

**Michigan Department of Environmental Quality  
Water Bureau  
August 2005**

**Total Maximum Daily Load for *E. coli* for  
Paint Creek  
Washtenaw 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 Paint Creek, a tributary of Stony Creek, located in Washtenaw County, Michigan.

**PROBLEM STATEMENT**

This water body was placed on the Section 303(d) list in 2004. This TMDL listing addresses approximately 4.6 miles of stream in the vicinity of Ypsilanti. The TMDL reach for Paint Creek appears on the Section 303(d) list as:

**PAINT CREEK**

County: Washtenaw

Location: R6E, T3S, Sec. 12 at Ypsilanti, stations are located just above and just below the retention basin 1600 feet S. of I-94.

HUC: 4100001      RF3RchID: 4100001 18

Problem: D.O.; Fish kills, Pathogens (Rule 100).

TMDL YEAR(s): 2005

WBID#: 061201D

Size: 4.6 M

Paint 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). Monitoring data collected by the Michigan Department of Environmental Quality (MDEQ) in 2003 documented periodic exceedances of the WQS for *E. coli* at the three sampling locations sampled during the total body contact recreational season of May 1 and October 31 (Figure 1 and Table 1).

**NUMERIC TARGET**

The impaired designated use addressed by this TMDL is total body contact recreation. The designated use rule (Rule 100 [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 *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.

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 maximum are the target levels for the TMDL reach from May 1 to October 31. The 2003 monitoring data indicated exceedances of the daily maximum WQS at the locations sampled.

## **DATA DISCUSSION**

Paint Creek in the vicinity of Ypsilanti was sampled at three locations to address the TMDL listing and met the 30-day geometric mean WQS at all stations sampled. Thirty-day geometric mean *E. coli* concentrations ranged from 20 *E. coli* per 100 ml at multiple locations to 73 *E. coli* per 100 ml in June and July at Michigan Avenue (PC-1) (Table 1, Figure 2). Daily geometric mean concentrations ranged from 20 *E. coli* per 100 ml at various locations to 9,772 *E. coli* per 100 ml in September at Michigan Avenue (PC-1).

The upstream station located at Michigan Avenue (PC-1) exceeded the daily geometric mean of 300 *E. coli* per 100 ml 3 times during the sampling season. The largest exceedance of 9,772 *E. coli* per 100 ml occurred on September 22, 2003, during a wet weather event (more than 1 inch of rain). The remaining stations at PC-2 and PC-3 exceeded the daily geometric mean only once during the sampling season.

## **SOURCE ASSESSMENT**

The official listed reach for Paint Creek is approximately 4.6 miles in the vicinity of Ypsilanti in Washtenaw County. The municipalities making up the largest portion of the TMDL watershed are Pittsfield Township (50%) and Ypsilanti Township (44%) (Table 2).

The primary pathogen sources for this water body are urban and suburban land uses. Specific sources include unpermitted storm water runoff and urban runoff. In addition, the Ypsilanti Community Utilities Authority (YCUA) had one reported sanitary sewer overflow (SSO) to Paint Creek on October 12, 2002, which resulted in a discharge to Paint Creek. Four additional SSOs occurred in 2003; however, none of them resulted in a discharge to Paint Creek.

There are 14 National Pollutant Discharge Elimination System (NPDES) permitted discharges to Paint Creek in the TMDL reach (Table 3, Figure 3), 8 industrial storm water permits, and 6 Municipal Separate Storm Sewer Systems (MS4) permits, 5 of which are general permits and one an individual permit (Michigan Department of Transportation (MDOT) – statewide permit).

The industrial storm water 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 Paint Creek TMDL watershed. The MS4 permittees are prohibited from discharges that may cause or contribute to a violation of a WQS. There are no combined sewers or concentrated animal feeding operations in the Paint Creek watershed.

