIR107793	Kent	----	----	----
Kent Co-Burton & Kraft Resurf	MIR105790	Kent	----	----	----
Georgetown Dev-Avalon Pointe	MIR104930	Kent	----	----	----
Alliance-Wildflower Ridge 4&5	MIR105350	Kent	----	----	----
Gallentine-Gaines Market Place	MIR107694	Kent	----	----	----
Zylstra-Smith Farms Ph I	MIR106377	Kent	----	----	----
Airlane-Driftwood Acres	MIR104620	Kent	----	----	----
Vineyard Ventures-Vineyd Place	MIR108751	Kent	----	----	----
Gunnink/DeVries-Paris Meadows	MIR108753	Kent	----	----	----

Table 4. continued.

Facility	Ind. Permit/Certificate of Coverage/Notice of Coverage	County	Receiving Water	Latitude	Longitude
Vip-Meadows N Estates #3	MIR106017	Kent	----	----	----
Canaltown Woods II	MIR107310	Kent	----	----	----
Kent Co-44th St Reconstruction	MIR108375	Kent	----	----	----
Burlingam Prop-Plateau Estates	MIR106595	Kent	----	----	----
Rubie-West Hamptons	MIR106938	Kent	----	----	----
Berkenpas-Amber Est Condos	MIR105845	Kent	----	----	----
Whistle Rdg Dev-Whistle Crk #4	MIR107552	Kent	----	----	----
Ridings-Eaglecrest Ofc Bldg J	MIR104024	Kent	----	----	----
Byron Manor Alzheimers Fac	MIR105965	Kent	----	----	----
Knapp Valley Condo Ph 3	MIR105546	Kent	----	----	----
Arlington Park Phase I	MIR109036	Kent	----	----	----
Vansingel-Pleasant Pond	MIR107541	Kent	----	----	----
Koetje-Railside West	MIR104025	Kent	----	----	----
Rivertree Community Church	MIR108155	Kent	----	----	----
Michcon-Fulton St Pipeline	MIR106930	Kent	----	----	----
MDOT M-6 Paving/Grading	MIR105295	Kent	----	----	----
Diephouse-Gd Rapids Town Cntr	MIR104081	Kent	----	----	----
Kent Co-Kenowa Ave	MIR105060	Kent	----	----	----
LaDuke Prop-Birnumwood Farms	MIR108477	Kent	----	----	----
Verhage-Greenleaf Dist	MIR105077	Kent	----	----	----
Deer View Estates	MIR106321	Kent	----	----	----
Claus-Brenton Woods # 3	MIR106902	Kent	----	----	----
Wyoming-Gezon Park	MIR108373	Kent	----	----	----
Gr Christian-Gainey Athletic	MIR105131	Kent	----	----	----
Baileys Grove Plat Ph 15 16 17	MIR104724	Kent	----	----	----
Arrigo-Pace Trailer Sales	MIR105932	Kent	----	----	----
Sycamore Woods-Grand Rapids	MIR108669	Kent	----	----	----
Hilton-Woodsview Hills Condo	MIR104176	Kent	----	----	----
Berkenpas-Amber Creek Condos	MIR105503	Kent	----	----	----
Bobo-Stevens Pt Town Homes	MIR105706	Kent	----	----	----
T&m-Weller Parcel	MIR107317	Kent	----	----	----
De Kline-Ridge Stone Place 3	MIR107193	Kent	----	----	----
Crestwood Mdl Sch Addition	MIR108033	Kent	----	----	----
Rivertown LLC-Town Center	MIR104149	Kent	----	----	----
TMGB-Rivertown Valley Ph IIC	MIR108165	Kent	----	----	----
Spica-Sierrafield Condo 3 & 4	MIR106676	Kent	----	----	----
Jack Loeks-Celebration Cinema	MIR104978	Kent	----	----	----
D&C Dev-Oriole Pk Est Ph 4 & 5	MIR108392	Kent	----	----	----
Daniel Molhoek-Heritage Meadow	MIR104053	Kent	----	----	----
Zylstra-Smith Farms # 2	MIR107204	Kent	----	----	----
Eastbrook-Arbor Hills Ph II	MIR106700	Kent	----	----	----
Maclind-Waters Edge Ph 2	MIR106660	Kent	----	----	----
Dta Prop-Gypsum Supply Company	MIR107604	Kent	----	----	----
Deer View Est Ph II & III	MIR107120	Kent	----	----	----
4505 Cascade Rd	MIR107689	Kent	----	----	----
Whitewood Farms Site Condos	MIR104421	Kent	----	----	----

Table 4. continued.

