

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

**Total Maximum Daily Load for Dissolved Oxygen
for the East Branch Coon Creek
Macomb 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 Michigan's Water Quality Standards (WQS) pursuant to Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). 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 (NPS) to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify the sources of dissolved oxygen (D.O.) standard nonattainment in East Branch Coon Creek in Armada (Figure 1), and to quantify reductions in these sources necessary for attainment of the standard. East Branch Coon Creek is designated as a warmwater stream with a D.O. standard of 5 milligrams per liter (mg/l) as a minimum. East Branch Coon Creek is located in Macomb County.

Historically, East Branch Coon Creek water quality was adversely impacted by combined sewer overflow (CSO) discharges. The village of Armada combined sewer system was separated in 1993 at which time the CSOs were eliminated. Continuous and instantaneous measurements of D.O. were conducted in the East Branch Coon Creek in the summers of 1999 and 2005. Full details of this work are contained in Trapp, 1999 and Limno-Tech Draft, 2005. The monitoring showed that periods of dry weather nonattainment and significant wet weather D.O. depressions continue to occur in the creek in the vicinity of Armada despite the removal of CSOs.

The East Branch Coon Creek TMDL reaches are defined on the 2004 Section 303(d) list (Wolf, 2004) as extending from the confluence of East Branch Coon Creek and Highbank Creek to upstream of Armada. The 2005 monitoring revealed there are additional reaches on East Branch Coon Creek near Armada which are appropriate for inclusion in this TMDL due to D.O. standard nonattainment. The East Branch Coon Creek D.O. TMDL reach should be extended from New Haven Road (Station 14) upstream through the city of Armada to McPhall Road (Station 1). The East Branch Coon Creek D.O. TMDL reach is located in Macomb County (see Figure 1).

Table 1 defines the extent and length of the TMDL reach. Note that the reach start is a downstream location, while the end location is an upstream location. A total of 14 river miles are addressed by this TMDL.

Table 1. East Branch Coon Creek D.O. TMDL Reach

River	Reach start	Reach end	Distance (mi.)
E. Br. Coon Creek	New Haven Road (T4N, R14E, Section 19)	McPhall Road, (T5N, R13E, Section 11)	14

East Branch Coon Creek has a drainage area of approximately 39.3 square miles at the New Haven Road. Summer season 50 percent and 95 percent exceedance flows (cubic feet per second [cfs]) for East Branch Coon Creek at this location are 0.4 and 0 cfs, respectively. All low flows were computed from a United States Geological Survey Grand River flow gage (04164300) located on Prospect Street in Armada.

PROBLEM STATEMENT

East Branch Coon Creek TMDL reaches appear on the 2004 303(d) list as:

COON CREEK, E. BR.	WBID#	061408C
County: Macomb	HUC:	4090003
Location: Highbank Creek confluence to u/s of Armada	Size:	12 M
Problem: CSOs, pathogens (Rule 100); WQS exceedances for D.O.		
TMDL YEAR(s): 2006	RF3RchID:	4090003 000

This TMDL addresses only the D.O. standard nonattainment in East Branch Coon Creek near Armada. The TMDL addressing the pathogen concerns has been developed by the Michigan Department of Environmental Quality (MDEQ) (Draft - Cooper, 2006). As noted above, the D.O. TMDL reach has been extended downstream to New Haven Road and upstream to McPhall Road. This change is reflected in the Draft 2006 Integrated Report (Edly, 2006).

NUMERIC TARGETS

Rule 100 (designated uses) of the WQS requires that the East Branch Coon Creek be protected for warmwater fish, other indigenous aquatic life and wildlife, agriculture, navigation, industrial water supply, public water supply at the point of intake, partial body contact recreation, total body contact recreation from May 1 to October 31, and fish consumption. The impaired designated uses for East Branch Coon Creek addressed by this TMDL are the warmwater fish and other indigenous aquatic life and wildlife uses. The D.O. standard was developed to provide protection of these designated uses. Attainment of the warmwater D.O. standard of 5 mg/l as a daily minimum will be the target of this TMDL. The D.O. WQS is defined as follows:

R 323.1064 Dissolved oxygen in Great Lakes, connecting waters, and inland streams.

Rule 64. (1) A minimum of 7 milligrams per liter of dissolved oxygen in all Great Lakes and connecting waterways shall be maintained, and, except for inland lakes as prescribed in R 323.1065, a minimum of 7 milligrams per liter of dissolved oxygen shall be maintained at all times in all inland waters designated by these rules to be protected for coldwater fish. In all other waters, except for inland lakes as prescribed by R 323.1065, a minimum of 5 milligrams per liter of dissolved oxygen shall be maintained. These standards do not apply for a limited warmwater fishery use subcategory or limited coldwater fishery use subcategory established pursuant to R 323.1100(11) or during those periods when the standards specified in subrule (2) of this rule apply.

