

Michigan Department of Environmental Quality
Water Division
April 2003

Total Maximum Daily Load for *Escherichia coli* for Wagner-Pink Drain
Monroe County, Michigan

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 waterbodies that are not meeting Water Quality Standards (WQS). The TMDL process establishes the allowable loadings of pollutants for a waterbody 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 *Escherichia coli* (*E. coli*) that will result in the attainment of the applicable WQS in Wagner-Pink Drain, in the Huron River Watershed, located in Monroe County, Michigan.

PROBLEM STATEMENT

The Wagner-Pink Drain was first placed on the Section 303(d) list in 1998. This TMDL addresses the *E. coli* problems in Wagner-Pink Drain from the Huron River confluence upstream. The TMDL reach is on the Section 303(d) list as:

WAGNER-PINK DRAIN

County: Monroe

HUC: 4090005

WBID#: **061203J**

Size: 0.5 M

Location: Huron River confluence upstream to South Huron River Drive

Problem: **Macroinvertebrate community rated poor; Pathogens (Rule 100).**

TMDL YEAR(s): 2005 2003

RF3RchID: 4090005 0

The current 303(d) listing for Wagner-Pink Drain includes both a poor macroinvertebrate community and pathogen exceedances. This TMDL only covers the pathogen portion of the listing. The macroinvertebrate TMDL will be completed in 2005.

Wagner-Pink Drain (Figure 1) was placed on the Section 303(d) list (Creal and Wuycheck, 2002) due to impairment of recreational uses as indicated by the presence of elevated levels of *E. coli*. Historical information dates problems with the discharge of raw sewage to Wagner-Pink Drain back to 1994 (Campbell, 2000). These conditions agree with recent monitoring data (Table 1) collected by the Michigan Department of Environmental Quality (MDEQ). Despite dry sampling conditions, the 2002 monitoring season documented exceedances of the WQS for *E. coli* at all stations sampled (Table 1 and Figures 2 and 3). Thirty-day geometric mean *E. coli* concentrations in Wagner-Pink Drain ranged from 128 *E. coli* per 100 milliliters (ml) in June at Will Carleton Drive to 2,369 *E. coli* per 100 ml in June at Telegraph/US-24. Daily geometric means ranged from 20 *E. coli* per 100 ml in June at South Huron River Drive to 6,729 *E. coli* per 100 ml in June at Telegraph/US-24.

Carter Drain was also sampled as part of this TMDL monitoring. Thirty-day geometric mean concentrations were only calculated in June due to low stream flows. Concentrations ranged from 180 *E. coli* per 100 ml to 492 *E. coli* per 100 ml. Daily geometric means ranged from 20 *E. coli* per 100 ml in May to 2,932 *E. coli* per 100 ml in June.

The official Section 303(d) listing for Wagner-Pink Drain was from the Huron River confluence upstream to South Huron River Drive. Based on a review of the listing and the 2002 monitoring data, the listed TMDL reach would more appropriately be described as the confluence of Wagner-Pink Drain with the Huron River, upstream approximately 1.6 miles to Will Carleton Drive (Figure 1). The modified TMDL reach is located entirely in Berlin Township. Wagner-Pink Drain has very low flows in this area (Table 2).

NUMERIC TARGET

The impaired designated use addressed by this TMDL is total body contact recreation. Rule 100 of the Michigan WQS requires that this waterbody 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 *Escherichia coli* (*E. coli*) per 100 milliliters, as a 30-day geometric mean. Compliance shall be based on the geometric mean of all individual samples taken during 5 or more sampling events representatively spread over a 30-day period. Each sampling event shall consist of 3 or more samples taken at representative locations within a defined sampling area. At no time shall the waters of the state protected for total body contact recreation contain more than a maximum of 300 *E. coli* per 100 milliliters. Compliance shall be based on the geometric mean of 3 or more samples taken during the same sampling event at representative locations within a defined sampling area.

