

Michigan Department of Environmental Quality  
Surface Water Quality Division  
July 2002

Total Maximum Daily Load for Biota  
for Plaster Creek  
Kent County, Michigan

**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, 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 a pollutant to a waterbody based on the relationship between pollutant sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reduction necessary from both point and/or nonpoint sources to maintain and/or restore the quality of their water resources. The purpose of this TMDL is to identify an appropriate reduction in sediment loadings from existing sources in the Plaster Creek Watershed that will result in WQS attainment.

**Problem Statement:** The TMDL reach of the Plaster Creek, a warmwater designated waterbody, is located in Kent County and extends from the Grand River confluence at Market Street upstream to its headwaters located upstream of the community of Dutton (Figure 1). The TMDL reach is about 12 miles in length. It is identified in the year 2002 Section 303(d) report (Creal, W. and J. Wuycheck, 2002) as follows:

**PLASTER CREEK**

WBID# **082806H**

County: KENT

HUC: 4050006

Size: 12 M

Location: Grand River confluence u/s to Dutton Park (Hanna Lake Avenue and 76th Street).

Problem: **Fish and macroinvertebrate communities rated poor; Pathogens (Rule 100).**

**TMDL Year(s): 2002**

RF3RchID: 4050006 10

The pathogen problem has been addressed in a separate TMDL (Thelen, 2002).

The impaired designated uses include aquatic life. Biological assessments of Plaster Creek, since 1977 (Sylvester, 1978), have indicated poor biological communities downstream of Breton Avenue (Figure 1). Using the Great Lakes and Environmental Assessment Section's Procedure 51 (Michigan Department of Environmental Quality (MDEQ), 1997 and 1998), a biological community and habitat quality assessment was conducted during a June 29, 2001 survey of Plaster Creek (Wuycheck, 2002). The macroinvertebrate community continued to be characterized as poor based on scores of -7 and -5 at 68<sup>th</sup> Street and Godfrey Avenue, respectively.

The low scores observed were attributable to impaired habitat quality as affected by elevated siltation and sedimentation that coated and obscured surfaces of larger substrate (e.g., logs, gravel, and cobble) suitable for macroinvertebrate colonization. This condition is commonly referred to as "embeddedness."

Excessive erosion and runoff contribute to elevated runoff volumes and runoff rates resulting in flashy flow conditions. These factors result in stream bank erosion, siltation, and sedimentation of desirable habitat. The June 2001 habitat assessment scores ranged from 38 (fair) at

68<sup>th</sup> Street to 81 (good) at Godfrey Avenue. A habitat score range of 35 to 70 defines a fair rating; however, habitat with scores in the lower end of this range will not support acceptable macroinvertebrate communities. Expectations are that with continued, excessive sediment additions and hydrologic loadings, the impaired reach will continue to not support its warmwater aquatic life designated use. Reductions in runoff rates and sediment loads from controllable upland sources and reduced stream bank erosion are necessary to reduce impacts on the aquatic life.

**Numeric Targets:** The impaired designated use for Plaster Creek is aquatic life. Michigan's WQS require, as a minimum, the protection of a variety of designated uses, including aquatic life (Rule 100 (1)(f) - Other indigenous aquatic life and wildlife). Since the biota in Plaster Creek are impacted due to habitat loss by excessive sedimentation, achievement of WQS for the aquatic life designated use is to be demonstrated via assessments of the integrity of the macroinvertebrate community and habitat quality.

The "primary" numeric targets involve the use of Michigan's biological community and habitat quality assessment Procedure 51. The biota TMDL target is to achieve a macroinvertebrate community with an acceptable, reproducible score equal to or greater than -4. The macroinvertebrate community scores will be evaluated based on a minimum of two Procedure 51 biological assessments conducted in two consecutive years following the implementation of Best Management Practices (BMPs) to minimize sediment loadings to the subject TMDL reach.

A stream habitat quality assessment will also be used. A habitat quality score of 65 (approaching the upper end of the fair habitat score range of 35 to 70) has been established as the target for the habitat quality. This represents a 70% increase over the June 2001 survey's lowest score of 38, which approaches the lower end of the fair habitat score range. The habitat assessment target score of 65 will be used to represent adequate control of anthropogenic sediment sources so as to improve habitat quality and the biological community. This targeted score is closely associated with macroinvertebrate community scores of -3 or greater, providing results better than a minimally acceptable value of -4. This level of conservation is appropriately high enough to minimize both temporal and spatial variability within the watershed and buffer variability within the macroinvertebrate and habitat assessment protocol itself.

A "secondary" numeric target for total suspended solids (TSS) will be used to further assess improvements in Plaster Creek. The secondary target goal is represented by a mean annual, in-stream TSS concentration of 30 milligrams per liter (mg/l). This secondary numeric target may be overridden by achievement of the biological and habitat numeric targets. However, if the TSS numeric target is achieved but the biota or habitat numeric targets are not achieved, then the TSS target may have to be reevaluated. Achievement of the secondary numeric target will help guide proper control over nonpoint sources of excessive suspended solids loadings from runoff, as well as the runoff discharge rates and instantaneous runoff volumes that affect increased stream flow instability, stream bank erosion, and increased suspended solids concentrations.

