Michigan Department of Environmental Quality

Water Division

August 2004

Total Maximum Daily Load for Biota for Malletts Creek

Washtenaw County

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 water bodies that are not meeting Michigan's Water Quality Standards (WQS). The TMDL process establishes the allowable loads of a pollutant to a water body 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 nonpoint sources (NPS) to restore and maintain the quality of their water resources. The purpose of this TMDL is to identify appropriate actions to achieve the fish and macroinvertebrate community targets and habitat quality targets, specifically a reduction in sediment loadings from sources in the Malletts Creek watershed that will result in WQS attainment. This TMDL follows the phased approach, due to inherent uncertainties in deriving numeric targets and estimating loading from NPS. Under the phased approach, load allocations (LAs) and waste load allocations (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 lead to attainment of the WQS. The phased approach provides for the implementation of the TMDL while additional data are collected to reduce uncertainty.

PROBLEM STATEMENT

The TMDL reach of Malletts Creek, a warmwater designated water body tributary to the Huron River at South Pond Park, is located in Washtenaw County in the vicinity of Ann Arbor (Figure 1). The impaired designated uses (Rule 100 of the Michigan WQS) include the lack of support of acceptable communities of warmwater fish and other aquatic life (macroinvertebrate) communities. This condition served as the basis for placing Malletts Creek on Michigan's Section 303(d) list of impaired water bodies requiring the development of a TMDL. The TMDL reach is about two miles in length and is identified on the Section 303(d) list (Creal and Wuycheck, 2002) as follows:

MALLETTS CREEK WBID#: **061203I**
County: WASHTENAW HUC: 04090005 Size: 2 M
Location: Huron River confluence u/s to Packard Road.
Problem: **Fish and macroinvertebrate communities rated poor.**
TMDL YEAR(s): 2004 RF3RchID: 4090005 499

This document represents the basis for the development of a biota TMDL that focuses on the

restoration of the biological communities of the impacted perennial reach of Malletts Creek in order to meet Michigan's WQS.

The headwater reach of Malletts Creek upstream of the Brown Park Pond dam is classified by the United States Geological Survey (USGS) as intermittent. Malletts Creek is classified by the USGS as perennial from Brown Park Pond Dam downstream to the Huron River confluence. Within the two-mile biota TMDL reach, habitat impairment is attributed to unstable flow regimes, reduced bank stability, bank erosion, sedimentation, and reduced stream quality due to excessive runoff/washoff throughout this highly urbanized watershed.

The TMDL reach was based on the August 1997, Michigan Department of Environmental Quality's (MDEQ's) Procedure 51, biological community assessment findings for Malletts Creek (Wuycheck, 2003). The Procedure 51 fish community assessments involve the evaluation of ten metrics with a score and rating system as follows: a score range of 5 to 10 is rated excellent; a score range of 4 to -4 is rated acceptable; and a score range of -5 to -10 is rated poor. The macroinvertebrate community assessments involve the evaluation of nine metrics with a score and rating system as follows: a score range of 5 to 9 is rated excellent; a score range of 4 to -4 is rated acceptable; and a score range of -5 to -9 is rated poor. A poor-rated macroinvertebrate community characterized the stream at Packard Road and a poor-rated fish community characterized the community upstream of Chalmers Road (Figure 1). The fish community was rated acceptable (-2) at East Eisenhower Parkway in the headwaters of the watershed, but poor (-7) at Chalmers Road located approximately 0.1 mile upstream of the Huron River confluence at South Pond Park. Additional Procedure 51 macroinvertebrate community assessments conducted in August 2002 and September 2003, at Scheffler Park (located between Platt Road and Washtenaw Road off Edgewood Drive) and Chalmers Road, indicated acceptable macroinvertebrate community scores of -3 and -1; and -3 and -2, respectively.

Procedure 51 habitat quality assessments involve the evaluation of ten metrics with a scoring and rating system as follows: a habitat score less than 56 is rated poor, 56 to 104 is rated marginal, 105 to 154 is rated good and a score greater than 154 (with a maximum of 200 points) is rated excellent. Habitats at two stations (Packard Road and Chalmers Road) in August 1997, were rated good (slightly impaired) based on scores of 83 and 93, respectively, based on the 1997 version of Procedure 51. The August 2002 and September 2003, habitat scores and ratings, using the May 2002, updated Procedure 51 habitat assessment protocol for sites at Scheffler Park (Edgewood Drive) and Chalmers Road were 141 and 150 in 2002; and 131 and 135 in 2003, respectively. This indicates that, overall, the habitats assessed were rated good. However, scores for the individual metric categories of flow stability and bank stability were generally 50 percent or less than their maximum potential scores indicating unstable habitat conditions in Malletts Creek. Similar scores were recorded for these same metrics during the August 2002, biological assessments of Malletts Creek at Scheffler Park (downstream of Platt Road) and Chalmers Road.

Biological community assessments by the Huron River Watershed Council (HRWC) volunteers characterized the macroinvertebrate communities at Scheffler Park and Chalmers Road as poor in the spring of 2003 (HRWC, 2003). The differences between the MDEQ and HRWC biological community assessment results may be attributed to assessment procedure used and/or seasonal differences.

Total suspended solids (TSS) monitoring in the Malletts Creek watershed was conducted during

the months of June, July, and August 2003, by Limno-Tech, Incorporated (LTI), as part of a Clean Michigan Initiative (CMI)-funded monitoring program. The assessment was prompted by MDEQ staff concern about the impact of excessive sedimentation on habitat quality and, therefore, the biological community. The project, requested by the MDEQ, required monitoring at least twice during the survey period to characterize background TSS concentrations during dry weather, stable flow conditions and to monitor at least three wet weather runoff events to assess increases in stream TSS during these events. Effort was directed towards sampling TSS during the rise and fall of the Malletts Creek hydrograph in response to a rainfall/runoff event of 0.1 inches or greater. Survey results (LTI, 2003b) indicated average background, stable, base flow TSS concentrations at Chalmers Road of 5 to 10 milligrams per liter (mg/l). Precipitation events of 1.22, 0.61, and 1.02 inches on June 21, August 1 through August 2, and August 12, 2003, resulted in maximum (average) in-stream TSS concentrations of 460 mg/l (257mg/l), 130 mg/l (95 mg/l), and 1276 mg/l (572 mg/l), respectively. This information indicates that precipitation runoff/washoff events in the watershed substantially increase the amount of TSS in transport in Malletts Creek. In-stream flows measured at the USGS gage (#04174518) during the three wet weather event monitoring dates show increases from 1.6 to 178 cubic feet per second (cfs); 1.7 to 60 cfs, and 2 to 205 cfs, respectively, demonstrating substantial flow responses to precipitation events observed.