(2) Surface waters of the state which do not meet the standards set forth in subrule (1) of this rule shall be upgraded to meet those standards. The department may issue permits pursuant to R 323.2145 which establish schedules to achieve the standards set forth in subrule (1) of this rule for point source discharges to surface waters which do not meet the standards set forth in subrule (1) of this rule and which commenced discharge before December 2, 1986. For point source discharges which commenced before December 2, 1986, the dischargers may demonstrate to the department that the dissolved oxygen standards specified in subrule (1) of this rule are not attainable through further feasible and prudent reductions in their discharges or that the diurnal variation between the daily average and daily minimum dissolved oxygen concentrations in those waters exceeds 1 milligram per liter, further reductions in oxygen-consuming substances

from such discharges will not be required, except as necessary to meet the interim standards specified in this subrule, until comprehensive plans to upgrade these waters to the standards specified in subrule (1) of this rule have been approved by the department and orders, permits, or other actions necessary to implement the approved plans have been issued by the department. In the interim, all of the following standards apply:

(a) For surface waters of the state designated for use for coldwater fish, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 6 milligrams per liter at the design flow during the warm weather season in accordance with R 323.1090(2) and (3). At the design flows during other seasonal periods, as provided in R 323.1090(3), a minimum of 7 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision.

(b) For surface waters of the state designated for use for warmwater fish and other aquatic life, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 4 milligrams per liter, or below 5 milligrams per liter as a daily average, at the design flow during the warm weather season in accordance with R 323.1090(3) and (4). At the design flows during other seasonal periods as provided in R 323.1090(3), a minimum of 5 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision.

(c) For surface waters of the state designated for use for warmwater fish and other aquatic life, but also designated as principal migratory routes for anadromous salmonids, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below 5 milligrams per liter as a minimum during periods of migration.

(3) The department may cause a comprehensive plan to be prepared to upgrade waters to the standards specified in subrule (1) of this rule taking into consideration all factors affecting dissolved oxygen in these waters and the cost effectiveness of control measures to upgrade these waters and, after notice and hearing, approve the plan. After notice and hearing, the department may amend a comprehensive plan for cause. In undertaking the comprehensive planning effort the department shall provide for and encourage participation by interested and impacted persons in the affected area. Persons directly or indirectly discharging substances which contribute towards these waters not meeting the standards specified in subrule (1) of this rule may be required after notice and order to provide necessary information to assist in the development or amendment of the comprehensive plan. Upon notice and order, permit, or other action of the department, persons directly or indirectly discharging substances which contribute toward these waters not meeting the standards specified in subrule (1) of this rule shall take the necessary actions consistent with the approved comprehensive plan to control these discharges to upgrade these waters to the standards specified in subrule (1) of this rule.

This TMDL will be considered the Comprehensive Plan referred to in Rule 64(3) for this water body.

SOURCE ASSESSMENT

Potential sources of D.O. demanding pollutants to East Branch Coon Creek (such as carbonaceous biochemical oxygen demand [CBOD], ammonia nitrogen, sediments, and indirectly, nutrients) include point and nonpoint sources. CBOD and ammonia can be oxidized in the water column, depleting levels of D.O. Decay of deposited organic sediments can also negatively affect in-stream D.O. concentrations. This process is known as sediment oxygen demand (SOD). Nutrients such as phosphorus and nitrogen can stimulate plant growths which in turn can reduce D.O. levels through respiration.

There is one individual National Pollutant Discharge Elimination System (NPDES) permitted discharge to the East Branch Coon Creek Watershed in the vicinity of Armada (Armada Wastewater Treatment Plant [WWTP]). There are also three industrial storm water permitted facilities, and three facilities permitted for construction. The Michigan Department of Transportation (MDOT) also has an individual statewide permit covering storm water (MI0057364). See Table 2 for a listing of all permitted facilities. Figure 2 indicates the location of individual, and storm water discharges. Of these facilities, only the Armada WWTP is known to be a relatively significant point source of D.O. demanding pollutants in the study reach.

The Armada WWTP (MI0022225), with a design flow of 0.35 million gallons per day (MGD), is permitted to discharge treated municipal wastewaters to East Branch Coon Creek in Section 23, T5N, R13E of Macomb County. See Table A.1 of Appendix A for Armada WWTP NPDES permit effluent limits.

Table 2. Permitted discharges to the East Branch Coon Creek TMDL Watershed. Source: MDEQ, Water Bureau's NPDES Permit Management System. Outfall locations are illustrated in Figure 2.

Facility	Number	County	Receiving Water	Latitude	Longitude
Individual Permit					
MDOT MS4	MI0057364	Statewide	---	---	---
Armada WWTP	MI0022225	Macomb	East Branch Coon Ck.	42.8358	-82.8861
MIS110000 General Permit Storm water from industrial activities					
Armada Rubber Mfg.	MIS110066	Macomb	East Branch Coon Ck.	42.8463	82.8677
Park Electric	MIS110962	Macomb	East Branch Coon Ck.	42.8436	82.8833
MIG610000 General Permit Municipal Separate Storm Sewer System					
Macomb County MS4	MIG610052	Macomb	Countywide		
Permit-by-Rule (R323.2190) Storm water discharges from construction activities					
Ansana Castle Court	MIR109178	Macomb	---	---	---
Blakes-Agg Irrigation Pond	MIR106865	Macomb	---	---	---
John Deere Landscapes	MIR106428	Macomb	---	---	---
MDOT M-53 Armada Wetland	MIR110383	Macomb	---	---	---

Table 3 contains permitted annual conventional pollutant loads for the Armada WWTP; conventional pollutants being defined as CBOD5, total suspended solids (TSS), ammonia nitrogen, and total phosphorus. The loads are calculated from the facilities' maximum daily permitted NPDES permit limits and design flows.

