MS4 TMDL Monitoring Manual

Lower Grand River Watershed

Updated 2021

Prepared for:
Grand Valley Metropolitan Council & Lower Grand River Organization of Watersheds

Approved March 2021

Blank Page

LGRW MS4 TMDL Monitoring Manual

Prepared for:
The Grand Valley Metropolitan Council & The Lower Grand River Organization of Watersheds

Approved March 2021

Prepared by:
LimnoTech
Ann Arbor, MI
&
The LGROW Technical Committee

TABLE OF CONTENTS

MS4 TMDL Monitoring Manual

The total maximum daily load (TMDL) Monitoring Manual was developed to address the three monitoring objectives described below. Ultimately, the goal of this monitoring manual is to provide an approach for municipal separate storm sewer system (MS4) permittees in the watershed to demonstrate progress towards meeting TMDL targets. The implementation of this plan over a 5 year period involves evaluation of structural and operational best management practices (BMP), sampling of targeted outfalls in dry and wet weather, monitoring of impaired streams, and reporting of other restoration and water quality surveys conducted in the impaired waterways.

Objectives

Objective 1. Determining progress toward meeting TMDL targets.

The State of Michigan is required by the Clean Water Act to assess all water resources. If, during this assessment, a water body is found not to support its designated use or attain its water quality standards (WQS), a TMDL is developed to define the steps necessary to achieve attainment. As of December 2020, 11 subwatersheds within the Lower Grand River Watershed (LGRW) require TMDLs (Attachment 1). The Lower Grand River Organization of Watersheds (LGROW) has developed a Watershed Management Plan (WMP), maintained under a separate cover, which includes more specific information regarding the conditions and impairments in the waterways (LGROW, 2011).

The TMDLs include *E. coli* and biota (using TSS as a surrogate). Note that the Michigan Department of Environment, Great Lakes & Energy (EGLE) periodically reassesses and updates the list of impaired streams in the LGRW. TMDLs addressing recreational and aquatic life use impairments have been developed for several waterways in the LGRW. Because bacteria are used to assess recreation use impairment, target concentrations for *E. coli* have been developed for the TMDLs addressing bacteria impairments.

Total suspended solids (TSS) have been used as a surrogate measure for biota by EGLE in developing TMDLs for waterbodies with impaired aquatic life. The TMDL target concentration represents the allowable level of TSS needed for a healthy biota community.

A number of communities within the LGRW own or operate a municipal separate storm sewer system (MS4) and are regulated by a National Pollutant Discharge Elimination System (NPDES) permit. NPDES permits are now issued to individual MS4 communities; however, MS4s in the LGRW are working on a watershed scale. By working on a watershed scale, communities are able to implement regional plans for permit compliance, saving money and reducing duplicate initiatives by neighboring communities.

MS4s in the LGRW submitted permit applications in 2015. These permits require MS4s to make progress in achieving the pollutant load reduction requirements in the TMDL. In addition, the MS4s are required to implement the monitoring plan to assess the effectiveness of the best management practices (BMPs) implemented in making progress towards achieving the TMDL. Communities that do not have a MS4 permit and areas outside the MS4 are not required to implement BMPs; however, BMPs implemented in these areas are consistent with the watershed-scale approach to meeting the TMDL in-stream targets.

Given the need to address the requirements in the TMDLs, the LGROW Technical Committee determined that it would be to the benefit of the LGRW if TMDL-related activities and other water quality monitoring were done in a collaborative, uniform manner throughout the watershed.

Objective 2. Evaluate the effectiveness of municipal stormwater runoff controls and practices (BMPs)

For permitted MS4 communities, the NPDES permit application requires the development and evaluation of BMPs. BMPs are implemented within each community, and each BMP is designed to reduce pollutants from entering a waterbody. A separate BMP Manual has been prepared as a part of the permit that identifies numerous structural and operational BMPs and their operation and maintenance.

Monitoring at MS4 outfalls in targeted areas that have the highest risk of polluting waterways will be one method to measure the effectiveness of operational BMPs on in-stream water quality. The monitoring locations and sampling identified in this monitoring manual provide information about water quality benefits resulting from BMP implementation by individual MS4 permittees. The sampling and analytical procedures identified can be further used in various illicit discharge detection and verification processes if needed.