For this TMDL, the WQS of 130 per 100 ml as a 30-day geometric mean is the target level for the TMDL reach from May 1 to October 31. As previously stated, the 2002 monitoring data indicated exceedances of WQS. Stations with the highest *E. coli* concentrations appear to be in Wagner-Pink Drain, particularly at the Telegraph/US-24 location.

SOURCE ASSESSMENT

Multiple reports of sewage in Wagner-Pink Drain have been documented since 1994 from both the MDEQ's Pollution Emergency Alerting System (reports #238-94D and #267-94D) and residential complaints to the Monroe County Health Department. Visual evidence of failing septic systems and raw/partially treated sewage were present in Wagner-Pink Drain along John L Street in Berlin Township. Subsequent sanitary surveys of Wagner-Pink Drain performed by the MDEQ resulted in a Notice of Noncompliance letter to Berlin Township (DEQ Number: NC-02-00-01-001J) in February 2000. This action resulted in the city of Flat Rock extending their sanitary sewer collection system to three residents on John L Street (Mattson, 2000). The MDEQ closed the notice of noncompliance on March 3, 2000, after the collection system was extended.

Presently, problems with raw sewage in Wagner-Pink Drain continue to be an issue in Berlin Township. Correspondence between the Monroe County Health Department and residents near Wagner-Pink Drain, in the area of John L Street, Monroe Street, and Toldeo Street,

continue to report failing septic systems and raw sewage discharges from residents (Kessler, 2001). A properly functioning septic system contains both a septic tank and appropriately sized drain field where the septic tank acts as a settling area and the drain field as a water filter. In addition, visual evidence of raw sewage in the Huron River, via Wagner-Pink Drain, were reported to the Department of Natural Resources' Fisheries Division in 1998 (Towns, 1998).

The above information is consistent with the 2002 monitoring data collected by the MDEQ. While all stations on Wagner-Pink Drain had high *E. coli* concentrations in June, the Telegraph Road/US-24 station was among the highest. Despite minimal precipitation 24 hours preceding the sample collection (less than 0.5 inches), *E. coli* concentrations in June had daily geometric means of greater than 3,000 *E. coli* per 100 ml for three consecutive weeks. Thirty-day geometric means were over 1,000 *E. coli* per 100 ml for the same time period.

LINKAGE ANALYSIS

The link between the *E. coli* concentrations in Wagner-Pink Drain and the potential sources is the basis for the development of the TMDL. The linkage is defined as the cause and effect relationship between the selected indicators and the sources. This provides the basis for estimating the total assimilative capacity of the stream and any needed load reductions. For this TMDL, a significant amount of the pathogen load enters Wagner-Pink Drain by illicit connections to the storm sewer drains.

The guiding water quality management principle used to develop the TMDL was that compliance with the numeric pathogen target in Wagner-Pink Drain depends on the control of *E. coli* from illicit connections. If the *E. coli* inputs can be controlled, then total body contact recreation in Wagner-Pink Drain will be protected.

TMDL DEVELOPMENT

The TMDL represents the maximum loading that can be assimilated by the waterbody while still achieving WQS. As indicated in the Numeric Target section, the target for this pathogen TMDL is the WQS of 130 *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 and R 323.1090. In general, the lowest monthly 95% exceedance flow for streams is used as a design condition for point source discharges. However, *E. coli* sources to Wagner-Pink Drain arise from a mixture of stable flow and run-off event related nonpoint sources, and there is no single critical condition that is protective for all other conditions. 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 in all portions of the TMDL reach for each month of the recreational season (May through October).

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 or explicitly, that accounts for uncertainty in the relation between pollutant loads and the quality of the receiving waterbody. 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. The overall loading capacity is subsequently allocated into the TMDL components of WLAs for point sources, LAs for nonpoint sources, and the MOS. As previously indicated, 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

At this time, there are no known permitted point source discharges to Wagner-Pink Drain; therefore, the WLA is equal to zero.

LAs

Because this TMDL is concentration-based, the LA is equal to 130 *E. coli* per 100 ml. The determination of individual LAs will be based on the assumption of equal bacteria loads per unit area for all lands in the watershed. 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 the local unit of government in the watershed. This TMDL reach is located entirely in Berlin Township.