Table 3. Permitted Annual Conventional Pollutant Loads for Armada WWTP.

Pollutant	Annual load (lbs/yr)
CBOD ₅	15,909
Total suspended solids	25,700
Ammonia nitrogen	6,210
Total phosphorus	1,059

Table 4 contains estimates of East Branch Coon Creek conventional pollutant loads from existing industrial storm water permitted facilities. Storm water loads in Table 4 were estimated based on commercial land use data contained in the Long-Term Hydrologic Impact Assessment (L-THIA) web-based software created and maintained by Purdue University and the USEPA (Purdue University and USEPA, 2001). This geographic information system-based application uses the event mean concentration (EMC) and curve number (CN) procedures to calculate annual pollutant loads based on land use, soil type, and meteorological data. The L-THIA application is supported by staff of the USEPA, Region 5.

Table 4. Estimated East Branch Coon Creek conventional pollutant loads from existing industrial storm water permitted facilities.

Pollutant	Daily Load (lbs/day)	Annual load (lbs/yr)
Biochemical Oxygen Demand (BOD)	3.89	1,421
Total suspended solids	9.39	3,429
Ammonia nitrogen	0.22	82
Total phosphorus	0.05	19

Potential NPS of pollutants were evaluated based on land use in the drainage basin. Land use proportions were derived using the L-THIA application and are presented in Table 5. It is possible that the urban land use proportions (e.g., commercial and residential) are in fact higher than indicated in Table 5 due to recent intensive residential development in this area. However, these possible increases in residential and/or commercial development are not expected to significantly affect the TMDL as the overall residential and commercial land use in the watershed are relatively minor when compared to other uses, e.g., agriculture.

Table 5. East Branch Coon Creek basin land use categories as percentages.

Land use category	Percent land use category
Water	4
Commercial	0.1
Agriculture	64
High density residential	0.3
Low density residential	2.2
Grass / pasture	16.1
Forest	13.3

The 1999 and 2005 summer D.O. surveys indicate that certain pollutants contribute toward D.O. standard nonattainment in East Branch Coon Creek near Armada. Land use-related inputs of various oxygen demanding pollutants (e.g., ammonia, BOD, total phosphorus) appear to cause the documented wet weather-related D.O. depressions in East Branch Coon Creek below Armada, and likely contribute toward D.O. standard nonattainment through SOD, and respiration from abundant plant growths observed throughout the TMDL Reach (Limno-Tech, Inc. 2005).

Estimates of land use-related annual loads of BOD (CBOD₅ + nitrogenous BOD), TSS, total phosphorus (TP), and total nitrogen to East Branch Coon Creek were estimated using the L-THIA application. Estimates of loads to East Branch Coon Creek at New Haven Road (Station 14) appear in Table 6. These loads include all East Branch Coon Creek tributaries, and are based on non-site-specific data and represent a best approximation using software default EMC and CN values. These estimates include construction site contributions based on commercial land use, as well as the estimated loads from storm water permitted facilities contained in Table 4. Note that the load estimates presented in Table 4 constitute only 0.2 percent of the estimated loadings to the TMDL reach.

Table 6. Estimated annual land use conventional pollutant loads, including East Branch Coon Creek storm water permitted facilities.

Pollutant	Daily Load (lbs/yr)	Annual Load (lbs/yr)
BOD	185	67,557
Total suspended solids	4270	1,557,740
Total nitrogen	180	65,911
Total phosphorus	51.8	18,916

In accordance with USEPA guidelines, urban runoff via storm water conveyances from Armada will be considered in the waste load allocation (WLA) portion of this TMDL. Industrial storm water permitted facilities will also be considered in the WLA portion of the TMDL. Industrial NPDES storm water permittees in the vicinity of Armada are listed in Table 2. There are no identified Phase II areas and no Phase II municipal storm water permittees in the drainage area of the TMDL reach.

LINKAGE ANALYSIS

The observed D.O. standard nonattainment in East Branch Coon Creek can be attributed to a number of factors. These factors were assessed using mathematical D.O. models of the reaches of concern. The model chosen was the O'Connor-DiToro multi-reach, steady-state D.O. model (O'Connor and DiToro, 1970), based on the modified Streeter-Phelps equation. This model has the capability of simulating diurnal D.O. variation resulting from plant photosynthesis and respiration. The respiration term includes D.O. depletion due to SOD. The O'Connor-DiToro model is considered appropriate for use in the TMDL as it can represent the system without being unnecessarily complex or too data-intensive. Modeling was conducted in accordance with guidance described in the Great Lakes and Environmental Assessment Section (GLEAS), Procedure 80 (MDEQ, 1995). The models were calibrated to data collected in the summer of 2005.