Municipal and commercial site storm water runoff/washoff associated with the numerous storm water outfalls within the Malletts Creek watershed are considered the most probable sources of unstable habitat conditions and associated impacts to aquatic life. The primary contributors to poor stream quality include excessive runoff/washoff, stream bank erosion, elevated runoff volumes, flow extremes (both lows and highs), and runoff rates from substantial areas of impervious surfaces in this highly urbanized/commercialized watershed that cause flashy, unstable flow conditions. These factors result in severe stream bank erosion; sediment induced erosivity of both habitat and colonizing organisms; and siltation and sedimentation of biologically important and desirable habitat. Reductions in storm sewer runoff rates and solids loads from both commercial and municipal storm water runoff sites, along with reduced stream bank erosion through more stable flow management are necessary to reduce impacts on the aquatic life.

NUMERIC TARGETS

The impaired designated use for Malletts 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)). The fish and macroinvertebrate communities of Malletts Creek are impacted due to habitat impairment and instability due to excessive bank erosion, sedimentation, and unstable flow extremes. Achievement of WQS for the aquatic life designated use is to be demonstrated via assessments of the integrity of the fish and macroinvertebrate community and habitat quality.

The primary numeric targets involve the use of Michigan's biological community and habitat quality assessment Procedure 51 (MDEQ, 1997 and 1998). The biota TMDL target is to establish both a fish community and macroinvertebrate community with acceptable, reproducible scores, each equal to or greater than -4 (acceptable). Both fish and macroinvertebrate communities will be evaluated based on a minimum of two Procedure 51 biological assessments to be conducted in successive years. The assessments would follow the implementation of Best Management Practices (BMPs) intended to stabilize flow extremes, bank erosion, and sediment loadings to the subject TMDL reach.

The Procedure 51 stream habitat quality assessment procedure has been revised and will also be used (MDEQ, 2002). A target habitat score equal to or greater than 130 is provided to assure protection of habitat conditions and minimized impairment to habitat. This is consistent with current acceptable scores for the habitats assessed at Scheffler Park and Chalmers Road. This level of conservation is appropriately high enough to minimize both temporal and spatial variability within the watershed and provide a buffer for the variability within the macroinvertebrate and habitat assessment protocol.

A secondary numeric target established to improve habitat conditions is for TSS. TSS measurements will be used to further assess improvements in Malletts Creek. The secondary goal is represented by a mean annual, in-stream TSS concentration target of 80 mg/l to characterize wet weather runoff/washoff events. 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 NPS of excessive suspended solids loads 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 80 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 TSS of 100 mg/l appears to separate those streams with a fish population from those without. The European Inland Fisheries Advisory Commission 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 TSS; good fisheries were unlikely to be found at 80 to 400 mg/l, while only poor fisheries are typically found at 400 mg/l (Alabaster, 1972). Decreases were demonstrated in the standing crop of both fishes and macroinvertebrates in an area receiving suspended solids loadings of no more than 40 mg/l (Gammon, 1970).

Water quality 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

Since the TMDL purpose is to restore the biological community to an acceptable condition and attain WQS, a value of 80 mg/l as a mean annual TSS target for wet weather events was chosen for Malletts Creek.

Overall, the secondary target of 80 mg/l TSS (as a mean annual value) is intended to evaluate solids loading influences 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 Malletts Creek become available.

The Washtenaw County Drain Commissioner's office has focused on reducing total phosphorus loads, including those from Malletts Creek, to the Huron River in response to the Huron River nutrient TMDLs for Ford and Belleville Lakes (Kosek, 1996). Current, local pollutant reduction and implementation plans for Malletts Creek involve the phosphorus TMDL to reduce the

occurrence of nuisance algal blooms in both Ford and Belleville Lakes. The Malletts Creek Restoration Plan targets a 50% reduction in total phosphorus, which is characterized as "…functionally equivalent to the mean TSS concentration of 80 mg/l…" (Malletts Creek Restoration Plan, 2000). Therefore, adherence to either the 80 mg/l TSS secondary target and/or the 50% total phosphorus reduction target will, presumably, equally effect desired reductions in both the TSS and/or total phosphorus loads, the latter targeted in the existing Malletts Creek Restoration Plan.

SOURCE ASSESSMENT

From the Huron River confluence upstream, land use in the watershed is dominated by residential, commercial, and industrial development. The estimated impervious surface area in the Malletts Creek watershed is 37% or 2478 acres (Malletts Creek Restoration Plan, 2000). Increasing the percent of impervious surface within a watershed can severely affect the extremes in a stream's hydrologic and hydraulic characteristics. Such increases cause rapid precipitation runoff and washoff of suspended solids and contaminant loads to the receiving waters (Fonger and Fulcher, 2001; Schueler and Holland, 2000). Substantial reductions in vegetative riparian zones and pervious areas throughout the watershed of Malletts 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 the landscape and serve to increase the rate of precipitation runoff to Malletts Creek.

Existing stream flow conditions of Malletts Creek can best be described as unstable and flashy in response to storm events as characterized by the flow extremes recorded at the USGS Malletts Creek (#04174518) stream flow gage (Figure 2). Note in this August 2003 example, the extremes in flow fluctuation from low flows of 2 cfs to highs of over 400 cfs occurred within a three to six-hour period. The hydrograph demonstrates the very flashy and unstable stream flow conditions that occur during wet weather runoff/washoff events. This condition results in excessive stream bank erosion, sedimentation, and erosivity of otherwise stable, inhabitable substrate suitable for macroinvertebrate colonization and fish community development. Therefore, the sources of sediment loadings to Malletts Creek are primarily attributable to periodic erosion and storm water runoff/washoff from impervious surfaces associated with residential, industrial, and commercial-dominated land uses in the watershed.

There are five National Pollutant Discharge Elimination System (NPDES) permitted dischargers in the Malletts Creek watershed that have general permits (Table 1 and Figure 3). Two facilities discharge treated groundwater and the other three discharge non-contact cooling water. Collectively, none of the five NPDES permitted point source facilities is required to monitor TSS in its effluent discharged to Malletts Creek since TSS limits are not commonly required or needed for these types of discharges. The combined maximum design discharge total of 1.673 million gallons/day or 610 million gallons/year applies to the five dischargers. Therefore, a worst-case estimate of TSS load for each of these five facilities was made assuming a TSS monthly average concentration of 25 mg/l; a typical monthly average permit limit provided in NPDES permits. The estimated TSS load from the five general permitted facilities is 349 pounds/day or 127,396 pounds/year.

There are at least 161 storm water outfalls to Malletts Creek watershed covered by the NPDES Phase I MS4 storm water runoff permit program (Figure 4). These outfalls are overseen by the city of Ann Arbor (137 outfalls), University of Michigan (11 outfalls), and Michigan Department of Transportation (2 outfalls - from Business Route 23 to Malletts Creek). Washtenaw County has at least 11 identified outfalls that are covered under the Phase II MS4 program.

The derivation of current annual TSS loads to the Malletts Creek watershed from the various land use categories, involved estimates of the acres of each land use category (LTI, 2003a), a mean annual rainfall of 34 inches, and the use of the USEPA's Simple Method model approach (USEPA, 2001). The estimated current, annual TSS load from the NPDES permitted storm water sources (WLA component) versus the remaining NPS land use categories (LA component) in the Malletts Creek watershed is approximately 1,173,788 pounds and 102,662 pounds, respectively (Table 2). The overall total estimated annual TSS load to the Malletts Creek from NPDES point sources, NPDES storm water, and NPS is approximately 1,403,846 pounds, representing 9%, 84%, and 7% of the total load, respectively.