Objective 3. Coordinate with partners' reasonable assurance activities toward meeting TMDL targets

Non-point source pollution includes both agricultural and urban pollution sources that are commonly difficult to define and locate. The majority of the watershed (51%) is used for farming and other agriculture (WMP, 2011). In addition, several villages and unincorporated developed areas do not have MS4 permits. The impact of runoff from these non-point sources contribute to the overall health of a watershed. Several entities are conducting water quality monitoring in impaired watersheds. This information will be collected and entered into the LGROW Data Repository to evaluate for effectiveness of activities outside of the MS4 areas in reducing pollutants.

BMP Tracking

Since 2003, MS4 communities have been tracking operational and structural BMPs implemented within their permitted areas as identified in the Good Housekeeping and Pollution Prevention Best Management Practices Manual and their individual Stormwater Management Plans. Following the guidelines within these documents, communities report operational and maintenance information respective to each BMP. For instance, reported information for Structural Control BMPs such as a catch basin would include number of catch basins cleaned and total amount of solids removed. For an Operational BMP such as Road Maintenance, reported information would include the number of street miles swept and total amount of solids disposed.

Performance metrics for TSS for specific structural BMP types have been compiled for the Stormwater Standards Manual for each MS4 permittee. These performance metrics are summarized in Table 1.

Table 1. Median Percent Removal of TSS by BMP Type.[1]

BMP Category	BMP Type	TSS Removal Efficiency (%)
Structural BMPs – Conveyance and Storage	Storm sewer	22%
	Detention basin (dry)	49%
	Detention basin (wet)	80%
	Detention basin (extended/wetland)	72%
	Retention basin	89%
Structural BMPs – LID and Small Site	Infiltration practices	89%
	Bioretention/rain gardens	86%
	Constructed filter	86%
	Planter box[2]	59%
	Pervious pavement	84%
	Pervious pavement[2] (roof discharge to stone)	50%
	Sediment forebay	50%
	Spill containment cell	50%
	Vegetated BMP (sized for pretreatment)	50%
	Water quality swale	86%
	Vegetated swale	81%
	Vegetated filter strip	81%

[1] Data source: LGRW NPDES MS4 Stormwater Standards Manual, Table 3.
[2]TSS removal efficiency assumes underdrained BMP, use value for infiltration practice, if applicable.

Bacteria removal efficiency has not been studied as well as TSS. Several literature sources were consulted for reasonable estimates of BMP performance with respect to bacteria for use in water quality modeling (LimnoTech, 2014; MPCA, 2019; Brown & Caldwell, 2013; Hathaway et al., 2009). These removal efficiencies are provided in Table 2 for general classes of BMPs. The removal efficiencies listed in Table 2 represent the annual average performance of the indicated BMP class. Removal efficiency in practice would vary by storm size, design considerations, and previous maintenance. For the purposes of calculating an annual average load reduction, representing BMP performance as an average is an appropriate simplification. If a BMP type is not listed in Table 2, the user should assume a nominal removal on the order of less than 10%.

Table 2. Typical Percent Removal of *E. coli* by Structural BMP Class.

BMP Class	Bacteria Removal Efficiency (%)
Infiltration	90%
Detention	10%
Retention	50%

Municipal operational BMPs refer to the common practices and procedures that can prevent the discharge of polluting materials to the MS4 or surface waters. The following operational BMPs listed in Table 3 are common to most MS4 communities and are being implemented to ensure compliance with permit requirements and to effectively minimizing pollutant runoff to the maximum extent practicable from

municipal operations. As shown, these practices help reduce both sediment and bacteria thus make progress in meeting pollutant reduction goals when implemented.