The mean annual target concentration of 30 mg/l TSS is based on a review of existing conditions and published literature on the effects of TSS. Vohs et al. (1993) indicated that chemically inert suspended solids of 100 mg/l appears to separate those streams with a fish population from those without. The European Inland Fisheries Advisory Commission (EFIAC) stated that, in the absence of other pollution, a fishery would not be harmed at suspended solids concentrations less than 25 mg/l. Good to moderate fisheries can be found at 25 to 80 mg/l suspended solids, good fisheries were unlikely to be found at 80 to 400 mg/l, while only poor fisheries would be found at 400 mg/l (Alabaster, 1972). Decreases were demonstrated in the standing crop of both fish and macroinvertebrates in an area receiving suspended solids loadings of no more than 40 mg/l (Gammon, 1970).

Water quality criteria for suspended solids (finely divided solids) may be represented by the following categories:

Optimum	= $\leq$ 25 mg/l
Good to Moderate	= >25 to 80 mg/l
Less than moderate	= >80 to 400 mg/l
Poor	= >400 mg/l

Based on the available TSS data for Plaster Creek, the TSS annual mean is generally 40 to 50 mg/l. This level is associated with poor biota. Since the TMDL purpose is to restore the biological community to an acceptable condition and attain WQS, a value of 30 mg/l, as a mean annual TSS target, was chosen for Plaster Creek.

Overall, the secondary target of 30 mg/l TSS (as a mean annual value) is intended to evaluate solids loading effects and assist in orienting and focusing corrective actions for source reductions. Additional TSS targets, based on flow related considerations, may be developed as additional data on Plaster Creek becomes available.

**Source Assessment:** A source characterization survey of the subject reach was conducted during the June 29, 2001 biological assessment to better define and document soil erosion sites throughout the riparian zone of the TMDL reach. Visual assessments were made in portions of the 12-mile river reach that extends from the Grand River confluence upstream to 76<sup>th</sup> Street.

From the Grand River confluence, progressing upstream residential, industrial, commercial, and suburban development and, ultimately, agricultural land use dominate the landscape (Figure 2). Development within a watershed alters its hydrologic characteristics (Fonger and Fulcher, 2001). Typically, such development and associated land use modification practices increase rapid precipitation runoff and suspended solids loads to surface waters in a watershed. Substantive reductions in vegetative riparian zones in the upper watershed of Plaster Creek and the extensive use of structural features, including paved impervious surface areas (e.g., roads and parking lots), curb and gutter, and numerous direct storm sewer discharges, dominate portions of the landscape and contribute to rapid precipitation runoff rates to Plaster Creek. This condition fosters stream bank erosion, unstable flow conditions, and sedimentation of desirable habitat in Plaster Creek. Therefore, the nonpoint sources of sediment loadings to Plaster Creek are primarily attributable to periodic erosion and runoff from urban, residential, industrial, commercial, suburban, and farmland dominated land uses in the watershed.

Table 1 provides available information that was used to characterize and estimate Plaster Creek loadings of TSS from nonpoint sources at a point just upstream from the Grand River confluence (Market Street). An estimated TSS loading of about 3,352,525 pounds/year is based on a grand mean TSS concentration of 50 mg/l and a grand mean monthly flow of 22 million gallons per day (mgd) (33 cfs).

Of the permitted sources of TSS to Plaster Creek, 5 are for facilities with individual National Pollutant Discharge Elimination System (NPDES) permits (one of which includes several combined sewer overflows (CSOs)); 11 facilities are covered by general permits; and numerous (104) storm water permits are associated, primarily, with facilities involving industries (Table 2).

Collectively, the 5 facilities with individual NPDES permits have a combined daily maximum allowable discharge volume (design flows) of over 3.5 mgd. Two of the facilities (R.K. Enterprises - MI0002861 and SteelCase Inc./Kentwood - MI0043061) have daily maximum TSS limits of 30 and 50 mg/l, respectively. A worst-case estimate of TSS loadings for these 5 facilities (excluding the Grand Rapids WWTP emergency release Outfall 002) was made

assuming a TSS monthly average concentration of 30 mg/l for all of the facilities (Table 3). The loadings estimate for the R.K. Enterprises facility was estimated using an assumed worst-case discharge of 0.25 mgd since they are authorized to discharge an unspecified volume of discharge. The estimated annual total loading from the 4 facilities is 421,593 pounds.

The 11 facilities with general discharge permits are not required to measure TSS. However, an estimate with an assumed monthly mean of 30 mg/l TSS and a total design discharge (for the 11 facilities) of about 1.17 mgd equals 293 pounds/day or 106,976 pounds/year (Table 3). The sum of estimated TSS loadings from the facilities with the individual NPDES permits and general permits represents 528,560 pounds/year. When compared to nonpoint source loadings, the solids loadings from the individual NPDES permitted sources are a minor source of solids to Plaster Creek. The overall TSS loadings effect on stream conditions from these point sources are lessened also because the discharges are widely distributed throughout the watershed (Figure 3).

Four CSO discharges to Silver Creek Drain (tributary to Plaster Creek) are scheduled to be eliminated as part of the Grand Rapids Phase 1 Municipal Storm Sewer Separation program by the year 2019 and are not considered into the total loadings estimate. The Silver Creek confluence with Plaster Creek is located about 1.25 miles upstream from the Grand River confluence.

In summary, excessive sedimentation of Plaster Creek is primarily associated with elevated levels of soil erosion from land development activities and stream bank erosion due to the erosive effects of excessive runoff rates. Upland development has disrupted the “natural” hydrology of Plaster Creek throughout the watershed resulting in erosive, flashy flows following precipitation/runoff events. These alterations to the Plaster Creek Watershed have destabilized stream banks, increased sediment loadings, and reduced or eliminated desirable fish and macroinvertebrate habitat.