In summary, excessive sedimentation and flashy flow conditions in Malletts Creek occur due to elevated wet weather event runoff/washoff volumes, associated TSS loads from the impervious urban areas in the watershed, and in-stream bank erosion and resuspension. The presence of substantial areas of impervious surfaces in the watershed has disrupted the natural hydrology of Malletts Creek, especially during wet weather runoff/washoff events. These alterations to the Malletts Creek watershed have destabilized stream banks, increased solids loads, shortened the runoff/washoff rate of delivery to the stream, modified extremes in stream flows (both high and low flows), and reduced or eliminated desirable fish and macroinvertebrate habitat. Approximately 2478 acres or 37% of the Malletts Creek watershed (6696 acres) is estimated to be impervious (Malletts Creek Restoration Plan, 2000). Stream degradation has been demonstrated to occur in watersheds containing as little as 10% to 20% impervious surface areas because of associated direct runoff discharges to a water body (Center for Watershed Protection, 1994). However, local studies within the Huron River watershed indicate a threshold range for impairment of 8% to 10% (Wiley and Martin, 1999).

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 bank erosion and 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 improved habitat through the reduction in sedimentation, both fish and macroinvertebrate communities respond with an increase in species diversity and an increase in the number of individuals of each species. As a result, the Procedure 51 assessment scores and ratings for quality of the fish and macroinvertebrate communities 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 water body while still achieving WQS. The Malletts Creek biotic community has been impaired by unstable flow conditions, bank erosion, and excessive sedimentation. Therefore, this TMDL is focused on reducing sediment loads throughout the watershed to a level that supports a biological community that meets WQS. Using the metrics from Procedure 51, a numeric score of -4 for

both fish and macroinvertebrate communities and a habitat score of 130 or greater, will serve as primary targets for this biota TMDL.

Concurrent with the selection of numeric endpoints, this TMDL 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 Rules 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 Malletts Creek are attributable to wet weather-driven discharges and resulting in-stream conditions. As such, there is no single condition that is protective for all conditions, but efforts are directed towards wet weather runoff/washoff events.

The target of 80 mg/l TSS is used to develop a secondary TMDL loading goal for TSS during wet weather runoff/washoff events, especially from storm water discharges from the area (3875 acres) of urban/industrial/built-up land use category that represents about 58% of the land use area in the Malletts Creek watershed.

ALLOCATIONS

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

$$TMDL = \Sigma^{WLAs} + \Sigma^{LAs} + MOS$$

The TMDL represents a maximum load of a pollutant or stressor that can be discharged to a receiving water and still meet WQS. The overall TMDL load capacity is allocated among the three TMDL components: WLA for NPDES permitted point sources, LA for NPS and background loads, and the MOS.

WLAs

Presently, the estimated total annual TSS load from all point sources is approximately 1,301,184 pounds. The combined individual/general NPDES permitted point source TSS load to Malletts Creek is estimated at 127,396 pounds/year (Table 1). Based on land use category TSS export coefficients (Cave et al., 1994), a total annual TSS load estimate of approximately 1,173,788 pounds is attributable to NPDES permitted storm water runoff/washoff discharges to the Malletts Creek watershed associated with the urban/industrial/built-up sources (Table 2). The projected annual TSS load (127,396 pounds) from the individual/general NPDES permitted point sources is considered acceptable. However, the combined effect on Malletts Creek by runoff/washoff loads of TSS from the urban/industrial/built-up storm water source should be reduced in order to achieve an in-stream mean annual wet weather TSS concentration goal of 80 mg/l or less by reducing runoff/washoff delivery rates to Malletts Creek. If the goal of 80 mg/l TSS were achieved, this would represent a 16% reduction in TSS load to Malletts Creek, resulting in a projected annual WLA of 1,113,249 pounds of TSS. Reduced runoff/washoff

delivery rates to Malletts Creek will play an important role in achieving the 80 mg/l goal by reducing TSS loads from upland sources, stream bank erosion, and re-suspension of in-place TSS.

For developing water quality-based effluent limits for the individual/general NPDES permitted point source discharges, the receiving stream design flow equals the lowest 95% exceedance flow. However, it is proposed that any TSS limits in NPDES point source permits be established at the target of 25 mg/l or less, as a monthly maximum average, which then makes it unnecessary to consider mixing zone scenarios. The point source contributions to the WLA are considered controllable through the existing NPDES individual/general permit requirements and storm water through the Phase I and Phase II MS4 storm water program requirements.

LAs

The LA component defines the load capacity for a pollutant that is nonpoint in origin that includes the following land use categories: agriculture, forested/shrub/open land, wetland, and water bodies (Table 2). An estimated annual TSS load of 102,662 pounds is attributed to these land use categories of NPS in the watershed. All but the agricultural land use are considered as background load sources. Therefore, the only targeted TSS load reduction source is from agricultural sources. A 45% annual reduction (from 53,822 to 29,695 pounds) from cropland areas in the watershed is recommended, resulting in the annual LA, TSS load target of 78,535 pounds, based on achieving the 80 mg/l TSS target concentration during wet weather runoff/washoff events.

In summary, the proposed reduction in the total annual TSS load to Malletts Creek (WLA + LA) to meet the annual average target of 80 mg/l is 1,191,784 pounds/year, an overall 15% reduction. Eleven percent (127,396 pounds/year) is allocated to the general NPDES permitted point source component of the WLA, along with 83% (985,853 pounds/year) to the NPDES permitted industrial and municipal storm water outfalls covered under the Phase I and Phase II MS4 storm water program, and the remainder of 7% (78,535 pounds/year) is attributed to the LA. To achieve the WLA, a reduction in the storm water runoff/washoff of the TSS load is recommended, especially, in the urban/industrial/built-up land use categories. The percent reduction in the TSS load is based on the reduction of wet weather runoff event TSS loads with a goal of an annual average in-stream target of 80 mg/l TSS during wet weather runoff/washoff events.

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 to the aquatic environment.

The habitat target score of 130 or greater will be used, so as to maintain habitat conditions and demonstrate acceptable stream quality conditions that provide adequate control of anthropogenic sediment sources to assure improved habitat quality and the biological communities. This targeted score is closely associated with macroinvertebrate community scores of -3 or greater, potentially providing better results than a minimally acceptable value of -4.

For comparison of survey assessment results from 1997, 2002, and 2003, follow-up biological and habitat quality assessments will be conducted during stable flow conditions within the months of June through September. The results will best reflect an MOS that is implicit and express an integration of the effects of the variability in sediment loads in the aquatic environment and minimize seasonal variability.

SEASONALITY

Seasonality is addressed in the TMDL in terms of sampling periods for fish and macroinvertebrate communities. To minimize temporal variability in the biological community, sampling will be conducted during June through September of each year during stable flow conditions. For assessing TSS loads to Malletts Creek, seasonal event monitoring will be conducted to define and characterize both hydraulic and TSS loads from the Malletts Creek watershed that influences the biota TMDL reach.