Plant Respiration: The presence of aquatic plants in a water body can have a very significant effect on levels of D.O. Plants, such as rooted macrophytes and algae, utilize photosynthesis during daylight hours to convert carbon dioxide and water into glucose, a process that releases oxygen. The oxygen is released to the surrounding water increasing levels of D.O. Throughout the day and night, plants also respire aerobically. This process removes D.O. from the water column. D.O. concentrations vary throughout the day in response to photosynthesis and respiration. Since the photosynthetic contribution of D.O. occurs only with sunlight, and respiration is relatively constant, levels of D.O. are most often lowest just before sunrise. Plant growth can be encouraged by the addition of nutrients, such as phosphorus, to a water body. This increased growth causes increases in photosynthesis and respiration rates, resulting in exaggerated daytime D.O. concentration peaks and potentially problematic early morning lows.

Phosphorus is an important nutrient of concern when considering D.O. problems in aquatic systems, such as the East Branch Coon Creek. Phosphorus can exist in dissolved and particulate forms. When dissolved, some of the phosphorus is available for use by aquatic

plants and increased growth can result. Phosphorus, in the particulate form in river sediments, can be released to the water column as dissolved phosphorus under certain conditions, contributing to increased plant growth. Solids that run off of land into water bodies or that are discharged directly to a stream typically have particulate phosphorus associated with them. Substantial loads of TSS can therefore result in substantial inputs of phosphorus available for plant use in a stream.

Prolific growths of rooted and detached macrophytes were noted in East Branch Coon Creek during the summers of 1999 and 2005 (Trapp, 1999, Limno-Tech, Inc. 2005). During routine maintenance visits to deployed monitoring instruments, D.O. sensors were found to be fouled with relatively heavy algal biofilm growths. This heavy plant growth results in high rates of photosynthesis and respiration. Very high D.O. diurnal variations were measured in 1999 (Trapp, 1999), and 2005, and early morning D.O. standard nonattainment was common throughout the TMDL reach (Station 1 through Station 14) (Limno-Tech Draft, 2005). One round of dry weather chemistry sampling on August 26, 2005, showed that TP concentrations exceeded 0.1 mg/l in eight of the nine sampled locations on the East Branch Coon Creek and its tributaries (Limno-Tech Draft, 2005).

SOD: Substrates in nonattaining reaches of East Branch Coon Creek within and downstream of the city of Armada are characterized primarily by fine sediments. In 2005, black, anoxic sludge beds were encountered in East Branch Coon Creek at both North Avenue stations (Stations 3 and 7) and at 33 Mile Road (Station 8) indicating that SOD is likely a contributing factor in D.O. standard nonattainment in East Branch Coon Creek in the vicinity of Armada. East Branch Coon Creek is characterized by low channel slopes and resulting low velocities. This appears to cause deposition of sediments from the water column, exacerbating SOD. The low velocities also result in relatively low rates of reaeration.

SOD was measured in 2005 at transects at North Avenue (Stations 3 and 7), just upstream of the Armada WWTP outfall (Station 6), and 33 Mile Road (Station 8). SOD ranged from 0.9 to 2.3 g / m²-d, with an overall average of 1.5 g / m²-d. These values are typical of SOD in sediments downstream of a treated municipal sewage discharge (Chapra, 1997). City of Armada CSOs which previously discharged to East Branch Coon Creek likely contributed to higher levels of SOD downstream of Armada. SOD and sediment deposits are typically highly variable spatially and temporally due to varying flow regimes affecting deposition and scour (Bowie et. al., 1985).

Observations made during the 1999 and 2005 surveys indicate that stream bank erosion contributes a substantial amount of sediments and SOD to East Branch Coon Creek. Numerous log jams, formed from fallen riparian trees, were noted in East Branch Coon Creek below Armada. Soil surveys by the Soil Conservation Service indicate that poorly drained, highly erodible organic soils pervade the banks of East Branch Coon Creek below Armada (USDA, 1971).

TMDL DEVELOPMENT

The TMDL represents the maximum loading of oxygen demanding substances, or other parameters that can indirectly cause oxygen demand (sediments, nutrients), that can be assimilated by the water body while still achieving WQS. As indicated in the Numeric Target section, the target for this D.O. TMDL is the WQS of 5 mg/l minimum D.O. TMDL development also defines the environmental conditions that will be used when defining allowable levels.

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 WQS). In general, the lowest monthly

95 percent exceedance flow and 90 percent occurrence temperature for streams are used as design conditions for conventional pollutant loadings.

Load allocations (LAs) and WLAs are calculated using the best available data and information, recognizing the need for additional monitoring data to determine if the load reductions required by the TMDL result in WQS attainment.