**Linkage Analysis:** A suitable method used to develop a TMDL that addresses the severity of the impacts of sedimentation to a biological community is to measure sediment impacts on stable, colonizable substrates in the stream channel and the associated changes in the biological community.

Increased siltation and embeddedness of colonizable substrates resulting from excessive sedimentation has been demonstrated to impair the biological integrity of rivers (Waters, 1995) by obscuring or reducing the suitability of colonizable or useable substrate by stream biota. With a reduction in sedimentation, the macroinvertebrate community typically responds with an increase in species diversity and an increase in the number of individuals of each species. This commonly results from increased habitat diversity as sedimentation rates decline. As a result, the Procedure 51 assessment scores and ratings for quality of the macroinvertebrate community and habitat are expected to increase as sedimentation rates decline, embeddedness decreases, and habitat diversity increases. These latter characteristics will serve to demonstrate improvement in habitat conditions, WQS attainment, and overall stream quality, as expressed through an acceptably rated biological community.

**TMDL Development:** The TMDL represents the maximum loading that can be assimilated by a waterbody while still achieving WQS. Because the biotic community has been impaired by excessive sedimentation and flow instability, this TMDL will be based on the response of the macroinvertebrate community to the reduction of sedimentation. The TMDL is based on reducing sediment loads throughout the watershed to a level that supports a biological community of the stream that meets WQS. Using the metrics from Procedure 51, a numeric score of -4 for a macroinvertebrate community and a habitat score of 65 will serve as the primary targets for this biota TMDL.

Concurrent with the selection of numeric endpoints, TMDL development also defines the environmental conditions that will be used when defining allowable levels. Some TMDLs are designed around the concept of “critical condition.” A “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 important conditions. For example, the critical conditions for the control of point sources in Michigan are provided in R 323.1082 and 323.1090 of Michigan’s WQS. In general, the lowest monthly 95% exceedance flow for a stream is used to establish effluent limits for point sources. However, the primary sediment inputs to Plaster Creek are attributable to wet weather driven nonpoint source discharges. As such, there are no single condition that is protective for all 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 this TMDL, the monthly mean flows for Plaster Creek were used to develop secondary TSS allocations.

The secondary target of 30 mg/l TSS was used to develop a secondary TMDL loading goal for TSS. Based on this TSS target for Plaster Creek at Market Street and the monthly mean flows and facility flows given in Tables 1 and 3, the secondary TMDL for TSS is 2,540,075 pounds/year.

**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. A margin of safety (MOS), either implicit or explicit, is also a component and accounts for uncertainty in the relationship between pollutant loads and the quality of the receiving waters. Conceptually, this relationship is defined by the equation:

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

The acronym TMDL refers to a maximum loading of a pollutant or stressor that can be discharged to a receiving water and still meet WQS. The overall loading capacity is subsequently allocated into the TMDL components of WLAs for point sources, LAs for nonpoint sources, and the MOS.

**WLA:** The permitted point source loading of TSS to Plaster Creek is estimated at 528,560 pounds/year. This represents approximately 21% of the TSS TMDL for Plaster Creek. This level of loading from the point sources was considered acceptable and was established as the WLA. For point sources, the receiving stream design flow equals the lowest 95% exceedance flow. However, it is proposed that any TSS limits in NPDES permits be established at the target of 30 mg/l, which then makes it unnecessary to consider mixing zone scenarios. The WLA is considered controllable through the existing NPDES permit requirements.

**LA:** The LA defines the loading capacity for a pollutant that is nonpoint in origin, including natural background sources and storm sewers. The nonpoint sources of sediment loadings to Plaster Creek are attributable to erosion and runoff from urban, residential, industrial, commercial, suburban, and farmland dominated land uses in the watershed.

As given above, the TSS TMDL for Plaster Creek equates to 2,540,075 pounds/year. If 21% (528,560 pounds/year) is allocated as the WLA, then 2,011,515 pounds/year is available for the LA. To achieve the LA, a 40% reduction in nonpoint source sediment loading is necessary.

**MOS:** The MOS in a TMDL is used, in part, to account for variability of source inputs to the system and is either implicit or explicit. An MOS is implicit for a biota TMDL because the quality of the biological community, its integrity, and overall composition represent an integration of the effects of the spatial and temporal variability in sediment loadings in the aquatic environment. For comparison of survey assessment results experienced in June 2001, follow-up biological

and habitat assessments will be conducted during the June through August timeframe, during stable flow conditions. The results collected will best reflect an MOS that is implicit and express an integration of the effects of the variability in sediment loadings in the aquatic environment and minimize seasonal variability.

**Seasonality:** Seasonality is addressed in the TMDL in terms of sampling periods for macroinvertebrates. To minimize temporal variability in the biological community, sampling will be conducted during the June through August period each year during stable flow conditions.

**Monitoring Plan:** Monitoring will be conducted by the MDEQ to assess progress towards meeting the biota TMDL targets, following implementation of applicable BMPs and control measures. Subsequently, annual sampling of the macroinvertebrate community and habitat quality at Godfrey Avenue, Eastern Avenue, and 68<sup>th</sup> Street, as a minimum, will be conducted until assessment results from two consecutive years demonstrate attainment of TMDL targets at these sites. For best comparative purposes, follow-up biological and habitat assessments will be conducted in a June to August timeframe, during stable flow conditions. Every effort will be made to sample during similar stream conditions and assess the same sampling locations.