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 locations in the vicinity of Chalmers Road, Washtenaw Road, Packard Road, and immediately downstream of the Brown Park Pond dam, 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 time frame during stable flow conditions. Every effort will be made to sample during similar stream conditions and assess the same sampling locations.

In-stream monitoring of TSS, stream flow, and representative land use runoff/washoff characteristics for a variety of stable flow and wet weather events will be necessary to refine the TSS loadings estimates for the Malletts Creek watershed. This information will further define the level of TSS load reduction necessary; seasonally, climatologically, and annually.

Once the BMPs are in place to minimize the effects of runoff and flashy conditions that exist in Malletts Creek, stream flow and TSS sampling can be implemented so as to measure progress towards the secondary numeric target of 80 mg/l as a mean annual TSS value during wet weather runoff events. Multiple sampling during critical high flow events, as well as low flow events, needs to be assessed to estimate future TSS loads in Malletts Creek.

REASONABLE ASSURANCE

The focus of the actions to protect Malletts Creek is directed towards installing BMPs and other control measures to reduce and minimize solids loads and excessive runoff/washoff discharge rates to the TMDL reach. The former action is to reduce sedimentation impacts, the latter to minimize stream bank erosion associated with the erosive effects of flashy flow extremes. Overall, control measures include: NPDES individual/general and storm water permit limits and approved BMPs for areas currently not under any permit.

For the WLA, existing general NPDES permit requirements for these sources will be adequate to meet the target.

NPDES storm water permits are issued to the various dischargers within a watershed. The permittees are required to collectively 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 Malletts Creek watershed) of their individual storm water prevention plans.

The MDEQ district staff will continue to work with and assist interest groups in the Malletts 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 Malletts Creek watershed.

- Upgrade and maintain the current vegetative riparian zone to reduce soil erosion and loadings to the Malletts Creek from sources within the watershed. BMPs need to be employed within the riparian zone adjacent to the urbanized, residential, industrialized, and commercial areas to minimize the loss through erosion and direct runoff/washoff, thereby minimizing habitat impairment of the Malletts Creek.

- Implementation of BMPs in the storm water permits program that reduces sediment loadings and moderate runoff release rates and excessive runoff/washoff to the Malletts 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. Available guidance regarding runoff detention and stream protection is provided by Fongers and Fulcher, 2001; Schueler and Holland, 2000; and Purdue, 2003.

The MDEQ approval of BMPs and implementation plans is required prior to implementation of proposed structural improvements.

A Quality Assurance Project Plan (QAPP) is being designed for the Washtenaw County Drain Commissioner, for a Malletts Creek Regional Detention Facility site, involving the Brown Park Pond area (CDM, 2003). The facility is intended to help stabilize stream conditions due to wet weather runoff/washoff events. This QAPP may well enhance and reduce current impacts to the hydrology of Malletts Creek and foster improved habitat and biological communities.

Also, the Ann Arbor City Planning Commission's resolution regarding development in the Malletts Creek watershed requires the incorporation of the following BMPs into any proposal for development:

- Minimize impervious surfaces by efficient parking and drive design, shared parking, parking deferral, and use of multiple-story building design wherever possible.
- Provide detention facilities that meet or exceed the Washtenaw County Drain Commissioner's rules.
- In the case of redevelopment sites, provide detention for all added impervious surfaces and, if feasible, as much of the existing development as possible.
- Incorporate techniques from the MDEQ's "Guidebook of Best Management Practices for Michigan Watersheds (Peterson et al., 1993)."
- Avoid placing detention facilities in the Malletts Creek floodplain.

Since the inception of the Malletts Creek Restoration Plan (2000), the city of Ann Arbor and the Washtenaw County Drain Commissioner have partnered with the MDEQ to implement illicit

connection discharge elimination and retrofit regional detention within the basin using CMI and USEPA Section 319 Grant funding (Bobrin, 2003). Also, the 2000 plan indicates that updates of local ordinances and development standards affecting physical, biological, and chemical integrity of Malletts Creek have been made. To date, the total local public commitment for plan implementation exceeds $2 million.

Prepared By: John Wuycheck
Surface Water Quality Assessment Section
Water Division
Michigan Department of Environmental Quality
August 6, 2004

REFERENCES:

Alabaster, J. S. 1972. Suspended Solids and Fisheries. Proceedings of the Royal Society of London, Series B. 180:395-406.

Bobrin, J. 2003. December 12, 2003 Memo to Jack Wuycheck Regarding the Malletts Creek TMDL.

Cave, K., T. Quarsebarth, and E. Harold. 1994. Selection of Storm Water Pollutant Loading Factors. Rouge River National Wet Weather Demonstration Project Technical Memorandum RPO-MOD-TM34.00. Detroit, Michigan.

CDM, 2003. Quality Assurance Project Plan for Malletts Creek Regional Detention Facility Site Design. Prepared for the Washtenaw County Drain Commissioner. Grant Tracking No. 2002-0026, Section 319 Grant.

Center for Watershed Protection (Watershed Protection Techniques). 1994. The Importance of Imperviousness. Vol. 1, No. 3.

Creal, W. and J. Wuycheck. 2002. CWA Section 303(d) List - Michigan Submittal for Year 2002. MDEQ Report #MI/DEQ/SWQ-02/013.

Fongers, D. and J. Fulcher. 2001. Hydrologic Impacts Due to Development: The Need for Adequate Runoff Detention and Stream Protection. MDEQ, Land and Water Management Division. 20 pp.

Gammon, J. R. 1970. The Effect of Inorganic Sediment on Stream Biota. Water Pollut. Contr. Research Series. Water Quality 18050 DWC12/70. USEPA Printing Office. 145 pp.

Kosek, S. 1996. A Phosphorus Loading Analysis and Proposed TMDL for Ford and Belleville Lakes, Washtenaw and Wayne Counties, December 1994-November 1995. MDEQ Report #MI/DEQ/SWQ-96/005.

LTI. 2003a. Storm Water Outfalls to Malletts Creek Watershed. Coverages provided by Scott Wade.

LTI. 2003b. Storm Water Event Monitoring Report for Malletts Creek and Swift Run Prepared for MDEQ by LTI as Part of CMI Grant Project Numbers 03-09 Malletts Creek. MDEQ Report: MI/DEQ/WD-03/109.

Malletts Creek Restoration Plan, 2000.

MDEQ. May 2002 Revision. Update of GLEAS Procedure 51- Qualitative Biological and Habitat Survey Protocols for Wadable Streams and Rivers.

MDEQ. May 1998 Revision. Update of GLEAS Procedure 51 - Metric Scoring and Interpretation. MDEQ Report #MI/DEQ/SWQ-96/068.

MDEQ. January 1997 Revision. GLEAS Procedure 51 - Qualitative Biological and Habitat Survey Protocols for Wadable Streams and Rivers.

Peterson, A., R. Reznick, S. Hedin, M. Hendges, and D. Dunlap. 1993. Guidebook of Best Management Practices for Michigan Watersheds. MDEQ, SWQD.

