Stormwater Management Program (SWMP)
National Pollutant Discharge Elimination System (NPDES)
Permit Application for Discharge of
Stormwater to Surface Waters of the State from a
Municipal Separate Storm Sewer System (MS4)

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Glossary

Annual monitoring frequency refers to a calendar year beginning on January 1 and ending on December 31. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Best management practices (BMPs) means structural devices or non-structural practices that are designed to prevent pollutants from entering into storm water flows, to direct the flow of storm water, or to treat polluted storm water flows.

Certificate of Coverage (COC) is a document, issued by the Department, which authorizes a discharge under a general permit.

Discharge means the addition of any waste, waste effluent, wastewater, pollutant, or any combination thereof to any surface water of the state.

Discharge point is the location where the point source discharge is directed to surface waters of the state or to a separate storm sewer. It includes the location of all point source discharges where storm water exits the facility, including outfalls which discharge directly to surface waters of the state, and points of discharge which discharge directly into separate storm sewer systems.

Illicit Connection means a physical connection to an MS4 that primarily conveys non-stormwater discharges other than uncontaminated groundwater into the MS4; or a physical connection not authorized or permitted by the local authority, where a local authority requires authorization or a permit for physical connections.

General permit means a National Pollutant Discharge Elimination System permit issued authorizing a category of similar discharges.

Illicit Discharge means any discharge to, or seepage into, an MS4 that is not composed entirely of stormwater or uncontaminated groundwater except discharges pursuant to an NPDES permit. A discharge that originates from the applicant’s property and meets the illicit discharge definition is considered an illicit discharge.

Inlet means a catch basin, roof drain, conduit, drain tile, retention pond riser pipe, sump pump, or other point where storm water or wastewater enters into a closed conveyance system prior to discharge off site or into waters of the state.

Maximum extent practicable means implementation of best management practices by a public body to comply with an approved storm water management program as required by a national
permit for a municipal separate storm sewer system, in a manner that is environmentally beneficial, technically feasible, and within the public body’s legal authority.

**Municipal separate storm sewer system (MS4)** means all separate storm sewers that are owned or operated by the United States, a state, city, village, township, county, district, association, or other public body created by or pursuant to state law, having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under state law, such as a sewer district, flood control district, or drainage district, or similar entity, or a designated or approved management agency under Section 208 of the Federal Act that discharges to the waters of the state. This term includes systems similar to separate storm sewer systems in municipalities, such as systems at military bases, large hospital or prison complexes, and highways and other thoroughfares. The term does not include separate storm sewers in very discrete areas, such as individual buildings.

**Outfall** means a discharge point from an MS4 directly to surface waters of the state.

**Point of Discharge** means a discharge from an MS4 to an MS4 owned or operated by another public body.

**Point source** means an outfall from a drainage system to waters of the state, or a point where a storm water drainage system discharges into a system operated by another public body.

**Pretreatment** is reducing the amount of pollutants, eliminating pollutants, or altering the nature of pollutant properties to a less harmful state prior to discharge into a public sewer. The reduction or alteration can be by physical, chemical, or biological processes, process changes, or by other means. Dilution is not considered pretreatment unless expressly authorized by an applicable National Pretreatment Standard for a particular industrial category.

**Regulated areas** means urbanized areas and areas identified by the permit applicant to be subject to a watershed planning process.

**Separate storm water drainage system** means drainage systems that convey storm water to waters of the state excluding combined sewer systems and sanitary sewer systems (separate storm water drainage systems are not intended to carry sanitary wastewater). The conveyance may be opened or enclosed, and may contain the non-stormwater discharges specified in Part I.A.1.c. and d.

**Stormwater** includes storm water runoff, snow melt runoff, and surface runoff and drainage.

**Total Maximum Daily Loads (TMDLs)** are required by the Federal Act for waterbodies that do not meet Water Quality Standards. TMDLs represent the maximum daily load of a pollutant that a waterbody can assimilate and meet Water Quality Standards, and an allocation of that load among point sources, nonpoint sources, and a margin of safety.
Urbanized area means a place and the adjacent densely populated territory that together have a minimum population of fifty thousand (50,000) people, as defined by the United States Bureau of the Census and as determined by the latest available decennial census.


Waters of the State means all of the following, but does not include drainage ways and ponds used solely for wastewater conveyance, treatment, or control:

- The Great Lakes and their connecting waters,
- All inland lakes,
- Rivers,
- Streams,
- Impoundments,
- Open drains, and
- Other surface bodies of water within the confines of the state.
Introduction

This document has been prepared in direct connection with a 2023 National Pollutant Discharge Elimination System (NPDES) Permit Application for Discharge of Stormwater to Surface Waters of the State from a Municipal Separate Storm Sewer System (MS4) prepared by Kieser & Associates, LLC (K&A) on behalf of Western Michigan University (WMU).

The NPDES Program protects the surface waters of the state by assuring that discharges of wastewater comply with state and federal regulations. Anyone discharging or proposing to discharge wastewater to the surface waters of the state are required to make application for and obtain a valid NPDES permit prior to wastewater discharge.


Regulated Area

A map identifying the urbanized area associated with the WMU jurisdictional boundary (as defined by the 2010 Census) is provided as Figure 1. The WMU MS4 system is located within the Kalamazoo urbanized area and discharges stormwater into surface waters of the state via stormwater outfalls to Arcadia Creek and/or points of discharge to the adjoining City of Kalamazoo MS4 drainage network.