Table 3. Municipal Operations & Maintenance.[1]

Operational BMPs	Potential Pollutants									
	Sediment	Nutrients	Trash	Metals	Bacteria	Oil & Grease	Organics	Pesticides	Oxygen Demanding Substances	Salt
Road, Parking Lot Bridge & Sidewalk Maintenance	x	x	x	x	x	x	x		x	x
ROW & Vegetated Property Maintenance	x	x	x		x			x		
Unpaved Road Maintenance	x									
Cold Weather operations	x									x
Fleet Maintenance	x			x		x	x			
Building & Grounds	x	x	x		x		x	x	x	
Solid Waste Handling and Disposal	x	x	x	x	x	x	x	x	x	
Materials Storage	x	x	x	x		x	x	x	x	x
Spill Response and Prevention	x	x	x	x	x	x	x	x	x	x

[1] From Good Housekeeping and Pollution Prevention Best Management Practiced Operations and Maintenance Manual for Stormwater Controls

Section X of the Stormwater Management Plan for each MS4 community that has an identified TMDL includes a list of structural and operational BMPs that are prioritized based on their contribution toward achieving the pollutant load reduction requirement for that TMDL. BMPs are assigned a priority of High (H), Medium (M), or Low (L) based on their anticipated impact. The tracking and recording of these BMPs are ongoing actions that are being implemented to address the problem. MS4 communities submit progress reports to EGLE detailing the implementation of the BMPs in terms of frequency and quantity of pollutants reduced when applicable.

Monitoring Approach

The MS4 permits include requirements to implement monitoring to assess the effectiveness of implemented BMPs in making progress toward achieving the TMDL pollutant load reductions. Methods selected to meet these requirements include: water quality monitoring, Illicit Discharge Elimination Plan (IDEP) implementation, and the successful implementation of the watershed Public Education Plan (PEP). MS4 permittees in the LGRW have chosen to work collaboratively on the TMDL Implementation Plan to address impairments to water quality. This collaborative effort provides an opportunity to work with watershed partners in a cost-effective manner. In-stream monitoring conducted by watershed partners will be recorded and assessed to complement the efforts taken under this Plan to evaluate water quality improvements. The monitoring approach follows a 5-year plan to ensure that an adequate amount of time is considered in showing pollutant reductions.

Outfall Sampling

Targeted Outfalls for *E. coli* and TSS Sampling in Wet and Dry Weather

MS4 communities will sample targeted outfalls during wet weather events and during dry-weather monitoring to determine contribution of pollutants to TMDL reaches. Outfalls will be prioritized based on the following criteria:

- Outfalls identified will be in the MS4 urbanized area.
- Outfalls will have a direct discharge to a State identified impaired reach for a TMDL stream.
- Drainage areas to each outfall will be compared against the HSPF watershed modeling that LimnoTech completed for each impaired subwatershed. The model took climate, landcover, soil, and topography data and was able to produce sediment and bacteria outputs based on a simulation using precipitation, radiation, runoff, baseflow and infiltration data. The results of the modeling identify the areas in each subwatershed that have the highest surface runoff and pollutant loading. Targeted outfalls will be those with the highest potential of bacteria and sediment yield in the drainage area.

In the future, sampling locations may be removed from the targeted list if sample results at that location are below threshold levels. The water quality standard of 130 E. coli per 100mL as a 30-day geometric mean and 300 E. coli per 100mL as a daily maximum for Total Body Contact use are the target levels for the TMDL reaches for May 1 through October 31, and 1,000 E.coli per 100mL as a daily maximum year-round for Partial Body Contact use. For TSS, the threshold level is 80 mg/L. Sampling locations have the possibility to be added to the targeted list as the IDEP and TMDL investigation deems necessary to identify and reduce pollution coming from MS4 areas. Outfalls may also be added to the list if IDEP screening results in flow present with no other field indicators present.

IDEP Dry Weather Sampling Conditions

The IDEP requirements of the permits have the potential to identify areas and take actions to reduce pollutants entering impaired water bodies. The first monitoring component of this TMDL plan is to evaluate past IDEP results. The IDEP requires permittees to develop a program to find and eliminate illicit connections and discharges to their MS4. The IDEP approved by EGLE in 2013 includes a plan to conduct dry-weather screening of each prioritized MS4 outfall and point of discharge once every five years. This approved plan will be implemented again in 2024. If outfalls in TMDL reaches are determined to have illicit discharges or connections during dry weather screening, extra sampling will be completed for the specific stream reach impairment because TSS and *E. coli* are not parameters that are evaluated in the IDEP. However, in order to gain insight on pollutant sources, samples from dry weather screening can aid data collected during wet weather in order to determine effectiveness of reducing TSS and/or *E. coli* in impaired reaches.