Purdue, 2003. Purdue University web site: https://engineering.purdue.edu/~watergen and the L-THIA model.

Schueler, T. and H. Holland. 2000. The Practice of Watershed Protection: Techniques for Protecting our Nation's Streams, Lakes, Rivers, and Estuaries. Published by the Center for Watershed Protection.

The Huron River Watershed Council. 2003. Results from the Spring 2003 Stream Assessment. 1100 N. Main Street. Suite 210, Ann Arbor, MI. 48104.

USEPA. 2001. PLOAD Version 3.0 – An ArcView GIS Tool to Calculate NPS of Pollution in Watershed and Storm Water Projects – User Manual. 48 pp.

Vohs, P., I. Moore, and J. Ramsey. 1993. A Critical Review of the Effects of Turbidity on Aquatic Organisms in Large Rivers. Report by Iowa State University, Ames, Iowa for the U.S. Fish and Wildlife Service, Environmental Management Technical Center, Onalaska, Wisconsin. EMTC 93-s002. 139 pp.

Waters, T. 1995. Sediment in Streams - Sources, Biological Effects and Control. American Fisheries Society Monograph 7, American Fisheries Society, Bethesda, MD.

Wiley, M. and J. Martin. 1999. State of the Huron: Current Conditions, Recent Changes, and Major Threats to the Huron River: A Report Based on Eight Years of Citizen Monitoring. Huron River Watershed Council Adopt-A-Stream report. (http://hrwc.org/publ/1publ.htm#monitoring).

Wuycheck, J. 2003. Biological Community Assessments of Malletts Creek, Washtenaw County, Michigan August 13, 1997, August 13, 2002, and September 10, 2003. MDEQ Report: MI/DEQ/WD-03/111.

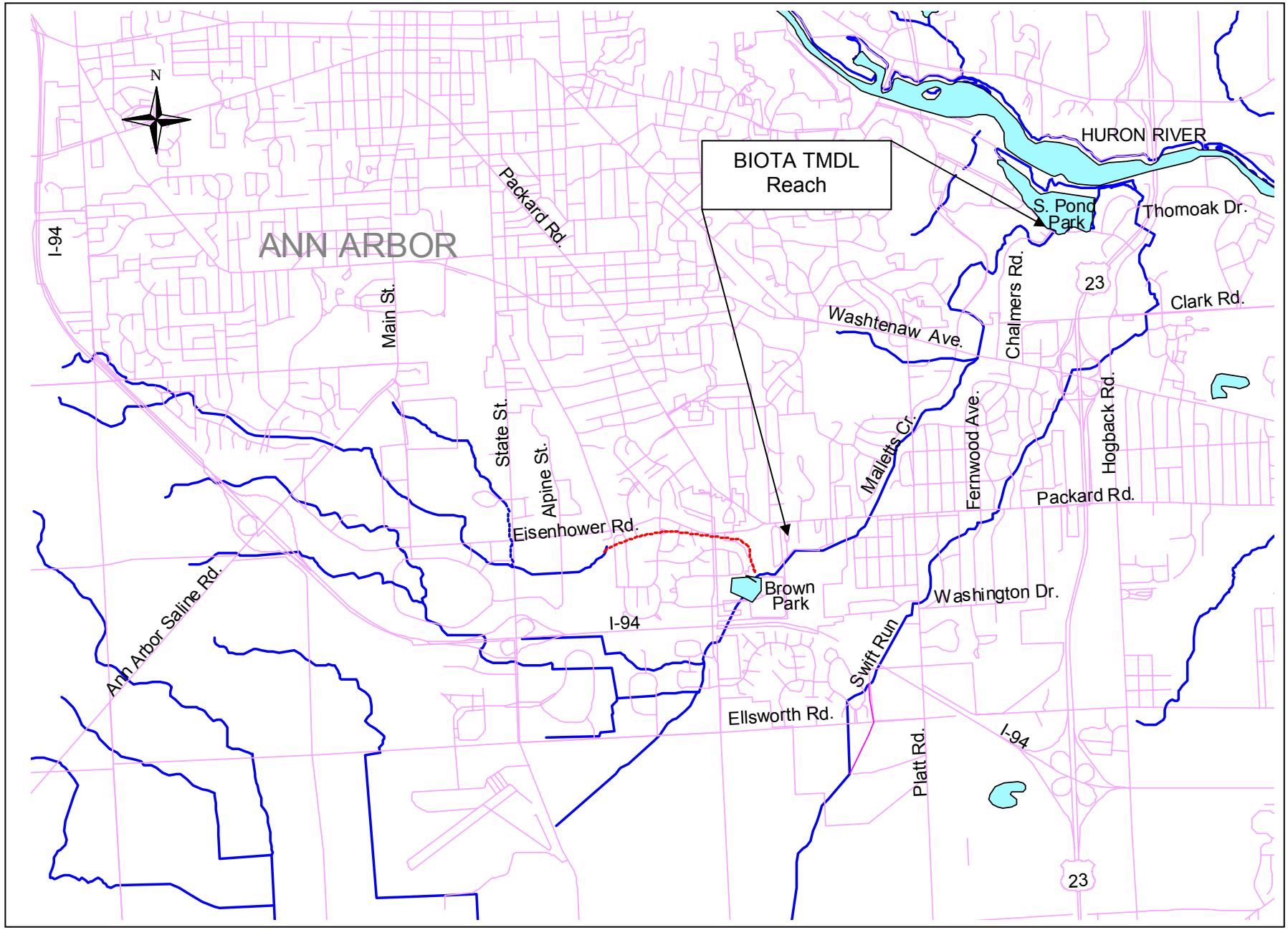
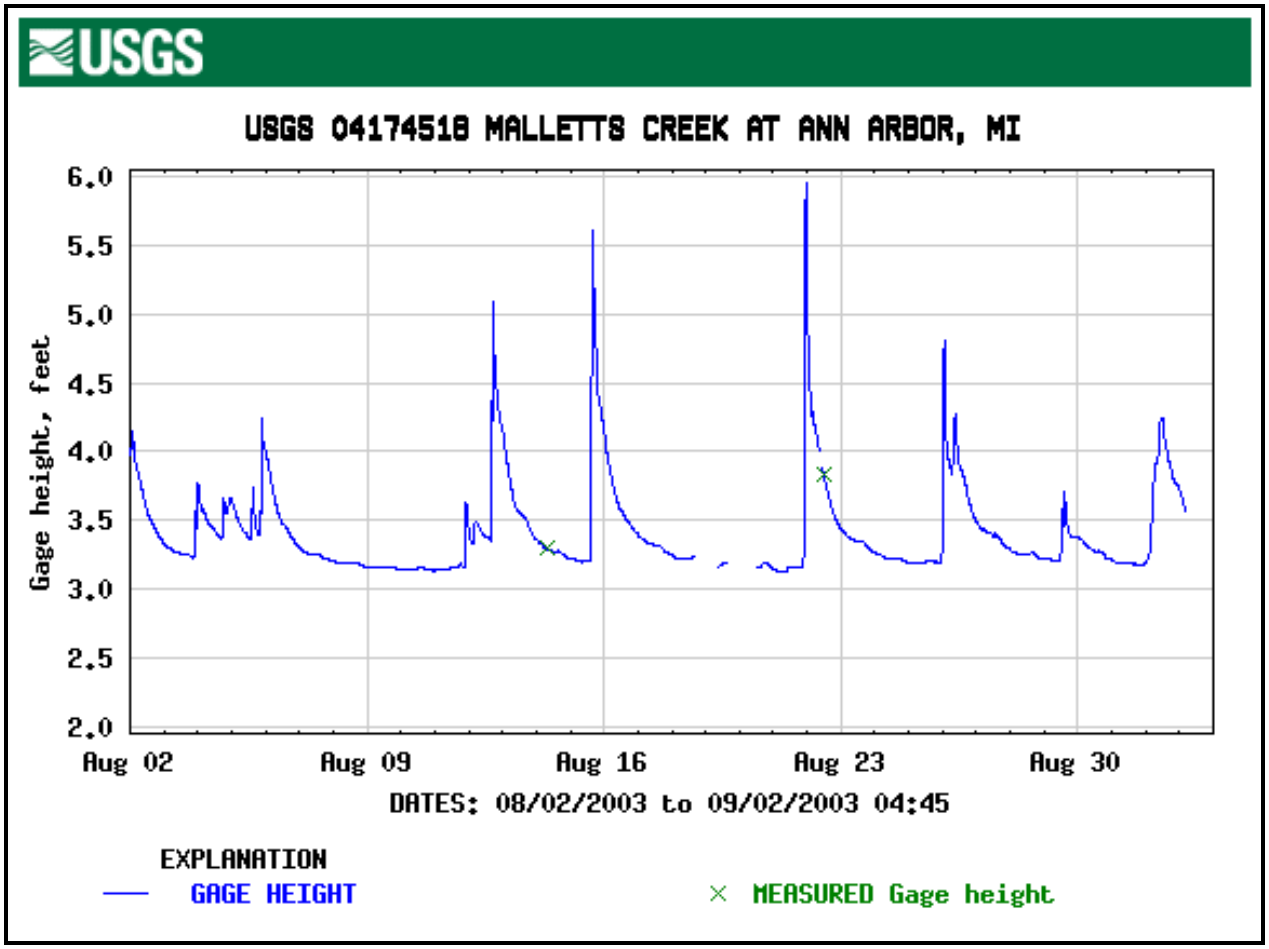


