

**Michigan Department of Environmental Quality  
Water Bureau  
March 2006**

**Total Maximum Daily Load for *E. coli* for  
Buck Creek  
Kent County**

**INTRODUCTION**

Section 303(d) of the federal Clean Water Act (CWA) 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 Buck Creek, tributary of the Grand River, located in Kent County, Michigan.

**PROBLEM STATEMENT**

The TMDL reach for Buck Creek appears on the Section 303(d) list as:

**BUCK CREEK**

County: Kent

Location: Grand River confluence u/s to 68<sup>th</sup> Street

HUC: 4050006                      RF3RchID: 4050006 8

Problem: Pathogens (Rule 100).

TMDL YEAR(s): 2006

WBID#: 082805L

Size: 10 M

The Buck Creek watershed drains approximately 51 square miles from its headwaters in southern Kent County to where it enters the Grand River in the city of Grandville. The headwaters of Buck Creek are located in Byron and Gaines Townships where agricultural areas are becoming increasingly urbanized (Fishbeck et al., 2003). Buck Creek 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). *E. coli* sampling by the Kent County Health Department has revealed frequent and persistent problems with bacterial contamination in many lakes and streams, including Buck Creek (Fishbeck, et al., 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 1-3, Tables 1 and 2).

**NUMERIC TARGET**

The impaired designated use addressed by this TMDL is total body contact recreation as established as indicated below in Rule 100 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:

R 323.1100 Designated uses.

Rule 100. (2) All surface waters of the state are designated for, and shall be protected for, total body contact recreation from May 1 to October 31 in accordance with the provisions of R 323.1062.

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.

For this TMDL, the WQS of 130 *E. coli* per 100 milliliters (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

Buck Creek and an unnamed tributary to Buck Creek were sampled at nine locations in the vicinity of Wyoming and Cutlerville to address this TMDL listing (Figure 1). Both water bodies exceeded the 30-day geometric mean WQS at all stations sampled (Figures 2 and 3, Tables 1 and 2). Thirty-day geometric mean *E. coli* concentrations in Buck Creek ranged from 40 *E. coli* per 100 ml in August at Chicago Drive (BKC-10) to 5,846 *E. coli* per 100 ml in July at A-45/Division (BKC-01) (Figure 2, Table 1). The daily geometric mean was also exceeded at every sampling location on Buck Creek. Daily geometric mean concentrations ranged from 2 *E. coli* per 100 ml in August at Chicago Drive (BKC-10) to 11,432 *E. coli* per 100 ml in July at A-45/Division (BKC-01). Exceedances of greater than 1,000 *E. coli* per 100 ml were found on 10 occasions at the A-45/Division (BKC-01) station.

One unnamed tributary to Buck Creek was also sampled (BKC-05, Figure 3). Thirty-day geometric mean *E. coli* concentrations ranged from 459 *E. coli* per 100 ml in August to 1,614 *E. coli* per 100 ml in July. Daily geometric means ranged from 38 *E. coli* per 100 ml in August to 6,108 *E. coli* per 100 ml in June (Table 2). Daily geometric mean concentrations of *E. coli* were above 1,000 per 100 ml on eight occasions.

## SOURCE ASSESSMENT

The official listed reach for Buck Creek is approximately ten miles from the Grand River confluence upstream to 68<sup>th</sup> Street. The municipalities making up the largest portion of the TMDL watershed include Byron Township, Gaines Township, and the city of Wyoming. 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 primary pathogen sources for this water body include agricultural inputs, failing septic systems, wildlife inputs, and urban run-off, which are common sources for developed and developing areas.

Agriculture accounts for approximately 50 percent of the land use in the TMDL watershed and can cause bacterial contamination in streams (Purdue University, 2005). *E. coli* have been shown to enter water bodies from pastureland runoff and land applications of manure via field drainage systems, such as tiles. Field tiles provide for significant transport of enteric bacteria through tile drainage systems under all manure application protocols and environmental conditions (Jamieson et al., 2002). Overland runoff from land application of manure is another possible source of *E. coli* (Oliver et al., 2005).

Residential land uses makes up the second largest portion (25 percent) of the TMDL watershed (Purdue University, 2005). The Kent County Health Department estimates failing septic systems discharge approximately one million gallons per day of domestic sewage to ground water or local waterways (Hegarty, 2002). Approximately 13 percent of the watershed is covered by impervious surfaces (Fishbeck, et al., 2003). Unpermitted urban runoff, wildlife inputs via overland runoff, direct deposition, and storm sewer systems are other possible sources of *E. coli*.

One sample on Buck Creek was collected for Deoxyribonucleic acid (DNA) ribotyping analysis. This is a technology that extracts DNA from *E. coli* isolates and compares the DNA to a library of known source isolates. It is one of many approaches that can be used to aid in source identification. The sample was collected at A-45/Division (BKC-01) on July 15, 2004. The results from this sample indicate all five isolates were of nonhuman origin, suggesting that domestic animals and/or wildlife inputs are a potential source (Table 4).

A small portion of the Buck Creek watershed receives land-applied sludge from nearby Wastewater Treatment Plants (WWTPs). Sludge application sites are not a likely source of *E. coli* to the Buck Creek watershed due to standard treatment practices. The use and disposal of treated sewage sludge (biosolids), including domestic septage, are regulated under 40 CFR Part 503. Pathogen requirements can be met in three different ways with the objective to ensure that pathogenic bacteria and enteric viruses are reduced in density, as demonstrated by a fecal coliform density in the treated sewage sludge (USEPA, 2003). The use of lime stabilization and anaerobic digestion are two such techniques utilized by the municipalities who land apply sludge in the Buck Creek watershed.

There are 304 National Pollutant Discharge Elimination System (NPDES) permitted discharges to Buck Creek, or its tributaries, in the TMDL reach (Table 5, Figure 4) including one individual permit, 51 certificates of coverage (COCs) under five general permits, and 252 notices of coverage under one permit-by-rule. Table 6 contains information on each of the general permits and the permit-by-rule. The permitted 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 Buck Creek TMDL watershed. The MS4 permittees (MIG61900), including the one individual permit (Michigan Department of Transportation (MDOT) – statewide permit) are prohibited from discharges that may cause or contribute to a violation of WQS. The general storm water permitted discharges (MIS110000 and MIS120000) must complete an evaluation of the reasonable potential for contribution of significant materials to run-off, such as pollutants from areas where animals are known to congregate. If a source of *E. coli* is found, the permittee is required to address the pollutant in their Storm Water Pollution Prevention Plan. This information is used by the permittee to estimate the annual load of pollutants to the water body and identify the level of control necessary to comply with any established TMDL. The permits-by-rule (MIR100000) involve earthwork in the TMDL watershed and are not considered

a significant source of *E. coli*. There are no combined sewers or concentrated animal feeding operations in the Buck Creek TMDL watershed.

## LINKAGE ANALYSIS

Determining the link between the *E. coli* concentrations in Buck Creek 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 Buck Creek during all weather conditions (i.e., wet and dry weather events). Potential sources include agriculture, failing septic systems, and urban runoff.

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 Buck Creek is included in Appendix A. The flows for the TMDL watershed were estimated using a gaged stream from a nearby watershed of similar size and land use characteristics. The United States Geological Survey gage used to estimate the flows discussed here is located on the Thornapple River near Hastings (Gage Number 04117500). 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 station located on Buck Creek at A-45/Division (BKC-01) indicates the majority of *E. coli* enters Buck Creek at this location during wet weather events (Figure A-1). Downstream stations, such as Clay (BKC-7), Burlingame (BKC-8), Ivanrest (BKC-9), and Chicago (BKC-10), show a majority of *E. coli* inputs occur during low to mid-range flow conditions. A possible explanation for the WQS exceedances observed under these flow regimes could be due to wildlife (i.e., raccoons) living in the storm sewer system.

The guiding water quality management principle used to develop the TMDL was that compliance with the numeric pathogen target in Buck Creek 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 Buck Creek 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 WQS Rules R 323.1082.

R 323.1082 Mixing zones.

Rule 82. (1) A mixing zone is that portion of a water body allocated by the department where a point source or venting groundwater discharge is mixed with the surface waters

of the state. Exposure in mixing zones shall not result in deleterious effects to populations of aquatic life or wildlife.

The applicability of water quality standards are defined in Rule 90 of the WQS as follows:

R. 323.1090. Applicability of water quality standards

Rule 90. (2) Water quality standards prescribed by these rules are minimally acceptable water quality conditions and shall apply at all flows equal to or exceeding the design flows, except where the department determines that a more restrictive design flow is necessary. The design flow in lotic systems shall be as follows:

- (a) Unless otherwise stated in this rule, the design flow is equal to the lowest of the 12 monthly 95% exceedance flows. The 95% exceedance flow is the flow equal to or exceeded 95% of the time for the specified month.

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 Buck Creek arise from a mixture of wet and dry weather-driven nonpoint 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

Title 40 of the CFR, Part 130.2(i) defines TMDLs as:

- (i) Total Maximum Daily Load (TMDL). The sum of the individual WLAs for point sources and LAs for nonpoint sources and natural background. If a receiving water has only one point source discharger, the TMDL is the sum of that point source WLA plus the LAs for any nonpoint sources of pollution and natural background sources, tributaries, or adjacent segments. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure. If Best Management Practices (BMPs) or other nonpoint source pollution controls make more stringent load allocations practicable, then wasteload allocations can be made less stringent. Thus, the TMDL process provides for nonpoint source control tradeoffs.