Outfalls and Points of Discharge

The surface water of the state that receives stormwater discharge from the WMU MS4 footprint is Arcadia Creek. All WMU stormwater outfalls and points of discharge are summarized in Table 1. Attachment G, "BMP Maintenance plan," contains Table 1 and Figures. WMU Facilities Management maintains this map, and a web based GIS system. There are a total of 10 stormwater outfalls that discharge to Arcadia Creek. Additionally, there are 24 stormwater points of discharge where the WMU storm sewer system enters an adjoining MS4 drainage network owned by the City of Kalamazoo. These City outfalls also discharge to Arcadia Creek.
Enforcement Response Procedure

The WMU campus is regulated as an MS4 under the NPDES Permit program. Unlike other municipalities, the University has total control over the storm sewer system within the campus footprint. More specifically, there are no opportunities or mechanisms to allow other entities to connect to the WMU MS4 infrastructure within the campus footprint. As a result, the University is solely responsible for its own MS4 permit compliance. As summarized within this SWMP, WMU has taken and will continue a proactive approach to stormwater management and implementation of stormwater control measures (or best management practices), and serves as a model for others within the Kalamazoo River Watershed to follow.

Tracking Non-Compliance

WMU will utilize a spreadsheet to track instances of non-compliance. The following information will be documented:

- Description of violation
- Location of violation
- Date violation occurred
- Name of responsible person/department
- Enforcement action taken by WMU
- Date compliance was reestablished
- Action(s) taken to reduce, eliminate and prevent recurrence of the non-compliant discharge

Detailed information and copies of correspondence for each violation will be maintained in a separate file.
Stormwater Management Program

The WMU Stormwater Management Program (SWMP) is comprised of six major elements. These six major elements include the minimum measures required by the U.S. EPA, EGLE, and are listed as follows:

1. **Public Participation/Involvement Program (PPP)** - to promote, publicize, and facilitate education for the purpose of encouraging the public to reduce the discharge of pollutants to stormwater to the maximum extent practicable

2. **Public Education Program (PEP)** - to share components of the SWMP and encourage participation in its review and implementation

3. **Illicit Discharge Elimination Program (IDEP)** - to detect and eliminate illicit connections and discharges to the MS4

4. **Construction Stormwater Runoff Control Program** - to augment Part 91 rules dealing with soil erosion, offsite sedimentation and other construction-related wastes

5. **Post-Construction Runoff Control Program** - (for new development and redevelopment projects) to address post-construction stormwater runoff from projects that disturb one acre or more, including projects less than one acre that are part of a larger common plan of development that would disturb one acre or more

6. **Pollution Prevention and Good Housekeeping Program** - to minimize pollutant runoff to the maximum extent practicable from municipal operations that discharge stormwater to the surface waters of the state

The following chapters of this text are intended to demonstrate compliance with these six minimum control measures and applicable water quality requirements as part of the NPDES Permit Application and SWMP.
1. Public Participation/Involvement Program (PPP)

WMU Environmental Health and Safety (EHS) seeks to promote, publicize, and facilitate watershed education for the purpose of encouraging the public to reduce the discharge of pollutants in stormwater to the maximum extent practicable. The WMU public education program has been developed to ensure that the targeted audiences are reached with the appropriate messages to meet the intent of the stormwater permit. It mimics plans of other area MS4s seeking to unify approaches, though maintains relevant aspects particular to the WMU setting.

The procedure for making the SWMP available for public inspection and comment involves posting an electronic copy of this document to the EHS website. An email address is provided on the website to allow for public comments to be received by a designated WMU representative. All SWMP email comments received by WMU will be documented as well as each WMU response. As a result, the WMU website will provide a direct means for public communication (refer to Attachment A for WMU EHS website information).

Educational materials on how community members can get involved is also included on protectyourwater.net. Some examples include keeping stormwater catch basins and inlets clear of debris, reporting of any illegal dumping down catch basins and inlets, washing cars on lawn areas, routing downspouts to vegetative areas, and implementing appropriate Best Management Practices (BMP).

Mechanisms to Invite Public Involvement and Participation

Publication and promotion of events and action items will typically be virtual activities (promotion of events and activities via a community’s website, Stormwater group’s website, social media, various website links, etc.). Additional WMU outlets to inform the student population include announcements from educators within WMU environmental classes (Biological Sciences, Environmental Sciences, Geological Sciences), WMU booth at Bronco Bash (attended by 15,000 people), and/or Benefits Expo (attended by 200-500 people). Tracking will involve final number of pamphlets distributed, as well as comments received on the SWMP. Approximately 1,200 students will be encouraged to visit the website and provide comments. Data tracking will include final number of students informed, comments received on the SWMP, as well as the number of visitation hits on the stormwater website.

To further involve the students and public at WMU the following mechanisms will be used:

- Landscaping crews will daily maintain catch basins, inlets, and BMPs. They will also report any illegal dumping of chemicals/debris from students or contractors on campus.
This mechanism that is already in place serves as an example for students and visitors as to how a community or residence needs to be maintained. The idea being, we lead by example so that the student population will bring these practices with them to their communities and know how a stormwater system should work.

BMPs themselves will be used to involve the students and a countless number of visitors to the campus. The thirty plus BMPs on campus is a working model of how communities can solve water management issues. Many visibly accessible BMPs on campus include signage that highlights the importance of stormwater management and WMU’s role in protecting local surface water resources. The goal of the signage is to educate WMU students and visitors on the impacts of stormwater and how best management practices can mitigate those impacts. This information will ultimately initiate interest and promote stewardship of water resources.