## **LINKAGE ANALYSIS**

Determining the link between the *E. coli* concentrations in Paint Creek and the potential sources are 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 concentrations of pathogens at levels that exceed WQS appear to enter Paint Creek during wet weather conditions. This determination is based on a review of the occurrence of rainfall and associated exceedances of WQS. Potential sources include storm water and urban runoff.

The guiding water quality management principle used to develop the TMDL is that compliance with the numeric pathogen target in Paint Creek depends on the control of *E. coli* from wet weather sources. If the *E. coli* inputs can be controlled to meet the numeric standards, then total body contact recreation in Paint 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 R 323.1082 (Mixing zones) and R 323.1090 (Applicability of water quality standards). In general, the lowest monthly 95% 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 pathogens for wastewater treatment plants. In addition, sources of pathogens to Paint 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

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 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

There are 13 permitted general and one individual storm water discharges to the listed reach of Paint Creek. The permitted storm water discharges are not considered significant sources of *E. coli* to Paint Creek due to the best management practices (BMPs) required in the permit. The general permits do not authorize the discharge of non-storm water and require a certified storm water operator for the facility. The one individual permitted discharge allow for the discharge of certain categories of non-storm water, e.g. air conditioning condensate, non of which are considered to be significant sources of *E. coli*. The WLA for these permits is equal to 130 *E. coli* per 100 ml as a 30-day average and 300 *E. coli* per 100 as a daily average during the recreation season of May 1 through October 31.

### LAs

Because this TMDL is concentration-based, the LA is equal to 130 *E. coli* per 100 ml as a 30-day average and 300 *E. coli* per 100 as a daily average during the recreation season of May 1 through October 31. This 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 5 municipalities (Table 2). The townships making up the largest portion are Pittsfield Township (50%) and Ypsilanti Township (44%).

### 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. Ordinarily, pathogen organisms 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 in order 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 as a 30-day average and 300 *E. coli* per 100 as a daily average during the recreation season of May 1 through October 31 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 3 stations on Paint Creek from May through September 2003. Future monitoring will take place as part of the five-year rotating basin monitoring once additional controls to reduce *E. coli* levels have been established. 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 YCUA had four SSO events in 2003. None of those discharges were to Paint Creek; however, they entered into an Administrative Consent Order (ACO) with the MDEQ in 2003 (ACO-SW03-012) to address the 2002 discharge to Paint Creek. In addition, a District Compliance Agreement was entered in 2003 between the MDEQ and YCUA to address capacity issues within the sanitary sewer system. The agreement requires that infiltration and inflow analyses, sanitary sewer evaluation surveys, and corrective actions be performed on the collection system, where necessary, to provide adequate sewer system capacity. YCUA must complete the infiltration and inflow analysis by March 1, 2010.

Eastern Michigan University acquired a Clean Water Act Section 319 grant in 2003 to develop a watershed management plan for the Stony Creek watershed, which includes Paint Creek. The watershed plan was completed in May 2005 and was submitted to MDEQ for approval. The objectives of the plan were to identify, document, and prioritize all nonpoint sources within the watershed.

The MDEQ approved the plan on June 7, 2005 with respect to criteria specified in the Administrative Rules for the Clean Michigan Initiative (CMI) Nonpoint Source Pollution Control Grants promulgated pursuant to Part 88, Water Pollution and Environmental Protection Act, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, effective October 27, 1999. The watershed management plan does not meet the nine required elements for plans described in the United States Environmental Protection Agency's (USEPA's) document entitled, "*Nonpoint Source Program and Grants Guidelines for States and Territories (Oct. 23, 2003).*" The USEPA's nine elements criteria require additional detail beyond that required by the CMI criteria. The plan will require further enhancement to meet the USEPA's nine elements and qualify for federal funding, if so desired.

As an outgrowth of the Stony Creek watershed planning project, a watershed council for Stony Creek is under formation.

Washtenaw County has adopted a time-of-sale property transfer program. This program requires certification that on-site waste treatment systems are properly functioning. If a system is found to be failing, corrections or repairs must be made prior to property transfer approval. In addition, Pittsfield Township is working to modify an existing ordinance to require inspections of on-site waste treatment systems every five years to ensure proper function.