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:

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

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 6 outlines the 304 permitted point source discharges to the listed reach of Buck Creek. The discharges include one individual permit, MI0057499, 51 COCs under five general permits, and 252 notices of coverage under one permit-by-rule. No illicit connections were found; however, if an illicit connection to Buck Creek is discovered, the discharge would be eliminated and the WLA will be equal to zero. 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. 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 eight municipalities (Table 3). The municipalities making up the largest portion of the watershed are Byron Township (27.0 percent), Gaines Township (25.8 percent), and the city of Wyoming (23.8 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 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 a total of nine stations on Buck Creek and one unnamed tributary from May through September 2004. Future monitoring will take place as part of the five-year rotating basin monitoring. When these results indicate that the water body may be meeting WQS, sampling will be conducted by the MDEQ 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 municipalities of Byron Township, Gaines Township, and the cities of Grandville, Kentwood, and Wyoming are under a watershed MS4 Permit. These permits require activities that reduce *E. coli* inputs to surface waters through public education, a storm water management plan, and illicit connection identification and elimination requirements. In 2003, an Illicit Discharge Elimination Plan was implemented in the above municipalities. Three outfalls were suspected of discharging pollutants and follow-up activities were recommended (Fishbeck, et al., 2003).

The industrial stormwater permits identified in Table 5 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 MDOT statewide permit requires the permittee to reduce the discharge of pollutants to the maximum extent practicable and employ BMPs to comply with TMDL requirements.

Several local activities beneficial to water quality have taken place in the Lower Grand River Watershed (LGRW), including a watershed management plan for Buck Creek. The plan includes several short-term objectives that, if implemented, will reduce *E. coli* to the watershed. Activities include proper installation and maintenance of septic systems, livestock exclusion in high-risk areas, reducing the amount of pet waste entering waterways, controlling urban wildlife (e.g., geese/raccoons), encouraging sanitary sewer extensions to areas serviced by water utilities, and location and removal of illicit connections to storm drains.

The Grand Valley Metropolitan Council was awarded a Section 319 Grant for the Lower Grand River Implementation Project. The goals of this project will have a direct impact on water quality in Buck Creek by performing additional *E. coli* source identification work with BMP implementation. The project involves sampling 13 stations to 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 USEPA Region 4 to develop a watershed characterization system for the Buck 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.

Another tool that will benefit the Buck Creek TMDL watershed is the *Lower Grand River Watershed Project Information and Education Guidebook*. This project was created under a CWA Section 319 Grant to the Grand Valley Metro Council and was used 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: <http://www.gvsu.edu/wri/isc/lower-grand-river-watershed-management-plan-312.htm>.

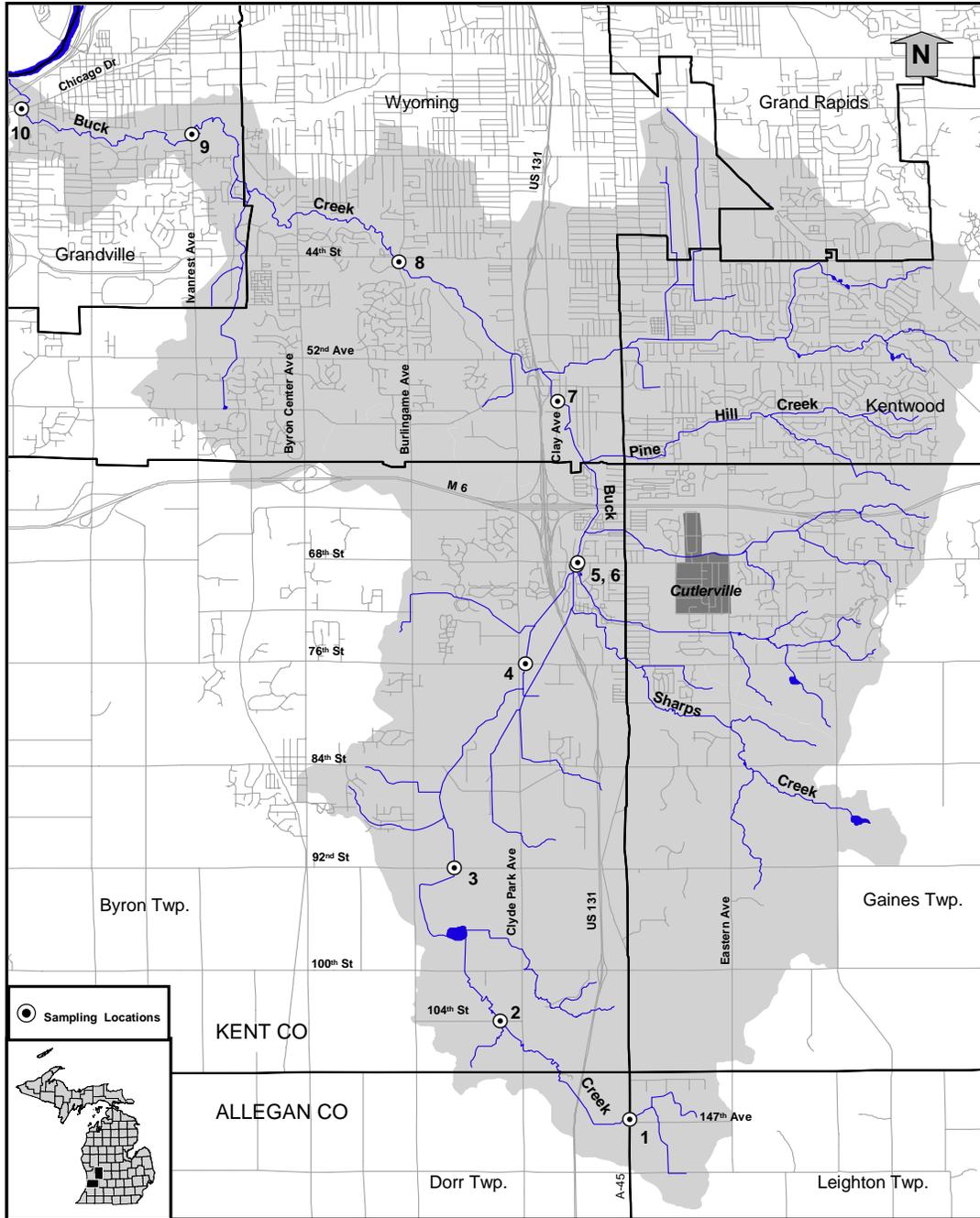
Using information generated by the Section 319 project, a Watershed Interactive Tool (WIT), was developed for the LGRW by the Grand Valley Metro Council and their partners. The WIT is a watershed-based interactive tool for local decision makers, educators, students, and residents of the LGRW. The tool 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-lower-grand-54.htm>.

As an active participant in the LGRW, Kent County has developed a Web page that contains information for homeowners with on-site septic systems. The information can be found at the following Web site: [www.gvsu.edu/wri/isc](http://www.gvsu.edu/wri/isc). The Kent County Health Department conducted *E. coli* monitoring on surface waters from 2000 to 2003. This sampling aided in prioritizing additional follow-up activities for the illicit connection identification and elimination program mentioned above.

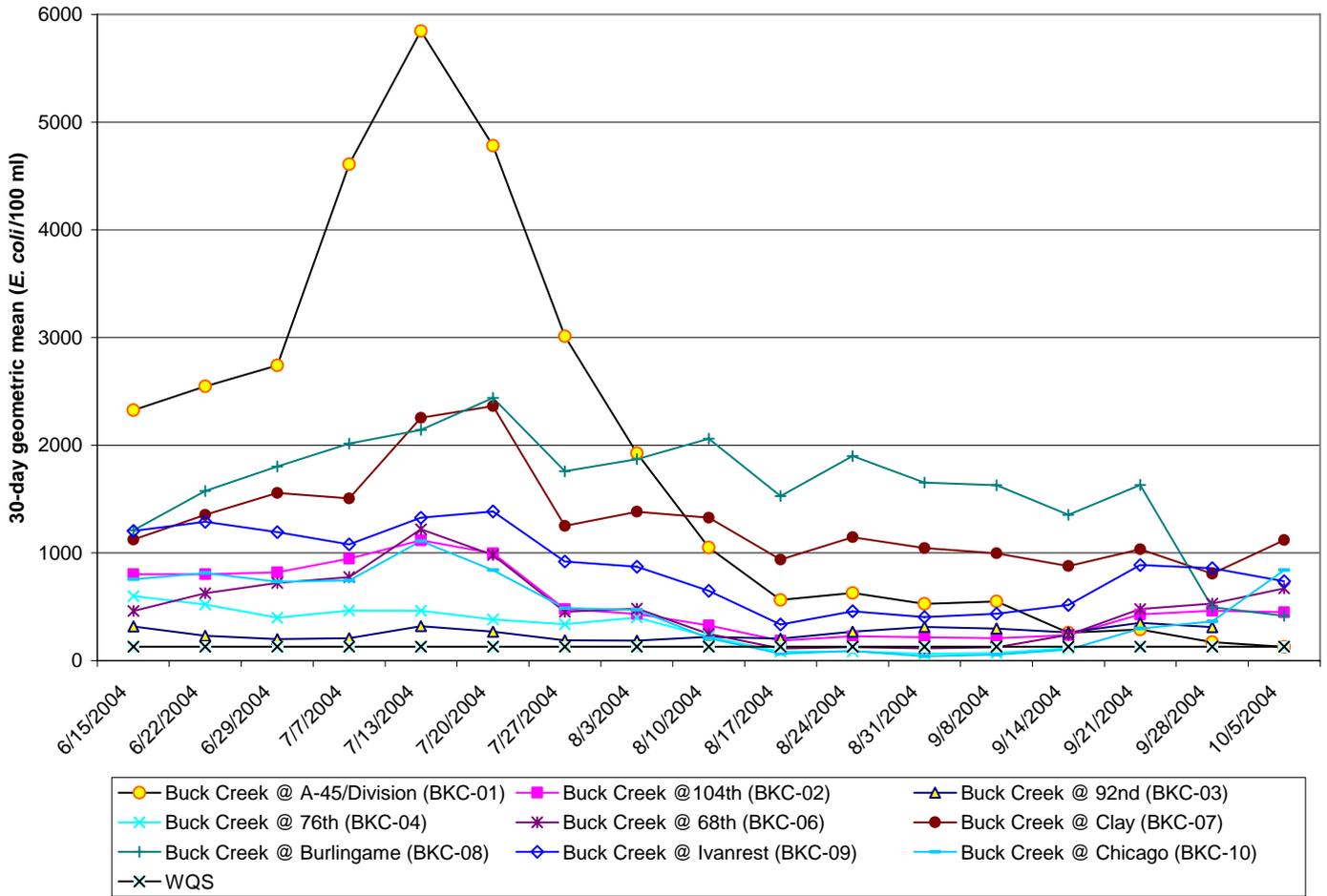
Prepared by: Christine Alexander, Aquatic Biologist  
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Water Bureau  
Michigan Department of Environmental Quality  
March 15, 2006