D.O. models were used to quantify reductions in river D.O. sinks necessary to attain the D.O. standard at critical conditions. Calibration data shows that along the 14 miles length of the East Branch Coon Creek D.O. deficits, on average, are caused by SOD (45 percent), plant respiration (40 percent), and the Armada WWTP (15 percent). There are reaches in East Branch Coon Creek where the D.O. deficit is due entirely to either plant respiration or to SOD. The calculated relative contributions to the D.O. deficit from plant respiration and SOD will vary depending on the conditions to which the models are calibrated.

In order to decrease SOD and nutrient loads, the loading of suspended sediments to the rivers must be reduced. Summer 2005, and past East Branch Coon monitoring has documented significant D.O. sags during wet weather events. It is likely that most nutrient inputs to the system are transported with the suspended sediment loads likely to accompany runoff. This is supported by wet weather water chemistry sampling conducted in other watersheds similar to the East Branch Coon Creek basin (Sunday 2003). Wet weather sampling conducted in development of the Grand River at Jackson D.O. TMDL (Sunday, 2003) showed that except for one wet weather event, TP concentrations are significantly higher than orthophosphate concentrations. These data indicate that most phosphorus loads are adsorbed to solids rather than being in a dissolved form. TSS reduction is therefore the best overall strategy to improve D.O. in the stream.

ALLOCATIONS

TMDLs are comprised of the sum of individual WLAs for point sources and LAs for NPS and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for uncertainty in the relation between pollutant loads and the quality of the receiving water body. Conceptually, this definition is denoted by the equation:

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

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

This D.O. TMDL targets a 50 percent reduction in land use-related TSS loads (point and NPS) to East Branch Coon Creek in the vicinity of Armada. The 50 percent TSS load reduction was chosen in part due to the results of D.O. modeling which indicates that SOD and plant activity in the reaches of concern should be reduced by approximately 50 to 95 percent, depending on the reach under consideration, in order to achieve the D.O. standard. The existence of considerable uncertainties which make it difficult to quantify the effects of TSS loads on in-stream D.O. levels make the proposed 50 percent reduction a reasonable objective.

WLAs

D.O. standard nonattainment in the relevant water bodies has been documented during the summer months only. Armada WWTP is the most significant point source of oxygen demanding substances to the nonattaining reaches. Armada WWTP is currently required to meet the interim D.O. standard of 4 mg/l due to D.O. diurnal variations in East Branch Coon Creek greater than 1 mg/l. Armada WWTP is required to meet the interim standard until a comprehensive plan to upgrade East Branch Coon Creek to the standards specified in Rule 63 has been approved, and orders, permits, or other actions necessary to implement the approved plans have been issued. This TMDL will be considered the Comprehensive Plan for this water body. Upon approval of this TMDL, Armada will be required under NPDES permit to meet the D.O. standard of 5 mg/l. Water quality modeling of East Branch Coon Creek indicates that in order to meet the D.O. standard of 5 mg/l, Armada WWTP will be required to meet effluent limits based on advanced waste treatment (AWT). These effluent limits are the most restrictive limits which the State of Michigan imposes on municipal wastewater treatment facilities, and effluent of this quality is considered to exert no oxygen demand in-stream (stable effluent). Requiring Armada WWTP to meet AWT limits will result in a 74 percent reduction in the permitted ammonia nitrogen loading and a 59 percent reduction in CBOD₅ from the facility (based on permitted monthly average load limits). Reductions in TSS limits will not be recommended for this facility as they are already permitted at AWT levels for this constituent in the critical summer months. The high level of treatment required at the Armada WWTP will lead to high conventional pollutant removal rates throughout the year. Armada WWTP will be given a schedule of compliance under their NPDES permit to comply with the new effluent limits.

TSS loads for the remaining point source facilities are allocated using the existing loads contained in Table 4 and reducing these land use-related loads by 50 percent. Table 7 contains proposed TSS WLAs for East Branch Coon Creek.

LAs

TSS inputs resulting from land use-related sediment loads will be the primary targets for reduction in the East Branch Coon Creek in this TMDL. Table 7 lists the land use source LAs for the East Branch Coon Creek. The target LA values in Table 7 represent 50 percent of the loads of the existing estimated TSS loads contributed by those land uses classified as nonurban (EG, agriculture, forest, grass/pasture) and not covered under storm water permits. Lands contributing TSS loads to the East Branch Coon Creek are located in Armada, Lenox, Ray, and Richmond Townships, Macomb County.

Table 7. Annual TSS load source allocations and numeric targets.

Water Body	Current Annual TSS Load (pounds/year)	Annual TSS Load Numeric Target (pounds/year)	NPDES Permitted TSS Loads (pounds/day)	WLA Annual TSS Load (pounds/year)	LA Annual TSS Load (pounds/year)	Percent Reduction
East Branch Coon Ck.						
Industrial/Municipal Storm Water Permitted Outfalls *	3400	1700	-	1700	-	50%
Existing Ind. NPDES Permitted Facilities (Armada WWTP)**	25,700	25,700	58 (May-Nov) 88 (Dec-Apr)	25,700	-	0%
Other Land Use-Related Sources ***	1,560,000	780,000	-	-	780,000	50%
East Branch Coon Creek Total Annual Loads	1,590,000	807,000	-	27,400	780,000	49%

* Primarily attributed to urban or built up land uses in the village of Armada.

