Michigan Department of Environmental Quality
Water Bureau
August 2007

Total Maximum Daily Load for Macroinvertebrate Communities for Brownstown Creek and Blakely Drain – Marsh Creek Wayne 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, 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 appropriate actions to achieve the biological (macroinvertebrate) community targets, specifically through reduction in sediment loadings from sources in the Blakely Drain watershed, thereby addressing in-stream habitat loss and hydrologic changes that will result in WQS attainment. Two separate Section 303(d) listings for poor macroinvertebrate communities appear in the Blakely Drain watershed (explained below); both are addressed herein due to their proximity and the similarity in both their TMDL goals and the impacts on those listed reaches.

PROBLEM STATEMENT

The 2006 Section 303(d) listed reaches for the Blakely Drain watershed total approximately 21 miles and include Brownstown Creek (7 miles) and Blakely Drain – Marsh Creek including Hale Drain (14 miles) in Wayne County in southeastern Michigan.

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

Brownstown Creek WBID#: **061301A**
County: Wayne HUC: 04090004 Size: 7M
Location: Detroit River confluence u/s to Telegraph Rd.
NHD Reach Code: 04090004000719
Problem Summary: Macroinvertebrate community rated poor
TMDL YEAR(s): 2007

Brownstown Creek was placed on the 2006 Section 303(d) list due to poor macroinvertebrate communities throughout the watershed. Monitoring in 2006 found poor macroinvertebrate communities at two of four sites sampled in the TMDL reach (Figure 1) (Goodwin [*in draft*], 2007). Monitoring in 2001 found poor macroinvertebrate communities at three of three sites in the TMDL reach (Figure 2) (Goodwin, 2002).

The TMDL reach for Blakely Drain – Marsh Creek appears on the Section 303(d) list as:

Blakely Drain – Marsh Creek WBID#: **061301B**
County: Wayne HUC: 04090004 Size: 14M
Location: Brownstown Creek confluence u/s (including Hale Creek and Excluding Blakely Drain u/s of Hale Creek confluence).

NHD Reach Code: 04090004000102
Problem Summary: Macroinvertebrate community rated poor
TMDL YEAR(s): 2007

Blakely Drain – Marsh Creek was placed on the 2006 Section 303(d) list due to poor macroinvertebrate communities throughout the watershed. Monitoring in 2006 found poor macroinvertebrate communities at eight of nine sites sampled in the TMDL reach (Figure 1) (Goodwin [*in draft*], 2007). Monitoring in 2001 found poor macroinvertebrate communities at three of five sites in the TMDL reach (Figure 2) (Goodwin, 2002).

Blakely Drain – Marsh Creek and its major tributary, Brownstown Creek, comprise the Blakely Drain watershed (Figure 3); one of three subwatersheds that make up the Combined Downriver watershed (Figure 4). The Combined Downriver watershed is located within Wayne County, in southeast Michigan. Frank and Poet Drain, Blakely Drain, and Brownstown Creek are the three primary water courses within the watershed. The watershed drains an area of approximately 85.9 square miles in a relatively urbanized region, including a portion of the Detroit Metropolitan Airport in the headwater region of the Frank and Poet Drain (Combined Downriver Watershed Inter-Municipality Committee [CDWIC], 2004). The Combined Downriver watershed borders the Ecorse Creek watershed to the north, the Lower Huron watershed to the south and west, and the Detroit River to the east.

The Blakely Drain watershed drains approximately 32 square miles and flows through both the Southern Michigan - Northern Indiana Till Plain, and Huron - Erie Lake Plain ecoregions (Omernik and Gallant, 1988) in southeast Michigan. Soils in the watershed are generally poorly drained and are moderately fine to fine textured with the headwaters being moderately fine to course in texture. Clay and silt dominated soils, such as those found in the watershed, exhibit low permeability and percolation rates, further exacerbating the effects of urbanization on flow regimes.

NUMERIC TARGET

The impaired designated use addressed by this TMDL for the Blakely Drain watershed is associated with the macroinvertebrate communities found in these reaches. The designated use rule (R 323.1100 of the Part 4 rules, WQS, promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, (NREPA)) requires the protection of, among other uses and specific to this TMDL, indigenous aquatic life (R 323.1100(1)(e)).

The primary numeric target is based on the Procedure 51 biological community assessment protocol (MDEQ, 1990). Macroinvertebrate communities can rate poor, acceptable, or excellent based on the total score of nine individual metrics. Individual metrics (such as total number of taxa, percent mayfly composition, percent surface dependant taxa, etc.) are scored -1, 0, or +1 based on how they compare to excellent sites in each of Michigan's ecoregions. Macroinvertebrate communities at a site can therefore have a total score that ranges from -9 to +9. Scores of +5 or higher are classified as excellent, and scores of -5 or lower are classified as poor. Acceptable sites, those streams meeting WQS, are scored between excellent and poor, in the range of +4 to -4 (MDEQ, 1996)

The TMDL target is the reestablishment of macroinvertebrate communities that, when monitored using Procedure 51, result in a consistent acceptable or excellent rating. Macroinvertebrate communities will be evaluated based on a minimum of two Procedure 51 biological assessments conducted in successive years, following the implementation of efforts like Best Management Practices (BMPs) to stabilize runoff discharges and extremes in stream flow conditions, and minimize sediment loadings to the watershed.

A secondary numeric target based on Total Suspended Solids (TSS) concentration will be used to assess improvements in the Blakely Drain watershed. This secondary target is a mean annual in-stream TSS concentration of 80 milligrams per liter (mg/L) for wet weather events. Achievement of the biological target will override this secondary target; however, if the TSS target is met, but the biological target not achieved, then the TSS target may be reevaluated.

The secondary numeric target is intended to help guide proper control over excessive suspended solids loads from runoff, as well as excessive runoff discharge rates and volumes that cause increased stream flow instability, stream bank erosion, and increased suspended solids concentrations. The secondary numeric target is intended to link a measurable in-stream parameter to the hydrologic changes in the watershed and the resultant habitat changes that are heavily impacting the biological communities in this system.

The mean annual target concentration of 80 mg/L TSS is based on a review of existing conditions and published literature on the effects of TSS to aquatic life. Vohs et al., (1993) indicated that a chemically inert suspended solids concentration of 100 mg/L appears to separate those streams with a fish population from those without. Gammon (1970) demonstrated decreases in the standing crop of both fishes and macroinvertebrates in river reaches continuously receiving suspended solids loadings of less than 40 mg/L. The European Inland Fisheries Advisory Commission (EIFAC) stated that, in the absence of other pollution, a fishery would not be harmed at suspended solids concentrations less than 25 mg/L (EIFAC, 1980).

Alabaster and Lloyd (1982) provided the following water quality goals for suspended solids for the protection of fish communities:

Optimum	=	< 25 mg/L
Good to Moderate	=	> 25 to 80 mg/L
Less than Moderate	=	> 80 to 400 mg/L
Poor	=	> 400 mg/L

Because the purpose of this TMDL is to identify possible steps to restore the biological community to an acceptable condition, thereby working toward attaining WQS, a value of 80 mg/L as a mean annual target for wet weather events was chosen for the Blakely Drain watershed as a secondary target.