Facility	Ind. Permit/Certificate of Coverage/Notice of Coverage	County	Receiving Water	Latitude	Longitude
Douma-Cook Valley South	MIR105995	Kent	----	----	----
Oeverman-Hightree Estates	MIR106192	Kent	----	----	----
Ridings-Byron Ctr Office Bldg	MIR108061	Kent	----	----	----
Ridings-Byron Ctr Office Bldg	MIR108061	Kent	----	----	----
Snyder Farms LLC-Snyder Farms	MIR104103	Kent	----	----	----
Serra Works GR-Rivertown Honda	MIR108771	Kent	----	----	----
Kent Co-60th St Reconstruction	MIR107327	Kent	----	----	----
Zylstra-Smith Farms No 3	MIR107841	Kent	----	----	----
Eastbrook-Baileys Grove 21	MIR106287	Kent	----	----	----
I Koetje-Oriole Park Estates	MIR104310	Kent	----	----	----
Geenen-Costco Warehouse	MIR108012	Kent	----	----	----
MDOT-M-6/Segment 5	MIR105918	Kent	----	----	----
JCB-Planters Row Phase 3	MIR108243	Kent	----	----	----
Resurrection Life Ch-Prkg Lot	MIR108455	Kent	----	----	----
Woodside Oaks Site Condo	MIR108387	Kent	----	----	----
Dykema-Hughes Building	MIR106634	Kent	----	----	----
Zeitter-Campau Leasing & Devel	MIR105390	Kent	----	----	----
Btp-Hammond Estates	MIR106259	Kent	----	----	----
Lone Pine-Jefferson Farms	MIR105844	Kent	----	----	----
Mvp Prop-Mvp Sportsplex	MIR107620	Kent	----	----	----
Koetje-Northbend Est # 2	MIR107105	Kent	----	----	----
Spica-Sierrafield Condo Ph 2	MIR105994	Kent	----	----	----
Eastbrook Dev-Arbor Hills 5&6	MIR108445	Kent	----	----	----
Grooters-Byron Commerce Ctr	MIR106477	Kent	----	----	----
Canaltown Woods I	MIR106609	Kent	----	----	----
Ggp-Potomac Place	MIR106038	Kent	----	----	----
Berkenpas-Amber Est Condo II	MIR106944	Kent	----	----	----
Agree Limited-Walgreens	MIR108313	Kent	----	----	----
Mountain Ridge-Saddleback	MIR105456	Kent	----	----	----
Algera-Center Park Row	MIR105656	Kent	----	----	----
Gd Rapids-Eastside Sewer Imp 7	MIR108483	Kent	----	----	----
Carestone at Kentwood	MIR104603	Kent	----	----	----
Land & Co-Hartman Est Ph 3	MIR107695	Kent	----	----	----
Miedema Prop-Bridge Place	MIR107510	Kent	----	----	----
Southwood LLC-Southpointe	MIR107614	Kent	----	----	----
Solkema-Harmony Cove	MIR104900	Kent	----	----	----
Baileys Grove E Condo Ph 1&2	MIR105373	Kent	----	----	----
Crystal Falls-Cornerston Est 2	MIR105893	Kent	----	----	----
Dayton Freight Facility	MIR107763	Kent	----	----	----
Lacks-4260 Airline Dr	MIR107261	Kent	----	----	----
Georgetown Dev-Avalon Pt #2	MIR106738	Kent	----	----	----
Woods-Rivertown Run Phases 1-3	MIR109102	Kent	----	----	----
Kent Co-68th St/US-131	MIR105064	Kent	----	----	----
Dykema-Bdr Commercial	MIR107377	Kent	----	----	----
Northpointe Park	MIR108925	Kent	----	----	----
Gd Rapids PS-Alger MS	MIR108900	Kent	----	----	----

Table 4. continued.