** Average daily load. Note that permit loads are consistent with this waste load allocation.

***Attributed to nonurbanized/built up land uses in the townships of Armada, Lenox, Ray, and Richmond.

The TMDL for TSS is calculated as the Annual TSS Load Numeric Target (807,000 pounds/year) divided by 365 days/year, and is equal to 2,211 pounds/day, based on the year-round standard for the designated uses of warmwater fisheries, and other indigenous aquatic life and wildlife.

MOS

The MOS accounts for any uncertainty or lack of knowledge concerning the relationship between pollutant loading and water quality. The MOS can be either implicit (i.e., incorporated into the TMDL analysis through conservative assumptions) or explicit (i.e., expressed in the TMDL as a portion of the loadings). This TMDL uses an implicit MOS with the following conservative assumptions incorporated in D.O. modeling: (1) background flows are represented at the 95 percent exceedance low flow as determined by MDEQ's Geological and Land Management Division; (2) seasonal river temperatures are represented at the highest monthly 90 percent occurrence temperature as defined in the Surface Water Assessment Section effluent limit coordination Procedure 15. These are the same conservative assumptions used in the determination of water quality-based effluent limits in NPDES WLAs.

SEASONALITY

Monitoring and modeling indicates that design conditions occurring during the summer season represents the most critical conditions for D.O. standard attainment in the East Branch Coon Creek. Modeling of the East Branch Coon Creek in other seasons using appropriate 95 percent exceedance low flows and 90 percent occurrence temperatures shows no predicted instances of D.O. standard nonattainment.

MONITORING

This TMDLs approach requires that future monitoring be conducted to assess whether activities implemented under the TMDL result in water quality improvements. This monitoring will be conducted as resources allow. Typically, Water Bureau (WB) monitors watersheds in accordance with the five-year NPDES permit review process. The East Branch Coon Creek will be reevaluated in 2010 when the Clinton River basin is next scheduled for monitoring. Limited D.O. monitoring (instantaneous measurements similar to those of the 1999 and 2005 surveys) may be conducted in the meantime.

REASONABLE ASSURANCE ACTIVITIES

Under the NPDES Permit Program, the Armada WWTP is responsible for meeting its effluent limits for oxygen demanding substances. Compliance is determined based on review of discharge monitoring report (DMR) data by MDEQ. Existing DMR data reviewed by the MDEQ indicates this facility is meeting those permit limits. It is the recommendation of this TMDL that the Armada WWTP be required to treat their effluent to AWT. This will result in 74 percent and 59 percent reductions in permitted ammonia nitrogen and CBOD₅ loadings respectively, from the facility, which will result in reduced D.O. demand in East Branch Coon Creek.

The industrial storm water permits identified in Table 2 require that if there is a TMDL established by the MDEQ for the receiving water that restricts a material that could impair or degrade water quality, then the required storm water pollution prevention plan shall identify the level of control for those materials necessary to comply with the TMDL and an estimate of the current annual load of those materials via storm water discharges to the receiving stream. The MDOT statewide permit requires the permittee to reduce the discharge of pollutants to the maximum extent practicable and employ best management practices to comply with TMDL requirements.

A tool that may be beneficial to stakeholders in the East Branch Coon Creek TMDL Watershed is the *Lower Grand River Watershed Project Information and Education Guidebook*. This tool was created under a Clean Water Act Section 319 grant to the Grand Valley Metro Council and was used to motivate stakeholders and decision makers in the watershed to protect water quality. The guidebook includes a summary of activities and products for improving water quality, how to start a successful outreach program, investigating strategy targets, how to make things happen, and how to evaluate the strategy. The following Web site offers helpful information and important links to other groups: <http://www.gvsu.edu/wri/isc/lowgrand/>.

Macomb County administers the NREPA Part 91, Soil Erosion and Sedimentation Control Program (SESC). This program aims to reduce sedimentation in rivers, lakes, and streams by controlling sediments in runoff from construction sites greater than 1 acre, or those located within 500 feet of a water of the state. Temporary (silt fences) and permanent control measures (such as fully vegetated buffer strips) are employed. The MDEQ, WB oversees the counties' programs to ensure that they are effectively enforcing SESC regulations.

Macomb County is in the fourth year of required storm water permit activities. East Branch Coon Creek is located in the North Branch of the Clinton River sub-watershed (NBCRW; [Macomb County, 2005]) and has a sub-watershed advisory group that consists of representatives from communities, departments, schools, and organizations that are located in the watershed. A partnership between Macomb County and several townships has resulted in county efforts to identify all outfalls to waters of the state. In return, each municipality will assure that there are no illicit connections to the municipal storm water system from township and city-owned and operated properties and facilities. The NBCRW sub-watershed (including East Branch Coon Creek) was granted deferment from the requirements of the Municipal Separate Storm Sewer System (MS4) permit because only a small portion of the watershed is urbanized. Due to this deferment any watershed management activities concerning storm water are voluntary in nonurbanized areas. A presentation was sponsored by a Farmers Forum in Ray Township to inform attendees on what a watershed is and how human actions affect it. In September 2005, members of the advisory group began conducting stream crossing surveys on approximately 30 percent of the crossings located within the NBCRW. Results from the stream crossing surveys should be available in the Macomb County MS4, 2006 annual report. It is expected that activities from this advisory group will increase with increasing population, as well as with the issuance of this TMDL.