DATA DISCUSSION

Biological surveys conducted in the Blakely Drain watershed indicate that the macroinvertebrate communities are not meeting biological integrity requirements of the Michigan WQS (Goodwin, 2002; Goodwin [*in draft*], 2007).

Biological surveys conducted in 2001 in the Blakely Drain watershed indicated that the macroinvertebrate community rated poor at 8 of 10 stations (Goodwin, 2002). Habitat conditions for 1 station rated poor while 12 others in the watershed rated fair. Biological surveys conducted in 2006 in the Blakely Drain watershed indicated that the macroinvertebrate community rated poor at 10 of 13 stations (Goodwin [*in draft*], 2007). One site on Brownstown Creek (at Hall Road) showed improvement in the macroinvertebrate community from 2001 to 2006 while all other repeated sites continued to score poor. Habitat conditions for 1 station rated good while 12 others rated marginal in 2006.

In each assessment, habitat conditions indicated a lack of hard, heterogeneous substrate and habitat suitable for fish and macroinvertebrate colonization, while the existing stable habitat is heavily silted. In addition, flow stability scores in the surveyed reaches indicated a relatively

flashy hydrologic regime, likely due to heavy suburban development and the resultant increased storm water runoff volume and delivery rate.

In 2005, dry and wet weather monitoring were conducted by RTI International and Environmental Consulting & Technology, Inc (RTI). TSS and stream flow monitoring were conducted at three stations in the Blakely Drain watershed. The dry weather TSS monitoring was conducted on three dates (June 21, 2005, July 12, 2005, and August 23, 2005) to determine base flow conditions and TSS concentrations and loads during stable flow conditions (Table 1).

To characterize stream flow and the associated TSS response during wet weather, event monitoring was conducted at three stations from July to September 2005 during five 24-hour precipitation accumulation events (Table 2). These data indicate that precipitation events in the watershed can substantially increase the amount of TSS in transport in the Blakely Drain watershed. Substantial flow responses are also indicated from precipitation events. The USEPA Method 106.2 was used to measure the TSS values gravimetrically as described in the Quality Assurance Project Plan for Total Suspended Solids and Flow Monitoring in Five Tributaries in the Rouge and Detroit River, dated May 5, 2005 (RTI, 2006). One laboratory blank and one duplicate were analyzed for every 20 grab samples. A more thorough discussion of sampling procedures, analytical methods, and results can be found in RTI (2006).

SOURCE ASSESSMENT

The 2006 Section 303(d) listed reaches for the Blakely Drain watershed total approximately 21 miles and include Brownstown Creek (7 miles) and Blakely Drain – Marsh Creek including Hale Drain (14 miles) in Wayne County in southeastern Michigan.

Land use in the watershed is becoming increasingly urbanized as the population increases and spreads further from more established population centers. The types of urban and suburban development found in the Blakely Drain watershed have dramatic effects on surface waters in terms of altered runoff patterns, increased flashiness/changed hydrologic response curve, increased suspended solids loading, and shifts in temperature characteristics among other effects. The loss of adequately vegetated riparian zone throughout the watershed combined with substantial land coverage by surfaces impervious to precipitation (roads, parking lots, roof tops) and a curb, gutter, and storm drain system combine to produce rapid runoff rates. This efficient movement of water directly to the stream channel results in unstable and flashy flow conditions, stream bank erosion, and sedimentation of in-stream habitats by new TSS loadings and resuspension of sediments previously deposited in the system. Resuspension and deposition of sediment may also be considered a source to down-gradient locations (USEPA, 2007).

The Michigan Department of Environmental Quality (MDEQ), Water Bureau's National Pollutant Discharge Elimination System (NPDES) permit Management System (NMS) found the following permitted discharges in the Blakely Drain watershed (Appendix A): 14 industrial storm water Certificates of Coverage (COCs) under general permit MIS319000, 7 Municipal Separate Storm Sewer System Phase II (MS4) COCs under the MS4 general watershed permit (number MIG619000), 1 individual MS4 permit (Michigan Department of Transportation [MDOT]), and 63 active or pending Notices of Coverage (NOCs) for construction site stormwater runoff under Permit-by-Rule (NMS, 2007). There are no Concentrated Animal Feeding Operation permitted discharges within the Blakely Drain watershed.

Estimation of the annual TSS loads in the Blakely Drain watershed from the various land use categories involved using the estimated acreage of each land use category based on the year 2000 land use imagery (Southeast Michigan Council of Governments [SEMCOG], 2006), a mean annual rainfall estimate of 33 inches, and the USEPA's PLOAD Simple Method model

approach (USEPA, 2001). These assumptions were used with the TSS loading factors developed for the Rouge River watershed from the Rouge River National Wet Weather Demonstration Project (Cave et al., 1994).

The estimated total current TSS load from both point and nonpoint sources in the Blakely Drain watershed is 10,478 pounds per day (lbs/day) (Table 3). Development of this load is described further in the Loading Capacity Development section of this TMDL.

LINKAGE ANALYSIS

Excessive sedimentation has repeatedly been identified as the leading cause of impairment of the Nation's waters, which include rivers, streams, lakes, reservoirs, ponds, and estuaries. In 1998, approximately 40 percent of assessed river miles in the United States were impaired or threatened from an imbalanced sediment supply (USEPA, 2000). In appropriate amounts, sediments (both suspended and bedded) are essential to aquatic ecosystems. Natural levels transport nutrients, detritus, and other essential organic matter throughout aquatic environments and replenish intermittently mobile bottom sediments and create valuable micro-habitats, such as pools and sand bars (USEPA, 2006). The effects of excessive sediments on aquatic biota can range in severity from no effects to behavioral effects (e.g., invertebrate drift, fish relocation, and impaired ingestion rates in mussels) to lethal effects (USEPA, 2006). Further, sedimentation of benthic substrates has been shown to decrease substrate heterogeneity, increase embeddedness, and alter benthic community structure and species diversity (Waters, 1995). Sediments may also have associated stressors such as nutrients, pesticides, and other bound toxins that further stress aquatic organisms.

Human activities that increase soil erosion or alter rates of sediment transport in waterways (e.g., forestry, mining, urban development, industrial activities, agriculture, dredging, channel alteration, and dam construction) are among the most pervasive causes of sediment imbalance in aquatic systems (Waters, 1995; Nietch et al., 2005; USEPA, 2006). Altered hydrology, or more specifically, increased flashiness due to increased runoff rates and volume, in the Blakely Drain watershed has been identified as the cause for the lack of stable in-stream habitat, increased in-stream erosion, channel aggradation, and heavy siltation of stable in-stream habitats (Goodwin, 2002; Edly and Wuycheck, 2006; Goodwin [*in draft*], 2007).