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. The MOS can be either implicit (i.e., incorporated into the TMDL analysis 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.

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

In 2002, pathogens were monitored weekly at five stations from May through October. Of the stations sampled, three were on Wagner-Pink Drain, one was on the Huron River, and one was on Carter Drain. Future monitoring will take place as part of the five-year basin monitoring. When these results indicate that the waterbody may be meeting WQS, sampling will be

conducted at the appropriate frequency to determine if the 30-day geometric mean value of 130 *E. coli* per 100 ml is being met.

REASONABLE ASSURANCE ACTIVITIES

Illicit discharges to the storm sewer drains and failing on-site septic systems are the main sources of *E. coli* to Wagner-Pink Drain. Problems have been well-documented for a number of years with both the MDEQ and the Monroe County Health Department. The solution to the problem and the infrastructure to correct it (i.e., nearby sanitary sewer collection system) lies within the municipalities in the area; however, it appears there is some jurisdictional dispute between them. Once the local municipalities come to an agreement regarding this, the discharge of raw or partially treated sewage will be addressed.

To facilitate an agreement between the local municipalities, the MDEQ convened a meeting on March 21, 2003, with the appropriate stakeholders to discuss solutions. The process to be followed will include administrative completion of this TMDL, with appropriate follow-up actions by the MDEQ, the Monroe County Health Department, the city of Flat Rock, and Berlin Township. Corrective action will most likely be in the form of a sewer extension from the city of Flat Rock.

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REFERENCES

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- Creal, W. and J. Wuycheck. 2002. Federal Clean Water Act Section 303(d) List – Michigan's Submittal for Year 2002. Michigan Department of Environmental Quality, Surface Water Quality Division, Report Number MI/DEQ/SWQ-02/013.
- Kessler, S. 2001. Investigation and notes for Wagner-Pink Drain, Monroe County Environmental Health Department.
- Mattson, M. 2000. Hennessey Engineers, Inc. Letter of Transmittal to Michigan Department of Environmental Quality.
- Towns, G. 1998. Michigan Department of Natural Resource Correspondence to Roy Schrameck, Department of Environmental Quality, Southeast District Office.
- USEPA. 2001. Protocol for Developing Pathogen TMDLs. United States Environmental Protection Agency, 841-R-00-002.