A stakeholder meeting was held on April 11, 2006, at the Lenox Township Hall in New Haven, Michigan. Stakeholders were determined by identifying municipalities (i.e., counties, townships, and cities) in the TMDL watershed. Copies of the draft TMDL were available upon request and posted on the MDEQ's Web site. Copies of the draft TMDL were also sent out with the stakeholder meeting invitations and available at the stakeholder meeting.

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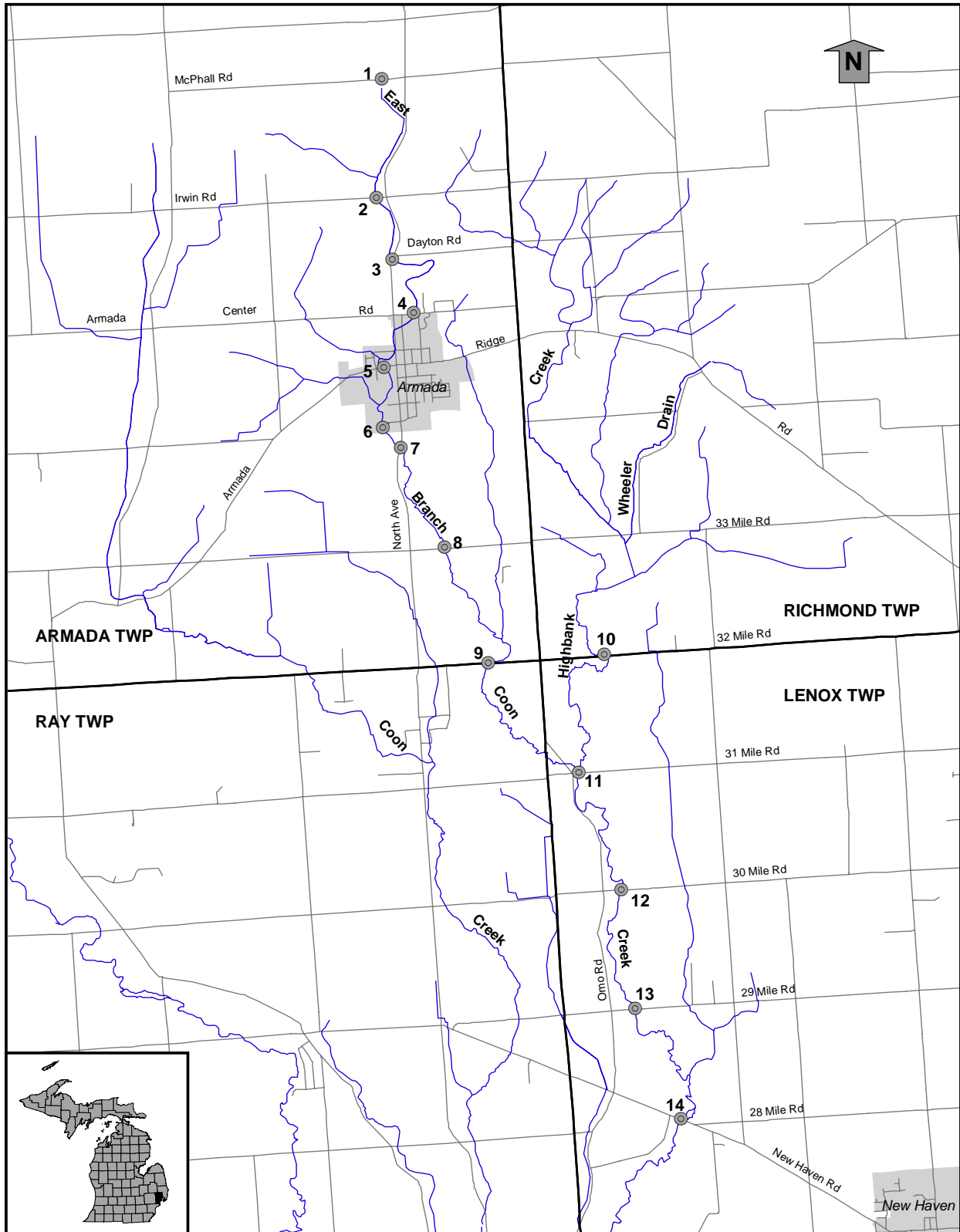


Figure 1. East Branch Coon Creek study sampling sites, including Highbank Creek, in the vicinity of Armada, Macomb County, Michigan, 2005.