Facility	Ind. Permit/Certificate of Coverage/Notice of Coverage	County	Receiving Water	Latitude	Longitude
Greenstone Holdings-Inglenook	MIR108429	Kent	----	----	----
Grooters-52nd St & Kraft Ave	MIR107070	Kent	----	----	----
Vanderlaan-Carlisle Shores #2	MIR107450	Kent	----	----	----
Eastbrook-Baileys Grove Ph 25	MIR107735	Kent	----	----	----
Bobo-Stevens Pointe Ph 3	MIR107152	Kent	----	----	----
Lamer-Steelcase Wood Plant	MIR104078	Kent	----	----	----
Spica-Greens Sierrafield 2&5	MIR108080	Kent	----	----	----
Gunnink-Summer Shores No 2	MIR105737	Kent	----	----	----
Coles Home & Land-Valley Forge	MIR108517	Kent	----	----	----
Vip-Meadows N Est No 2	MIR105046	Kent	----	----	----
Buck/Lake Estates	MIR105738	Kent	----	----	----
Village West at Railside	MIR107666	Kent	----	----	----
Del Mar Farms No 4 Comm Bldg	MIR104181	Kent	----	----	----
Breton Woods North Phase I	MIR108711	Kent	----	----	----
Dykema Excav-Old Orchard E #2	MIR107048	Kent	----	----	----
Maier-Stations Edge-Byron	MIR108522	Kent	----	----	----
Lone Pine Develop-Buck Creek	MIR104290	Kent	----	----	----
Jack Goodale-Johnson Est #12	MIR107039	Kent	----	----	----
Dwp-Cutlerville Orchard West	MIR104767	Kent	----	----	----
N Bergen-South Creek Ph I	MIR107116	Kent	----	----	----
Jarr-Misty Ridge Est Ph 4	MIR104901	Kent	----	----	----
Kentwood Christian Church	MIR106414	Kent	----	----	----
Pulte-Aberdeen Valley Ph I	MIR106675	Kent	----	----	----
Pulte-Fairways Ph 2	MIR105580	Kent	----	----	----
S Christian Hs-Athletic Complx	MIR105438	Kent	----	----	----
44th-Pkwy Place Office/Commer	MIR105956	Kent	----	----	----
Redstone Group-Enclave	MIR108495	Kent	----	----	----
Kentwood-Dept of Public Fac	MIR106993	Kent	----	----	----
Steelcase-Mac Office Building	MIR104036	Kent	----	----	----
Douma-Porter Hills	MIR107192	Kent	----	----	----
Ravines Cap-Cobblestone East	MIR107910	Kent	----	----	----
St Marys Health Care SW Campus	MIR109084	Kent	----	----	----
Spica Properties Sierrafield	MIR105232	Kent	----	----	----
Bobo-Stevens Pointe Ph 4	MIR107151	Kent	----	----	----
B & G-Amber Creek Condo 4	MIR108164	Kent	----	----	----
D&c-Oriole Park Est #2	MIR105997	Kent	----	----	----
Hughes-4069 Lake Dr	MIR106627	Kent	----	----	----
New Era Dev-Brewer Park Place	MIR107537	Kent	----	----	----
T&m-Clyde Industrial Extention	MIR106325	Kent	----	----	----
Metro Hosp & Health Care	MIR107129	Kent	----	----	----
Dekleine-Rdge Stone Place Cndo	MIR104095	Kent	----	----	----
Copperwood	MIR104883	Kent	----	----	----
Langlois-Vineyards Ph II	MIR104854	Kent	----	----	----
Creekwood Village	MIR104882	Kent	----	----	----
Brook Hollow Phase 2	MIR104897	Kent	----	----	----

Table 4. continued.

Facility	Ind. Permit/Certificate of Coverage/Notice of Coverage	County	Receiving Water	Latitude	Longitude
Crahen-The Orchards No 5 & 6	MIR104695	Kent	----	----	----
Resurrection Life Church Expan	MIR107807	Kent	----	----	----
Berkenpas-Amber Est Condo Ph 3	MIR108575	Kent	----	----	----
44th/Shaffer-Pfeiffer Woods Dr	MIR108081	Kent	----	----	----
Plute-The Village # 2	MIR107749	Kent	----	----	----
Hamptons Site Condominium	MIR104543	Kent	----	----	----
Koetje-Railside West No 2	MIR107059	Kent	----	----	----
Southwood-Clear Pointe	MIR109062	Kent	----	----	----
Cobblestone at the Ravines	MIR109160	Kent	----	----	----
Tmgb-Rivertown Valley-Ph 2b	MIR107251	Kent	----	----	----
MDOT-M-6/Wilson to 64th St	MIR105919	Kent	----	----	----
Goodale-Johnson Estates No 11	MIR105346	Kent	----	----	----
Eastbrook-Baileys Grove Ph 22	MIR106369	Kent	----	----	----
Burlingame-Sweetgrass Ridge	MIR108440	Kent	----	----	----
Townhouse 24 Wilson Avenue	MIR105213	Kent	----	----	----
Bosgraaf-Cobblestone Corners	MIR109006	Kent	----	----	----
Land-Byron Lake Estates	MIR105446	Kent	----	----	----
Essenberg-Quality Car Wash	MIR106815	Kent	----	----	----
Westley&Velting-Wildflower Crk	MIR108360	Kent	----	----	----
Redstone-Eastlake Condos	MIR107067	Kent	----	----	----
Hibma-Fieldstone Apts	MIR105679	Kent	----	----	----
Pulte-Wood Site Condos	MIR106090	Kent	----	----	----
Rohde-Bayberry Farms Village	MIR107176	Kent	----	----	----
Halland-Ryann Ridge	MIR108372	Kent	----	----	----
Eastbrook-Baileys Grove	MIR106180	Kent	----	----	----
Oeverman-Hightree Est Ph 2	MIR107006	Kent	----	----	----
Blackberry @ Shears Crossing	MIR106981	Kent	----	----	----
Deppe-Deppe Office Site	MIR107960	Kent	----	----	----
Railside West Phase 3	MIR108736	Kent	----	----	----
Alliance-Wildflower Ridge No 3	MIR104169	Kent	----	----	----
Bobo-Stevens Pointe Ph 2	MIR105417	Kent	----	----	----
GR-East Side Sewer Imp 4 & 5	MIR108581	Kent	----	----	----
Omc-Camelot Office Park	MIR105408	Kent	----	----	----
Eastbrook-Arbor Hills Condo	MIR106128	Kent	----	----	----
Evergreen-Lake Off Pk-North	MIR105604	Kent	----	----	----
Airport Industrial Park No 3	MIR108616	Kent	----	----	----
Windy Ridge-Windy Ridge Est 2	MIR104042	Kent	----	----	----
Trinity-Woodbury Commons #1	MIR107746	Kent	----	----	----
Simon Koster-Koster South No 5	MIR104195	Kent	----	----	----
Mch-Eastern Meadows	MIR106343	Kent	----	----	----
Van Singel Farms #4-Byron Ctr	MIR107512	Kent	----	----	----
Trinity- Copperfield Phase 1	MIR108902	Kent	----	----	----
Land & Company-Hartman Estates	MIR105396	Kent	----	----	----
Howell-Applewood Est	MIR106873	Kent	----	----	----
R Deppe-Vantage Point No 4	MIR104652	Kent	----	----	----