There are several measures in the NPDES permits identified in Table 3 that will contribute to attaining WQS in the listed reach of Paint Creek:

The industrial storm water general permits identified in Table 3 (denoted by an asterisk) 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 Ypsilanti Twp, Washtenaw County Drain Commission (CDC) and Washtenaw County Road Commission (CRC) MS4 watershed permits and certificates of coverage require that the permittees submit to the MDEQ approvable illicit discharge elimination plans, public education plans, public participation plans, and storm water pollution prevention initiatives (SWPPI). The objective of a SWPPI is to reduce the discharge of pollutants to the maximum extent practicable. Specifically, the SWPPI requires, at a minimum, an evaluation and implementation of pollution prevention and good housekeeping practices, a description of storm water structural controls to reduce pollutants, development and implementation of a storm water management program for areas of development, and a requirement to implement BMPs to prevent or minimize water quality impacts.

The Ypsilanti Township MS4, Washtenaw CDC MS4, and Washtenaw CRC MS4 watershed permits require the permittees to participate in the development and implementation of a watershed management plan (WMP). The purpose of the WMP is to identify and execute the actions needed to resolve water quality and water quantity concerns, such as TMDLs, by fostering cooperation among the various public and private entities in the watershed. Those concerns related to TMDLs established within the watershed should be included and details for those actions specific to storm water controls shall be listed in the WMP.

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

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## REFERENCES

USEPA. 2001. Protocol for Developing Pathogen TMDLs. United States Environmental Protection Agency, 841-R-00-002.

Wolf, S. and J. Wuycheck. 2004. Water Quality and Pollution Control in Michigan: 2004 Sections 303(d) and 305(b) Integrated Report. Michigan Department of Environmental Quality, Report No. MI/DEQ/WD-04/029.