Once the BMPs are in place to minimize the effects of runoff and flashy conditions that exist in Plaster Creek, stream flow and suspended solids sampling can be implemented so as to measure progress towards the secondary numeric target of 30 mg/l as a mean annual TSS value. Multiple sampling during critical high flow events, as well as low flow events, needs to be assessed to better estimate TSS loads in Plaster Creek.

**Reasonable Assurance:** The focus of the actions to protect Plaster Creek is directed towards installing BMPs and other control measures to reduce and minimize nonpoint source sediment loadings and excessive runoff discharge rates to the TMDL reach of Plaster Creek. The former action is to reduce sedimentation impacts, the latter to minimize the erosive effects to the stream. Overall, control measures include: CSO elimination, individual and general NPDES permit limits, storm water permits that include BMPs, and BMPS for areas not under any permit.

For the WLA, existing NPDES permit requirements will be adequate to meet the target.

Storm water permits, pursuant to the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, require the collective units of government within a watershed to develop a watershed management plan that includes the detailing of short- and long-term goals and attainment actions; public education plans; illicit discharge elimination plans; and the development, by each local unit of government within the Plaster Creek Watershed, of their individual storm water prevention plans.

Plaster Creek has an MDEQ approved (November 23, 1999) watershed management plan in accordance with the requirements of the Clean Michigan Initiative (CMI) Nonpoint Source Pollution Control Grants Program (KCDC, 1999). A CMI grant was approved by the MDEQ for two storm water detention basin retrofit construction projects located in the Plaster Creek Watershed: the Wyoming Department of Public Works and the Laraway-Brooklyn detention basins. The contract end date for the retrofitting projects is July 2002. The CMI grant amount was for \$386,100 with local match of \$128,700 (\$514,800 total).

MDEQ district staff will continue to work with and assist interest groups in the Plaster Creek Watershed. The purpose is to assist in defining and designing approvable actions and programs that assess, develop, plan, and implement BMPs and control measures that best minimize or prevent soil erosion and excessive runoff rates to the Plaster Creek Watershed.

The MDEQ's Guidebook of BMPs for Michigan Watersheds (Peterson et al., 1993, as modified) can be used to develop BMP elements that should include:

- Upgrade and maintain the current vegetative riparian zone to reduce soil erosion and loadings to the Plaster Creek from farmland, subdivision, and urban sources. BMPs need to be employed within the riparian zone adjacent to the farmland to minimize the loss, through erosion and direct runoff, thereby minimizing habitat impairment of the Plaster Creek and preserving farmland soils.
- Implementation of BMPs in the storm water permits program that reduce sediment loadings and moderate runoff release rates and excessive runoff to the Plaster Creek Watershed are expected to improve and protect designated use support throughout the watershed. The goals are for reduced solids loadings and greater flow stability throughout the watershed so that WQS are restored and protected. Recent guidance regarding runoff detention and stream protection is provided by Fongers and Fulcher, 2001.

MDEQ approval of BMPs and implementation plans will be required prior to implementation of proposed structural improvements.

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## References:

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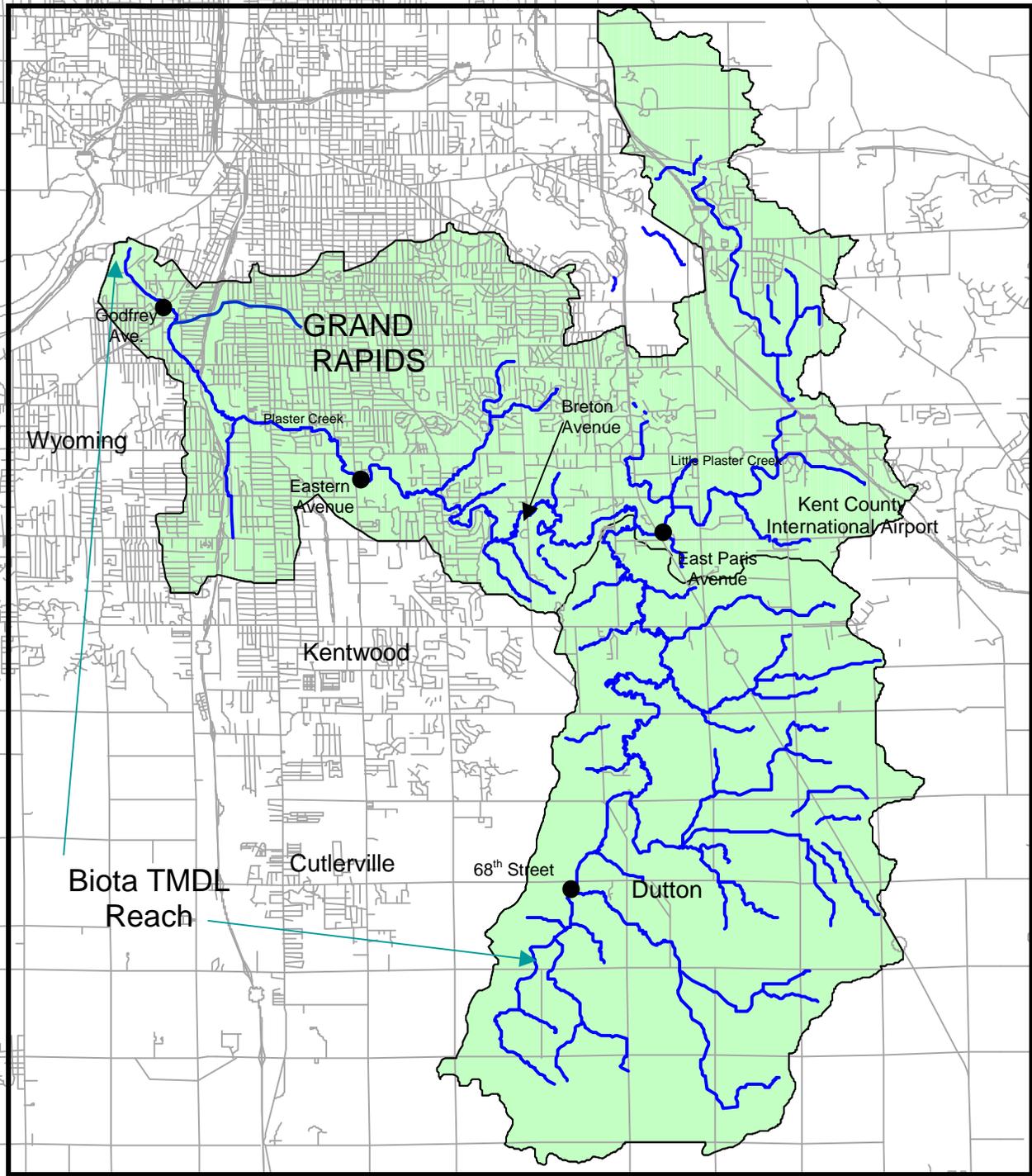