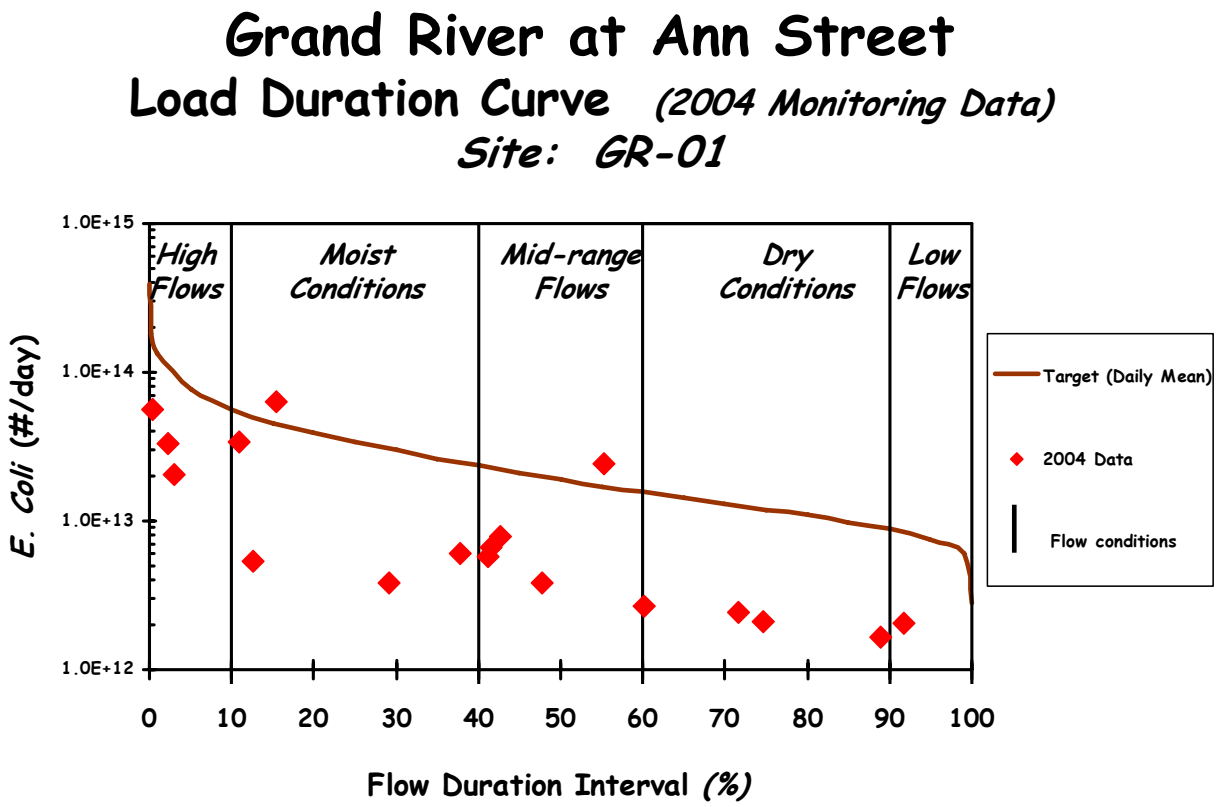
Table 4. continued.