If dry weather flow is detected at a targeted outfall during IDEP screening, the IDEP procedure will be followed. If IDEP contaminants (ammonia, pH, temperature, surfactants in a certain range) are not detected during the field analysis, then an *E. coli* sample will be taken and transported to the lab for analysis, if that waterbody has a TMDL impairment for *E. coli*. If the lab analysis is above threshold levels, then the IDEP will be followed in order to discover and eliminate the source of the illicit discharge or connection.

Wet Weather Sampling Conditions

The sampling conditions in this monitoring component should target sample collection during wet weather conditions at the targeted outfalls. Samples will be collected during a qualifying rain event. A qualifying rain event is a storm event of sufficient size to produce enough runoff to influence local

receiving water quality after the local streams have been predominantly base flow. A qualifying rain event has these characteristics:

- Precipitation event generally greater than 0.25 inches
- Preceded by dry weather or less than 0.1 inches of rain in the previous 48 hours; and,
- Occurs during Michigan's recreation season, which is May through October.

However, sampling should never occur during unsafe weather conditions. Samples should capture the first flush, which occurs within the first 30 minutes of the rain event if possible, but not longer than the first 60 minutes.

Sampling Frequency

Sampling will occur twice during wet weather at the targeted outfalls within 5 years of the approval of this plan. The LGROW Technical Committee recommends that the targeted locations be sampled according to the Timeline for Implementation outlined in this plan. MS4s in the LGRW commit to sampling a minimum of 50 targeted outfalls across the impaired waterways over the timeline of this plan. This number of targeted outfalls encompasses the locations of the highest pollutant loading; characterizes an appropriate representative number of outfalls requiring follow up during the 2018 IDEP screening results; supports the regional, watershed, collaborative approach endorsed by Lower Grand River Watershed MS4 members; maximizes the availability of limited resources. Depending on sampling results, outfalls can be removed from the list as outlined under the prioritization requirements. This number of targeted outfalls should provide enough data for individual communities to address pollutant loading and offer information on a watershed scale that will allow LGROW to target solutions regionally.

Watershed Partners' Monitoring Efforts

To fulfill Objective 3 of this plan, LGROW will leverage its relationships with partners across the watershed to compile and evaluate water quality sampling efforts that are working towards TMDL goals. Table 4 lists partners working in the LGRW that can provide LGROW data regarding impaired stream reaches.

Table 4. LGROW Partners working in impaired waterbodies

Impaired Waterbody	Partner	Link to Available Resources
Grand River	City of Grand Rapids	https://www.grandrapidsmi.gov/Government/Departments/Environmental-Services/Stormwater-Management
Grand River	USGS	https://waterdata.usgs.gov/monitoring-location/04119000/#parameterCode=00065
Buck Creek	City of Wyoming	https://www.lgrow.org/data-repository
Buck Creek	Friends of Buck Creek	https://mibuckcreek.org/research/

Buck Creek	Trout Unlimited	https://www.monitormywatershed.org/
Plaster Creek	City of Wyoming	https://www.lgrow.org/data-repository
Plaster Creek	Plaster Creek Stewards	https://calvin.edu/plaster-creek-stewards/
Bass Creek	Ottawa Conservation District	http://www.ottawacd.org/
Unnamed tributary	TBD	
Strawberry Creek	LGROW	Friends of Mill Creek group being formed to collect data.
York Creek	TBD	
Sand Creek	Ottawa Conservation District	http://www.ottawacd.org/
All	EGLE	Basin Year 1 - 2024, 2029

Data Repository and Public Availability

The LGROW Data Repository is available for groups conducting stream monitoring to store data. Any organizations collecting data are encouraged to submit data for long-term monitoring purposes. Data submitted to LGROW will be analyzed and verified for quality assurance by LGROW staff and/or the Technical Committee. Much of the data collected by partners listed in Table 4 is compiled and continually updated in the LGROW Data Repository.

The LGROW Data Repository is intended as a public source of water quality data throughout the LGRW. Data can be used as an educational tool for teachers, a source of data for research and to inform the public about the health of the watershed. The Data Repository User Guide (https://www.lgrow.org/data-repository/) is available for groups to learn how to submit data. This site will be referenced for new data that can be included for reporting on water quality improvements.