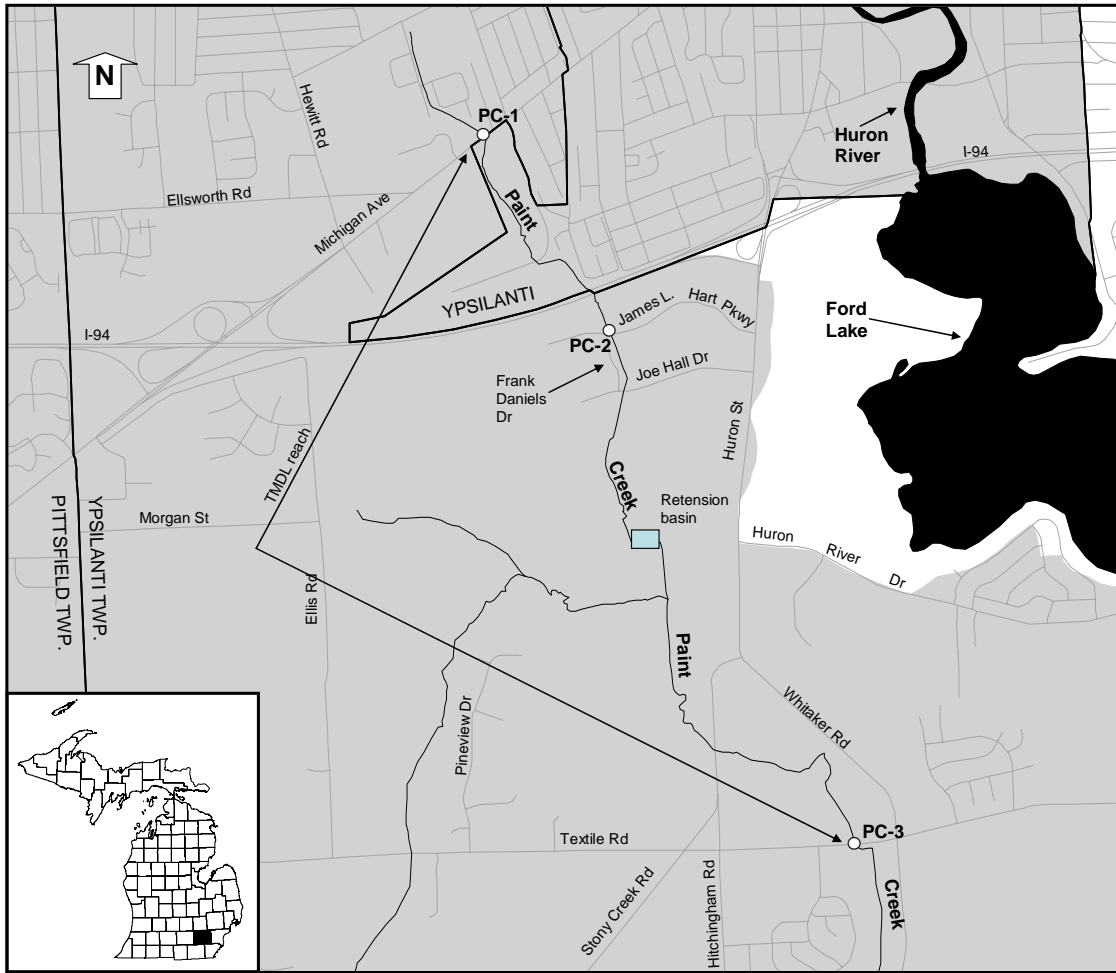
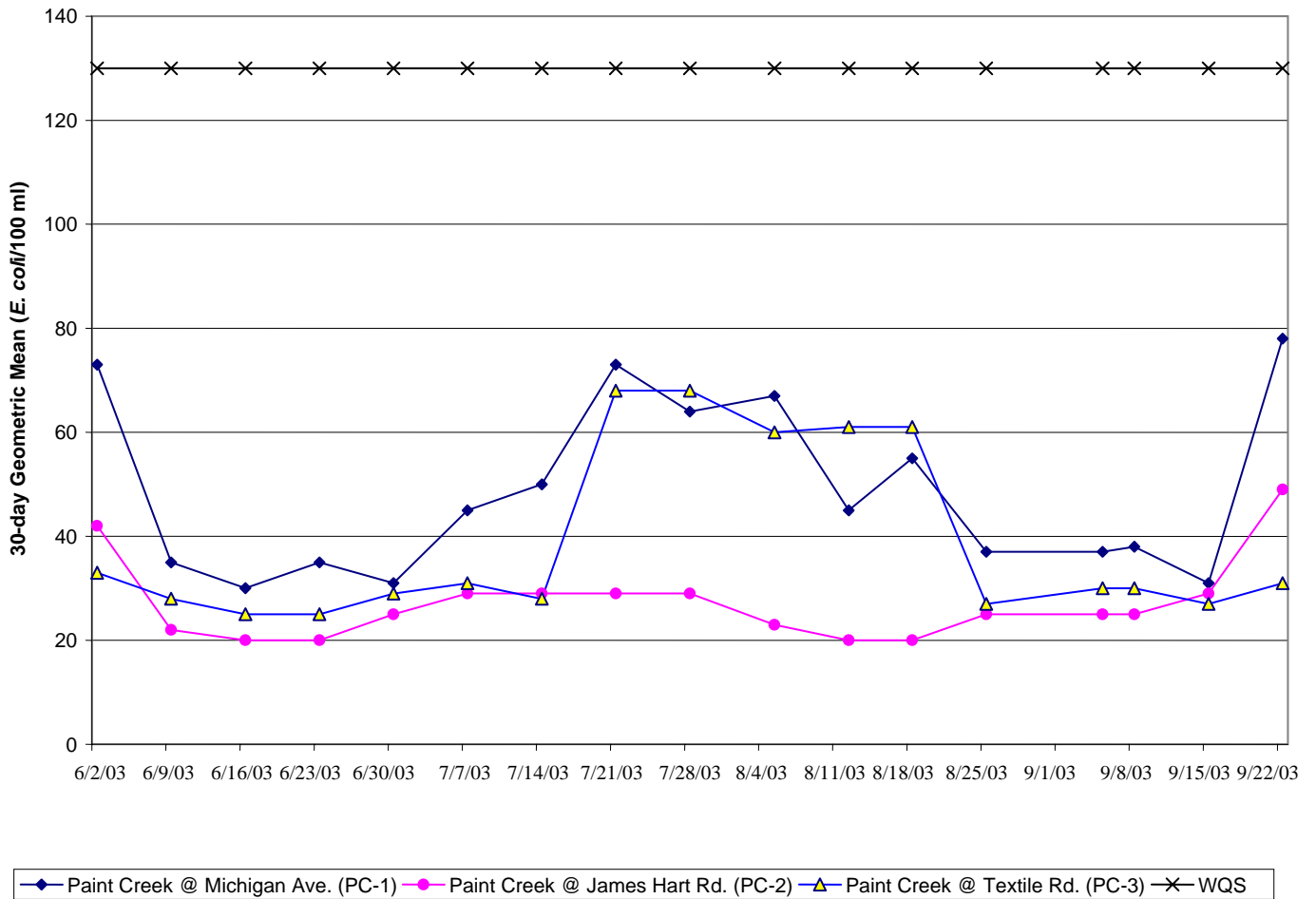