Facility	Ind. Permit/Certificate of Coverage/Notice of Coverage	County	Receiving Water	Latitude	Longitude
Holland Home-Hospice of HH	MIR108262	Kent	----	----	----
Rivertown-Rivertown Center	MIR104168	Kent	----	----	----
Ald-Wildflower Ridge No 4	MIR105828	Kent	----	----	----
Town Crossing Condos	MIR105967	Kent	----	----	----
Visser-Elmridge Meadow Est # 3	MIR107330	Kent	----	----	----
B & G-Amber Ck Condo # 3	MIR107167	Kent	----	----	----
Lk Mich Acad-Old Orchard Est	MIR104948	Kent	----	----	----
Van Singel Farms #2 & 3	MIR106019	Kent	----	----	----
Maclind Dev-Waters Edge	MIR105505	Kent	----	----	----
Dekleine-Ridge Stone Pl Condos	MIR105795	Kent	----	----	----
Grand Rapids-Rec of Knapp St	MIR105914	Kent	----	----	----
Pulte Land Co-Evergreen Lake	MIR107544	Kent	----	----	----
Ravines North Ph I-Kentwood	MIR108629	Kent	----	----	----
City of Kentwood-City Hall	MIR107291	Kent	----	----	----
Eastbrook-Baileys Grove 18/19	MIR105935	Kent	----	----	----
Kent Co-KalamazooAve-76th-68th	MIR108489	Kent	----	----	----
Tmgb-Rivertown Valley Ph I	MIR105510	Kent	----	----	----
Covenant-Villas at Rivertown	MIR109149	Kent	----	----	----
Pulte-The Village	MIR106381	Kent	----	----	----
MDOT M-6 Pavement	MIR105293	Kent	----	----	----
Kent Co-E Paris Ave	MIR105065	Kent	----	----	----
Kent Co-Leffingwell Ave	MIR105059	Kent	----	----	----
Whistle Ridge No 3	MIR105141	Kent	----	----	----
Lowes City of Kentwood	MIR105250	Kent	----	----	----
Jcb-Planters Row Ph I	MIR106166	Kent	----	----	----
SPS-Grand Pointe Dev	MIR105882	Kent	----	----	----
Eastbrook-Baileys Grove 23/24	MIR106841	Kent	----	----	----
Gantos-Select Forest	MIR105582	Kent	----	----	----
Diversco-Cornerstone Est	MIR105384	Kent	----	----	----
Grooters-Canton Union Station	MIR107806	Kent	----	----	----
Kent Co-Byron Center Ave	MIR107329	Kent	----	----	----
JCB/Georgetown-Planters Row 2	MIR107012	Kent	----	----	----
Reeds Crossing Condominiums	MIR104391	Kent	----	----	----
Gerald Ford Airport	MIR108389	Kent	----	----	----
Progressive-Northbend Est No 3	MIR108712	Kent	----	----	----
Takens-Woodside Court Plat	MIR107264	Kent	----	----	----
De Vries-Cross Ck Greens	MIR106352	Kent	----	----	----
Kentwood Pub Sch-New Statium	MIR107104	Kent	----	----	----
Red Investors-Emerald Woods	MIR108041	Kent	----	----	----
Koetje-Northbend Est	MIR105374	Kent	----	----	----
Insites-Pines Commercial & Res	MIR109092	Kent	----	----	----
Macdonalds-Plt #3 Storm Water	MIR107795	Kent	----	----	----
Del Mar Farms Commercial/off	MIR104935	Kent	----	----	----

Table 5. Types of General Permits

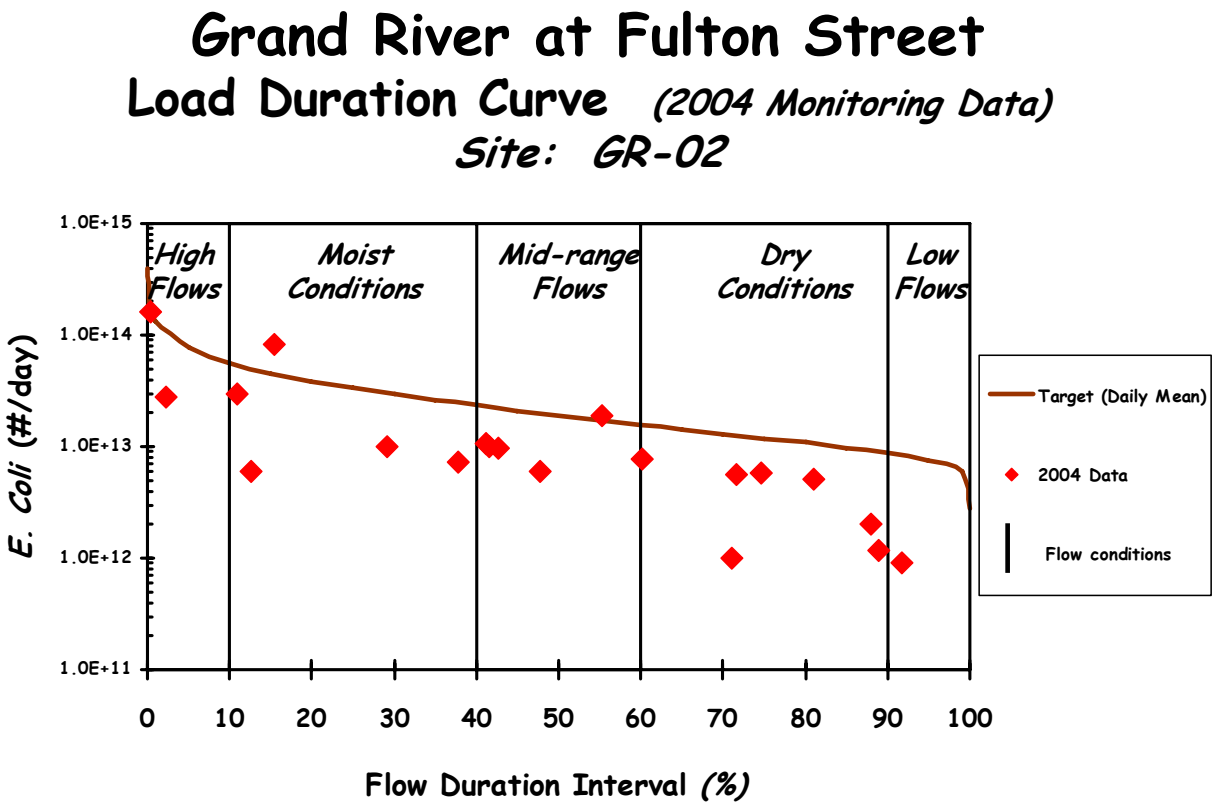
Permit Number	Description
General Permit	
MIS110000	Stormwater from industrial activities
MIG250000	Noncontact cooling water
MIG080000	Wastewater from cleanup of water contaminated with gasoline and related products
GW15_ _ _ _	Above ground sanitary sewage, public and private vehicle wash, slaughterhouse, gravel, sand, limestone, oil field brine,
Permits-by-Rule	
MIR100000	Storm water discharges from construction activities
GW11_ _ _ _	Sanitary sewage, laundromat, non-contact cooling water, fruit and vegetable washwater, portable power washer, pump test water, hydrostatic test water, commercial animal care