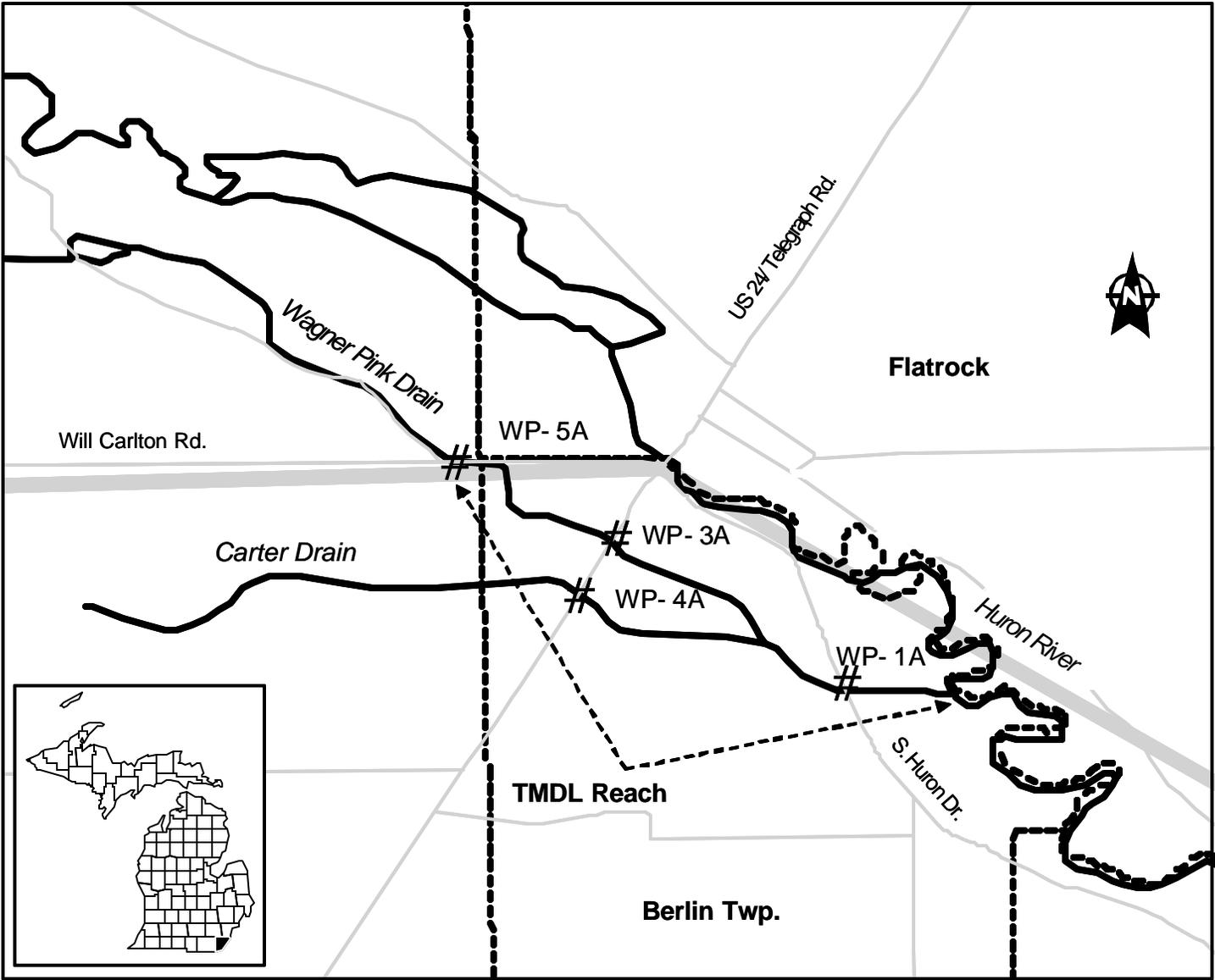


Figure 1. Wagner-Pink Drain *E. coli* sampling locations, Berlin Township, Michigan, 2002.