Therefore, reducing TSS loads in the Blakely Drain watershed, along with the commensurate decrease in flow volume and rate, should increase macroinvertebrate community diversity and abundance, thus providing a tangible target towards meeting WQS.

LOADING CAPACITY (LC) DEVELOPMENT

Concurrent with the selection of numeric targets, development of the LC requires identification of the critical conditions. The "critical condition" is the set of environmental conditions (e.g., flow) used in developing the TMDL that result in attaining WQS and with an acceptably low frequency of occurrence that, if protected for, should also be protective of other more frequent occurrences. The critical conditions for the applicability of WQS in Michigan are given in Rule 90 (R 323.1090), Applicability of WQS. R 323.1090 requires that the WQS apply at all flows equal to or exceeding the water body design flow, generally the lowest of the 12 monthly 95 percent exceedance flows (the stream flow equal to or exceeded 95 percent of the time). However, the habitat degradation and poor biological communities in the Blakely Drain watershed are linked to the excessive flows attributable to wet weather driven discharges. Because the numeric target of 80 mg/L TSS is aimed at wet weather discharge conditions, and because elevated TSS concentrations are most typically associated with wet weather flows in the Blakely Drain watershed, it is expected that this target concentration will be met under lower flow conditions as well.

LC

The LC is 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 LC 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:

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

The LC represents the maximum loading that can be assimilated by the receiving water while still achieving WQS. The overall LC is subsequently allocated into WLAs for point sources, LAs for nonpoint sources, and the MOS.

WLAs

Queries of the MDEQ's NMS database yielded one individual NPDES permitted facility in the Blakely Drain watershed; the MDOT statewide stormwater permit (NMS, 2007). Based on assumptions of 468 acres of roadways addressed by the MDOT permit within the Blakely Drain watershed, and an expected TSS concentration of 141 mg/L in roadway runoff, a TSS load of approximately 363 lbs/day was allocated to the MDOT permit, a reduction of 43 percent (Table 3).

All residential, urban open, commercial and industrial land use categories are covered under NPDES general industrial and municipal storm water permits or Permits-by-Rule. In accordance with USEPA guidelines regarding NPDES land use runoff, runoff from these uses will be considered in the WLA portion of this TMDL. Based on land use distribution from SEMCOG (2006) and TSS export coefficients derived from the Rouge River Storm Water Demonstration Project (Cave et al., 1994), a current total load estimate of approximately 9,525 lbs/day is attributable to these sources.

No reductions are specified for the urban open, medium density residential and commercial land uses because the modeled runoff concentrations of TSS are typically less than the 80 mg/L numeric target (Cave et al., 1994). The targeted source load reductions are from the high density residential and industrial land uses (Table 3), which have estimated average runoff TSS concentrations of 97 and 149 mg/L, respectively (Cave et al., 1994). To achieve the goal of 80 mg/L as an annual average during wet weather runoff events from all point sources, a reduction of 17 percent (from 414 to 342 lbs/day) from high density residential, 46 percent (from 5,670 to 3,044 lbs/day) from industrial sources, will result in a projected WLA target load of 6,551 lbs/day of TSS, an overall 31 percent reduction in loads from regulated point sources (Table 3).

LAs

The LA component of the TMDL defines the fraction of the LC for TSS from nonpoint sources including the following land use categories: forested/rural open, water/wetlands, and agriculture (Table 3). An estimated annual TSS load of 953 lbs/day is attributed to these categories in the Blakely Drain watershed. The forest/rural open and water/wetland land uses are treated as background loading sources because the modeled runoff concentrations of TSS are typically less than the 80 mg/L numeric target. The only targeted source load reduction is from the agricultural land use, which has an estimated average runoff TSS concentration of 145 mg/L (Cave et al., 1994). A 45 percent reduction (from 472 to 260 lbs/day) from agricultural areas in the watershed is recommended resulting in an LA TSS target of 741 lbs/day, based on achieving a mean annual runoff concentration of 80 mg/L TSS during wet weather events.

MOS

The MOS in a TMDL is used, in part, to account for variability in source inputs to the system and is either implicit or explicit. A MOS is implicit in a biota TMDL because the quality of the biological community, its integrity, and overall composition represent an integration of the effects of spatial and temporal variability in sediment loads to the aquatic environment. Ultimately, it is the reflection by the biological community, signified by an acceptable or higher rating using Procedure 51, which is the goal of this TMDL, thereby providing an MOS for the numeric TSS goal. Follow-up biological and habitat quality assessments will be conducted to determine the progress in attaining the TMDL goals and will reflect this integration. Additionally, the goal of 80 mg/L TSS for a mean annual runoff concentration integrates a MOS because it is based on literature values from longer-term exposure concentrations versus the wet weather event-driven target used herein.

In summary, the proposed total annual TSS target load in the Blakely Drain watershed (WLA + LA) is 7,291 pounds/day, an overall 30 percent reduction from existing estimated loads.

To achieve the secondary numeric TMDL target of 80 mg/L mean annual TSS concentration during wet weather events, and thereby address the primary target of biological communities increasing in quality, a reduction in the wet weather runoff of TSS is necessary. It is likely that steps will need to be taken to control runoff rates and volumes during precipitation events. It may be necessary to employ BMPs to attenuate the runoff delivery rates and volume to reduce flashiness, TSS resuspension, and excessive siltation/sedimentation that impacts habitat quality, and therefore biological integrity, throughout the Blakely Drain watershed.

SEASONALITY

Seasonality is addressed in this TMDL through specified sampling periods for fish and macroinvertebrate communities. To minimize temporal variability in the biological community, sampling will be conducted between June and September during stable, low flow conditions, following Procedure 51. These summer conditions are particularly critical because dilution of pollutants is minimal and stream temperatures are elevated, which may affect dissolved oxygen fluctuations and increase metabolic rates of the biota, providing additional stress on these in-stream organisms. Support of the designated uses using these biological indicators further addresses seasonality by their presence in the aquatic environment over their entire (or large portions of) life cycles, thereby being reflective of seasonal shifts in the condition of the water body.

For assessing progress in reducing TSS loading to the Blakely Drain watershed, seasonal event monitoring will be conducted, if necessary, once source control measures are in place, to better define and characterize TSS loading and the associated hydrologic pattern that influences the biota in the TMDL reaches.

MONITORING

Monitoring will be conducted by the MDEQ to assess progress toward meeting the TMDL target following implementation of applicable BMPs and control measures. Follow-up biological assessments will be conducted from June through September and under stable, low flow conditions, following Procedure 51 (MDEQ, 1990). Additionally, the Brownstown Creek and Blakely Drain – Marsh Creek watershed will continue to be monitored on a five-year rotating basis and the information from those surveys will be used to assess the condition of the biological communities as well.

In-stream monitoring of TSS concentrations may be conducted, if necessary, to augment ongoing local monitoring efforts. This type of information will be used in determining whether the secondary TSS target is met.