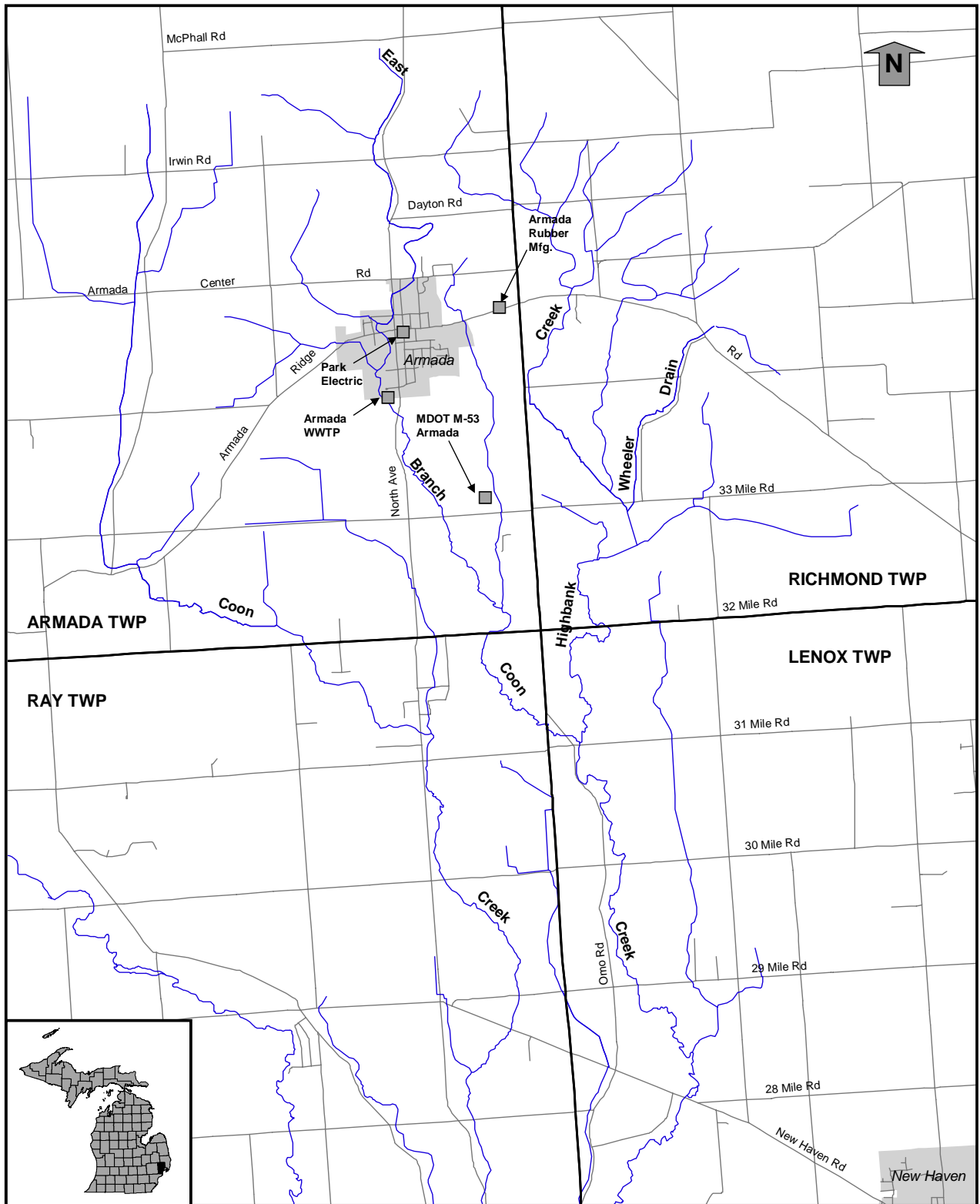


Figure 2. East Branch Coon Creek, NPDES permitted facilities, in the vicinity of Armada, Macomb County, Michigan, 2005.

**APPENDIX A – ARMADA WWTP CONVENTIONAL PARAMETER
NPDES PERMIT LIMITS**

TABLE A.1

ARMADA WWTP NPDES conventional parameter permit limits (design flow 0.35 MGD)

Parameter	Period	Maximum loading (lbs/d)		Maximum concentration (mg/l)		
		Monthly	7-day	Monthly	7-day	Daily
CBOD ₅ (mg/l)	5/1 – 11/30	-	29	-	-	10
	12/1 – 3/31	73	120	25	40	-
	4/1 – 4/30	29	44	10	-	15
Total suspended solids (mg/l)	5/1 – 11/30	58	88	20	30	-
	12/1 – 4/30	88	130	30	45	-
Ammonia Nitrogen (mg/l)	5/1 – 9/30	5.8	10	2.0	-	3.5
	10/1 – 11/30	14	29	4.7	-	9.9
	12/1 – 4/30	29	44	10	-	15
	5/1 – 5/31	32	44	11	-	15
Total phosphorus (mg/l)	Year round	2.9	-	1.0	-	-
D.O. (min., mg/l)	Year round	-	-	6.0	-	-