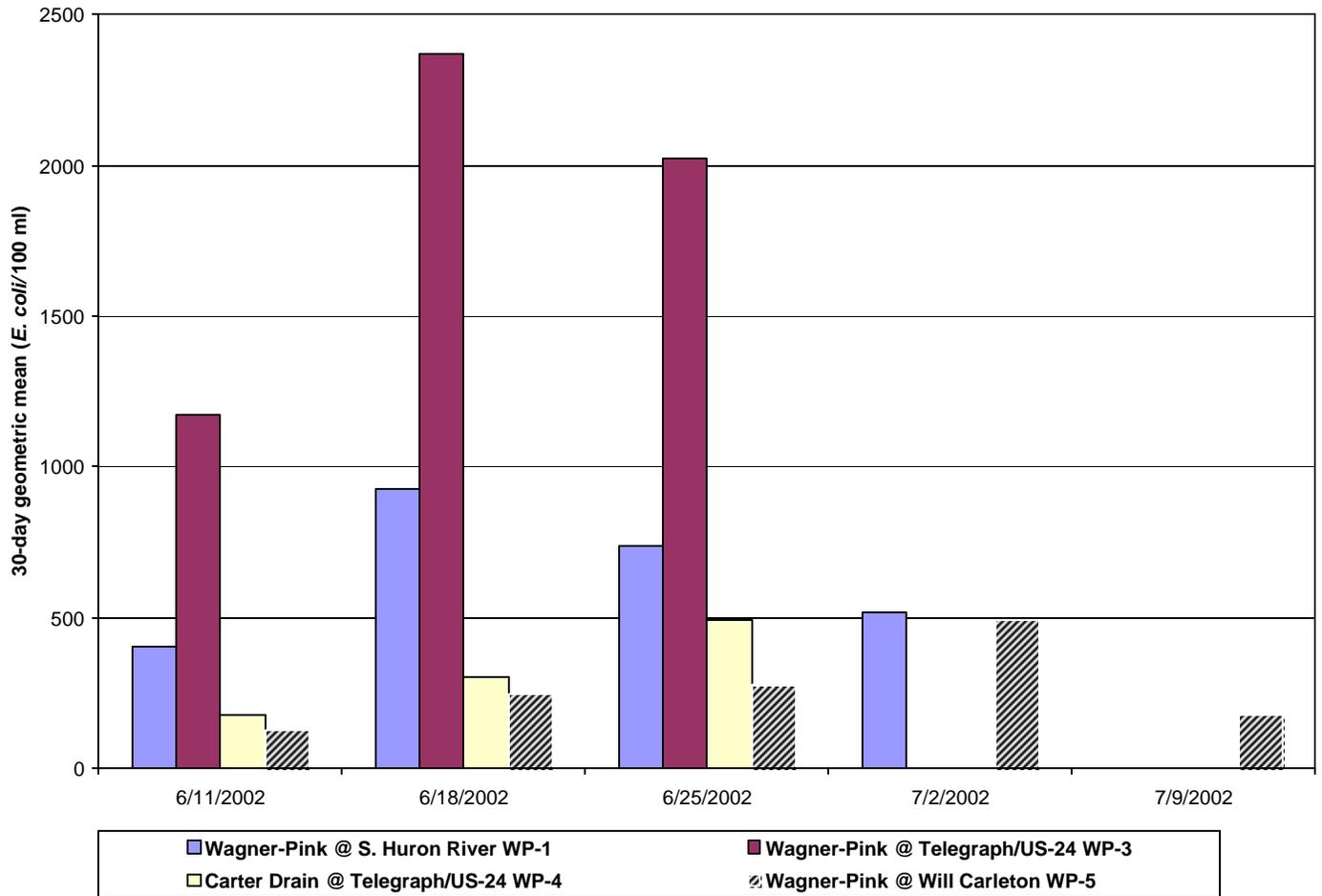


Figure 2. Thirty-day Geometric mean for *E. coli* in Wagner-Pink Drain and Carter Drain, Monroe County, Michigan, 2002.