APPENDIX A



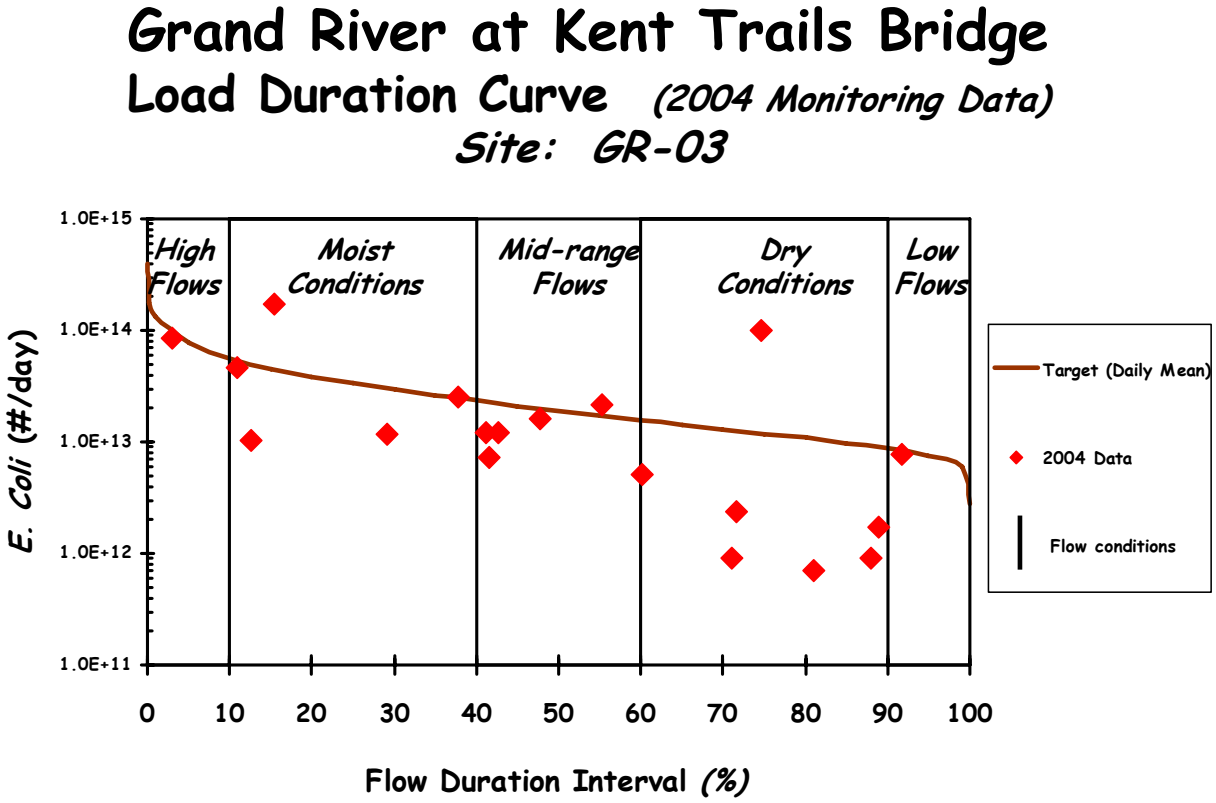
E. Coli Data & USGS Gage Duration Interval *4900 square miles*

A-1. The Grand River at Ann St. Load duration curve based on daily geometric mean. Site: GR-01.