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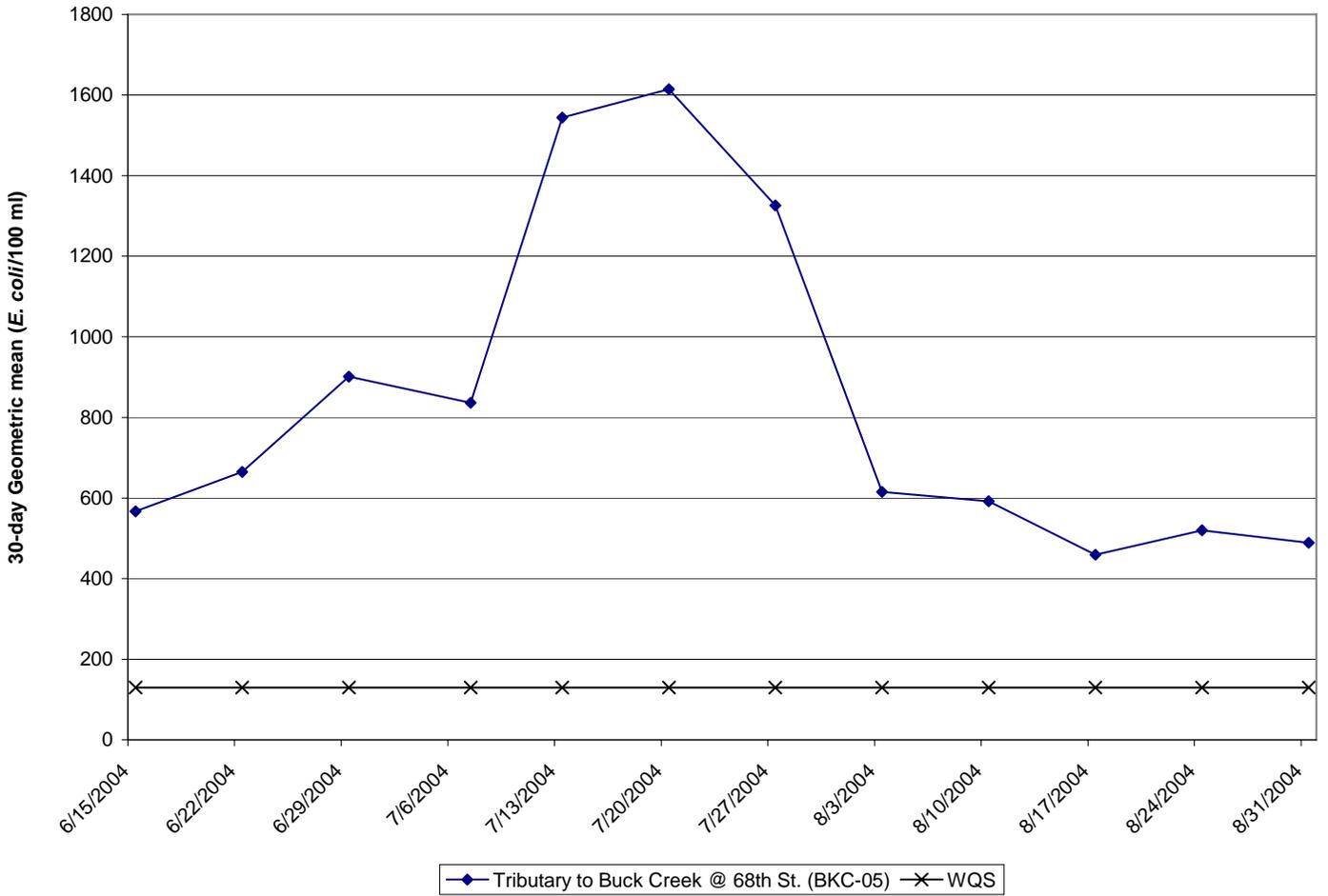
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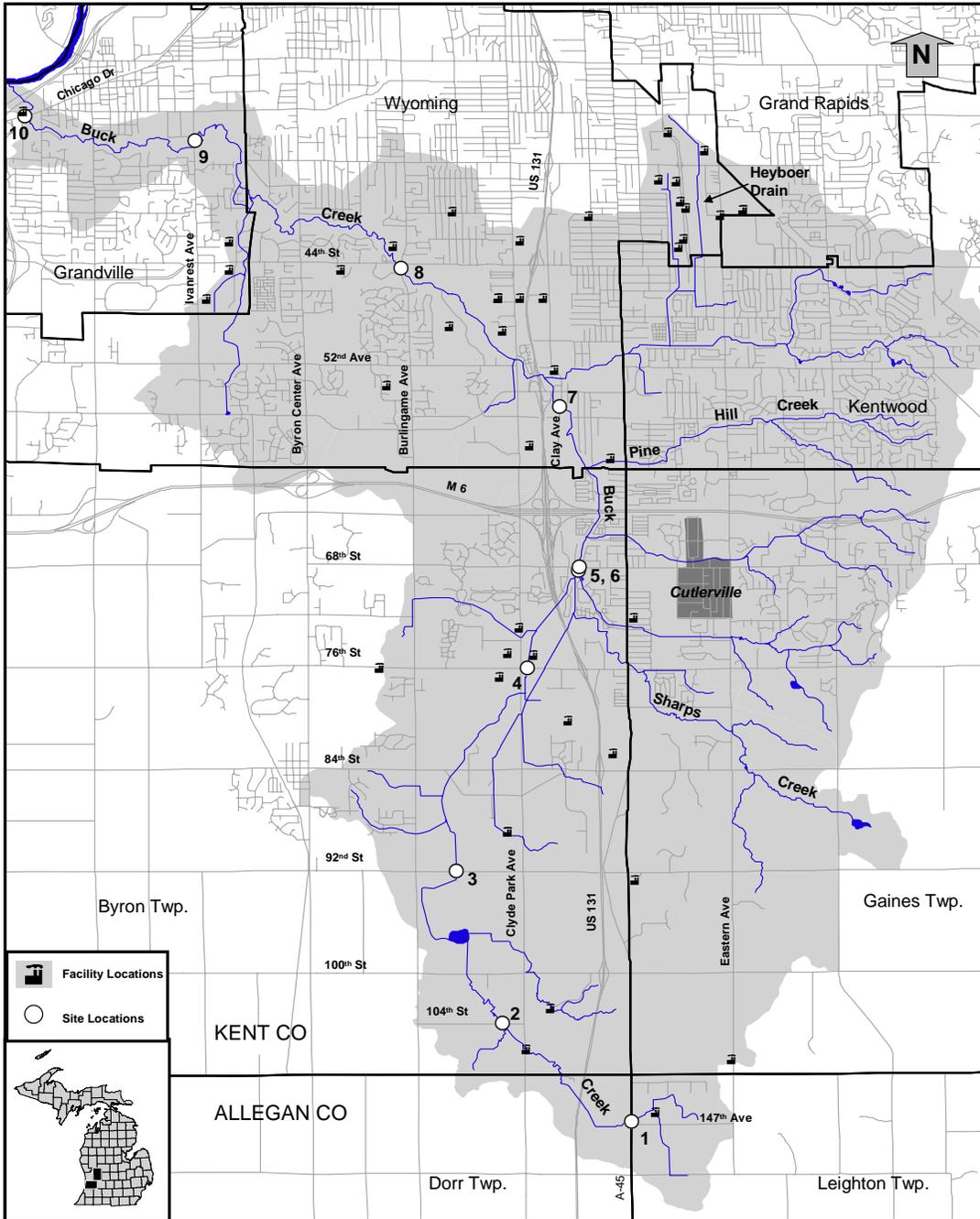
**Figure 1. Buck Creek *E. coli* sampling locations, vicinity of Wyoming and Cutlerville, Kent County, Michigan, 2004.**



**Figure 2. Thirty-day geometric mean for *E. coli* in Buck Creek, vicinity of Wyoming and Cutlerville, Kent County, Michigan, 2004.**



**Figure 3. Thirty-day geometric mean for *E. coli* in an unnamed tributary of Buck Creek, vicinity of Cutlerville, Kent County, Michigan, 2004.**



**Figure 4. NPDES permitted discharges to the Buck Creek 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 Buck Creek in the vicinity of Wyoming and Cutlerville. Shaded areas indicate exceedances of the WQS. Data are presented upstream to downstream. Note: precipitation is noted for 24 hours preceding sampling.**

	Buck Creek @ A-45/Division (BKC-01)			Buck Creek @ 104th (BKC-02)			Buck Creek @ 92nd (BKC-03)			
DATE	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	Precip. data
5/18/2004	8300	5142	---	3600	4384	---	1900	2632	---	1.3"
	4200			3900			3000			
	3900			6000			3200			
5/25/2004	800	2374	---	2600	866	---	1100	540	---	0.5"
	4400			640			1100			
	3800			390			130			
6/2/2004	1200	849	---	600	701	---	230	249	---	0.9"
	690			820			280			
	740			700			240			
6/8/2004	1100	1508	---	420	233	---	3	27	---	0.6"
	1200			86			40			
	2600			350			160			
6/15/2004	5200	4357	2326	490	539	803	840	338	317	0
	3700			570			270			
	4300			560			170			
6/22/2004	7700	8089	2547	9600	4369	802	650	530	230	0.5"
	8700			7900			370			
	7900			1100			620			
6/29/2004	1900	3417	2740	730	957	819	250	253	198	2.3"
	7000			600			270			
	3000			2000			240			
7/7/2004	15000	11432	4608	1600	1454	947	320	322	208	0
	8300			1600			400			
	12000			1200			260			
7/13/2004	4700	4957	5846	520	530	1117	200	232	320	0
	4800			610			270			
	5400			470			230			