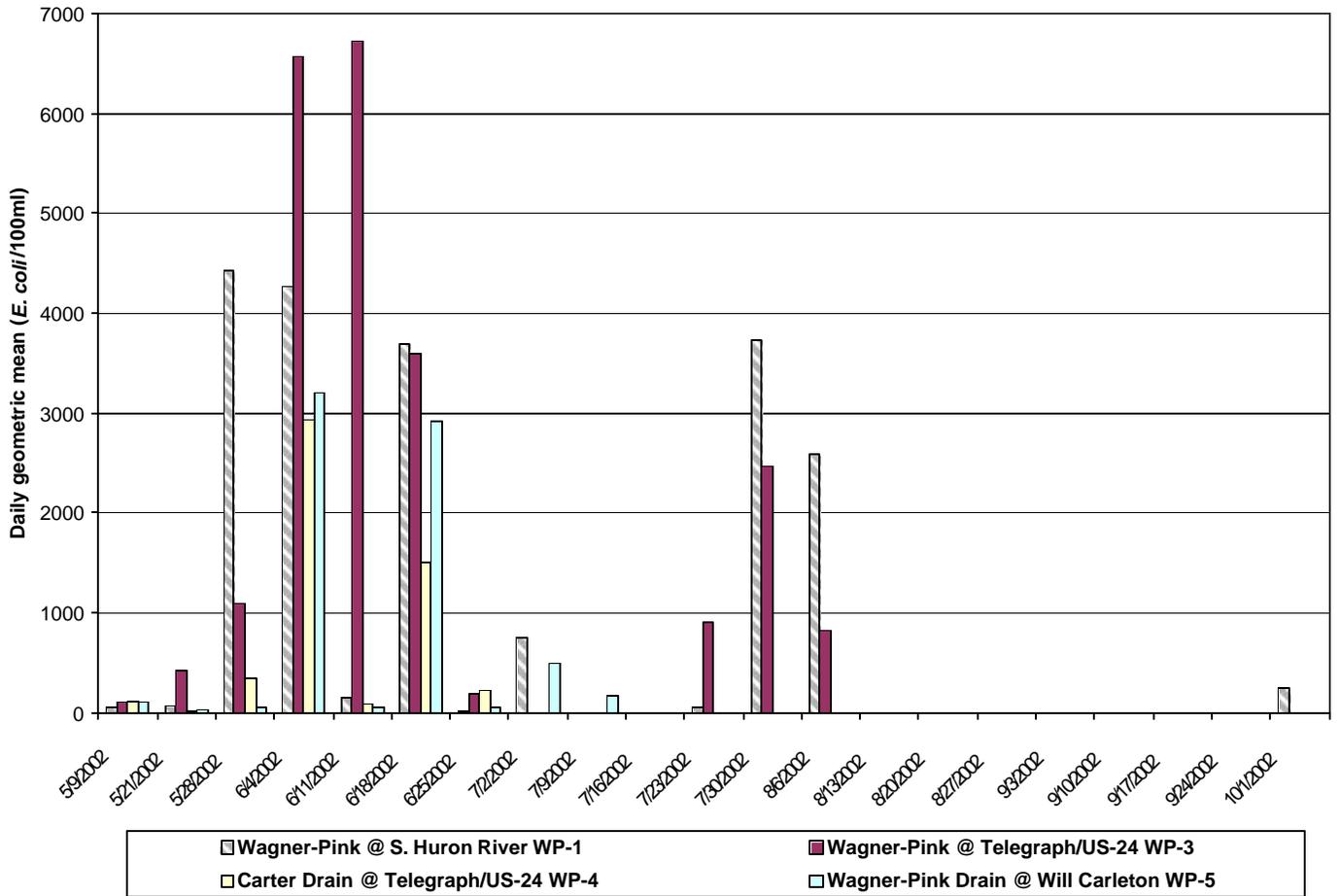


Figure 3. Daily geometric mean *E. coli* concentrations in Wagner-Pink Drain and Carter Drain, Monroe County, Michigan, 2002.

Table 1. MDEQ 2002 *E. coli* monitoring data for Wagner-Pink Drain, including the Huron River and Carter Drain (*E. coli*/100 ml). Shaded areas indicate exceedances of the Water Quality Standard.

	Wagner-Pink Drain @ S. Huron River Drive WP-1			Wagner-Pink Drain @ Telegraph/US-24 WP-3			Wagner-Pink Drain @ Will Carleton Drive WP-5			
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	Weather data
5/9/2002	20	60	---	760	107	---	100	106	---	thunderstorms, 60°
	540			20			40			
	20			80			300			
5/21/2002	100	62	---	1000	427	---	40	32	---	sunny, 45°
	40			300			40			
	60			260			20			
5/28/2002	6000	4437	---	220	1097	---	150	53	---	sunny, 70°
	2800			2000			50			
	5200			3000			20			
6/4/2002	4400	4266	---	6800	6573	---	800	3200	---	overcast, 55°
	4200			5800			6400			
	4200			7200			6400			
6/11/2002	20	157	406	6400	6729	1172	60	60	128	hazy, 80°
	1600			6800			60			
	120			7000			60			
6/18/2002	2400	3701	926	6400	3598	2369	3800	2927	249	hazy, 80°
	4800			5200			2200			
	4400			1400			3000			
6/25/2002	20	20	738	20	193	2021	80	54	277	partly sunny, 75°
	20			600			100			
	20			600			20			
7/2/2002	400	756	518	*	---	---	900	965	494	hazy, 85°
	1800			*			2000			
	600			*			500			

* data not collected due to dry conditions.