Figure 1. Malletts Creek biota TMDL reach, Washtenaw County, Michigan.



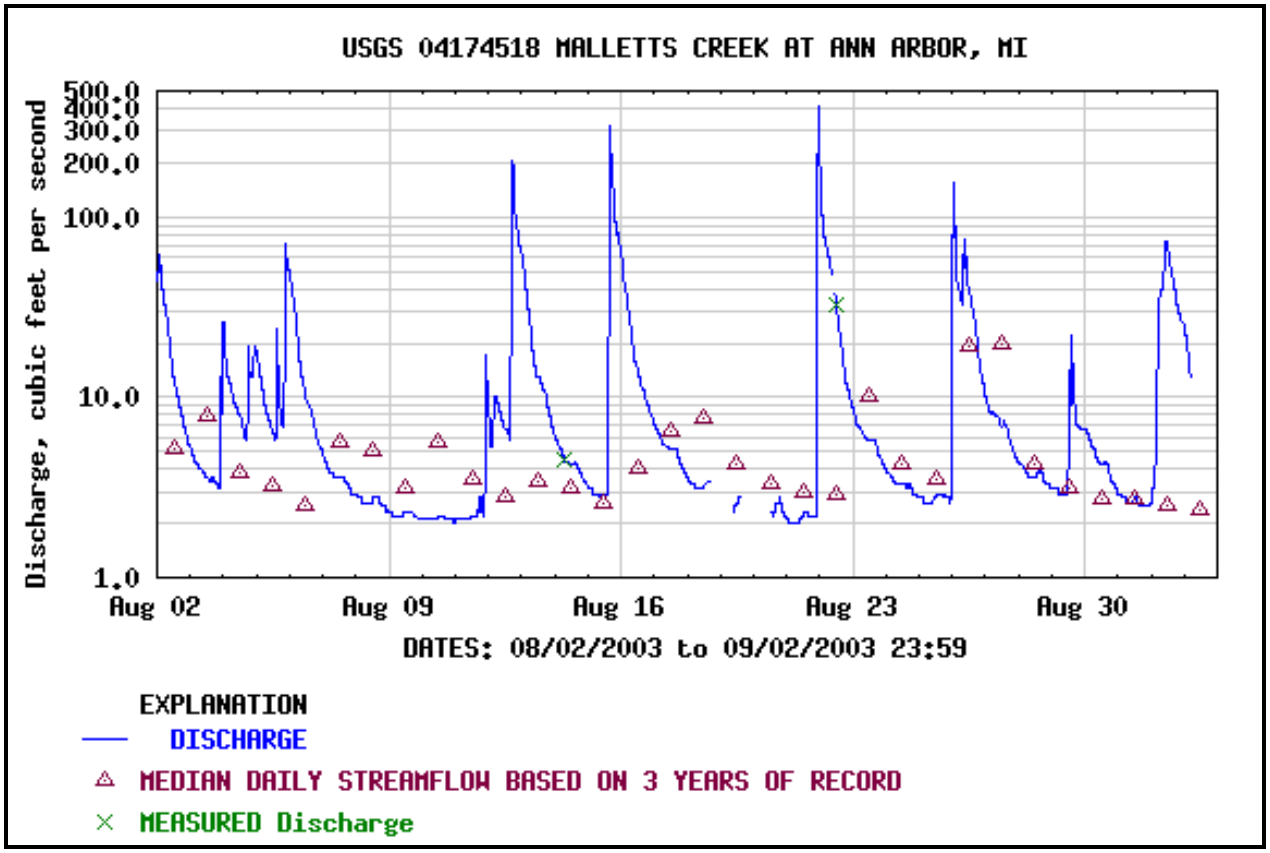


Figure 2. Malletts Creek storm event response in height and flow at the USGS gage.