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

	Buck Creek @ A-45/Division (BKC-01)			Buck Creek @ 104th (BKC-02)			Buck Creek @ 92nd (BKC-03)			
DATE	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	Precip. data
7/20/2004	900	1594	4781	670	304	996	140	138	268	0
	2500			840			110			
	1800			50			170			
7/27/2004	620	802	3011	3	112	479	6	89	187	0
	640			1200			450			
	1300			390			260			
8/3/2004	250	365	1926	750	589	434	410	240	185	0
	630			470			120			
	310			580			280			
8/10/2004	350	552	1051	10	351	327	800	800	222	0
	660			1400			800			
	730			3100			800			
8/17/2004	130	222	564	2	31	185	220	148	203	0
	200			50			57			
	420			300			260			
8/24/2004	2700	2700	627	800	800	225	830	559	269	0
	2700			800			350			
	2700			800			600			
8/31/2004	470	337	527	130	94	217	160	188	313	0
	290			10			260			
	280			630			160			
9/8/2004	520	448	549	110	479	208	220	188	298	0
	480			1300			190			
	360			770			160			

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

	Buck Creek @ A-45/Division (BKC-01)			Buck Creek @ 104th (BKC-02)			Buck Creek @ 92nd (BKC-03)			
DATE	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	Precip. data
9/14/2004	3	13	260	690	655	236	300	411	261	0
	3			600			290			
	260			680			800			
9/21/2004	300	364	288	630	626	430	800	651	351	0
	220			600			370			
	730			650			930			
9/28/2004	200	205	172	1000	1160	463	800	506	344	0.2"
	80			1200			360			
	540			1300			450			
10/5/2004	87	76	128	120	80	449	110	113	311	0
	57			30			110			
	90			140			120			

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

DATE	Buck Creek @ 76th (BKC-04)			Buck Creek @ 68th (BKC-06)			Buck Creek @ Clay (BKC-07)			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	3300	2750	---	800	1061	---	1700	2665	---	1.3"
	1800			1800			2100			
	3500			830			5300			
5/25/2004	630	1292	---	400	429	---	590	764	---	0.5"
	1800			380			780			
	1900			520			970			
6/2/2004	180	253	---	300	608	---	1600	1724	---	0.9"
	320			680			2000			
	280			1100			1600			
6/8/2004	510	407	---	2	106	---	30	407	---	0.6"
	400			660			1400			
	330			910			1600			
6/15/2004	150	211	599	630	708	461	330	1252	1123	0
	480			750			2700			
	130			750			2200			
6/22/2004	420	1361	520	4200	4902	626	6700	6799	1354	0.5"
	3000			5500			6700			
	2000			5100			7000			
6/29/2004	460	338	398	1700	868	721	1400	1528	1556	2.3"
	220			550			1500			
	380			700			1700			
7/7/2004	450	547	464	510	876	776	1400	1466	1506	0
	700			1100			1500			
	520			1200			1500			
7/13/2004	430	403	463	870	1020	1219	3200	3047	2253	0
	400			870			2600			
	380			1400			3400			

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

	Buck Creek @ 76th (BKC-04)			Buck Creek @ 68th (BKC-06)			Buck Creek @ Clay (BKC-07)			
DATE	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	Precip. data
7/20/2004	490	80	382	900	238	980	2200	1587	2363	0
	3			10			790			
	350			1500			2300			
7/27/2004	380	726	337	10	103	453	1600	282	1250	0
	630			100			10			
	1600			1100			1400			
8/3/2004	870	798	400	930	1200	483	3100	2526	1382	0
	730			930			2000			
	800			2000			2600			
8/10/2004	10	29	222	10	30	247	100	1192	1326	0
	10			280			4700			
	240			10			3600			
8/17/2004	3	3	83	3	19	111	33	541	939	0
	3			760			2000			
	3			3			2400			
8/24/2004	2	82	84	130	437	126	4500	4301	1146	0
	340			800			3400			
	800			800			5200			
8/31/2004	250	185	64	2	60	113	33	178	1045	0
	180			250			570			
	140			430			300			
9/8/2004	1000	1366	71	800	1800	122	1500	1993	997	0
	1500			2700			2400			
	1700			2700			2200			

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

	Buck Creek @ 76th (BKC-04)			Buck Creek @ 68th (BKC-06)			Buck Creek @ Clay (BKC-07)			
DATE	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	Precip. data
9/14/2004	190	312	114	730	849	238	190	635	879	0
	590			900		900				
	270			930		1500				
9/21/2004		---	---	500	621	477	930	1219	1034	0
	1000			550		1300				
	360			870		1500				
9/28/2004	540	398	---	730	733	530	970	1237	806	0.2"
	260			540		1500				
	450			1000		1300				
10/5/2004	230	146	---	240	195	670	970	919	1119	0
	200			140			1000			
	67			220			800			

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

	Buck Creek @ Burlingame (BKC-08)			Buck Creek @ Ivanrest (BKC-09)			Buck Creek @ Chicago (BKC-10)			
DATE	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	Precip. data
5/18/2004	4200	2274	---	6300	5022	---	4700	4658	---	1.3"
	800			3000			5000			
	3500			6700			4300			
5/25/2004	200	659	---	1300	1679	---	870	815	---	0.5"
	1300			2600			740			
	1100			1400			840			
6/2/2004	930	976	---	1600	1441	---	870	1161	---	0.9"
	1300			1700			1200			
	770			1100			1500			
6/8/2004	1900	1430	---	250	336	---	290	90	---	0.6"
	1100			270			250			
	1400			560			10			
6/15/2004	150	1243	1211	730	619	1204	580	621	755	0
	6400			880			700			
	2000			370			590			
6/22/2004	8200	8463	1575	7000	7090	1290	6800	6788	814	0.5"
	8800			7600			6300			
	8400			6700			7300			
6/29/2004	1200	1293	1802	1300	1132	1192	350	481	733	2.3"
	1500			930			530			
	1200			1200			600			
7/7/2004	1300	1703	2014	1900	873	1078	1100	1248	744	0
	2000			500			1900			
	1900			700			930			
7/13/2004	2000	1945	2142	1100	946	1326	690	670	1111	0
	2300			700			580			
	1600			1100			750			

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

	Buck Creek @ Burlingame (BKC-08)			Buck Creek @ Ivanrest (BKC-09)			Buck Creek @ Chicago (BKC-10)			
DATE	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	Precip. data
7/20/2004	2200	2384	2440	930	769	1385	10	153	840	0
	2800			730			580			
	2200			670			620			
7/27/2004	1100	1647	1758	2300	924	921	570	441	486	0
	1400			490			750			
	2900			700			200			
8/3/2004	1300	1752	1869	860	855	871	310	413	471	0
	1800			970			420			
	2300			750			540			
8/10/2004	3200	2764	2059	770	197	647	3	21	207	0
	3000			10			960			
	2200			1000			3			
8/17/2004	33	436	1527	10	35	334	2	2	65	0
	1400			1400			2			
	1800			3			2			
8/24/2004	5400	7079	1898	2700	3673	457	800	800	90	0
	9000			2700			800			
	7300			6800			800			
8/31/2004	830	822	1652	500	501	404	2	8	40	0
	1000			570			2			
	670			440			120			
9/8/2004	1900	1630	1628	530	1245	436	1600	1977	55	0
	1200			1400			2100			
	1900			2600			2300			

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

	Buck Creek @ Burlingame (BKC-08)			Buck Creek @ Ivanrest (BKC-09)			Buck Creek @ Chicago (BKC-10)			
DATE	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	Precip. data
9/14/2004	1100	1097	1354	430	462	516	550	455	102	0
	1200			520			450			
	1000			440			380			
9/21/2004	870	1107	1631	710	516	886	400	416	298	0
	650			340			420			
	2400			570			430			
9/28/2004	10	18	495	2800	3120	857	1800	2210	365	0.2"
	20			3100			2500			
	30			3500			2400			
10/5/2004	260	346	416	240	236	738	610	509	841	0
	370			220			490			
	430			250			440			

**Table 2. MDEQ 2004 *E. coli* monitoring data (*E. coli*/100 ml) for an unnamed tributary of Buck Creek, in the vicinity of Wyoming and Cutlerville. Shaded areas indicate exceedances of the WQS. Data are presented upstream to downstream. Note: precipitation is noted for 24 hours preceding sampling.**

DATE	Tributary to Buck Creek @ 68th (BKC-05)			Precip. data
	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	
5/18/2004	3000	2754	---	1.3"
	2400			
	2900			
5/25/2004	370	389	---	0.5"
	430			
	370			
6/2/2004	1600	1382	---	0.9"
	1500			
	1100			
6/8/2004	10	69	---	0.6"
	40			
	830			
6/15/2004	440	572	567	0
	820			
	520			
6/22/2004	3700	6108	665	0.5"
	4400			
	14000			
6/29/2004	2100	1774	901	2.3"
	1900			
	1400			
7/7/2004	800	952	836	0
	1200			
	900			
7/13/2004	1200	1483	1544	0
	1600			
	1700			

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

<b>Tributary to Buck Creek @ 68th (BKC-05)</b>				
<b>DATE</b>	<b>SAMPLE RESULTS</b>	<b>DAILY G. MEAN</b>	<b>30-day G. MEAN</b>	<b>Precip. data</b>
<b>7/20/2004</b>	800	714	1614	0
	670			
	680			
<b>7/27/2004</b>	2000	2289	1326	0
	2400			
	2500			
<b>8/3/2004</b>	550	38	615	0
	10			
	10			
<b>8/10/2004</b>	250	787	592	0
	930			
	2100			
<b>8/17/2004</b>	620	417	459	0
	530			
	220			
<b>8/24/2004</b>	1200	1328	520	0
	1500			
	1300			
<b>8/31/2004</b>	2000	1687	489	0
	1500			
	1600			
<b>9/8/2004</b>		---	---	0
	7400			
	13000			