Public Education Plan Coordination

Much of the pollution contributing to the degradation of the LGRW is coming from rural areas (i.e. agricultural land) that is outside of MS4 jurisdiction. The collaborative LGRW Public Education Plan (PEP) addresses education in the watershed that focuses on things like: proper septic system maintenance, properly disposing of pet waste, the impacts of feeding waterfowl, and reporting illicit

discharges. Many of the actions found in the PEP directly impact the TMDL requirements. The success of this TMDL plan depends on implementation of the PEP, in addition to other operational BMPs performed by communities.

Timeline for Implementation

The implementation of this plan involves evaluation of structural and operational BMPs, sampling of targeted outfalls in dry and wet weather, monitoring of impaired streams, and reporting of other restoration and water quality surveys conducted in the impaired waterways. The following is the 5-year implementation plan:

Year 1:

- Prepare progress reports on BMP implementation and document effectiveness as defined in Stormwater Management Plans.
- Collect and analyze data regarding TSS and *E. coli* from partners who performed in-stream or outfall water quality sampling in TMDL watersheds.
- Prioritize BMPs to reduce pollutants entering MS4.
- Implement activities listed in the LGRW PEP including education on proper septic system maintenance, properly disposing of pet waste, etc.
- Create a list of targeted TMDL outfalls based on potential contribution of TSS and/or *E. coli* to water body to guide wet weather and IDEP sampling efforts.

Year 2:

- Conduct outfall sampling of TSS and *E. coli* at targeted outfalls in wet weather.
- Continue to implement prioritized BMPs to reduce pollutants entering MS4.
- Collect and analyze data regarding TSS and *E. coli* from partners who performed in-stream or outfall water quality sampling in TMDL watersheds.
- Implement activities listed in the LGRW PEP including education on proper septic system maintenance, properly disposing of pet waste, etc.

Year 3:

- Prepare progress reports on BMP implementation and document effectiveness as defined in Stormwater Management Plans.
- Continue to implement prioritized BMPs to reduce pollutants entering MS4
- Collect and analyze data regarding TSS and *E. coli* from partners who performed in-stream or outfall water quality sampling in TMDL watersheds.
- Implement activities listed in the LGRW PEP including education on proper septic system maintenance, properly disposing of pet waste, etc.

Year 4:

- Adjust BMP implementation based on monitoring results.
- Review TMDL Implementation Plan to identify next steps.
- Continue to implement prioritized BMPs to reduce pollutants entering MS4.
- Collect and analyze data regarding TSS and *E. coli* from partners who performed in-stream or outfall water quality sampling in TMDL watersheds.
- Implement activities listed in the LGRW PEP including education on proper septic system maintenance, properly disposing of pet waste, etc.

- Conduct outfall sampling according to IDEP, with addition of TSS and *E. coli* at targeted outfalls in wet weather.

Year 5:

- Prepare progress reports on BMP implementation and document effectiveness as defined in Stormwater Management Plans.
- Continue to implement prioritized BMPs to reduce pollutants entering MS4.
- Collect and analyze data regarding TSS and *E. coli* from partners who performed in-stream or outfall water quality sampling in TMDL watersheds.
- Implement activities listed in the LGRW PEP including education on proper septic system maintenance, properly disposing of pet waste, etc.

Evaluation

The effectiveness of this plan will be evaluated by the following:

- Determining if progress has been made to meet the TMDL by evaluating the actions outlined in Section X of the community's Stormwater Management Plan (ex: number of catch basins cleaned, miles of streets swept, number of projects constructed under new stormwater standards)
- Meeting goals and metrics outlined in the community's PEP and IDEP
- Data collected from sampling events shows reasonable progress towards meeting the TMDL

Summary

NPDES regulations require the development and evaluation of BMPs. BMPs are implemented within each community, and each BMP is designed to reduce pollutants from entering a waterbody. A separate BMP Manual has been prepared that identifies numerous structural and operational BMPs and their operation and maintenance. That BMP manual will be referenced to complete the objectives outlined in this plan.

Non-point source pollution includes both agricultural and urban pollution sources that are commonly difficult to define and locate. The majority of the watershed (51%) is used for farming and other agriculture (LGROW, 2011). In addition, several villages and unincorporated developed areas do not have MS4 permits. The impact of runoff from these non-point sources contribute to the overall health of a watershed and will be taken into consideration when analyzing data that is collected and determining BMP implementation and feasibility.