WMU in collaboration with Kalamazoo Stormwater Working Group (KSWG) will continually promote educational materials by linking the WMU EHS’s website to KSWG’s website. The method of Assessment will be to record the number of programs promoted on the KSWG website.

Other

Any questions on this policy and procedure should be directed to WMU Environmental Health and Safety.

Process for Updating/Revising the Procedure

This procedure shall be reviewed on an annual basis by EHS for any updates to improve effectiveness.

2. Public Education Program (PEP)

OVERVIEW

This updated PEP is integrated into the 2022 Stormwater Management Plan (SWMP) and is consistent with the Kalamazoo Stormwater Working Group (KSWG) efforts to unify public education messaging. This narrative and associated Attachment K supplant the previously submitted WMU Public Education Plan (PEP).

The primary strategy of this PEP is to provide free public education material to the campus community via WMU’s website, utilize a regionally-developed and widely shared social media campaign to cover each PEP topic, and to promote ongoing stormwater education activities by others. Unified and shared messaging will benefit regional education efforts and support consistent public education program efforts.

INTRODUCTION
The unique purpose of the public education portion of the NPDES MS4 permit is to increase the awareness of the WMU community about how their everyday activities contribute pollutants to their community’s water resources. Most citizens recognize the recreational and aesthetic benefits they receive from water, and most even recognize that water quality degradation is a serious concern in the Great Lakes Region. However, most people have not made the connection that the majority of this pollution can be generated from their normal everyday actions and not simply from large commercial and industrial sources.

This PEP is jurisdictionally-based. However, portions may be performed in conjunction, cooperation, and coordination with the other water quality educational efforts within the watershed, such as MS4 permit holders, partners within the KSWG and the TMDL Implementation Committee. It is recognized that some existing educational components were designed to address groundwater, certain watersheds, stretches of streams, particular audiences, to convey a specific message, or to implement a particular type of educational strategy or technique. However, many of the on-going educational efforts share certain general water quality messages and strategies that are relevant to the stormwater program.

The following ten educational components are PEP requirements of the MS4 program also reflected in Attachment K.

- Topic 1: Promote public responsibility in the applicant’s watershed.
- Topic 2: Inform and educate the public about the connection of the MS4 to area waterbodies and the potential impacts discharges could have on surface waters of the state.
- Topic 3: Educate the public on illicit discharges and promote public reporting of illicit discharges and improper disposal of materials into the MS4.
- Topic 4: Promote preferred cleaning materials and procedures for car, pavement, and power washing.
- Topic 5: Inform and educate the public on proper application and disposal of pesticides, herbicides, and fertilizers.
- Topic 6: Promote proper disposal practices for grass clippings, leaf little, and animal waste that may enter into the MS4.
- Topic 7: Identify and promote the availability, location, and requirements of facilities for collection or disposal of household hazardous waste, travel trailer sanitary wastes, chemicals, yard wastes, and motor vehicle fluids.
- Topic 8: Inform and educate the public on proper septic system care and maintenance, and how to recognize system failure.
- Topic 9: Educate the public on and promote the benefits of green infrastructure and Low Impact Development.
- Topic 10: Identify and educate commercial, industrial, and institutional entities likely to contribute pollutants to storm water runoff.

WMU PEP TASK ELEMENTS

WMU’s planned educational goals are specified in Attachment K. More specifically, these are the educational tasks to be undertaken by WMU as a component of its individual permit. Attachment K of the SWMP is intended to illustrate the relationship between the 10 topical components listed
above and the delivery mechanisms, evaluation methods, measurable goals, and an associated timetable for implementation.

SUMMARY

WMU will increase public education by the following:
1. Participate in the KSWG, the TMDL, or another active group. (Attend meetings, promote educational activities on website, etc.)
2. Provide information on the WMU Community website and/or links to a centralized web page and utilize social media platforms to direct people to the educational materials.
3. Continue to support and provide Employee Training.
4. Educate stakeholders including students, faculty, employees as well as commercial, industrial, and institutional entities engaged with WMU as the need arises.
5. Conduct public survey twice per permit cycle.
6. Evaluate the effectiveness of the PEP at the time of annual reporting.

WMU - MEASURE OF ASSESSMENT

WMU will conduct a public survey twice per permit cycle to measure change in education level. The first survey will be within the first 2 years of the permit cycle (year 1 or 2) and the second survey will occur in the last 2 years of the permit cycle (year 4 or 5). This survey will be a brief and is intended to measure delivery mechanism effectiveness along with change in knowledge and behavior among the WMU community. It will be consistent with similar surveys conducted by other KSWG permittees.

WMU will assess at a staff level, the effectiveness of the overall PEP at the time of the annual report and make changes to improve the PEP for the remaining years within the permit cycle as it relates to the measurable goals for each Best Management Practice (BMP). The procedure for evaluating and determining the effectiveness of the overall PEP will be at the discretion of the Storm Water Program Manager at the time of evaluation based on survey responses and other data available (website data, comments provided, etc.).

OTHER

Any questions on this policy and procedure should be directed to the WMU Office of Environmental Health and Safety, Storm Water Program Manager.

PROCESS FOR UPDATING/REVISING THIS PROCEDURE

This procedure shall be reviewed on an annual basis by the Storm Water Program Manager for any updates to improve effectiveness. If current procedures or portions of the PEP are determined by the Storm Water Program Manager to be ineffective, WMU will make changes to the PEP based on input from EGLE and recommendations of the Storm Water Program Manager to improve delivery.
mechanism effectiveness along with increasing knowledge and behavior among the WMU campus community.