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

Tributary to Buck Creek @ 68th (BKC-05)				
DATE	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Precip. data
9/14/2004	420	269	---	0
	580			
	80			
9/21/2004	300	328	---	0
	420			
	280			
9/28/2004	1600	1592	---	0.2"
	1400			
	1800			
10/5/2004	280	81	---	0
	190			
	10			

**Table 3. Distribution of land for each municipality in the Buck Creek TMDL reach.**

<b>Municipality</b>	<b>County</b>	<b>Square Miles</b>	<b>Percent</b>
Byron Township	Kent	13.7	27.0
Gaines Township	Kent	13.1	25.8
Wyoming	Kent	12.1	23.8
Kentwood	Kent	6.8	13.4
Grandville	Kent	2.1	4.1
Grand Rapids	Kent	1.3	2.6
Leighton Township	Allegan	1.0	1.9
Dorr Township	Allegan	0.7	1.4
<b>TOTAL</b>		<b>50.8</b>	<b>100</b>

**Table 4. Discriminant analysis of ribotype profiles of *E. coli* isolates from water sample collected from Buck Creek at A-45/Division (BKC-01) on July 15, 2004.**

<b>Fecal coliform mpn*/100 ml</b>	<b><i>E. coli</i> isolate number</b> (5 colonies of cultured <i>E. coli</i> were analyzed)	<b>Probable Source</b>
>2,400	1	Non-human
	2	Non-human
	3	Non-human
	4	Non-human
	5	Non-human

\*mpn = most probable number of fecal coliforms in 100 mL of sample after 20 hrs of cultivation at 44.5 degrees Celcius.

**Table 5. Permitted outfalls to the Buck Creek TMDL watershed. Source: MDEQ, Water Bureau's NPDES Permit Management System.**

<b>Facility</b>	<b>Certificate of Coverage/Notice of Coverage</b>	<b>County</b>	<b>Receiving Water</b>	<b>Latitude</b>	<b>Longitude</b>
MDOT MS4	MI0057364	Statewide	Statewide	----	----
Byron Twp MS4-Kent	MIG610122	Kent	Buck Creek	----	----
Center Mfg Inc-84th	MIG250409	Kent	Buck Creek	42.802777	-85.686111
De Jager Construction Inc	MIG250162	Kent	Pine Hill Creek	42.856111	-85.666666
Center Mfg Inc – Piedmont	MIG250456	Kent	Buck Creek	42.826390	-85.709720
Emro Marketing Co-Burlingame	MIG080879	Kent	Buck Creek	42.886666	-85.706944
Gaines Twp MS4-Kent	MIG610127	Kent	Buck Creek	----	----
Grandville MS4-Kent	MIG610123	Kent	Buck Creek	----	----
Kentwood MS4-Kent	MIG610131	Kent	Buck Creek	----	----
R L Adams Plastics-Burlingame	MIG250423	Kent	Trib. to Buck Creek	42.866666	-85.708333
Speedway SuperAmerica-Kentwood	MIG080640	Kent	Heyboer Drain	42.770000	-85.644722
Steelcase Inc-Grand Rapids	MIG250481	Kent	Heyboer Drain	42.891666	-85.641666
Wyoming MS4-Kent	MIG610138	Kent	Buck Creek	----	----
Alvan Motor Freight Inc	MIS110839	Kent	Buck Creek	42.890833	-85.646111

**Table 5. continued.**

<b>Facility</b>	<b>Certificate of Coverage/Notice of Coverage</b>	<b>County</b>	<b>Receiving Water</b>	<b>Latitude</b>	<b>Longitude</b>
Apex Rack & Coating Co	MIS110980	Kent	Grand River	42.875000	-85.725000
Arrow Door Company	MIS110627	Kent	Heyboer Drain	42.887500	-85.652777
Arvron Inc	MIS110139	Kent	Buck Creek	42.879166	-85.679166
Auto Cast Inc	MIS110612	Kent	Buck Creek	42.883333	-85.737500
Benteler Automotive-Clay Ave	MIS111269	Kent	Buck Creek	42.890830	-85.670560
Benteler Automotive-Hagen Dr	MIS110634	Kent	Grand River	42.896111	-85.657500
BMC Bil-Mac Corp	MIS110609	Kent	Buck Creek	42.887500	-85.737500
Bouma Furniture Express	MIS110858	Kent	Buck Creek	42.895833	-85.654166
Cascade Die Casting-Midstate	MIS110043	Kent	Grand River	42.795833	-85.662500
Center Mfg Inc-84 <sup>th</sup>	MIS110710	Kent	Buck Creek	42.802777	-85.686111
Center Mfg Inc – Wayland	MIS111238	Allegan	Buck Creek	42.762500	-85.658888
Center Mfg Inc – Piedmont	MIS111212	Kent	Buck Creek	42.82639	-85.70972
Die Matic Tool & Die Inc	MIS110138	Kent	Grand River	42.887500	-85.683333
Farmland Dairies	MIS110741	Kent	Buck Creek	42.868888	-85.676944
Frito-Lay-Grand Rapids	MIS111356	Kent	Buck Creek	42.828210	-85.685990
Gainey Corp	MIS110575	Kent	Buck Creek	42.891666	-85.695833
Grandville Printing Co	MIS110136	Kent	EB Rush Ck / Huizenga Dr	42.879166	-85.741666
Holland American Wafer Co	MIS110140	Kent	Buck Creek	42.902777	-85.655555
Kent Co-S Kent Landfill	MIS120008	Kent	Buck Creek	42.771666	-85.682777
Market Development Corp	MIS110050	Kent	Buck Creek	42.825000	-85.687500
Miarnng-Wyoming Armory-OMS #4	MIS110633	Kent	Buck Creek	42.883333	-85.716666
Model Die & Mold Inc	MIS111107	Kent	Buck Creek	42.892950	-85.653400
Piedmont Mich Inc-Byron Center	MIS110281	Kent	Buck Creek	42.813888	-85.666388
Plasma-Tec Inc	MIS110803	Kent	Buck Creek	42.828055	-85.681111
Premarc-GRD RV Infrastructure	MIS110493	Kent	Grand River	42.906111	-85.775833
Rapistan Systems-Wyoming	MIS110866	Kent	Grand River	42.886388	-85.653888
Roman Mfg Inc	MIS110485	Kent	Buck Creek	42.879166	-85.687500
RoMan Mfg Inc-901 47 <sup>th</sup>	MIS111329	Kent	Buck Creek	42.875200	-85.696580
RoMan Mfg Inc-912 47 <sup>th</sup>	MIS111141	Kent	Buck Creek	42.879166	-85.687500
RTS	MIS111128	Kent	Grand River	42.831944	-85.683888
State Spring Service	MIS110298	Kent	Buck Creek	42.833333	-85.662500
Steelcase Inc-Grand Rapids	MIS111381	Kent	Heyboer Drain	42.891666	-85.641666
Sterk Brothers Redi-Mix	MIS110853	Kent	Buck Creek	42.874444	-85.686666
Suspa Inc	MIS110295	Kent	Grand River	42.891944	-85.652500
USF Holland Inc-Clyde Park	MIS110037	Kent	Buck Creek	42.879166	-85.683333
VEC Inc	MIS111203	Kent	Buck Creek	42.777500	-85.678333
Wikoff Color Corp	MIS111384	Kent	Buck Creek	42.900120	-85.648790
Wil-Kast Inc	MIS111229	Kent	Sharps Creek	42.818611	-85.674722
Zeichman Mfg Inc	MIS111082	Kent	Buck Creek	42.858055	-85.681666
Center Mfg Inc-Wayland	MIS111238	Allegan	Buck Creek	42.762500	-85.658888
Wagner-Sunny Lake Est	MIR106734	Allegan	----		
Allegan Co-142nd Ave St Recon	MIR108928	Allegan	----		
Dykstra-Cooke Farms Est	MIR105337	Allegan	----		
Chandler-Serenity Ridge Condos	MIR109120	Allegan	----		
Sun Comm-Hunters Glen MHC	MIR105339	Allegan	----		
M&g-Leighton Industrial Pk 2	MIR105135	Allegan	----		
Morren-Moline Industrial Park	MIR104035	Allegan	----		

**Table 5. continued.**

<b>Facility</b>	<b>Certificate of Coverage/Notice of Coverage</b>	<b>County</b>	<b>Receiving Water</b>	<b>Latitude</b>	<b>Longitude</b>
Shoemaker-Horseshoe Estates	MIR106341	Allegan	----		
T&M-Harvest Meadows II	MIR108464	Allegan	----		
Trident-Hunters Glen Mfg Comm	MIR105666	Allegan	----		
T&M-Harvest Meadows III	MIR108909	Allegan	----		
Bob-O-Link-Green Lake Ridge 4	MIR108456	Allegan	----		
T&m-Harvest Meadows Ph I	MIR106760	Allegan	----		
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	----		
GRP-Woodpointe Crossings	MIR109069	Kent	----		
Jarr-Misty Ridge Estates Ph 3	MIR104160	Kent	----		

**Table 5. continued.**

<b>Facility</b>	<b>Certificate of Coverage/Notice of Coverage</b>	<b>County</b>	<b>Receiving Water</b>	<b>Latitude</b>	<b>Longitude</b>
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 5. continued.**

<b>Facility</b>	<b>Certificate of Coverage/Notice of Coverage</b>	<b>County</b>	<b>Receiving Water</b>	<b>Latitude</b>	<b>Longitude</b>
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 5. continued.**

<b>Facility</b>	<b>Certificate of Coverage/Notice of Coverage</b>	<b>County</b>	<b>Receiving Water</b>	<b>Latitude</b>	<b>Longitude</b>
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 5. continued.**

<b>Facility</b>	<b>Certificate of Coverage/Notice of Coverage</b>	<b>County</b>	<b>Receiving Water</b>	<b>Latitude</b>	<b>Longitude</b>
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 5. continued.**