Figure 1. Plaster Creek Watershed, Kent County, Michigan.

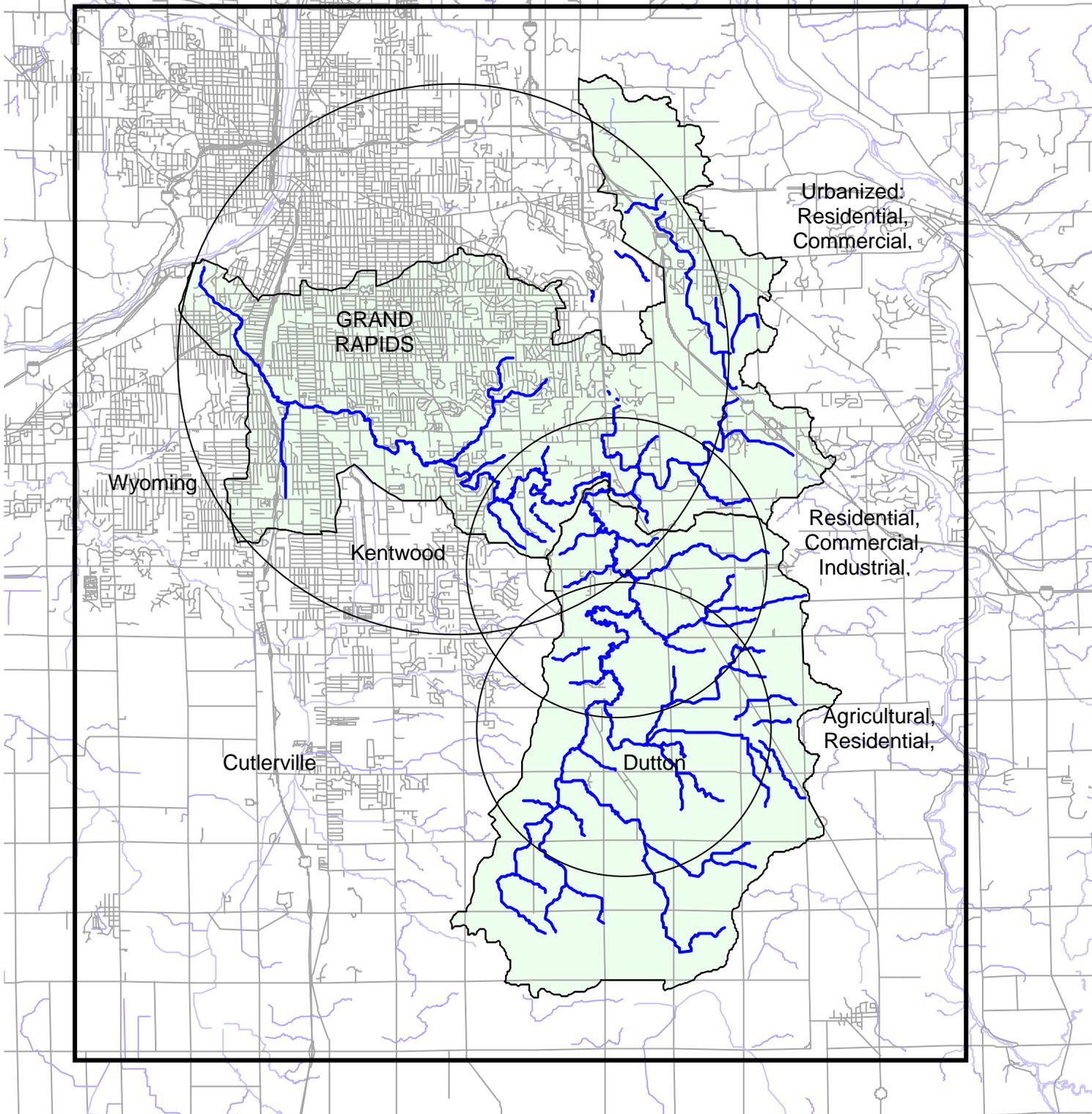


Figure 2. Dominant land use types in the Plaster Creek Watershed.