3. Illicit Discharge Elimination Program (IDEP)

All non-stormwater discharges are strictly prohibited from entering into the WMU MS4 infrastructure. WMU has complete authority and control over its MS4. Refer to Attachment B - WMU Stormwater Control Policy. The following definitions apply to the IDEP:

**Illicit Discharge:** Any discharge to, or seepage into, a Municipal Separate Storm Sewer System (MS4) that is not composed entirely of stormwater or uncontaminated groundwater except discharges pursuant to an NPDES permit.

**Illicit Connection:** A physical connection to an MS4 that primarily conveys non-stormwater discharges other than uncontaminated groundwater into the MS4; or a physical connection not authorized or permitted by the local authority, where a local authority requires authorization or a permit for physical connections.

A current WMU storm sewer system map is available at the WMU Physical Plant and is also available on the WMU intranet system. This storm sewer system is part of the larger campus Geographic Information System (GIS) that is maintained by WMU Facilities Management staff. As previously identified in this document, a hard copy storm sewer map is attached as Figure 2. WMU outfalls and points of discharge are typically inspected during the same year and therefore these locations are not prioritized or ranked in any order of importance. However, all such locations will be screened at least once during each permit cycle. As part of this IDEP inspection program, WMU will also include the stormwater discharge pipes entering the Goldsworth Valley Stormwater Detention Pond (refer to Figure 3). This pond is designed to overflow during heavy rain events into the City of Kalamazoo MS4 network via the City’s pond outflow structure (Kalamazoo Storm Structure ID# STCVIKC20390) that serves the stormwater pond.

The WMU IDEP plan involves a standard operating procedure (i.e., standardized, step-wise approach) for performing field observations at stormwater outfalls and points of discharge within the entire MS4 footprint during dry weather at least once during each permit cycle. Documented checklist observations include, but are not limited to, discernable flows, water clarity, odor, color, and floatables. A copy of the IDEP checklist used during field observations is provided in Attachment C. DryWeather stormwater monitoring plan for each permit cycle will be attachment I.

If unusual flow is observed during dry weather screening (i.e., no obvious explanation), the flow will be tracked upstream within the MS4 drainage network to determine the source. The source flow will then be containerized in sterile laboratory bottles in the field, at the time of observation, by the field inspection crew. The collected samples will be properly labeled, stored on ice in a
cooler, and submitted to a certified laboratory within 24-hours for analyses including ammonia, fluoride, detergents, and pH at a minimum.

If the source of flow is not immediately apparent, one or more of the following methods listed below will be initiated by WMU staff via the existing WMU internal Work Order process. Potential illicit sources will be available for identification since they are on WMU property.

- Indicator parameter sampling
- Dye testing
- Video testing
- Smoke testing
- Documented visual observations or physical indicators
- Drainage area investigations

If an illicit discharge is reported, or a complaint is filed, it will be investigated within 24 hours. If an illicit discharge is reported, identified, and confirmed, through sampling or other means described above, WMU Facilities Management will further assist to identify the source, and the source will be stopped immediately. Downstream storm sewers will be cleaned and vactored within 24-hours to prevent any further influence on surface waters. Illicit discharge response activities will be fully documented and kept in a separate file maintained by WMU staff. Illicit discharge response activities along with field inspection sheets will be kept during each permit reporting period. IDEP response information is outlined below in further detail.

<table>
<thead>
<tr>
<th>Illicit Discharge Response</th>
<th>Schedule</th>
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<tbody>
<tr>
<td>Once an illicit discharge is detected and the source is immediately discovered the following occurs:</td>
<td>Create work order: same day/within 24-hours</td>
</tr>
<tr>
<td>- The source will be stopped; the storm lines will be cleaned and vactored</td>
<td>Evaluate for quick fix or engineering fix: within 48-hours</td>
</tr>
<tr>
<td>- A work order will be created to determine if a simple solution is available such as permanent or temporary capping or whether an engineered resolution is required</td>
<td>Engineering design solution if necessary: within 10 days</td>
</tr>
<tr>
<td>- Releases will be reported to EHS to ensure compliance with spill notification requirements</td>
<td>Implement/construct permanent fix within 40-days of discovery.</td>
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<tr>
<td></td>
<td>Work order remains open until work completed.</td>
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</tbody>
</table>
If the source of an illicit discharge is not immediately apparent, dye testing or other methods will be initiated.

Completed and approved application for tracer dye testing for the current permit cycle.

Clean problematic sanitary lines to prevent overflow and inspect lines to evaluate cracks and the potential for breaks.

Facilities management reports annual preventative maintenance activities performed on sanitary sewers.

**Responding to Illicit Discharges and Spills**

Spill response procedures require prompt and decisive action and well-trained staff. WMU is committed to providing the required level of manpower, equipment, and materials to ensure timely and effective action to minimize impacts to the environment as a result of a spill or illicit discharge. EHS staff shall work with Facilities Management staff to determine the source of any known or reported illicit discharge.

In addition to dry weather field screening, the University utilizes specific language within the Stormwater Control Policy (Attachment B) to prohibit illicit connections. WMU Public Safety or EHS is notified if a potential or confirmed release of polluting materials from our MS4 to surface waters of the State is identified. Upon receiving such notification, EHS will call the local EGLE District Office unless determination is made that the release is not in excess of the threshold reporting quantities in Part 5 Rules. If the notice is provided after regular working hours, EHS will call EGLE’s 24-hour Pollution Emergency Alerting System (PEAS) telephone number at 800-292-4706. Upon discovery of a spill or illicit discharge, trained facility personnel will initiate the following actions:

1. Identify exact source and extent of the released materials.
2. Deploy booms or pads as needed.
3. Notify Facilities Management and/or WMU Public Safety, as needed.
4. Evacuate all non-essential personnel from the immediate area, if required.
5. Stop processes and operations that may be causing release.
6. Take all steps necessary to minimize and mitigate the spill and contact outside emergency contractor, if necessary.
7. Use inert absorbent materials to clean up the spill. Place booms around outfalls with illicit discharge.
8. Collected spilled material and/or cleanup materials will be properly managed and disposed of by a WMU approved licensed contractor.