<b>Facility</b>	<b>Certificate of Coverage/Notice of Coverage</b>	<b>County</b>	<b>Receiving Water</b>	<b>Latitude</b>	<b>Longitude</b>
Slater-Deerfield Run	MIR105355	Allegan	----		
Bob-O-Link/Green Lk Ridge #3&4	MIR106134	Allegan	----		
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	----		
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 6. Types of General Permits**

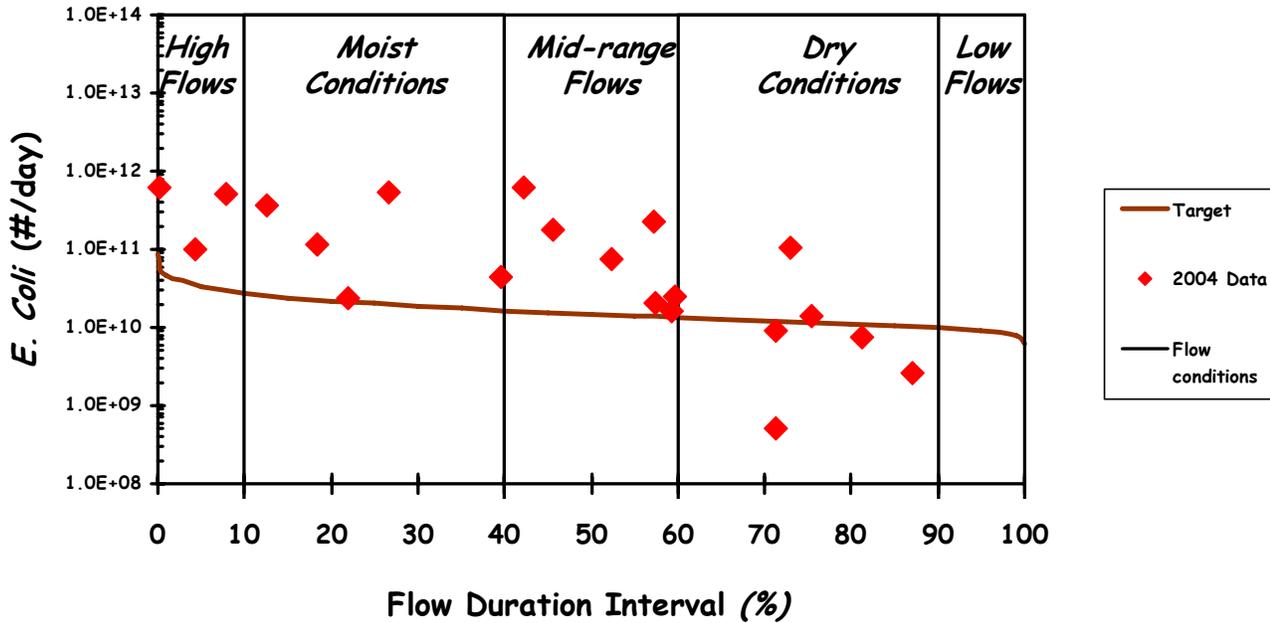
<b>Permit Number</b>	<b>Permit Title</b>
<b>General Permit</b>	
MIS110000	Stormwater from industrial activities
MIS120000	Stormwater discharge with required monitoring
MIG250000	Noncontact cooling water
MIG080000	Wastewater from cleanup of water contaminated with gasoline and related products
MIG619000	Storm water discharges from Municipal Separate Storm Sewer Systems (MS4) subject to watershed plan requirements
<b>Permits by Rule</b>	
MIR100000	Storm water discharges from construction activities

## **APPENDIX A**

# Buck Creek at A-45/Division

## Load Duration Curve (2004 Monitoring Data)

### Site: BKC-1



*E. Coli Data & Modified USGS Gage Duration Interval*

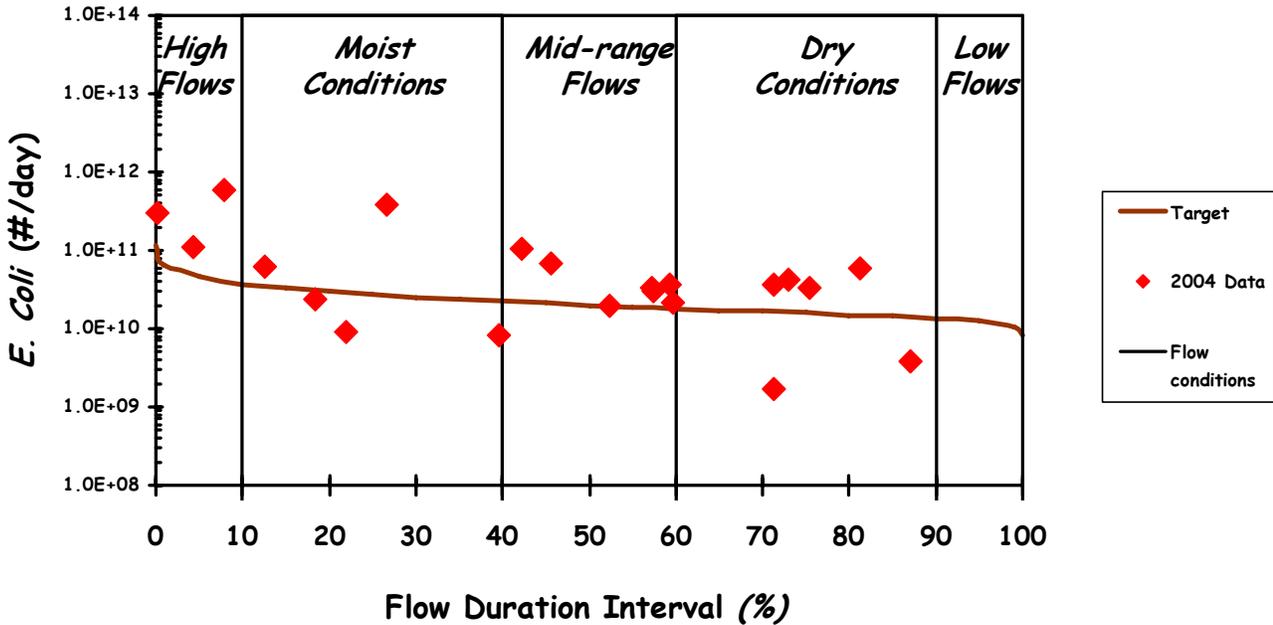
*3.74 square miles*

A-1. Buck Creek at M-45/Division. Load duration curve based on daily geometric mean.  
Site: BKC-1.

# Buck Creek at 104th

## Load Duration Curve (2004 Monitoring Data)

### Site: BKC-2



*E. Coli Data & Modified USGS Gage Duration Interval*

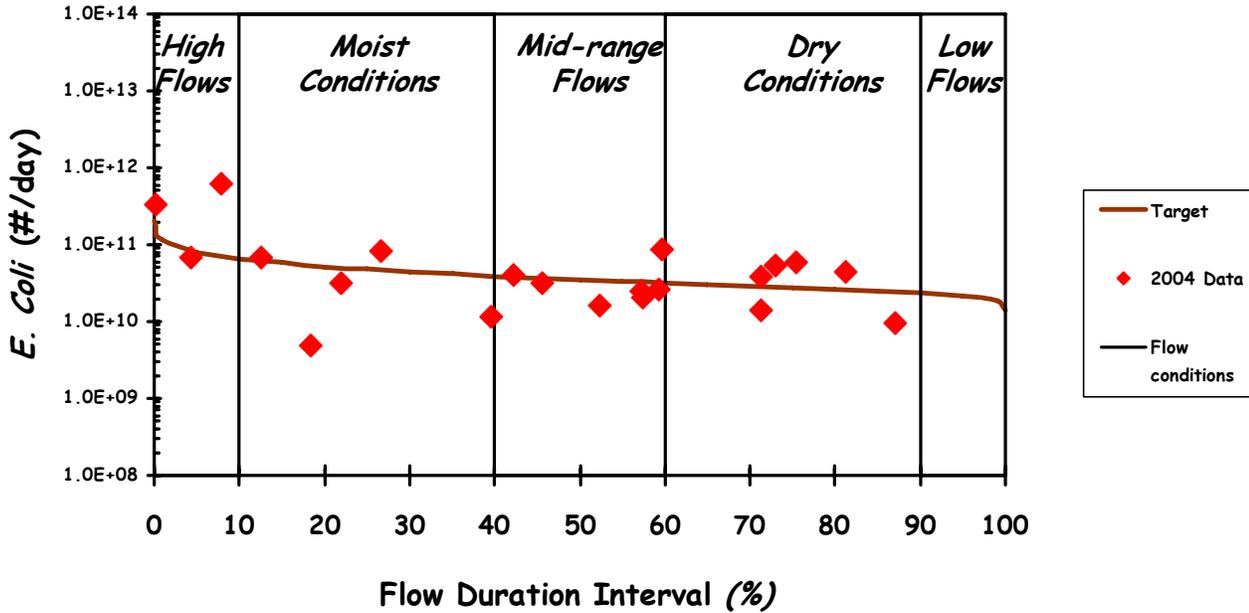
*5.11 square miles*

A-2. Buck Creek at 104<sup>th</sup>. Load duration curve based on daily geometric mean.  
Site: BKC-2.