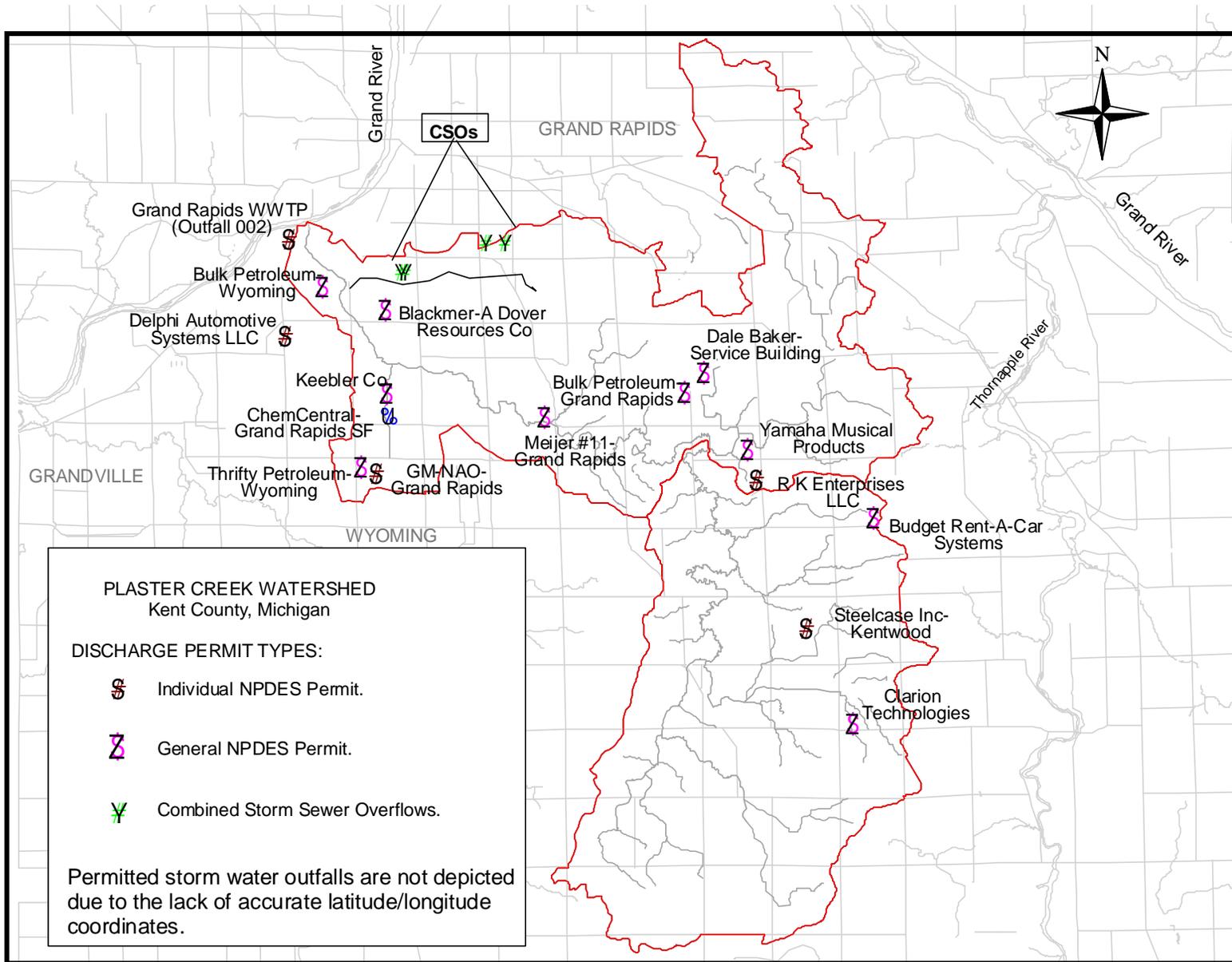


Figure 3. Permitted outfalls in the Plaster Creek Watershed.

Table 1. Plaster Creek suspended solids loadings estimate at Market Avenue (STORET Station 410121).

Month/Year	Monitoring Years/Total Suspended Solids (as mg/l)							Mean	Mean		Grand Mean Annual Estimate (Pounds)
	1970	1973	1974	1975	1979	1980	1992	TSS (mg/l)	Monthly Flow (cfs)	(mgd)	
Jan			12	23				18	33	21	
Feb			35	8				18	34	22	
Mar			30				144	87	63	41	
Apr		7					6	7	62	40	
May		10	364				12	129	39	25	
Jun		16	37				7	20	27	17	
Jul		20	186				76	94	21	14	
Aug	19		8				4	10	18	12	
Sep		32	6			2	9	12	18	12	
Oct		11	103		10			41	22	14	
Nov		5	26					16	29	19	
Dec		148						148	35	23	
							<b>Grand Mean:</b>	<b>50</b>		<b>22</b>	<b>3,352,525*</b>

\* 50 mg/l x 22 mgd x the factor of 8.35 to convert to pounds.

Table 2. Permitted Outfalls to the Plaster Creek Watershed.

Source: MDEQ/SWQD's NPDES Permit Management System (NMS).