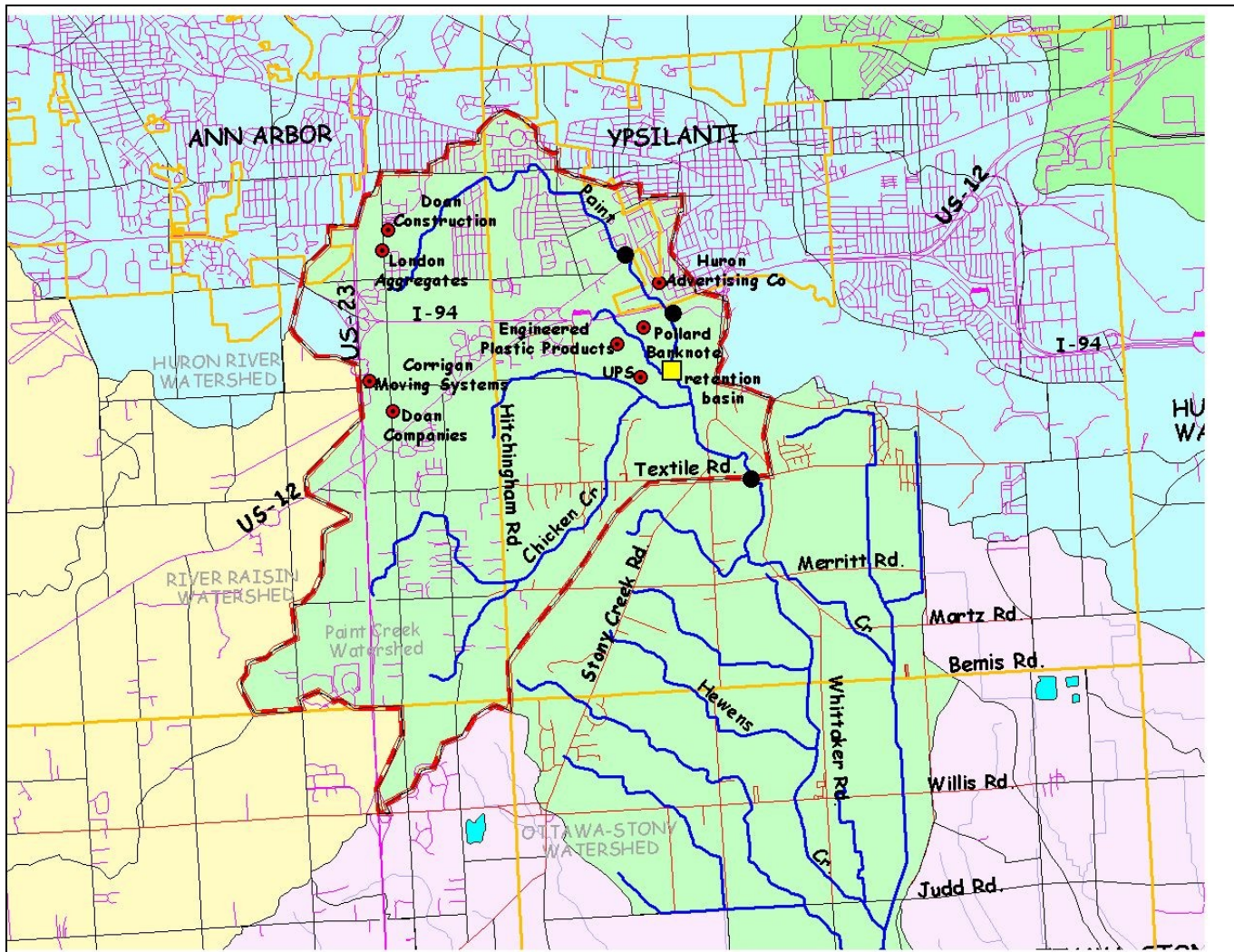
Figure 1. Paint Creek *E. coli* sampling locations, vicinity of Ypsilanti, Washtenaw County, Michigan, 2003.