REASONABLE ASSURANCE ACTIVITIES

There are currently 63 active or pending NOCs under Permits-by-Rule for construction activities of five acres or more issued by the MDEQ in the Blakely Drain watershed. The MDEQ currently utilizes Permit-by-Rule for NPDES authorization of these sites. Construction activities of five acres or more, with a point source discharge to waters of the state, are required to submit an NOC to obtain coverage under Permits-by-Rule. Prior to submitting the NOC, a Soil Erosion and Sedimentation Control (SESC) permit must be obtained.

Regulated construction activities that disturb one to five acres are not required to submit an NOC. These sites have automatic coverage under Permits-by-Rule if they have obtained coverage under the SESC program, in accordance with Part 91, SESC, of the NREPA. The land owner or easement holder must comply with the requirements of the Permit-by-Rule. Therefore, the owner or easement holder is required to provide for weekly inspections of the SESC practices identified in their SESC permit. In addition, the site should be inspected after major rain events that may cause a discharge from the site. These inspections should be conducted by, and recorded in, inspection logs by a storm water operator who is trained and certified by the MDEQ (MDEQ, 2007).

With regard to the MDOT's statewide MS4 permit (MI0057364), the permit requires that the MDOT shall develop, implement, and enforce storm water management programs designed to reduce the discharge of pollutants from the MDOT drainage systems in the state of Michigan to the Maximum Extent Practicable, to protect the designated uses of the waters of the state, to protect water quality, and to satisfy the appropriate state and federal water quality requirements. If a water body has a TMDL established by the MDEQ for a particular pollutant, the Maximum Extent Practicable includes the development, implementation, and enforcement of storm water controls designed to meet the responsibilities established by the TMDL. Storm water management programs require implementation of BMPs to comply with the minimum measures identified in the permit and any TMDLs if applicable.

In order to comply with their MS4 permits (MIG619000), the municipalities in the Blakely Drain watershed (as listed in Appendix A), in conjunction with other permittees in the Combined Downriver watershed, are required to submit a joint Public Participation Process and a joint Watershed Management Plan. The permittees are also required to submit a Storm Water Pollution Prevention Initiative and Implementation schedule.

In 2003, the CDWIC was formed to facilitate the implementation of the requirements of the state of Michigan General Permit (MIG619000) for Phase II MS4s subject to watershed plan requirements. Some of these requirements include: public education and outreach, illicit discharge detection and elimination, construction site runoff control, and pollution prevention and good housekeeping. Thirteen communities and entities developed the watershed management plan (Combined Downriver Watershed Management Plan) as required by the general permit. The final revised watershed management plan was submitted to the MDEQ on May 12, 2006. The Blakely Drain watershed is part of the Combined Downriver Watershed Management Plan.

The Alliance of Downriver Watersheds, a new organization proposed under the Watershed Alliance legislation (Public Act 517 of the Public Laws of 2004), is composed of the public agencies in the Combined Downriver watershed and the Ecorse Creek and Lower Huron River watersheds. The purpose of this organization is to facilitate the implementation of the

management plans recently developed for each watershed, including the Blakely Drain watershed.

As part of the Combined Downriver Watershed Management Plan, 54 road-stream crossing sites in the Blakely Drain watershed were assessed using the MDEQ's Stream Crossing Watershed Survey Procedure. Where possible, the data collected included background information, river substrate, river morphology, physical appearance, instream cover, stream corridor, and potential pollutant sources.

In addition, the Combined Downriver Watershed Management Plan identified 19 potential, desired BMPs that will or have been implemented in the Blakely Drain watershed. The BMPs include ten bank stabilization/restoration sites, two storm water retention/detention sites, four hydraulic capacity improvement sites, one culvert/bridge replacement site, and two areas where floodplain connectivity will be improved.

The Wayne County Department of Management, Watershed Management Division, received a Clean Michigan Initiative-Clean Water Fund grant in 2006 for $163,196 to implement BMPs in the Combined Downriver watershed, including the Blakely Drain watershed. These funds were matched with local funds for an overall $326,000 project to develop low-impact grow zones and rain gardens. The grow zone sites may include bioretention swales and/or woody debris log revetments. The project will also focus on public education about grow zones. These projects will help improve water quality by expanding greenspace and natural habitat in the watershed.

The Downriver Citizens for a Safe Environment was founded in 1989 by residents in five downriver communities to address chemical exposure to area residents (Wayne County Department of Environment, 2004). The Downriver Citizens for a Safe Environment conducts a variety of programs and events in the Blakely Drain watershed, such as Stream Team Adopt-A-Waterway, stream cleanups and restorations, and water testing. "Stream Team" volunteers receive training in how to use benthic monitoring to assess the health of the watershed. The eventual goal is to expand this program to all of the schools and communities in the Ecorse Creek and Downriver Combined watersheds. Data collected by the Lake Erie Watersheds Volunteer Stream Monitoring Program, a Stream Team participant, indicated that one of two stations sampled in the Blakely Drain watershed in spring 2005 rated poor (Brownstown Creek near Hall and Van Horn Roads) while the other rated fair (Brownstown Creek at Brownstown Township Hall).

Wayne County Department of Environment and Brownstown Township were awarded a grant from the Great Lakes Commission to create a buffer zone of native plants to stabilize 120 feet of streambank on Brownstown Creek. A Riparian Corridor Management Workshop, Hands-on Technique Training Workshop and Demonstration Project were held at the site. A grant from the Great Lakes Basin Program for SESC covered additional material costs.

Located in the Blakely Drain watershed in Brownstown Township, the Sibley Prairie Complex, totaling approximately 700 acres, is the largest remnant of lake plain prairie and oak savanna ecosystems left in Michigan. According to the Michigan Natural Features Inventory, this site is the largest and most diverse lakeplain prairie remnant in Michigan. Regional organizations such as the Sierra Club, the Detroit Audubon Society, the Detroit Remedial Action Plan, Friends of the Detroit River, Michigan Nature Association, Clinton Huron Ecological Coalition, Grosse Ile Nature and Land Conservancy, Michigan Botanical Club – Southeast Michigan Chapter, Michigan Natural Areas Council, and the Southeast Michigan Land Conservancy have banded together to form the Friends of Sibley Prairie in a concerted effort to protect the land. Thus far, only five acres have been saved, purchased by the Southeastern Michigan Land Conservancy. Area activists are hoping that the newly designated International Wildlife Refuge for the Detroit River will serve as an impetus for protecting the Sibley Prairie. Preserving this prairie benefits

the entire watershed. By inhibiting development, rainfall is allowed to infiltrate the soils instead of being sent directly to the stream via storm sewers and overland flow.