Depending on the type of material spilled, proper protective equipment shall be worn prior to response activities. All spill cleanup debris will be disposed of according to local, state, and federal regulations.
**Reporting Any Releases of Polluting Materials**

All response agencies required to respond to the spill event will be notified as necessary by EHS staff personnel, including state and federal authorities.

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**Emergency Contact List**

<table>
<thead>
<tr>
<th>Service</th>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGLE, PEAS</td>
<td>800-292-4706</td>
</tr>
<tr>
<td>National Response Center</td>
<td>800-424-8802</td>
</tr>
<tr>
<td>Kalamazoo Fire Department</td>
<td>911</td>
</tr>
<tr>
<td>Kalamazoo Police Department</td>
<td>911</td>
</tr>
<tr>
<td>Kalamazoo County Environmental Health Department</td>
<td>269-373-5210</td>
</tr>
</tbody>
</table>

* During regular business hours, please call the Kalamazoo District Office at 269-567-3500

WMU provides training to employees and regular staff related to techniques for identifying an illicit discharge or connection, field observation and screening, and source identification. Training also includes proper illicit discharge reporting protocols and is conducted at least once during each permit cycle, or within the first year of hire for new staff, if applicable. To further protect from illicit discharges WMU has a multi-year dry-weather screening approach. WMU has identified each outfall on campus and inspected every outfall within each permit cycle. WMU has included stormwater discharges into GVP to the dry weather inspection to further protect the large area GVP treats. Catch Basins that are not treated further downstream by current stormwater BMP’s on campus will also be inspected and monitored while performing dry weather screening at least once per permit cycle. Specific catch basins that are inspected during each year’s annual inspections are maintained with the dry-weather screening report.

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<table>
<thead>
<tr>
<th>IDEP Training</th>
<th>Schedule</th>
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<tbody>
<tr>
<td>Train affected employees and regular staff on requirements of permit and to notify EHS if an illicit discharge is detected for following up on proper notification requirements.</td>
<td>EHS and Facilities Management complete training prior to dry weather screening in this permit cycle. If dry weather screening runs over into a second year with new employees, the training will be repeated.</td>
</tr>
</tbody>
</table>

WMU uses the following procedure for evaluating and determining the overall IDEP effectiveness.
At the end of the dry weather testing, the results and data collected will be reviewed and notes made on how the screening could be improved. Completed once during each permit cycle.

The WMU stormwater website provides a list of prohibited activities for employees, faculty and students such as not allowing wastewater, oils, paints or other materials into the storm sewer system and reporting to WMU Public Safety or EHS immediately upon discovery.

**Non-Stormwater Discharges**

In the event of a fire emergency on campus, the Fire Marshall (or Chief in charge) will determine if fire water will generate a significant source of pollution to surface waters of the state. Non-stormwater discharges are discouraged from entering into the WMU MS4 drainage infrastructure network.

**4. Construction Stormwater Runoff Control Program**

This chapter of the WMU SWMP is intended to summarize the University's procedures to address stormwater runoff from construction activities on campus. These are specific to discharges from construction activities where potential pollutants can enter the WMU MS4 drainage network and when the pollutants are in violation of any of the following:

- Section 9116 of Part 91 of the Michigan Act- Sec.9116. A person who owns land on which an earth change has been made that may result in or contribute to soil erosion or sedimentation of the waters of the state shall implement and maintain soil erosion and sedimentation control measures that will effectively reduce soil erosion or sedimentation from the land on which the earth change has been made.

- Michigan’s Permit-by-Rule at R 323.2190(2)(a)- Not directly or indirectly discharge wastes such as discarded building materials, concrete truck washout, chemicals, lubricants, fuels, litter, sanitary waste, or any other substance at the construction site into the waters of the state in violation of Part 31 of the Act or rules promulgated there under.

For projects with one acre or more of soil disturbance or within 500 feet of a lake or stream, a Soil Erosion and Sediment Control (SESC) permit must be obtained from the local enforcing agency. For WMU’s main campus, the City of Kalamazoo Community Planning and Economic Development Department is the Municipal Enforcing Agency. WMU has a two-step process. First, WMU requires an SESC permit to be approved and filed with EHS. A Notice of Coverage is also filed via MiEnviro for sites with 5 or more acres of soil disturbance and a potential to discharge to surface waters of the state. Secondly, WMU requires the permit to be posted on site and observed by EHS prior to commencement of any permitted earthwork activity. Furthermore,
as the property owner for all WMU construction projects on campus, the University fully complies with the State of Michigan Permit by Rule (Rule 323.2190). Permitted activities are inspected once per week, and within 24 hours of rain event. Complaints and other information submitted by the public or identified internally, as it relates to construction stormwater runoff control, will be reported to the WMU construction project manager and EHS. In the event of a construction related release of other pollutants, all potential concerns are reported to EHS to ensure compliance with spill notification requirements to EGLE. Specifically, where pollutants are discharged from a construction activity in violation of applicable Part 91 statutes to WMU’s storm sewer system, the University will provide the following notifications:

- If there is a discharge of sediment to the MS4, project managers are responsible for contacting EHS staff. To maintain compliance, and understanding of permit requirements, project managers will be trained on reporting protocol once per permit cycle or within a year of hire.