# Buck Creek at 92nd

## Load Duration Curve (2004 Monitoring Data)

### Site: BKC-3



*E. Coli Data & Modified USGS Gage Duration Interval*

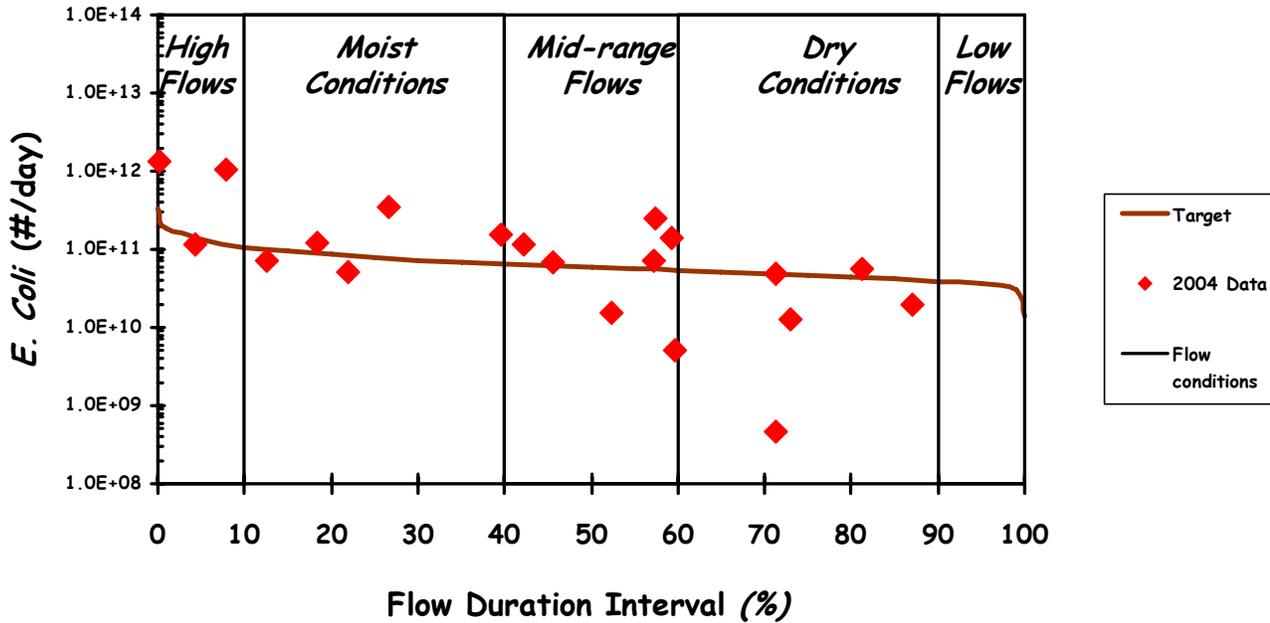
*8.94 square miles*

A-3. Buck Creek at 92nd. Load duration curve based on daily geometric mean.  
Site: BKC-3.

# Buck Creek at 76th

## Load Duration Curve (2004 Monitoring Data)

### Site: BKC-4



*E. Coli Data & Modified USGS Gage Duration Interval*

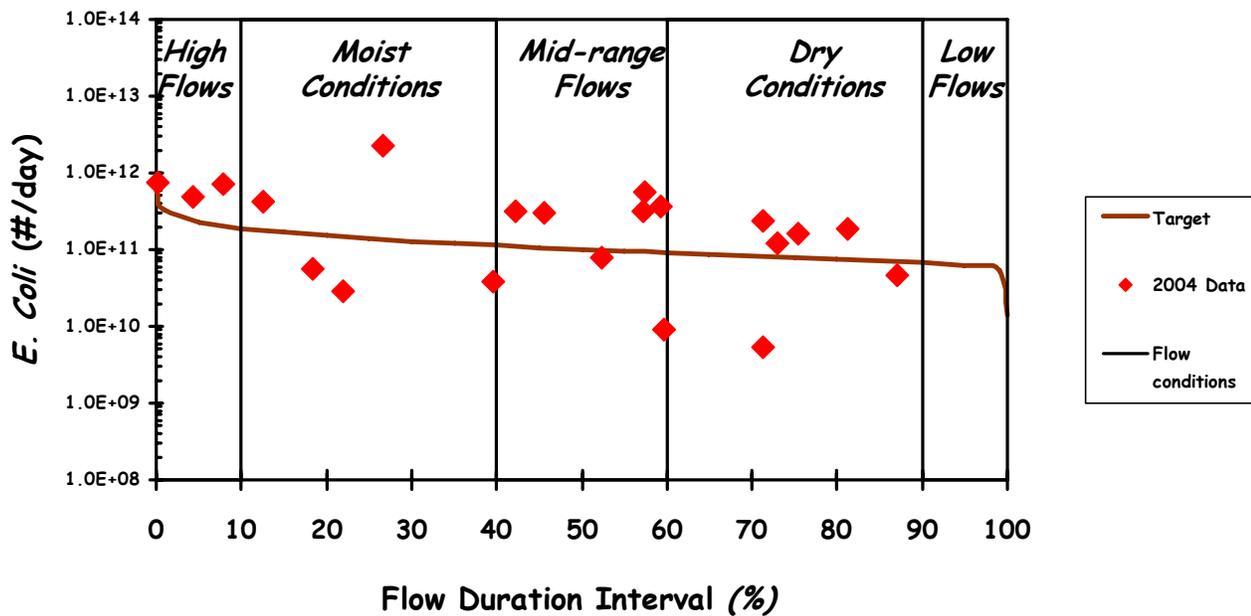
*14.7 square miles*

A-4. Buck Creek at 76th. Load duration curve based on daily geometric mean.  
Site: BKC-4.

# Buck Creek at 68th

## Load Duration Curve (2004 Monitoring Data)

### Site: BKC-6



*E. Coli Data & Modified USGS Gage Duration Interval*

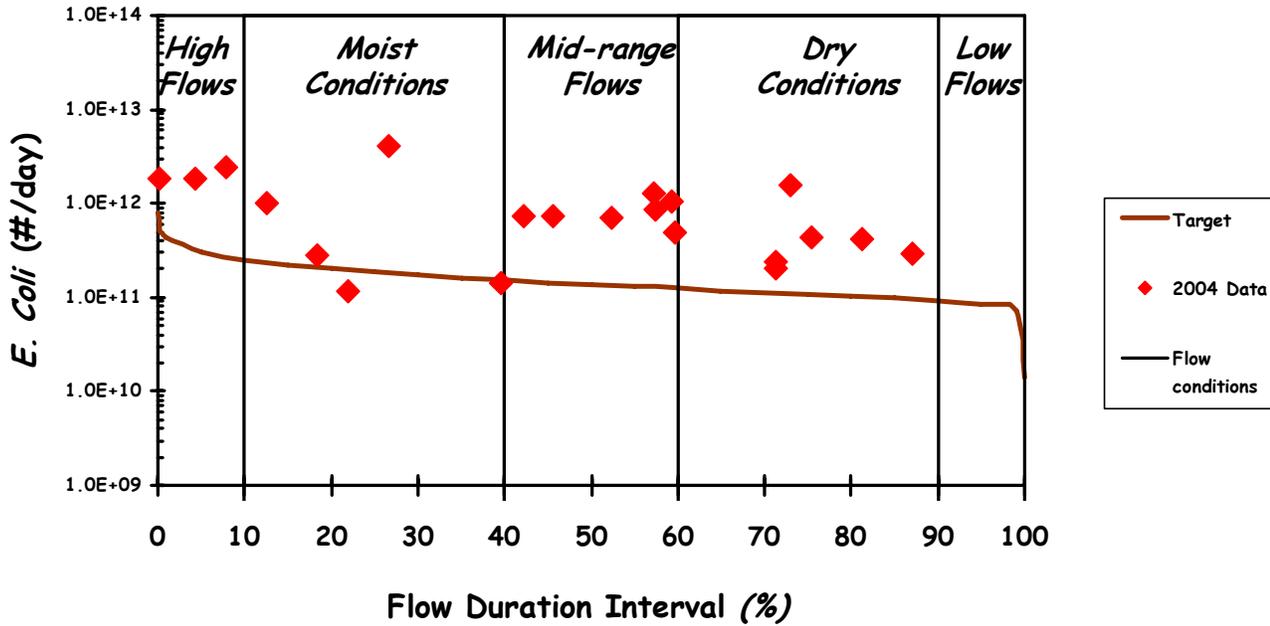
*25.8 square miles*

A-5. Buck Creek at 68th. Load duration curve based on daily geometric mean.  
Site: BKC-6.

# Buck Creek at Clay

## Load Duration Curve (2004 Monitoring Data)

### Site: BKC-7



*E. Coli Data & Modified USGS Gage Duration Interval*

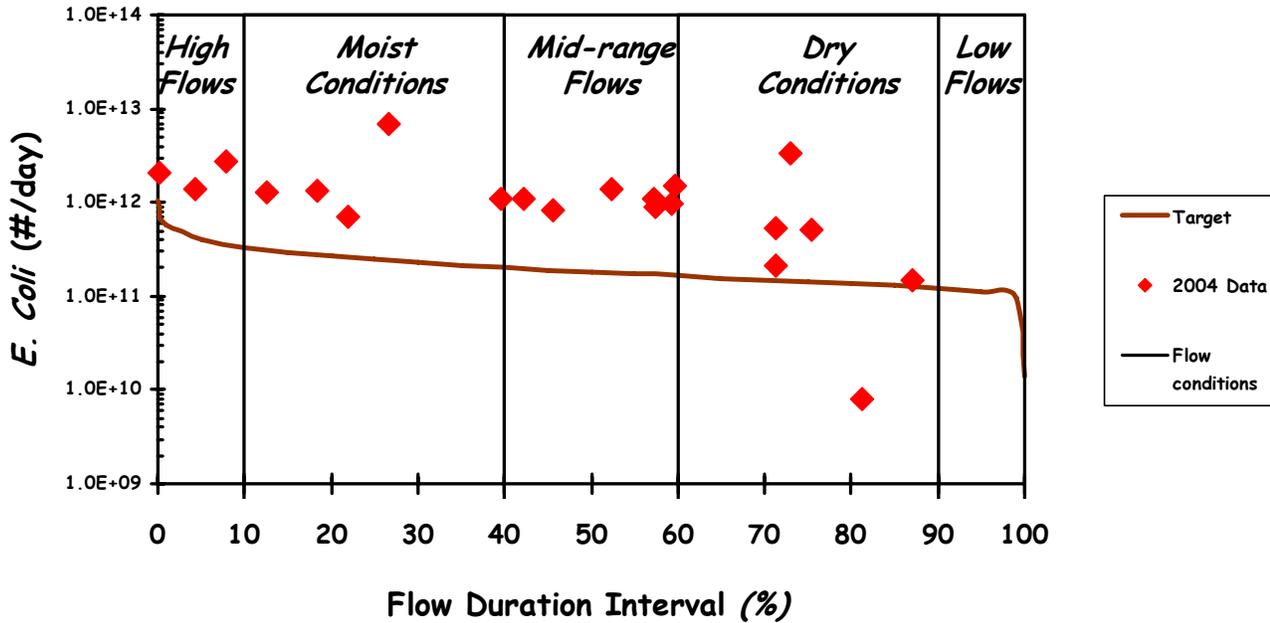
*34.6 square miles*

A-6. Buck Creek at Clay. Load duration curve based on daily geometric mean.  
Site: BKC-7.