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

DATE	Wagner-Pink Drain @ S. Huron River Drive WP-1			Wagner-Pink Drain @ Telegraph/US-24 WP-3			Wagner-Pink Drain @ Will Carleton Drive WP-5			Weather 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	
7/9/2002	*	---	---	*	---	---	20	20	179	rain, 80°
	*			*			20			
	*			*			20			
7/16/2002	*	---	---	*	---	---	*	---	---	overcast, 80°
	*			*			*			
	*			*			*			
7/23/2002	60	55	---	20	904	---	920	72	---	sunny, 75°
	140			6600			20			
	20			5600			20			
7/30/2002	3600	3732	---	600	2465	---	8000	5590	---	humid, 80°
	3800			4800			5200			
	3800			5200			4200			
8/6/2002	2600	2595	---	1200	818	---	200	238	---	mostly sunny, 65°
	2400			600			240			
	2800			760			280			
8/13/2002	*	---	---	*	---	---	*	---	---	humid, 75°
	*			*			*			
	*			*			*			
8/20/2002	*	---	---	*	---	---	*	---	---	sunny, 70°
	*			*			*			
	*			*			*			
8/27/2002	*	---	---	*	---	---	*	---	---	sunny, 70°
	*			*			*			
	*			*			*			

* data not collected due to dry conditions.

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

DATE	Wagner-Pink Drain @ S. Huron River Drive WP-1			Wagner-Pink Drain @ Telegraph/US-24 WP-3			Wagner-Pink Drain @ Will Carleton Drive WP-5			Weather 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	
9/3/2002	*	---	---	*	---	---	*	---	---	mostly cloudy, 75°
	*			*			*			
	*			*			*			
9/10/2002	*	---	---	*	---	---	*	---	---	sunny, 75°
	*			*			*			
	*			*			*			
9/17/2002	*	---	---	*	---	---	*	---	---	sunny, 75°
	*			*			*			
	*			*			*			
9/24/2002	*	---	---	*	---	---	*	---	---	sunny, 60°
	*			*			*			
	*			*			*			
10/1/2002	200	256	---	*	---	---	*	---	---	sunny, 75°
	300			*			*			
	280			*			*			

* data not collected due to dry conditions.

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

DATE	Carter Drain @ Telegraph/US-24 WP-4			Weather data
	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	
5/9/2002	20 200 360	113	---	thunderstorms, 60°
5/21/2002	20 20 20	20	---	sunny, 45°
5/28/2002	300 400 350	348	---	sunny, 70°
6/4/2002	2800 3000 3000	2932	---	overcast, 55°
6/11/2002	140 20 200	82	180	hazy, 80°
6/18/2002	2400 2000 720	1512	303	hazy, 80°
6/25/2002	280 300 140	227	492	partly sunny, 75°
7/2/2002	* * *	---	---	hazy, 85°

* data not collected due to dry conditions.

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

DATE	Carter Drain @ Telegraph/US-24 WP-4			Weather data
	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	
7/9/2002	*	---	---	rain, 80°
	*			
	*			
7/16/2002	*	---	---	overcast, 80°
	*			
	*			
7/23/2002	300	124	---	sunny, 75°
	20			
	320			
7/30/2002	620	457	---	humid, 80°
	320			
	480			
8/6/2002	480	524	---	mostly sunny, 65°
	500			
	600			
8/13/2002	*	---	---	humid, 75°
	*			
	*			
8/20/2002	*	---	---	sunny, 70°
	*			
	*			
8/27/2002	*	---	---	sunny, 70°
	*			
	*			

* data not collected due to dry conditions.

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

Carter Drain @ Telegraph/US-24 WP-4				
DATE	SAMPLE RESULTS	DAILY G. MEAN	30-day G. MEAN	Weather data
9/3/2002	*	---	---	mostly cloudy, 75°
	*			
	*			
9/10/2002	*	---	---	sunny, 75°
	*			
	*			
9/17/2002	*	---	---	sunny, 75°
	*			
	*			
9/24/2002	*	---	---	sunny, 60°
	*			
	*			
10/1/2002	*	---	---	sunny, 75°
	*			
	*			

* data not collected due to dry conditions.

Table 2. Wagner-Pink Drain average flows (cfs) at Will Carleton Drive, Monroe County, Michigan.

May	June	July	August	September	October
0.3	0.2	0.1	0.1	0.1	0.1