- Project managers will notify EHS if there is a discharge of soil, sediment or other pollutants to the MS4 from a construction site, even if there is not an immediate threat of danger to public health or the environment. When necessary, EHS staff will notify city and state officials.

5. Post-Construction Runoff Control Program

Post-construction stormwater runoff controls are necessary to maintain or restore stable hydrology in receiving waters by limiting surface runoff rates and volumes and reducing pollutant loadings from sites that undergo new development or significant redevelopment. Under Michigan’s MS4 stormwater permit, post-construction stormwater runoff from new and redevelopment projects that disturb one acre or more, must meet the criteria as identified in the WMU Stormwater Control Policy within Attachment B.

**Stormwater Design Standards**

The WMU Stormwater Control Policy sets forth the University's stormwater design standards associated with new and redevelopment projects that disturb one or more acre of land. These design standards also include projects less than one acre that are part of a larger common plan of development that encompasses one acre or more or where significant runoff is expected. WMU stormwater guidelines are enforced by the University within each Professional Service (A/E) contract for new and redevelopment projects on campus. No new outfalls or discharges to Arcadia Creek will be installed. Post-construction runoff rate and volume of discharge will not exceed the pre-development rate and volume for all storms up to the two-year, 24-hour storm. Furthermore, these design guidelines require designer review and direct adherence with EGLE standards (for both water quality and quantity) to ensure WMU maintains full compliance. Each item enumerated within the stormwater Design Guidelines, along with the stormwater checklist,
are used during the WMU plan review process. These Design Guidelines also apply to water quantity projects (i.e., flood control).

Each Professional Service (A/E) contract for new development or redevelopment must comply with these WMU design standards. The site plan review is based on the initial guidelines for the BMP and approved contractor. All new BMPs will be installed in areas absent soil and groundwater contamination. Currently there are no areas of soil and/or groundwater contamination on WMU campus. The need for site-specific BMPs will be determined during the review process.

**Operation and Maintenance**

New and redevelopment projects on WMU campus are required to have a written inspection and maintenance plan for each BMP installed. WMU provides routine maintenance, and maintenance schedules are developed and implemented to ensure pollution removal effectiveness at design performance and to ensure that the controls are maintained in a condition to reduce to the maximum extent practicable, the contribution of pollutants to the Surface Waters of the State. These maintenance activities apply for the life of practice for each BMP on campus, or until such time that the BMP is replaced or upgraded with no change in performance outcomes. WMU owns and operates each BMP on campus and is obligated to maintain them as part of their SWMP. Therefore, BMP maintenance agreements are not applicable.

### 6. Pollution Prevention and Good Housekeeping Program

NPDES stormwater requirements stress the importance of developing proper pollution prevention procedures and maintaining good housekeeping practices for municipal property.

Municipal operations cover a wide variety of activities and land uses that are potential sources of stormwater pollutants. These include but are not limited to roadways; parking lots; transportation and equipment garages; fueling areas; warehouses; stockpiles of salt and other raw materials; open ditches and storm sewers; and turf and landscape management for municipal properties.

WMU’s separate stormwater drainage system consists of separate storm sewer pipes, manholes, inlets, catch basins, bioretention areas and other green infrastructure facilities, and proprietary devices for treating stormwater runoff. Web-based University utility maps are available which identify catch basins, storm drains and structural controls. These records are located at the WMU Physical Plant and are maintained on a continuous, real-time schedule by WMU Facilities Management. Furthermore, EHS will provide written notification to Facilities Management when changes are necessary. Structural stormwater controls are serviced by WMU Landscape Services.

As part of the campus-wide good housekeeping activities, WMU Public Safety and WMU Landscape Services contracts street sweeping twice per year. Parking lots/ramps, bridges, and
roads are daily being inspected and cleaned throughout the year. WMU landscaping crews continuously clean area of campus that are prioritized by landscaping management. This is accomplished by sweeping, blowing, and/or shoveling debris from impervious surfaces to minimize sediment loading to surface waters during runoff events. The practice of keeping roads and parking lots clean is a high priority for landscaping due to the visual aspect of keeping our campus clean. Reduced pollutant runoff is a benefit of this practice. Street sweeping equipment is operated in accordance with manufacturers operating instructions to maximize effectiveness for water quality protection. These practices remove several tons of sediment annually. Ninety percent of seasonal leaves and plant materials are mulched in place. The remaining 10% of compostable materials that cannot be mulched in place are placed in a bin at lot 95. Kalamazoo Landscape Supplies (KLS) removes the excess material from the bin and delivers it to a certified composting facility.

Snow and ice removal on campus is another responsibility of WMU Landscape Services. A delicate balance of maintaining safe conditions while reducing the use of deicing products is prioritized each winter season. The overall salt usage has been reduced by 28% since 2009 with the use of beet juice for prewetting. Landscape Services also picks up trash on paved surfaces 5-days per week, all year long except on heavy snow days.

University vehicle washing activities are conducted in a contained garage area with an oil/water separator connected to the sanitary sewer collection system or at local commercial carwashes. These and other WMU good housekeeping efforts are evaluated annually by EHS and reported to EGLE within the MS4 Permit Annual Report.

WMU Landscape Services employees are trained in vegetative land management. A significant number of employees have achieved certification in the Michigan Turf Grass Environmental Stewardship Program and are certified pest control applicators, master gardeners and arborists. WMU has purchased and applied only non-phosphorus fertilizers since 2004. Vegetated stormwater BMPs utilize native Michigan vegetation and buffer zones.