The monitoring locations and outfall sampling and analytical procedures identified in this monitoring program provide a solid foundation for water quality benefits resulting from BMP implementation by individual MS4 permittees. MS4 permittees in the LGRW will follow the objectives (1) Determining progress toward meeting TMDL targets (2) Evaluate the effectiveness of municipal stormwater runoff controls and practices (BMPs), and (3) Coordinate with partners' reasonable assurance activities toward meeting TMDL targets in order to make progress towards meeting TMDL requirements.

References

Brown and Caldwell. 2013. Northeast and Crooked Creek Watershed Improvement Plan. Prepared for City of Durham. June 2013.

City of Grand Rapids. 2019. Stormwater Standards Manual: Procedures & Design Criteria for Stormwater Management.

Florida Department of Environmental Protection. 2014. Online: http://www.dep.state.fl.us/water/sas/sop/sops.htm.

Hathaway, J.M., W.F. Hunt, and S. Jadlocki. 2009. Indicator Bacteria Removal in Storm-Water Best Management Practices in Charlotte, North Carolina. Journal of Environmental Engineering, 135 (12).

LimnoTech. 2014. Technical Memorandum: BMPs and BMP Implementation. Prepared for District Department of the Environment. December 2014.

LimnoTech. 2019a. Technical Memorandum: GVMC Model Application Approach and Results. Prepared for the Grand Valley Metropolitan Council. October 2019.

LimnoTech. 2019b. Development of a Watershed and Water Quality Model of the Lower Grand River. Prepared for the City of Grand Rapids. March 2019.

LimnoTech. 2019c. Technical Memorandum: GVMC Model Enhancement Task. Prepared for the Grand Valley Metropolitan Council. May 2019.

Lower Grand River Organization of Watersheds (LGROW). 2011. Lower Grand River Watershed Management Plan.

Michigan Department of Environmental Quality (MDEQ). 2015. Online: http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156-11433--,00.html).

Michigan Department of Environment, Great Lakes, and Energy. 2019. Michigan's Statewide *E. coli* Total Maximum Daily Load.

Standard Methods for the Examination of Water and Wastewater, 20th Edition, Method 2320 B, APHA, 1998.

United States Environmental Protection Agency (USEPA). 2009. EPA Industrial Stormwater Monitoring and Sampling Guide. Online: http://water.epa.gov/polwaste/npdes/stormwater/upload/msgp_monitoring_guide.pdf

United States Environmental Protection Agency (USEPA). 40 CFR Part 136. Online: http://www.epa.gov/region9/qa/pdfs/40cfr136_03.pdf

United States Environmental Protection Agency (USEPA). 1992. Online: http://yosemite.epa.gov/water/owrccatalog.nsf/852887bbc1ca359585256ad400705867/4323148a5bbfba3a85256b0600724566!OpenDocument

Attachments

Attachment 1. TMDL-Listed Streams in the Lower Grand River Watershed.

Attachment 2. Sampling Procedure.

Attachment 3. TMDL Monitoring Locations by Subwatershed.

Attachment 1. TMDL-Listed Streams in the Lower Grand River Watershed.

Community	*E. Coli*				Biota					
	Grand River	Buck Creek	Plaster Creek	Bass River	Plaster Creek	Bass River	Unnamed Trib	Strawberry Creek	York Creek	Sand Creek
City of East Grand Rapids	X		X		X					
Forest Hills Public School	X									
Georgetown Charter Township				X		X				
City of Grand Rapids	X	X	X		X		X			
Grand Rapids Charter Township							X			
City of Grandville	X	X								
Kent County Drain Commissioner and Administration	X	X	X		X		X	X	X	
Kent County Road Commission	X	X	X		X		X	X	X	
City of Kentwood	X	X	X		X					
Plainfield Charter Township	X									
City of Walker	X								X	X
City of Wyoming	X	X	X		X					

Attachment 2. Sampling Procedures.