Friends of the Detroit River, Riverkeeper Program (CDWIC, 2004) envisions an ever-improving quality of life for people, plants, and animals in southeast Michigan and southwest Ontario through development of a balance of grass roots advocacy and staffed programs forming an environmental group that watches and protects the Detroit River, including creation of a highly visible resource center focusing on Detroit River issues, programs, research, policies, and partnerships. The mission of Friends of the Detroit River is to enhance the environmental, educational, economic, cultural, and recreational opportunities associated with the Detroit River watershed, through citizen involvement and community action. One recent example is achievement of the designation of the Detroit River as an American Heritage River through collaborative efforts of many agencies and organizations. Another example is their collaboration with many agencies and organizations to preserve the Humbug Marsh, Humbug Island, and Humbug Bay. Many of the entities in the watershed have been working with the Detroit Riverkeeper group on their "Storm Drain Labeling and Educational Program." The Riverkeeper program has been working closely with the Combined Downriver and Ecorse Creek watershed groups to put together a program that involves storm drain labeling and a region-wide storm water educational program. Over 12,000 labels were produced and distributed to the participating communities in these watersheds. Installation of the curbside storm drain labels started in the spring of 2004, helping to bring attention to storm drain born water quality issues.

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August 17, 2007

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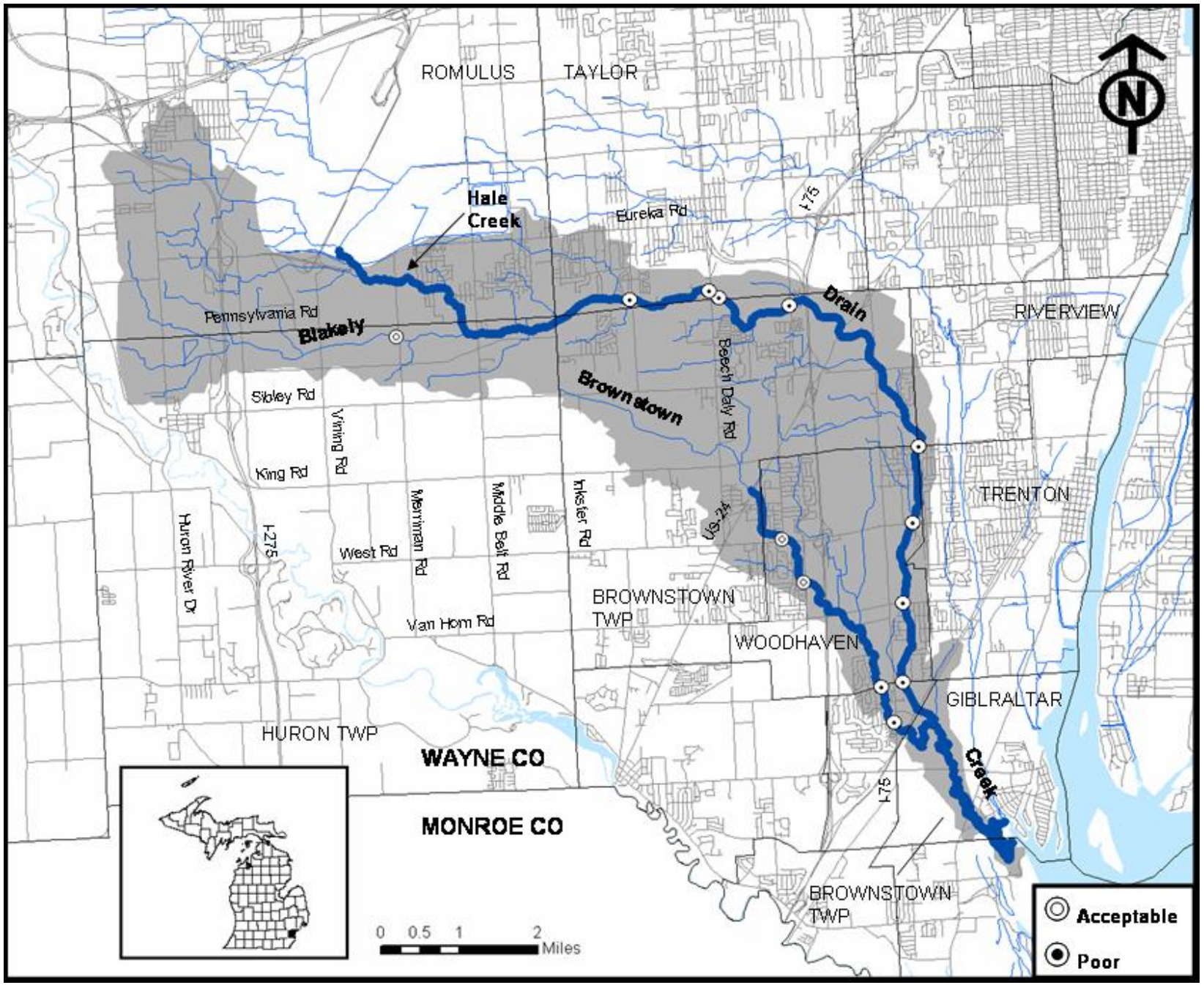

Figure 1. 2006 biosurvey locations in the Blakely Drain watershed. TMDL reaches are highlighted.