Other important WMU pollution prevention and good housekeeping efforts on campus are summarized as follows:

<table>
<thead>
<tr>
<th>Operation/Maintenance Activity</th>
<th>Potential Pollutant</th>
<th>BMP</th>
<th>Assessment Updating Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory/hazardous waste</td>
<td>Drugs, chemicals,</td>
<td>Disposal through licensed firms by incineration or licensed landfills</td>
<td>Ongoing through EHS; volume of waste collected</td>
</tr>
<tr>
<td></td>
<td>electronics, lamps, brine from salt dome, oil-water separator waste</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WESTERN MICHIGAN UNIVERSITY
Stormwater Management Program
June 2023
<table>
<thead>
<tr>
<th>Operation/Maintenance Activity</th>
<th>Potential Pollutant</th>
<th>BMP</th>
<th>Assessment Updating Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm drain cleanout</td>
<td>Leaves and/or Mulched grass</td>
<td>Landscape employees report full or covered catch basins; Documented and disposed of via Clean Earth Company</td>
<td>Ongoing through Facilities Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trash and debris</td>
<td>Clean out 5 days/wk (except in heavy snow)</td>
</tr>
<tr>
<td>Detention and Retention basins</td>
<td>Yard waste, vegetation</td>
<td>Inspect and remove nuisance species and yard waste semiannually</td>
<td>Ongoing through Facilities Management</td>
</tr>
<tr>
<td>Roadway/parking lots</td>
<td>Sand</td>
<td>No sand used</td>
<td>Ongoing through Landscape Services</td>
</tr>
<tr>
<td>Road salt and deicing materials</td>
<td>Beet juice used to reduce salt application</td>
<td>Salt dome operation and maintenance procedure</td>
<td>Ongoing through Landscape Services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Snowmelt systems on sidewalks</td>
<td>WMU Facilities Mgmt as budget allows with construction projects</td>
</tr>
<tr>
<td>Debris, sediment on curbs and roads</td>
<td>Street cleaning twice per year</td>
<td>WMU Public Safety contractors</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parking lots cleared of sediment by power blowing into vegetated areas annually</td>
<td>Public Safety</td>
</tr>
<tr>
<td>Coal tar emissions from asphalt</td>
<td>No coal tar used</td>
<td>WMU Design Guidelines</td>
<td></td>
</tr>
<tr>
<td>Automotive and equipment spills</td>
<td>Clean up by EHS, Landscape Services, Public Safety. Notice in parking guide that no vehicle leaking fluids is allowed to park on campus.</td>
<td>Ongoing; number of spills cleaned</td>
<td></td>
</tr>
<tr>
<td>Operation/Maintenance Activity</td>
<td>Potential Pollutant</td>
<td>BMP</td>
<td>Assessment Updating Process</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------------------</td>
<td>------------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Trash and debris</td>
<td>Remove 5 days/wk</td>
<td>Landscape Services ongoing</td>
<td></td>
</tr>
<tr>
<td>Vehicle Fleet maintenance</td>
<td>Automotive fluids</td>
<td>WMU Garage &amp; Recycling Services, Maintenance at least annually</td>
<td>WMU garage, ongoing</td>
</tr>
<tr>
<td>Car washing</td>
<td>Washing occurs in WMU garage w/ oil-water separator or commercial car wash</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Lawn equipment fluids</td>
<td>WMU Landscape Services annual preventative maintenance via WMU garage</td>
<td>Ongoing</td>
<td></td>
</tr>
<tr>
<td>Batteries, diesel fuel, hydraulic oil</td>
<td>Storage of emergency equipment at Physical Plant</td>
<td>Ongoing</td>
<td></td>
</tr>
<tr>
<td>Gas pumps</td>
<td>Gas pumps and above ground storage tanks at Lot 95</td>
<td>Inspections</td>
<td></td>
</tr>
<tr>
<td>Grounds maintenance</td>
<td>Phosphorus</td>
<td>WMU uses only phosphorus-free fertilizers on lawns; no fertilizer in buffer zones</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Plant materials</td>
<td>Staff trained to sweep grass clipping off sidewalks and roads; maintain 20’ buffer around Goldsworth Valley Detention Pond</td>
<td>Ongoing and continuing</td>
<td></td>
</tr>
<tr>
<td>Pesticide/herbicide use (only certified staff, and certified outside contractor)</td>
<td>Employee certification as master gardeners, pest control applicators, arborists; portable mixing pads for pesticide mixing</td>
<td>Landscape Services, EHS, ongoing</td>
<td></td>
</tr>
<tr>
<td>Eroded soils</td>
<td>Leak detectors on sprinklers</td>
<td>Ongoing</td>
<td></td>
</tr>
<tr>
<td>Operation/Maintenance Activity</td>
<td>Potential Pollutant</td>
<td>BMP</td>
<td>Assessment Updating Process</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------</td>
<td>----------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Refuse handling</td>
<td>Pesticide containers</td>
<td>Pesticide containers triple-rinsed before disposal and placed in dumpster with no runoff</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>Oil cans, oil filters, antifreeze containers, batteries</td>
<td>Stored inside prior to recycling to appropriate source</td>
<td>WMU Garage and Recycling Services</td>
</tr>
</tbody>
</table>