Scale: 1" = 0.5 miles





**Figure 2. Thirty-day geometric mean for *E. coli* in Paint Creek, vicinity of Ypsilanti, Washtenaw County, Michigan, 2003.**



**Figure 3. NPDES-permitted discharges to the Paint Creek TMDL reach (dash outline), Washtenaw County, Michigan. (Note: Black circles indicate sampling locations. Bullets indicate the industrial storm water permits. MS4 permits are not shown in figure).**

Scale: 1" = 2.7 miles

**Table 1. MDEQ 2003 *E. coli* monitoring data for Paint Creek (*E. coli*/100 ml) in the vicinity of Ypsilanti. Shaded areas indicate exceedances of the WQS. Data are presented upstream to downstream. Note: precipitation is noted for 24 hours preceding sampling.**

	Paint Creek @ Michigan Ave. (PC-1)			Paint Creek @ James Hart Rd. (PC-2)			Paint Creek @ Textile Rd. (PC-3)			
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/precip.
5/5/2003	840	765	---	880	502	---	380	147	---	overcast, 69°
	740			180			420			0.5"
	720			800			20			
5/12/2003	20	60	---	20	32	---	20	32	---	overcast, 70°
	60			80			20			0.3"
	180			20			80			
5/19/2003	20	20	---	20	20	---	20	20	---	cloudy, 55°
	20			20			20			0"
	20			20			20			
5/27/2003	20	36	---	20	20	---	20	20	---	sunny, 65°
	20			20			20			0.1"
	120			20			20			
6/2/2003	140	61	73	20	20	42	20	20	33	sunny, 72°
	20			20			20			0.6"
	80			20			20			
6/9/2003	20	20	35	20	20	22	340	65	28	partly sunny, 70°
	20			20			40			0"
	20			20			20			
6/16/2003	20	29	30	20	20	20	20	20	25	sunny, 80°
	60			20			20			0"
	20			20			20			
6/23/2003	160	40	35	20	20	20	20	20	25	sunny, 80°
	20			20			20			0"
	20			20			20			