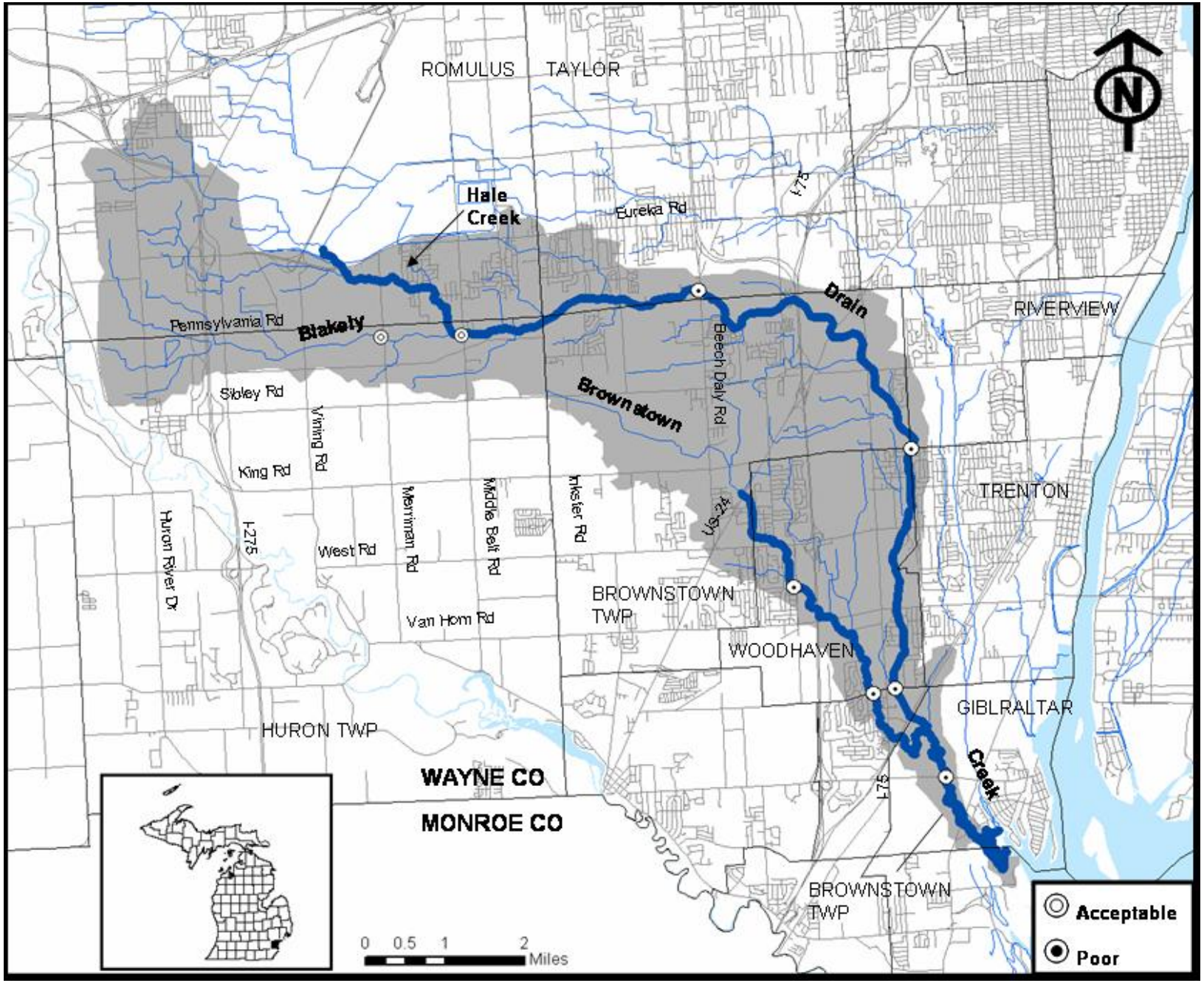

Figure 2. 2001 biosurvey locations in the Blakely Drain watershed. TMDL reaches are highlighted.

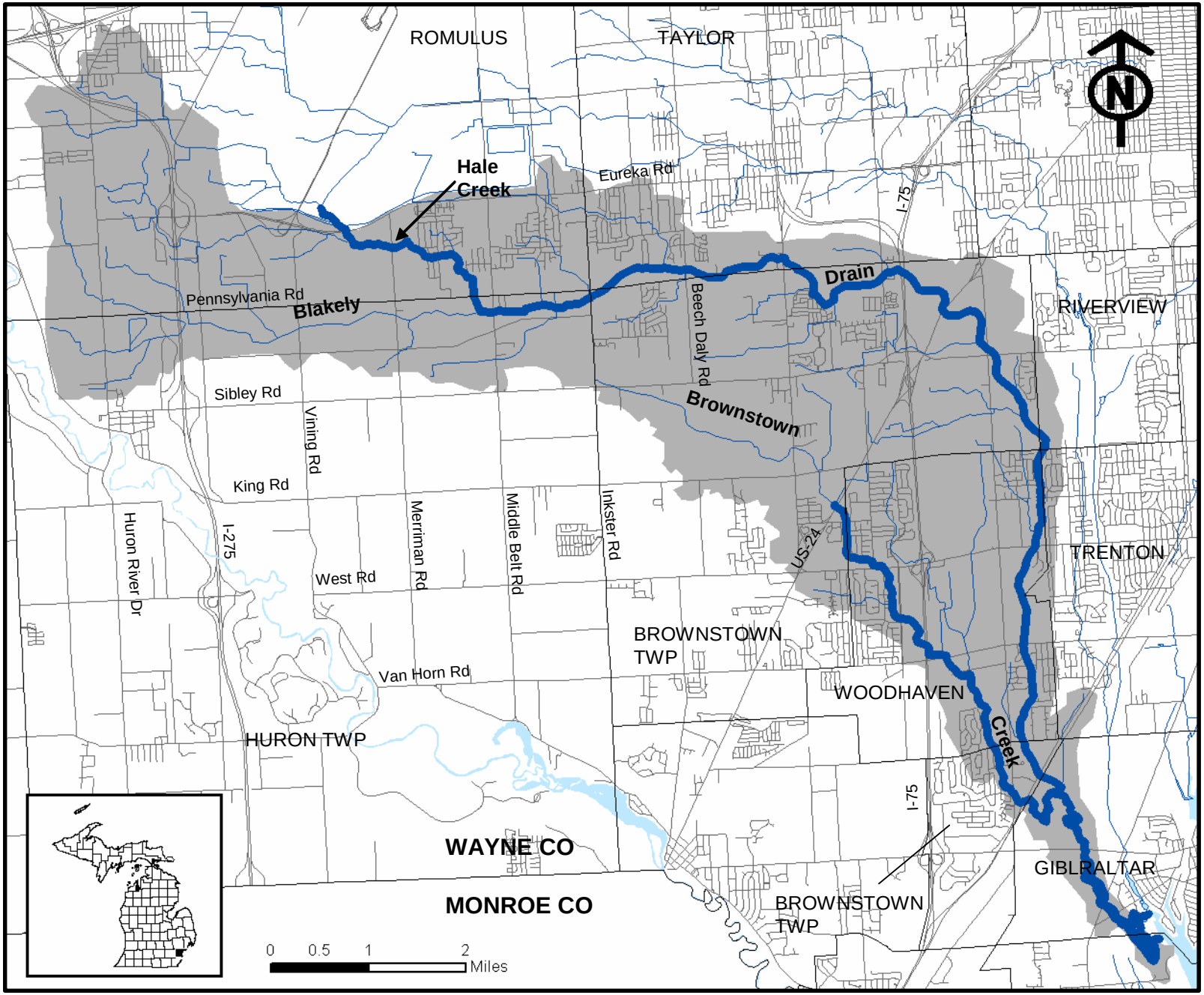

Figure 3. Blakely Drain watershed with TMDL reaches highlighted.