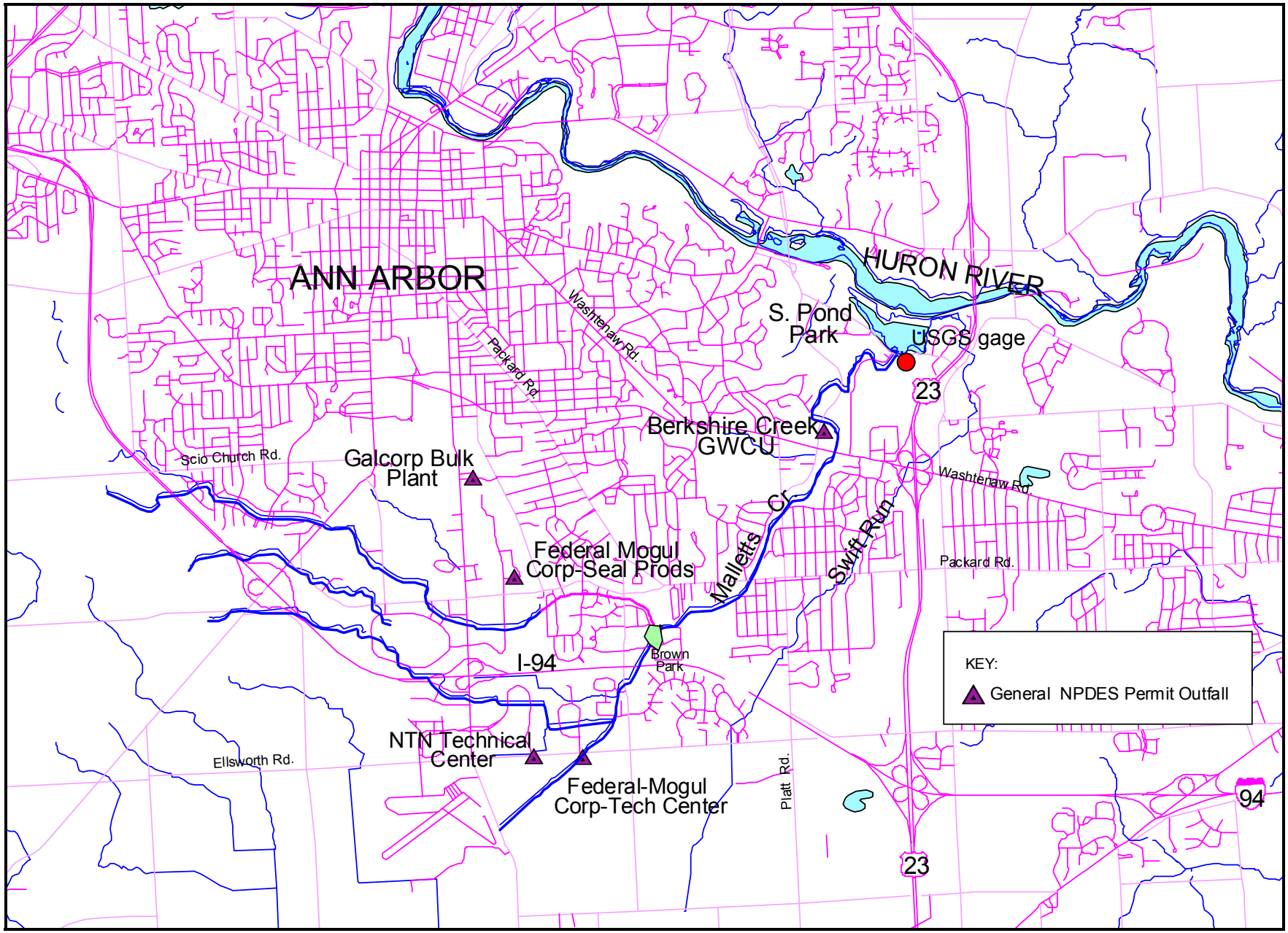


Figure 3. NPDES permitted (individual, general, and industrial storm water) facility outfalls to Malletts Creek watershed, Washtenaw County, Michigan.

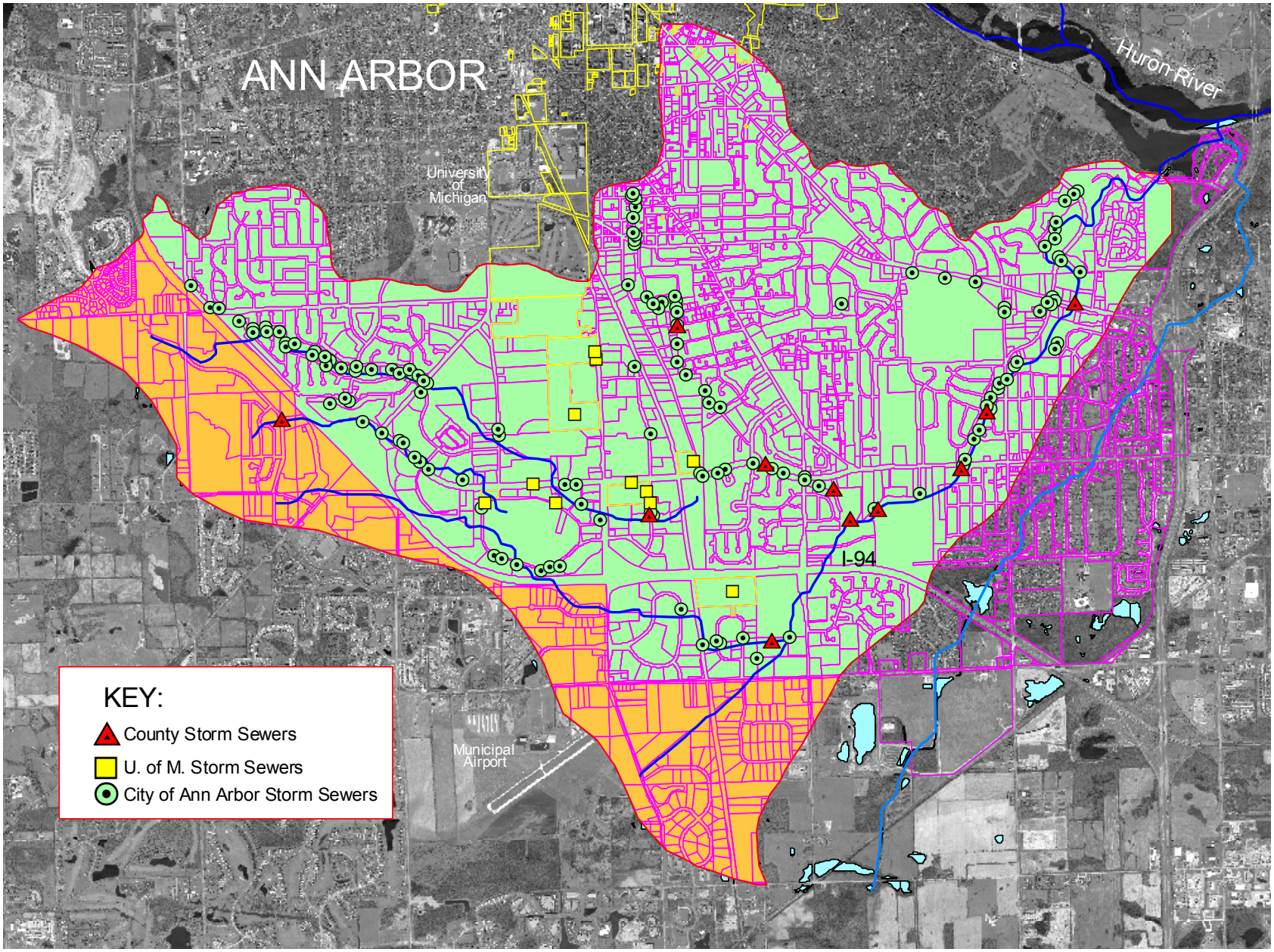


Figure 4. Washtenaw County Phase I and II storm sewer outfalls in the Malletts Creek watershed managed by the city of Ann Arbor, University of Michigan, and Washtenaw County. Source: Scott Wade – (LTI, 2003).