The LGROW Technical Committee recognizes that the generation of quality, usable data begins with properly trained sampling staff, the use of approved analytical methods, and rigorous quality control. Rather than develop detailed standard operating procedures and analytical methods, the LGROW Technical Committee intends to utilize the skill sets of existing partners currently involved in water/wastewater/stormwater sampling and analysis as the foundation for the monitoring program. Many of the details below have been taken from the 2009 EPA Industrial Stormwater Monitoring and Sampling Guide Document (#EPA 832-B-09-003) and the 1992 EPA NPDES Storm Water Sampling Guidance Document (#EPA 833-B-92-001), as officially referenced at the end of this manual. Other documents include the Standard Operating Procedures from the Florida Department of Environmental Protection (http://www.dep.state.fl.us/water/sas/sop/sops.htm).

Sampler Qualifications

Sample collection should be done by personnel who are familiar with the sampling locations, sampling equipment, field practices and analytical methods. Personnel should have been previously trained in wastewater, drinking water, or stormwater sample collection such that an adequate understanding of proper sampling procedures is known. Ideally, staff should be used who understand the stormwater program, potential pollutant sources, monitoring and reporting requirements, principles of (cross) contamination, as well as general health and safety procedures. These staff should also understand and follow all quality assurance quality control techniques as mandated by the laboratory performing the analytical procedures to ensure valid data.

Health and Safety

Hazardous Weather

Sampling should never occur during unsafe weather conditions, which includes flooding events, lightning storms, hailstorms, high winds, etc. Every attempt should be made to conduct the sampling event using the guidelines of a qualifying storm event so that a representative dataset can be obtained to meet the monitoring objectives.

Chemical, Physical and Biological Hazards

Chemical hazards that may be encountered primarily include the preservatives used in sample collection containers for sample preservation. Review of applicable Safety Data Sheets (SDS) should be done to follow appropriate safety procedures.

A number of physical hazards include traffic hazards, slippery slopes and lifting hazards. Sampling personnel should be aware of their surroundings at all times and exercise prudent use of appropriate safety equipment.

Sampling personal may encounter ticks, mosquitoes, poison ivy, rodents, etc. as biological hazards. Proper repellants should be used if the sampling location has indications of these hazards.

Safety Equipment

Sampling personnel should be aware of their surroundings and hazards potentially involved. Some appropriate safety equipment should include:

- Cell phone or other communication equipment
- Safety glasses
- Traffic cones
- Insect or poison ivy repellent
- Gloves

Confined Spaces

No unauthorized sampling will be conducted in confined space. If sampling in confined space is needed, the confined space protocol from the sampler's organization shall be used.

Sampling Preparation

Prior to initiating a sampling event, personnel should review proposed sampling sites, weather, past weather, equipment, etc. to verify that they are properly prepared. It is a good idea to develop a sampling equipment checklist to ensure that all equipment, containers, and paperwork are available.

Documentation

Sampling personnel should document their sampling event and activities within a field notebook or field sheets. Sampling personnel must also secure the proper Chain of Custody sheets as required by the laboratory used.

It is the responsibility of the certified laboratory used to retain appropriate standard operating procedures (SOPs), calibration information, quality assurance/quality control (QA/QC) program information as required both by the certifying agency and/or as required by internal controls.

Identification and Labeling

Personnel should consult with the certified laboratory for proper sampling identification and labeling procedures. In general, samples should be identified by using the site identification as described in this document as a combination of the waterbody name and the site location (e.g. Plaster Creek at Burton St. SW). Other relevant information should include date, time, sampler, preservative, required test, sample type, and any special handling instructions.

Sample Collection and Handling

The laboratory and analytical methods used will dictate how a sample should be collected and handled. Refer to individual methods prior to sample collection to properly understand appropriate requirements. Generally, guidelines established in 40 CFR 136 should be followed (http://www.epa.gov/region9/qa/pdfs/40cfr136_03.pdf).

Containers, Volume and Preservative

Each analytical method will have specific containers, preservatives, and holding times associated with that method. Table 1 lists the containers and preservatives for each parameter.

Table 1. General Container, Volume and Preservative Information

Parameter	Bottle Type[1]	Recommended Sample Volume	Preservative[2]	Hold Time
E. coli	Sterilized Plastic	at least 100mL	Sodium Thiosulfate	6 hours
Total Suspended Solids (TSS)	Pre-cleaned HDPE	1 L	None	7 days

[1] HDPE = high density polyethylene
[2] All samples should be cooled to 4°C

Sample Handling and Hold Time

Generally, samples collected must be cooled to 4 degrees C upon collection. Hold times are provided in Table 1. Refer to the sample collection SOP for specific handling instructions.