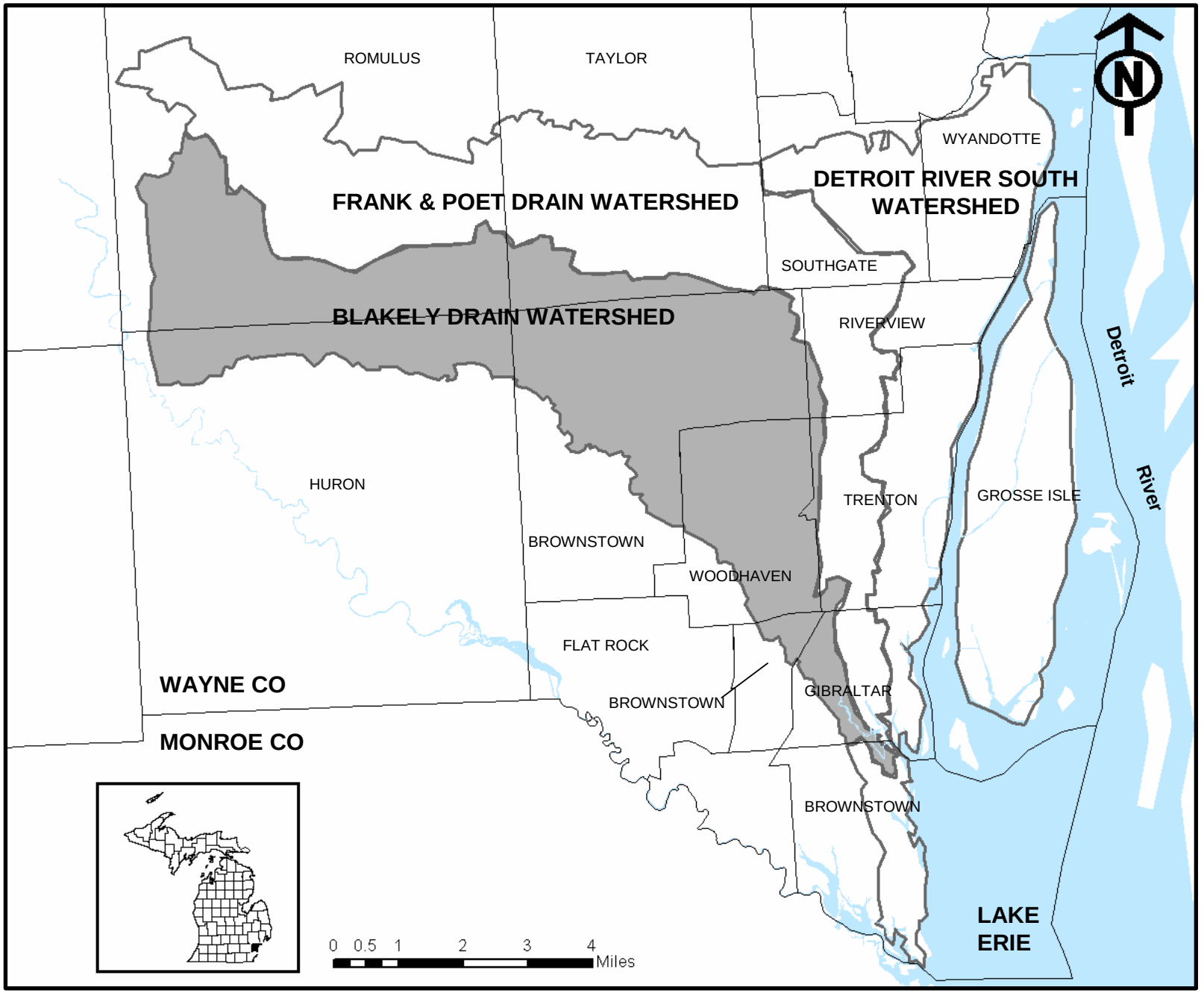

Figure 4. Combined Downriver watershed with subwatersheds delineated.

Site Description	Avg. Concentration (mg/L)	Avg. Loadings (lb/day)	Avg. Hourly Loading (lb/hr)
Blakely Drain @Telegraph Rd.	128	509	21
Brownstown Creek @ Vreeland Rd.	30	1199	50
Marsh Creek @ Vreeland Rd.	35	198	8

Table 1. Summary base flow TSS monitoring data from the Blakely Drain watershed.

Rainfall	Event 1 - 0.46			Event 2 - 0.63			Event 3 - 0.63			Event 4 - 0.34			Event 5 - 1.89		
Site Description	Event Loading (lb)	Avg. Hourly Loading (lb/hr)	Avg. TSS conc. (mg/L)	Event Loading (lb)	Avg. Hourly Loading (lb/hr)	Avg. TSS conc. (mg/L)	Event Loading (lb)	Avg. Hourly Loading (lb/hr)	Avg. TSS conc. (mg/L)	Event Loading (lb)	Avg. Hourly Loading (lb/hr)	Avg. TSS conc. (mg/L)	Event Loading (lb)	Avg. Hourly Loading (lb/hr)	Avg. TSS conc. (mg/L)
Marsh Creek @ Vreeland Rd.	402	37	60	233	17	55	9,842	394	28	161	25	28	19.841	748	41
Brownstown Creek @ Vreeland Rd.	871	82	42	2,120	153	68	2,177	86	34	1,197	192	70	14,570	551	74
Blakely Drain @ Telegraph Rd.	47	5	15	75	5	26	214	8	27	110	18	26	29,534	1,124	63

Table 2. Summary wet weather event TSS monitoring data in the Blakely Drain watershed.

	Land Use	Acres	% Land Use	Expected TSS (mg/L)	Expected TSS Daily Load (lbs/day)	% Total Load	Target TSS (mg/L)	Target Load (lbs/day)	% Reduction Needed
WLA	Commercial	1,000	5.0	77	784	7.5	-	784	0.0
WLA	**Industrial**	2,819	14.0	**149**	**5,670**	**54.1**	**80**	**3,044**	**46.3**
WLA	**High Density Res.**	456	2.3	**97**	**414**	**4.0**	**80**	**342**	**17.4**
WLA	Medium Density Res.	3,782	18.8	70	1,908	18.2	-	1,908	0.0
WLA	Urban Open	788	3.9	51	110	1.0	-	110	0.0
WLA	**MDOT MS4**	468	2.3	**141**	**639**	**6.1**	**80**	**363**	**43.2**
WLA	WLA Total	9,313	46.3	-	9,525	90.9	-	6,551	31.2
LA	**Agricultural**	2,602	12.9	**145**	**472**	**4.5**	**80**	**260**	**44.9**
LA	Forest/Rural Open	2,828	14.1	51	180	1.7	-	180	0.0
LA	Water/Wetlands	5,358	26.7	6	301	2.9	-	301	0.0
LA	LA Total	10,788	53.7	-	953	9.1	-	741	**22.2**
	Overall Total	**20,101**	**100**	**-**	**10,478**	**100**	**-**	**7,292**	**30.4**

Table 3. Land use categories, estimated current TSS loads (lbs/day), and target TSS loads in the Blakely Drain watershed, Wayne County, Michigan.

Appendix A. Permitted outfalls in the Blakely Drain watershed. Source: MDEQ, NMS database.