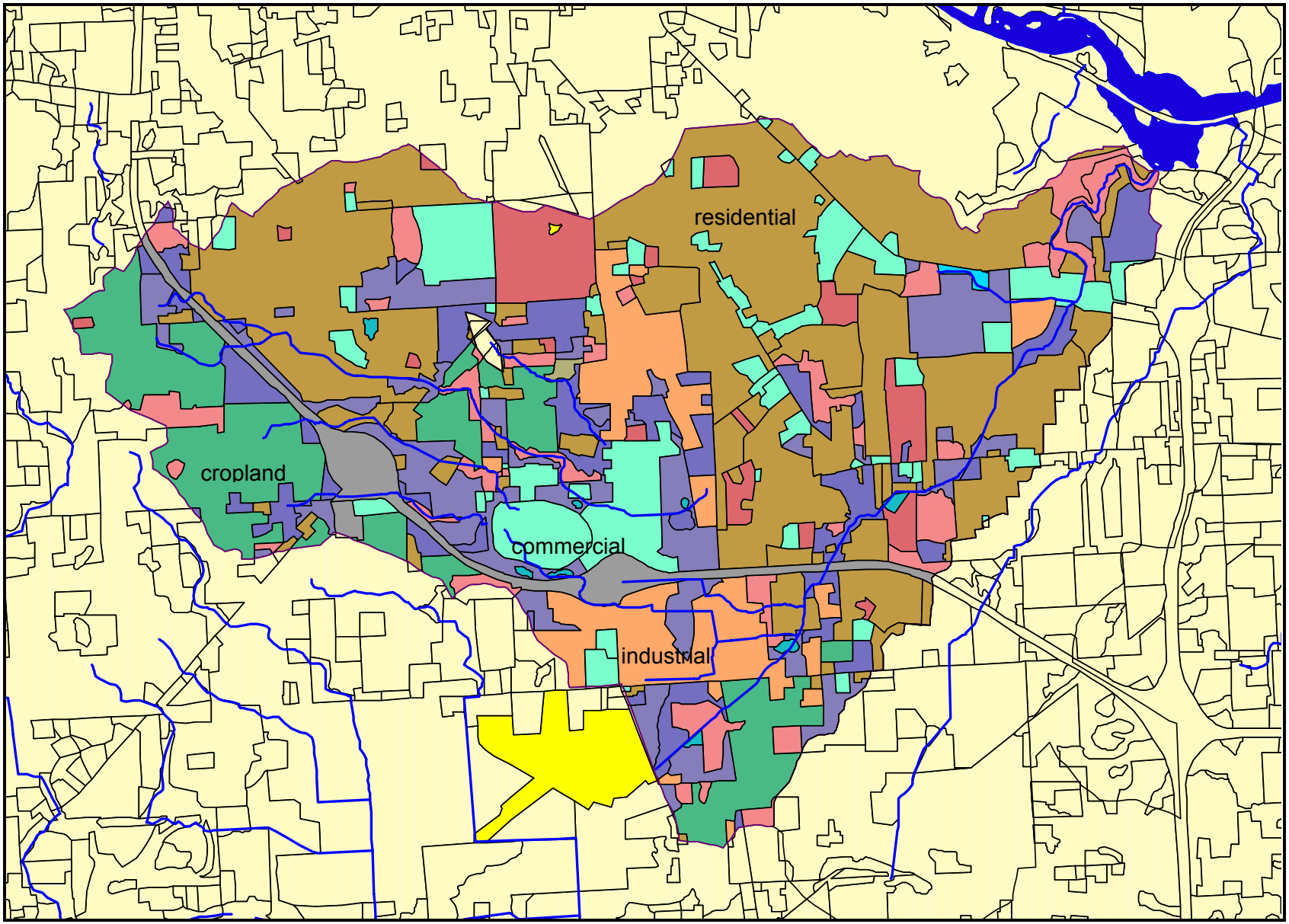


Figure 5. Land use categories in the Malletts Creek watershed, Washtenaw County, Michigan.
(Source: Scott Wade – (LTI, 2003 using 2002 (Ann Arbor) and 1998 (township) land use coverages).

Table 1. Individual, general, and industrial storm water NPDES permitted outfalls tributary to the Malletts Creek watershed and estimated TSS loads for non-storm water outfalls. (Source: MDEQ/WD NPDES permit Management System. *mgd = million gallons per day.

PERMIT NUMBER	FACILITY	DESIGN FLOW (mgd*)	Latitude (decimal degrees)	Longitude (decimal degrees)	Annual TSS Load at 25 mg/l (pounds)
General NPDES Permits:					
MIG080756	Galcorp Bulk Plant	0.043	42.255	-83.73855	3,274
MIG081010	Berkshire Creek GWCU	0.01	42.258333	-83.695	761
MIG250419	NTN Technical Center	0.33	42.22944	-83.73167	25,129
MIG250420	Federal-Mogul Corp-Tech. Center	0.09	42.917	-83.72556	6,853
MIG250421	Federal-Mogul Corp-SealProducts	1.2	42.245833	-83.73333	91,378
	Total Daily Design Flow (mgd):	**1.673**			**127,396**
Storm Water NPDES Permits (Phase I – MS4 Program):					
MI0053856	City of Ann Arbor				
MI0053902	University of Michigan				
MI0053911	Michigan Depart. of Transportation				
Storm Water NPDES Permits (Phase II – MS4 Program):					
(eleven outfalls)	Washtenaw County				

Table 2. Annual TSS loads based on NPDES permitted point sources and various land use categories in the Malletts Creek watershed. Estimated annual TSS loads and recommended TSS reductions (WLA and LA) are derived.

Source Category	Acres	Estimated Current TSS (Pounds/Year)*	TMDL TSS Target Load TSS (Pounds/Year)
WLA Components:			
NPDES Individual/General Permitted Point Source TSS Load:		127,396	127,396
NPDES Permitted Storm Water TSS Load:			
Residential	2422	496,343	
Industrial	535	202,971	
Commercial and Service	686	405,831	
Transportation/Comm/Util.	232	68,643	
Subtotal:		1,173,788	985,853 (16% reduction)
WLA Total:	3875	1,301,184	1,113,249 (**WLA)**
LA Components:			
Agricultural Land			
Cropland	787	53,822	29,695 (45% reduction)
(Background Sources)			
Forested/Shrub/Open Land			
Deciduous Forest	437	10,512	10,512
Openland/Shrub/Rangeland	1559	37,500	37,500
Confier Forest	8	192	192
Wetland			
Forested	9	191	191
Water Body			
Lake/Reservoir	21	445	445
LA Subtotal:	2821	102,662	78,535 (**LA**)
Overall Totals:	6696	1,403,846	1,191,784 (overall 15% reduction)

**Load estimates based on PLoad Version 3 model (USEPA, 2001), land use acres derived from 2002 (Ann Arbor) and 1998 (township) land use coverages and a mean annual rainfall value of 34 inches.*