PERMIT NUMBER	FACILITY NAME	RECEIVING WATERS
<b>Individual NPDES Permits:</b>		
MI0001236	Delphi Automotive Systems LLC	Plaster Creek
MI0002861	R K Enterprises LLC	Plaster Creek
MI0043061	SteelCase Inc-Kentwood	Plaster Creek
MI0043877	GM-NAO-Grand Rapids	Cole Drain
MI0026069	Grand Rapids WWTP (Emergency Outfall 002)	Plaster Creek/Silver Creek Drain
	Ionia Avenue and Stevens Street CSO	Silver Creek Drain
	Alexander Street and Cooper Avenue CSO	Silver Creek Drain
	Alexander Street and Kalamazoo Avenue CSO	Silver Creek Drain
	Stevens Street at Railroad Crossing CSO	Silver Creek Drain
<b>General Permits:</b>		
MIG080036	Thrifty Petroleum-Wyoming	Plaster Creek
MIG080083	Meijer #11-Grand Rapids	Ken-O-Sha Creek
MIG080115	Bulk Petroleum-Wyoming	Plaster Creek
MIG080172	J & H Oil Co-Wyoming	Plaster Creek
MIG080422	Budget Rent-A-Car Systems	unnamed tributary to Plaster Creek
MIG080985	Bulk Petroleum-Grand Rapids	Whiskey Creek
MIG081003	Dale Baker-Service Building	Whiskey Creek
MIG250151	Keebler Co	Plaster Creek
MIG250152	Blackmer-A Dover Resources Co	Plaster Creek
MIG250156	Clarion Technologies	Plaster Creek
MIG250271	Yamaha Musical Products	Little Plaster Creek
<b>Substantive Requirements Document:</b>		
MIU990004	ChemCentral-Grand Rapids SF	Cole Drain
<b>Storm Water Permits:</b>		
MIR20G102	River City Metal Products	Plaster Creek
MI0053937	MDOT - Grand Rapids - MS4	Plaster Creek
MI0053872	Grand Rapids - MS4	Plaster Creek
MIS110038	Burton St Recycling-Supply Co	Plaster Creek
MIS110041	Midwest Bumper Co	Silver Creek
MIS110042	Grand Rapids Plastics-4220 RBC	Plaster Creek
MIS110052	Thompson-McCully Co-Market Co	Plaster Creek
MIS110057	Kentwood Packaging-Powder	Plaster Creek
MIS110118	Mitco Inc	Plaster Creek
MIS110129	P & K Steel Service Inc	Plaster Creek
MIS110137	Grand Rapids Carvers Inc	Plaster Creek
MIS110283	Wamar Products Inc	Plaster Creek
MIS110294	Tabletting Inc	Plaster Creek
MIS110296	Starcade Inc	Plaster Creek
MIS110297	State Heat Treat-Grand Rapids	Plaster Creek
MIS110299	Stagood-Metal Components Inc	Plaster Creek
MIS110347	USPS-Wyoming	Plaster Creek
MIS110352	Stephenson & Lawyer-GR	Plaster Creek
MIS110365	Schupan & Sons Inc-Recycling	Plaster Creek
MIS110366	Conway Central Express-Kentwood	Plaster Creek
MIS110486	Riviera Tool Company	Plaster Creek
MIS110487	Reliance Finishing Co	Plaster Creek

Table 2 (continued).

<b>PERMIT NUMBER</b>	<b>FACILITY NAME</b>	<b>RECEIVING WATERS</b>
MIS110488	Rapid Die & Engineering	Plaster Creek
MIS110491	Price Industries Inc	Plaster Creek
MIS110497	Lacks-Brockton Mold	Plaster Creek
MIS110504	Michigan Packaging Co	Little Plaster Creek
MIS110505	Michigan Colprovia	Plaster Creek
MIS110506	Mich Cert Con-Grand Rapids	Plaster Creek
MIS110508	Consolidated Rail Corporation	Plaster Creek
MIS110515	Lake Mich Packaging Products	Plaster Creek
MIS110526	Lily Products of Mich	Plaster Creek
MIS110527	Knoll Inc-Grand Rapids	Plaster Creek
MIS110529	Kentwood Manufacturing Co	Plaster Creek
MIS110530	Key Plastics Inc-GR	Plaster Creek
MIS110538	Hill Machinery Co Inc	Plaster Creek
MIS110553	BF Goodrich Avionics Sys Inc	Plaster Creek
MIS110563	Christopher Metal Fabricating	Plaster Creek
MIS110568	Die Dimensions Corp	Plaster Creek
MIS110569	Blackmer-A Dover Resources Co	Plaster Creek
MIS110570	Cascade Engineering 5141-36	Little Plaster Creek
MIS110572	Helen Inc-Envir Coatings	Plaster Creek
MIS110573	Country Fresh Inc	Plaster Creek
MIS110574	Dyna Plate Inc	Plaster Creek
MIS110577	Hi Tec Laser Die-J-Tec Prod	Plaster Creek
MIS110578	Imperial Sheet Metal	Plaster Creek
MIS110581	Keebler Co	Plaster Creek
MIS110583	Consolidated Metal Prdts Inc	Silver Creek Drain
MIS110585	Consumers Concrete-15	Plaster Creek
MIS110586	CSX Transport-Wyoming Yard	Plaster Creek
MIS110591	Lacks Ent-Plastic Plate 2	Plaster Creek
MIS110592	Lacks Ent-52nd-Paint East	Plaster Creek
MIS110593	Lacks Ent-52nd-Paint West	Plaster Creek
MIS110594	Lacks Ent-Barden Assembly	Plaster Creek
MIS110595	Lacks Ent-52nd Mold	Plaster Creek
MIS110596	Lacks Ent-Airlane Plant	Plaster Creek
MIS110597	Lacks Ent-Distribution Center	Plaster Creek
MIS110599	Interface AR-32nd Street	Whiskey Creek
MIS110601	Meridian Auto-GR-Plt 1	Plaster Creek
MIS110602	Meridian Auto-GR-Plt 4 & 5	Plaster Creek
MIS110603	Meridian Auto-GR-Plt 7	Plaster Creek
MIS110607	Allied Finishing Inc	Plaster Creek
MIS110613	American Litho-Inc	Plaster Creek
MIS110616	Adac Plastics Inc-GR	Plaster Creek
MIS110618	Autocam Corporation	Plaster Creek
MIS110621	Advance Packaging Corp	Plaster Creek
MIS110626	Amerikam	Plaster Creek
MIS110630	A & K Finishing-Danvers	Plaster Creek
MIS110631	A & K Finishing-Donker	Plaster Creek
MIS110658	Electro Chem Finish Co-44th	Plaster Creek
MIS110660	Detroit Diesel Remanufacturing	Plaster Creek
MIS110673	Smith Industries Inc-Patterson	Plaster Creek
MIS110703	MC Van Kampen Trucking	Plaster Creek
MIS110707	Modular Transportation-Mart	Plaster Creek