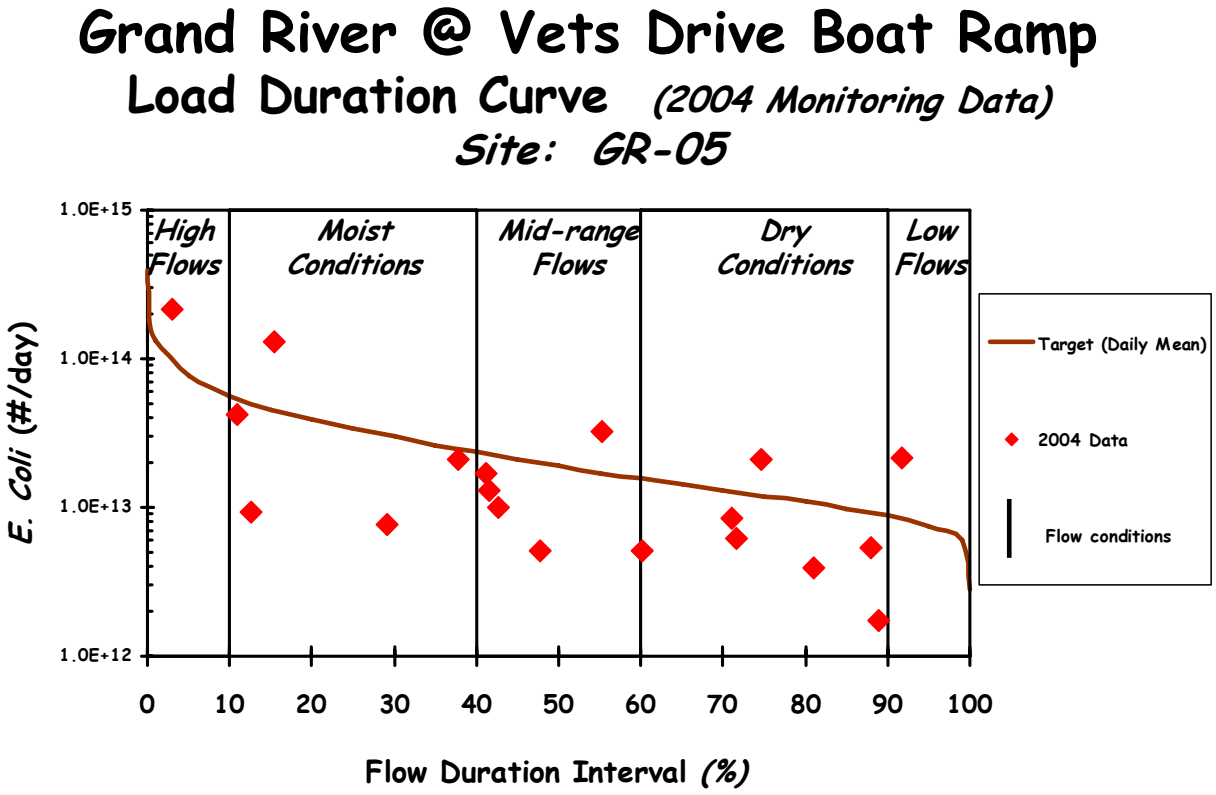
E. Coli Data & USGS Gage Duration Interval *4900 square miles*

A-2. Grand River at Fulton St. Load duration curve based on daily geometric mean. Site: GR-02.