Collection Technique

Samples should be collected according to laboratory specifications and analytical methods used.

Flow Monitoring

At this time, flow monitoring is not part of the watershed or TMDL monitoring effort unless adequate resources are available. The USGS maintains flow monitoring stations on the Grand River and some others within the LGRW. These can be accessed at http://www.waterdata.usgs.gov. Table 2 lists the station number and station name.

Table 2. USGS Flow and Station Information

Station Number	Station Name	Watershed
04114000	Grand River at Ionia	Lower Grand
04118105	Grand River at Ada	Lower Grand
04119000	Grand River at Grand Rapids	Lower Grand
04119055	Plaster Creek at 28th Street	Lower Grand/Plaster Creek
04117500	Thornapple River near Hastings	Lower Grand/Thornapple
04118000	Thornapple River near Caledonia	Lower Grand/Thornapple
04118500	Rogue River near Rockford	Lower Grand/Rogue
04119160	Buck Creek at Wilson Ave. at Grandville	Lower Grand/Buck

Certified Laboratories

As was previously mentioned, samples collected by LGROW members for watershed monitoring purposes must be analyzed using laboratories certified by either the EPA or the State of Michigan for the previously listed parameters. Certified laboratories are required to develop and maintain a quality assurance plan which details quality control procedures specific to each method (http://water.epa.gov/scitech/drinkingwater/labcert/index.cfm, http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156-11433--,00.html). These plans and certification status should be reviewed by the organization collecting the samples to verify their program. Prior to collecting and submitting for analysis, LGROW members should ensure that the laboratory providing analysis is certified.

Quality Assurance / Quality Control Procedures

Calibrations and Verifications

Generally, the laboratory maintains all relevant quality assurance/quality control procedure documentation. This documentation is subject to review during certification audits and is thus assumed to be in good order. However, certain field instruments require routine calibration and recordkeeping. For field instruments such as those measuring pH, temperature or dissolved oxygen, a calibration logbook must be maintained. This logbook must include, at a minimum, the date and time of the calibration/verification/maintenance; value of standard or buffer used; instrument reading and indication of pass/fail; name of analyst performing calibration/verification/maintenance.

Chain of Custody

Each laboratory used will have its specific chain of custody and will provide the sampler with the appropriate document. In general, the sampler must note the sample ID, date and time of sample collection, matrix (water), analysis requested, preservative used, and relevant contact information. Some laboratories may require other field measurements such as pH, temperature, or dissolved oxygen on their chain of custody.

Duplicates, Equipment and Field Blanks

Field duplicates are used to assess the precision of the sampling methods used in the field. Field duplicates are prepared by collecting and transferring additional sample volume into a separate bottle. Both the original sample and the field duplicate are sent to the laboratory for analysis. The general rule of thumb is to collect one field duplicate per 10 samples collected. Proper communication is important with each laboratory to ensure that the appropriate number of duplicate samples is collected, and sample bottles have been prepared for the field duplicates.

Laboratories will prepare replicates in the laboratory for the purpose of assessing the precision of laboratory practices. In general, each laboratory dictates the number of duplicates needed to properly maintain their certification. In general, laboratories will analyze one replicate per 20 samples collected (EPA Region 3 guidance (http://www.epa.gov/region3/esc/qa/pdf/blanks.pdf)).

If field equipment is used in sample collection (i.e. automated sampler, sampling jug, etc.), an equipment blank must be collected at least once per 20 samples per parameter, with a minimum of one per day whichever is more frequent. Equipment blanks are used to ensure that equipment used is free from contamination resulting from improper cleaning.

Field blanks should also be collected at least once per 20 samples per parameter, with a minimum of one per day, whichever is more frequent. Field blanks are collected to verify that field conditions do not contribute to sample contamination.

For equipment blanks, the water is poured over/through the collection device and collected in the appropriate sample container. For field blanks, a sample of analyte free water is poured into the appropriate sample container.

Attachment 3. TMDL Monitoring Locations.

Monitoring locations will be established per the timeline and the criteria in this plan.