Facility	Permit Number	County	Latitude	Longitude	Receiving Water
Individual Permit					
MDOT MS4	MI0057364	Statewide	---	---	---
General Permit MIG619000	Municipal Separate Storm Sewer System (MS4)				
Brownstown Twp MS4-Wayne	MIG610356	Wayne	---	---	Blakely/Brownstown Ck.
Gibraltar MS4-Wayne	MIG610346	Wayne	---	---	Brownstown Ck.
Gibraltar PS MS4-Wayne	MIS040055	Wayne	---	---	Blakely Drain
Taylor MS4-Wayne	MIG610348	Wayne	---	---	Blakely Drain
Wayne Co MS4	MIG610040	Wayne	---	---	Combined Downriver
Woodhaven MS4-Wayne	MIG610354	Wayne	---	---	Blakely/Brownstown Ck.
Woodhvn-Brownstwn PS MS4-Wayne	MIG610359	Wayne	---	---	Brownstown Ck.
Notice of Coverage	Stormwater Discharge from Construction Activities				
Barbee-Kirkway Village	MIR107102	Wayne	---	---	---
BASF Corp-Riverview IRA	MIR109957	Wayne	---	---	---
Bonks Bay Subdivision	MIR106152	Wayne	---	---	---
Bridgewater by Del Webb Ph 2	MIR109732	Wayne	---	---	---
Brigewater by Del Webb Ph 1A	MIR109397	Wayne	---	---	---
Brock Dev-Marsh Ck Condo	MIR106126	Wayne	---	---	---
Carmen-Crystal Crossing	MIR106057	Wayne	---	---	---
Celtic Farms Subdivision	MIR108811	Wayne	---	---	---
Centex Homes-Falkirk	MIR109037	Wayne	---	---	---
Crosswinds-Laurel Gardens	MIR110026	Wayne	---	---	---
CSX Trans-TDSI Auto Facility	MIR107662	Wayne	---	---	---
Flat Rock-Woodcreek Pk # 3	MIR106349	Wayne	---	---	---
Flowers Creek Subd No 2 & 3	MIR104626	Wayne	---	---	---
Ford Motor Land-Woodhaven 13	MIR109233	Wayne	---	---	---
Ford-Woodhaven 11	MIR108258	Wayne	---	---	---
Fox River	UNKNOWN	Wayne	---	---	---
Fritz Ent-King Rd Property	MIR106849	Wayne	---	---	---
Group-Cambridge Meadows #3	MIR106243	Wayne	---	---	---
GTR Builders-Hampton Square	MIR107855	Wayne	---	---	---
Henry Ford Ambulatory Care	MIR108444	Wayne	---	---	---
Howey-Vernon Park Subdivision	MIR109779	Wayne	---	---	---
Htwa-Carleton Meadows	MIR107130	Wayne	---	---	---
Hunter Creek Condominiums	MIR110068	Wayne	---	---	---
Huron Estates II	MIR106382	Wayne	---	---	---
Huron Twp-Mercer Dr Impr	UNKNOWN	Wayne	---	---	---
J & V-Oakwood Farms Estates	MIR108097	Wayne	---	---	---
King Commons-Bryce Commons	MIR109297	Wayne	---	---	---
King/Inkster-Doves Point	MIR106337	Wayne	---	---	---
Kings Pointe Res Community	MIR106248	Wayne	---	---	---
Kirby Freewilll Bapt Church	MIR108220	Wayne	---	---	---
Knottingham Estates	UNKNOWN	Wayne	---	---	---
Ksa-Prairie Ck Vill Sub Ph II	MIR106449	Wayne	---	---	---

Lowes of Woodhaven	UNKNOWN	Wayne	---	---	---
MDOT-I-75 Gibraltar to Sibley	MIR109391	Wayne	---	---	---
MDOT-US-24 and I-75	MIR110146	Wayne	---	---	---
MDOT-US-24 and I-75 Brownstown	MIR110147	Wayne	---	---	---
Mich Memorial-Garden of Angels	MIR109494	Wayne	---	---	---
Middlewest-Trail Ck Blvd Condo	MIR106755	Wayne	---	---	---
Mjc-Fox Ck of Brownstown II	MIR106894	Wayne	---	---	---
Mjc-Wheatland Estates Sub	MIR106171	Wayne	---	---	---
N Pointe Group-River Valley	MIR106549	Wayne	---	---	---
Oak-Liberty Square Condos	MIR104732	Wayne	---	---	---
Oakwood-Southshore Hospital	MIR109970	Wayne	---	---	---
Orco-Brookside Estates Condos	MIR109906	Wayne	---	---	---
Peen Rd-Woodridge Estates	MIR106683	Wayne	---	---	---
Pine Ridge-Timber Ck Sub	MIR106466	Wayne	---	---	---
Pineview LLC-The Evergreens	MIR108098	Wayne	---	---	---
Plute-Bridgewater by Del Webb	MIR109946	Wayne	---	---	---
Preston Pointe-Brownstown Twp	MIR108151	Wayne	---	---	---
Pulte-Bridgewater by Del Webb	MIR109003	Wayne	---	---	---
Rali-Winding Creek Ph III	MIR106757	Wayne	---	---	---
S Huron Valley UA-WWTP Flow	MIR107969	Wayne	---	---	---
Seville Homes-Hawthorne Woods	MIR107073	Wayne	---	---	---
St Roch Catholic Church	MIR109072	Wayne	---	---	---
The Evergreens	UNKNOWN	Wayne	---	---	---
Trenton Grande Condo	MIR108381	Wayne	---	---	---
Trimarr-Fox River	MIR108149	Wayne	---	---	---
Uniland-Hidden Oaks Condo	MIR106883	Wayne	---	---	---
Vanderbilt @ Williamsburg	MIR106542	Wayne	---	---	---
Waltz-Huron Village	MIR106148	Wayne	---	---	---
Westhuron Dvpt-Pinegroves Cond	MIR108437	Wayne	---	---	---
Woodhaven-Brownstown HS	MIR107579	Wayne	---	---	---
General Permit MIS319000	Storm Water Discharges From Industrial Activities				
ASC-Trenton	MIS310489	Wayne	42.104166	-83.220833	Marsh Creek
Aztec Manufacturing-Romulus	MIS310387	Wayne	42.19243	-83.40161	Blakely Drain
Best Concrete & Supply	MIS310041	Wayne	42.15	-83.258333	Blakely Drain
Contract Freighters-Taylor	MIS310316	Wayne	42.1875	-83.25	Blakely Drain
CTS Engineering-Taylor	MIS310508	Wayne	42.1875	-83.266666	Blakely Drain
Ford-Woodhaven Forging Plt	MIS310276	Wayne	42.141666	-83.258333	Marsh Creek
Fritz Enterprises-Brownstown	MIS310147	Wayne	42.1625	-83.283333	Brownstown Creek
Fritz Enterprises-Taylor	MIS310146	Wayne	42.1875	-83.270833	Blakely Drain
G & J Cartage Co-Taylor	MIS310143	Wayne	42.183333	-83.2375	Blakely Drain
Hi-Way Auto Equipment	MIS310183	Wayne	42.183333	-83.266666	Blakely Drain
Levy-Penn Landfill	MIS310211	Wayne	42.183333	-83.241666	Blakely Drain
Suburban Industries-Gibraltar	MIS310209	Wayne	42.104166	-83.220833	Brownstown Creek
Taylor Auto Salvage Inc	MIS310091	Wayne	42.1875	-83.266666	Blakely Drain
Waste Mgt of Mi-Area Disposal	MIS310292	Wayne	42.183333	-83.2375	Blakely Drain