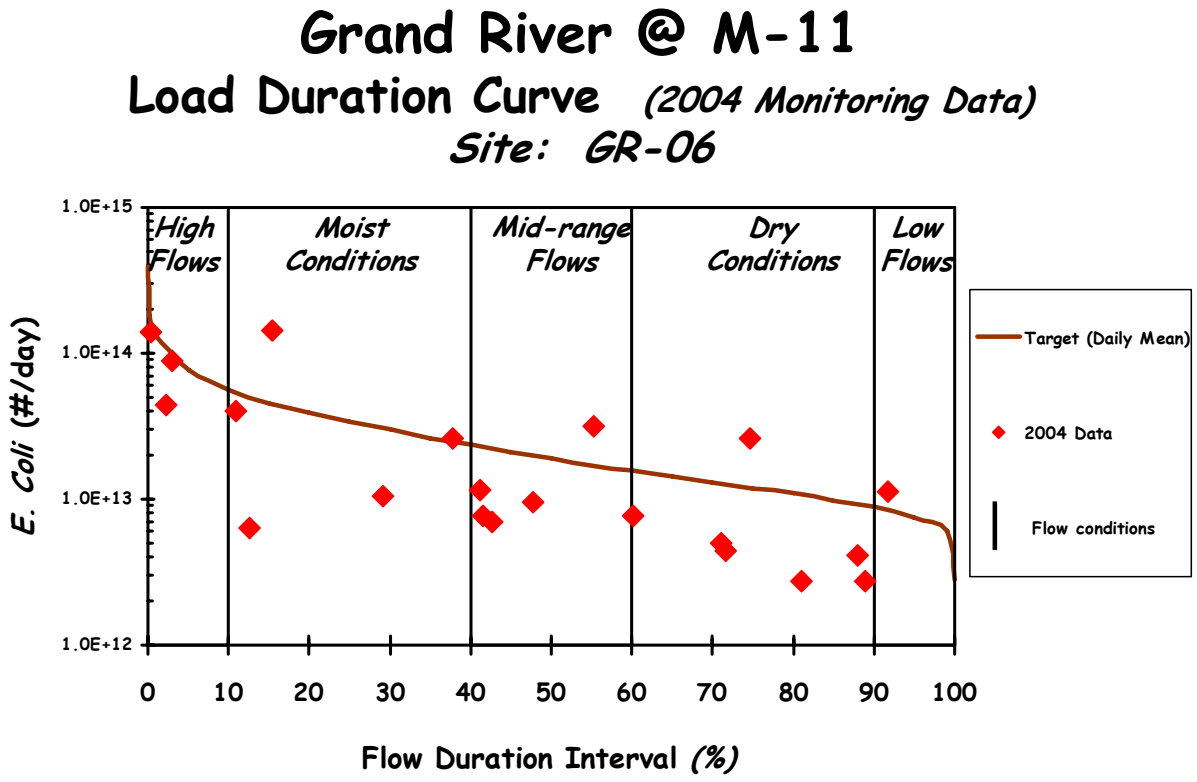


E. Coli Data & USGS Gage Duration Interval *4900 square miles*

A-3. Grand River at Kent Trails Bridge. Load duration curve based on daily geometric mean. Site: GR-03.

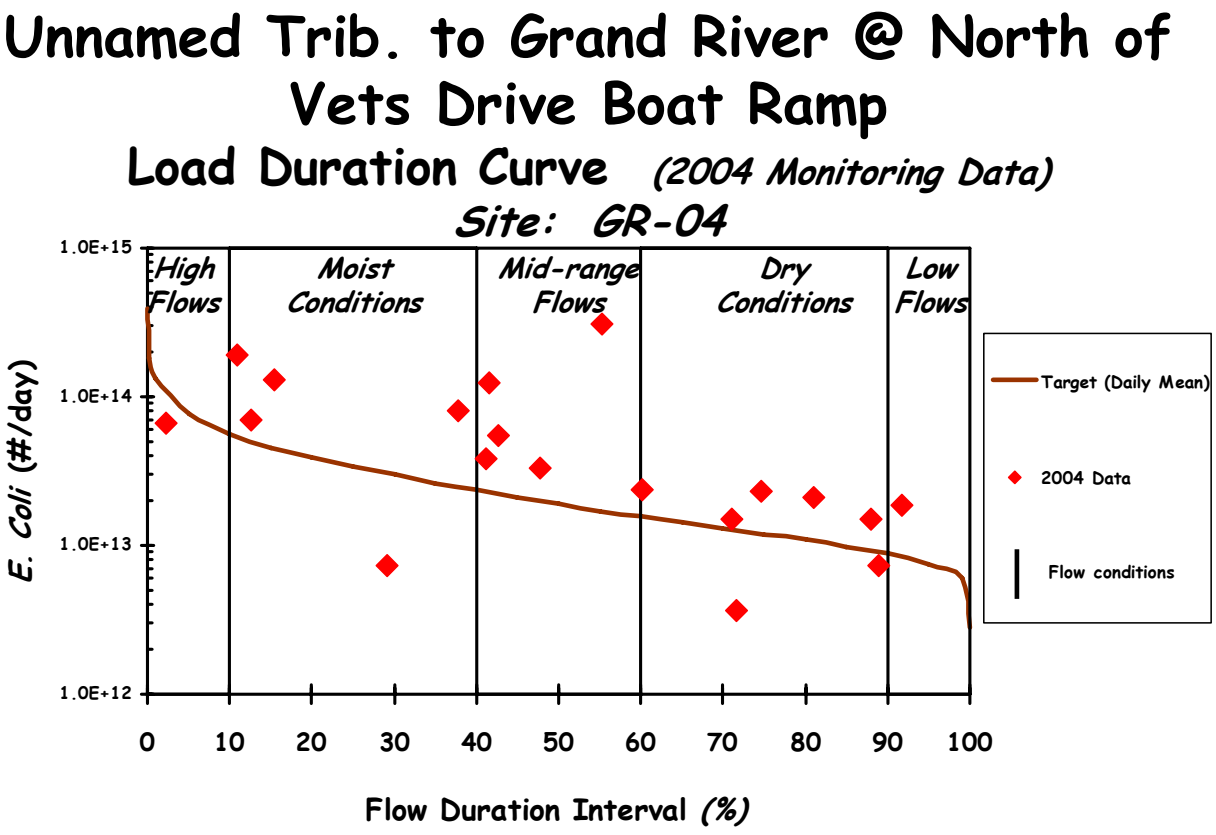


A-4. Grand River at Vets Dr. boat ramp. Load duration curve based on daily geometric mean. Site: GR-05.



E. Coli Data & USGS Gage Duration Interval *4900 square miles*

A-5. Grand River at M-11. Load duration curve based on daily geometric mean. Site: GR-06.



E. Coli Data & USGS Gage Duration Interval *4900 square miles*

A-6. Unnamed trib. to the Grand River at Vets Dr. boat ramp. Load duration curve based on daily geometric mean.
Site: GR-04.