# Buck Creek at Burlingame

## Load Duration Curve (2004 Monitoring Data)

### Site: BKC-8



*E. Coli Data & Modified USGS Gage Duration Interval*

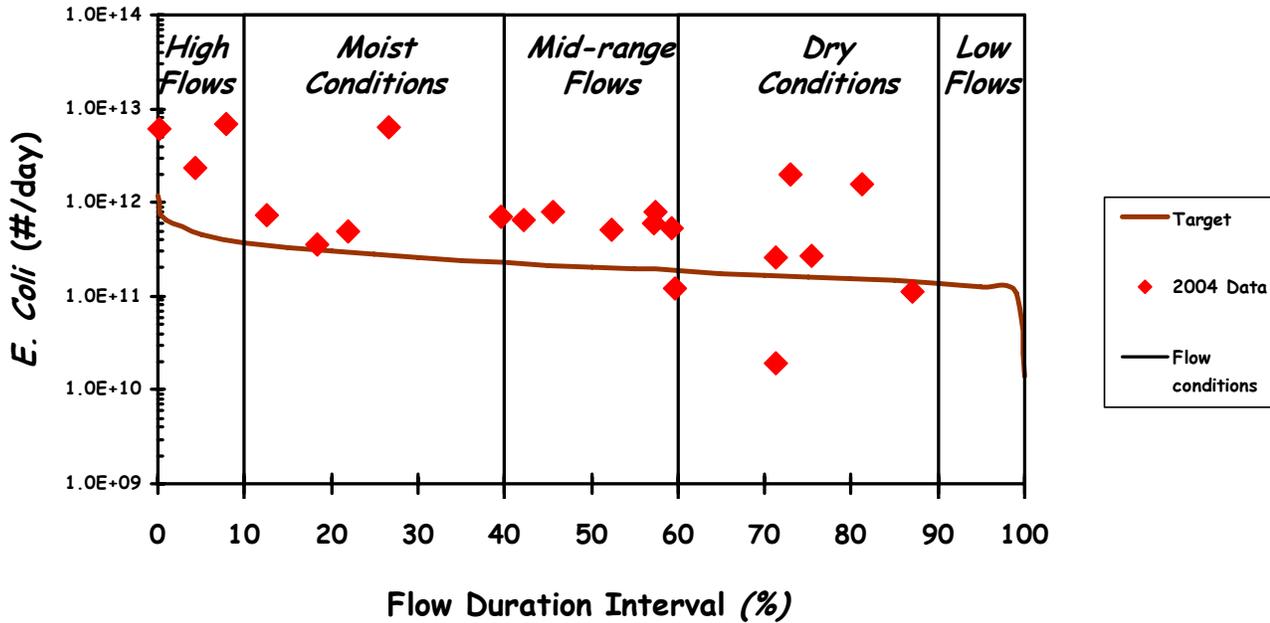
*45.8 square miles*

A-7. Buck Creek at Burlingame. Load duration curve based on daily geometric mean.  
Site: BKC-8.

# Buck Creek at Ivanrest

## Load Duration Curve (2004 Monitoring Data)

### Site: BKC-9



*E. Coli Data & Modified USGS Gage Duration Interval*

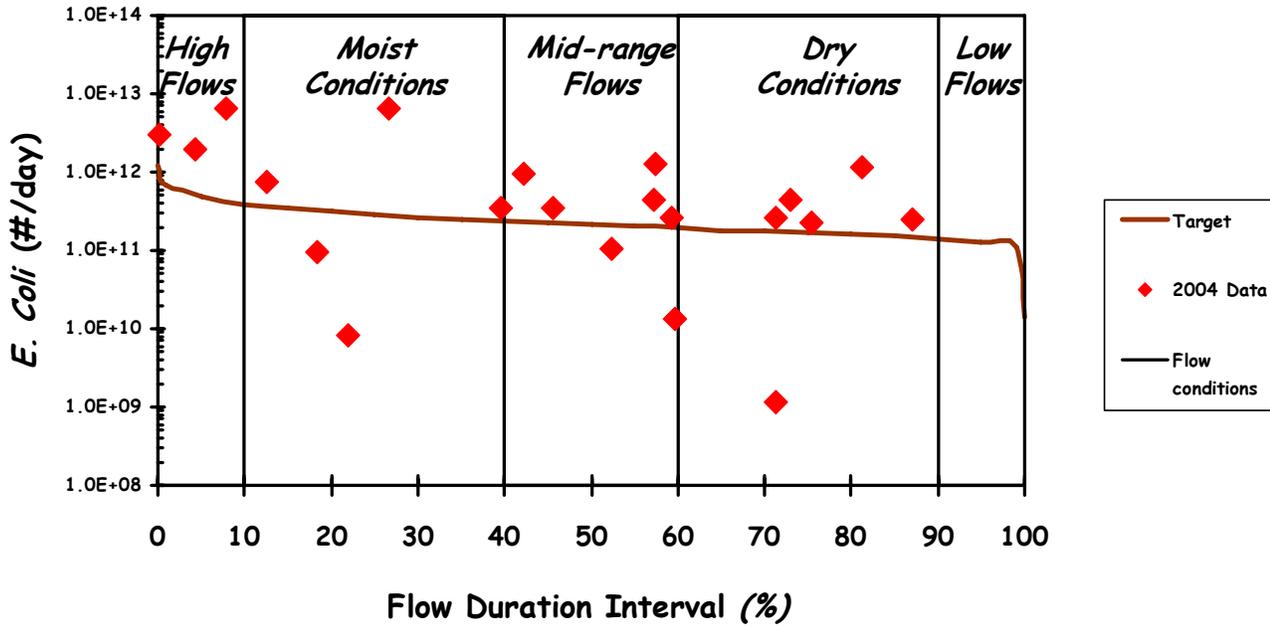
*51.7 square miles*

A-8. Buck Creek at Ivanrest. Load duration curve based on daily geometric mean.  
Site: BKC-9.

# Buck Creek at Chicago

## Load Duration Curve (2004 Monitoring Data)

### Site: BKC-10



*E. Coli Data & Modified USGS Gage Duration Interval*

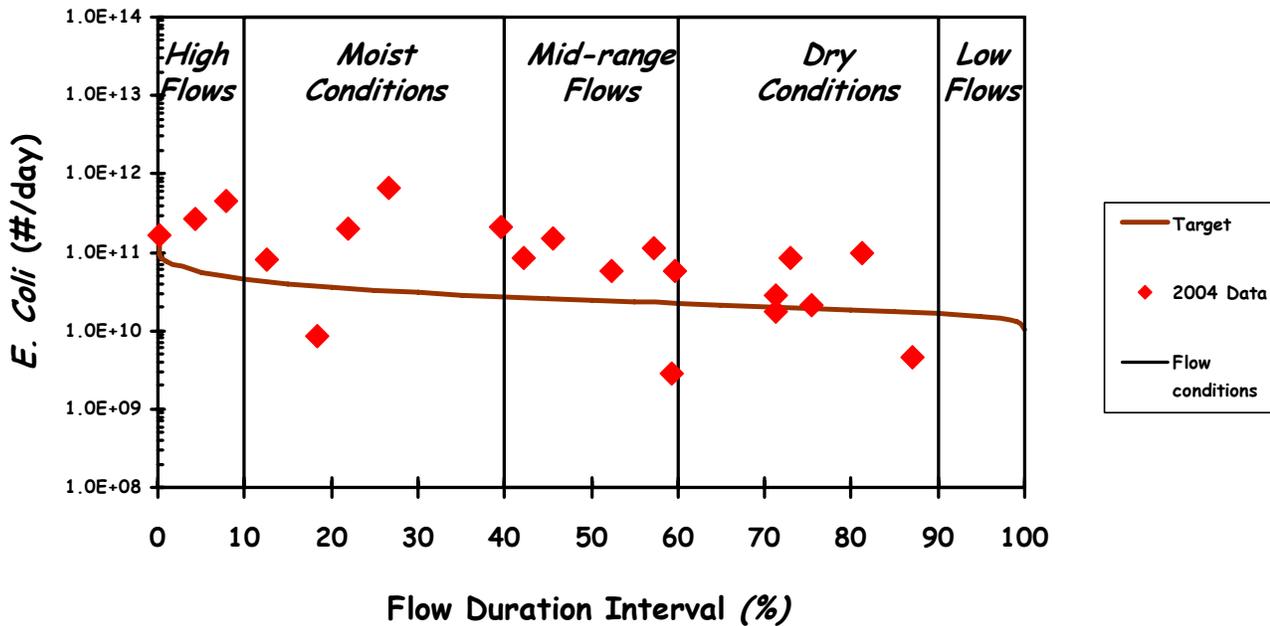
*53.7 square miles*

A-9. Buck Creek at Chicago. Load duration curve based on daily geometric mean.  
Site: BKC-10.

# Tributary to Buck Creek @ 68th

## Load Duration Curve (2004 Monitoring Data)

### Site: BKC-5



*E. Coli Data & Modified USGS Gage Duration Interval*

*6.2 square miles*

A-10. Tributary to Buck Creek at 68th. Load duration curve based on daily geometric mean.  
Site: BKC-5.