Table 2 (continued).

<b>PERMIT NUMBER</b>	<b>FACILITY NAME</b>	<b>RECEIVING WATERS</b>
MIS110709	Lacks Ent-Airwest Mold	Plaster Creek
MIS110751	Venture Grand Rapids	Plaster Creek
MIS110778	Reliance Plastisol Coating Co	Plaster Creek
MIS110802	Diecraft-GR	Plaster Creek
MIS110818	Paladin Ind Inc	Plaster Creek
MIS110820	Parker Motor Freight Inc	Plaster Creek
MIS110823	Team Industries	Plaster Creek
MIS110825	Fki Indust-Keeler Die Cast	Silver Creek Drain
MIS110827	Plastic Mold Technology Inc	Plaster Creek
MIS110829	Yamaha Musical Products	Little Plaster Creek
MIS110840	M & E Manufacturing	Plaster Creek
MIS110848	Grand Rapids Plastics-4050 RBC	Plaster Creek
MIS110850	MacDonalds Ind-44th St	Plaster Creek
MIS110894	American Metal & Plastics	Plaster Creek
MIS110945	Master Finish Company	Plaster Creek
MIS111015	Development-GR	Plaster Creek
MIS111017	Dieline-GR	Plaster Creek
MIS111028	Magic Finishing Company	Plaster Creek
MIS111048	Bishop Distributing Co	Plaster Creek
MIS111058	Eerdmans Printing Co	Plaster Creek
MIS111078	Steeltech Ltd	Silver Creek Drain
MIS111080	Davidson Plyforms Inc	Plaster Creek
MIS111104	Towne Air Freight Inc	Plaster Creek
MIS111105	Beverlin Manufacturing Corp	Plaster Creek
MIS111106	Cascade Engineering 4950-37	Little Plaster Creek
MIS111110	Magna-Lakeland	Plaster Creek
MIS111111	CSX Transport-BIDS GR	Plaster Creek
MIS111119	Federal Express-GRRA	Plaster Creek
MIS111137	Michigan Wheel Corp	Plaster Creek
MIS111190	Lacks Airplane Campus	Plaster Creek
MIS111191	Lacks Brockton Campus	Plaster Creek
MIS111192	Lacks 52nd Campus	Plaster Creek
MIS111193	Lacks Barden Campus	Plaster Creek

Table 3. Individual and general NPDES permitted facilities in the Plaster Creek Watershed and estimated loadings of total suspended solids.

Permit No.	Facility Name	Design Flow (mgd)	Mean TSS* (mg/l)	Daily Load (Pounds)	Annual Load (Pounds)
MI0002861	R.K. Enterprises	0.025	30	6	2285
MI0043061	SteelCase Inc. – Kentwood	0.25*	30	63	22856
MI0043877	GM – NAO – Grand Rapids	0.836	30	209	76438
MI0026069	Grand Rapids WWTP (Emergency Outfall 002)	NA	NA	-	-
MI0001236	Delphi Automotive Systems LLC	3.5	30	877	320014
				Total:	<b>421,593</b>
MIG080036	THRIFTY PETROLEUM-WYOMING	0.14	30	36	13166
MIG080083	MEIJER #11-GRAND RAPIDS	0.03	30	7	2633
MIG080115	BULK PETROLEUM-WYOMING	0.01	30	2	658
MIG080172	J & H OIL CO-WYOMING	0.14	30	36	13166
MIG080422	BUDGET RENT-A-CAR SYSTEMS	0.01	30	2	658
MIG080985	BULK PETROLEUM-GRAND RAPIDS	0.01	30	4	1317
MIG081003	DALE BAKER-SERVICE BUILDING	0.01	30	2	731
MIG250151	KEEBLER CO	0.70	30	175	64003
MIG250152	BLACKMER-A DOVER RESOURCES CO	0.004	30	1	357
MIG250156	WAMAR PRODUCTS INC	0.002	30	1	219
MIG250271	YAMAHA MUSICAL PRODUCTS	0.11	30	28	10058
				Total:	<b>106,967</b>
				Grand Total:	<b>528,560</b>

\* Assumed worst case discharge flow or TSS concentration, NA = not applicable.