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

DATE	Paint Creek @ Michigan Ave. (PC-1)			Paint Creek @ James Hart Rd. (PC-2)			Paint Creek @ Textile Rd. (PC-3)			Weather data/precip.	
	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		
6/30/2003	20	20	31	20	65	25	20	36	29	sunny, 70° 0.1"	
	20			700			20				20
	20			20			120				20
7/7/2003	20	397	45	20	40	29	20	32	31	overcast, 70° 0.3"	
	1560			160			20				20
	2000			20			80				20
7/14/2003	20	34	50	20	20	29	20	34	28	sunny, 85° 0"	
	100			20			20				20
	20			20			100				20
7/21/2003	40	193	73	20	20	29	6800	1804	68	cloudy, 65° 0" (1.82" in early morning hours)	
	9000			20			360				20
	20			20			2400				20
7/28/2003	20	20	64	20	20	29	20	20	68	cloudy, 70° 0.4"	
	20			20			20				20
	20			20			20				20
8/5/2003	40	25	67	20	20	23	20	20	60	sunny, 85° 0.9"	
	20			20			20				20
	20			20			20				20
8/12/2003	380	53	45	20	20	20	100	34	61	overcast, 75° 0.1"	
	20			20			20				20
	20			20			20				20
8/18/2003	560	96	55	20	20	20	20	34	61	partly cloudy, 89° 0"	
	80			20			20				20
	20			20			100				20

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

DATE	Paint Creek @ Michigan Ave. (PC-1)			Paint Creek @ James Hart Rd. (PC-2)			Paint Creek @ Textile Rd. (PC-3)			Weather data/precip.
	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	
8/25/2003	20	25	37	520	59	25	20	29	27	sunny, 80° 0"
	40			20			20			
	20			20			60			
9/5/2003	20	20	37	20	20	25	20	34	30	sunny, 68° 0"
	20			20			100			
	20			20			20			
9/8/2003	20	29	38	20	20	25	20	20	30	sunny, 75° 0"
	60			20			20			
	20			20			20			
9/15/2003	20	20	31	240	46	29	20	20	27	partly cloudy, 70° 0.3"
	20			20			20			
	20			20			20			
9/22/2003	10800	9772	78	1300	270	49	20	70	31	rain, 65° 1.4"
	8000			760			20			
	10800			20			840			

**Table 2. Distribution of land for each municipality in the Paint Creek TMDL reach.**

<b>Municipality</b>	<b>County</b>	<b>Square Miles</b>	<b>Percent</b>
Pittsfield Township	Washtenaw	8.4	50
Ypsilanti Township	Washtenaw	7.4	44
City of Ypsilanti	Washtenaw	0.4	2.7
York Township	Washtenaw	0.4	2.7
City of Ann Arbor	Washtenaw	0.1	0.6
<b>TOTAL</b>		<b>16.7</b>	<b>100</b>

**Table 3. Permitted outfalls to the Paint Creek TMDL watershed. Source: MDEQ, Water Bureau's NPDES Permit Management System.**

<b>Facility</b>	<b>Permit Number</b>	<b>Receiving Water</b>	<b>Latitude</b>	<b>Longitude</b>
Corrigan Moving Systems	MIS510181	Paint Creek	42.21670	-83.68330
Doan Companies-Ypsilanti	MIS510459	Paint Creek	42.21250	-83.67920
Doan Companies-Ypsilanti	MIS510178	Paint Creek	42.23750	-83.67920
Engineered Plastic Products	MIS510588	Paint Creek	42.22080	-83.63720
Huron Advertising Co – Ypsilanti	MIS510180	Paint Creek	42.22920	-83.62920
London Aggregates – Ypsilanti	MIS510576	Paint Creek	42.23470	-83.68030
Pittsfield Township MS4	MIS040021	Paint Creek	--	--
Pollard Banknote Ltd – Ypsilanti	MIS510497	Paint Creek	42.22310	-83.63220
United Parcel Service	MIS410015	Paint Creek	42.21667	-83.63333
Ypsilanti MS4 - Washtenaw	MIS040015	Paint Creek	--	--
Washtenaw CRC MS4	MIG610314	Paint Creek	--	--
Ypsilanti Township MS4	MIG610037	Paint Creek	--	--
Washtenaw CDC MS4	MIG610039	Paint Creek	--	--
MDOT – Statewide MS4	MI0057364	Statewide	--	--