**Facility-Specific Stormwater Management**

The WMU Stormwater Committee (comprised of Director of Engineering, Landscape Services Director, Maintenance Director, Director of Environmental Health and Safety, GIS Coordinator, and other Facilities Management staff) continues to review the facilities with the potential to discharge pollutants to surface waters of the state. The Stormwater Committee meets biannually to review campus-wide stormwater issues, catch basin cleaning, BMP inspection results, along with a SWMP review of facilities with pollutant potential. All updates are made to the SWMP following decisions made in committee meetings. Changes made to policy are disseminated down through management of affected departments. When assessing the pollution potential of a facility, the committee considers the following factors:

- Amount of urban pollutants stored at the site (e.g., sediment, nutrients, metals, hydrocarbons, pesticides, fertilizers, herbicides, chlorides, trash, bacteria, or other site-specific pollutants)
- Identification of improperly stored materials
- The potential for polluting activities to be conducted outside (e.g., vehicle washing)
- Proximity to waterbodies
- Housekeeping practices
- Discharge of pollutants of concern to impaired waters

**Priority Facilities**

The WMU Stormwater Committee has identified the following priority facilities:

1. Campus Services (High Potential - structural best practices in place, daily maintenance and oversight, routine monthly inspection)
2. Waldo Stadium (Medium Potential - structural best practices in place, routine monthly inspection)

The current Physical Plant conducts all maintenance activities within the building and has no exposure of industrial activities or storage outside, and therefore has been changed to low potential.

A Stormwater Pollution Prevention Plan (SWPPP) has been developed for each of these WMU facilities. Each SWPPP includes site-specific structural and non-structural stormwater controls.
implemented and maintained to prevent or reduce pollutant runoff at each facility. Information related to potential polluting materials, preventative maintenance, routine maintenance inspections, and site-specific structural stormwater controls are provided in Attachments D, E, F, G, and H respectively. The presence of stormwater controls, scheduled routine and comprehensive inspections provide WMU with a means to assess any need for changes or corrections. Facilities Management will confirm annually if any corrections are warranted.

The goals of each SWPPP include:

1. Maximize control of significant polluting materials
2. Reduce the potential levels of these materials that could enter stormwater
3. Ensure that stormwater discharges from the site will not cause a violation of Michigan’s water quality standards.

A copy of the SWPPP is located at EHS. A designated Industrial Stormwater Operator EHS staff person is responsible for monitoring the implementation of the plans.

Separate procedures for spill prevention and control are documented in the University’s Spill Prevention, Control and Countermeasure (SPCC) plans for campus, which are designed to meet federal requirements under 40CFR Part 112 dealing with aboveground oil storage facilities. WMU’s Pollution Prevention Incident Plan (PIPP) exists to meet the requirements of Part 5 Rules of the State of Michigan associated with chemical and petroleum storage.

**Catch Basin Cleaning and BMP Inspection**

WMU Facilities Management is responsible for the cleaning of the separate storm sewers and catch basins and inlets associated with the stormwater infrastructure and structural controls. This work is contracted out to a licensed utility contractor. Time and Materials (T&M) contract for catch basin cleaning are required to follow WMU’s “Storm Water Catch Basin Inspection & Cleaning Procedure,” (See Attachment H) as part of the agreed contract. Approximately 80% of storm structures within WMU’s MS4 are treated by BMP’s. All existing stormwater BMPs (i.e., detention, retention, infiltration, bioretention, etc.) are inspected annually by Landscape Services (see Attachment G). Prioritization and cleaning for catch basins and BMP’s are then based upon these field inspections (if observed greater than 6” sediment depth) and the internal WMU Work Order process. Materials removed from catch basin cleaning activities are properly manifested and disposed of by the licensed utility contractor. WMU has created a BMP location map within the internal GIS system. The map with locations of BMP’s are accessible on the Facilities Management website under stormwater section. Attachment G is the current Maintenance Plan which includes the BMP treatment area map for areas of main campus. This map will be updated as the BMP maintenance plan is updated. Any updates or revisions to this inspection and cleaning process are made within 30 days of a change in priority level. WMU will prioritize inspections of catch basins that are not treated by current BMP’s on a 3-year cycle, or more frequent if inspection is warranted. Catch basins that are treated downstream by BMP’s will be inspected as needed (i.e. during construction activity, regular landscaping cleaning of roads,
during work order maintenance, and/or if WMU personnel note a deficiency with the storm system). Attachment I, contains the "Dry Weather Screening and Catch Basin Monitoring Plan." WMU’s current stormwater design guidelines require new building projects and redevelopments sites to capture the 25-yr, 24-hour storm event or greater with the goal to eliminate all storm water volume discharge post-development. This means that as each project is completed WMU will eventually have minimal or no catch basins that release directly to Waters-of-the-State. Currently, 45 BMP’s treat over 80% of catch basins on campus.

**Contractor Requirements and Oversight**
Contractors hired by WMU to perform municipal operation and maintenance activities relative to stormwater receive stormwater-related information provided by the associated WMU department contracting work to be performed. Stormwater information is also incorporated into a pre-construction meeting prior to beginning new projects. In addition, project representatives are trained to provide oversight to contractors to ensure that WMU pollution prevention and good housekeeping requirements are followed.

**Employee Training**
WMU EHS staff provides pollution prevention and good housekeeping classroom training for employees in Maintenance Services, Power Plant, Landscape Services, Facilities Management, Project Managers and Custodian Services. These employees are trained once during each permit cycle, or within the first year of employment. Training includes topics on how to reduce pollutants at home such as washing cars in yards or adding a rain garden.

**Total Maximum Daily Load (TMDL) Implementation Program**

**GENERAL OVERVIEW**
The total maximum daily load (TMDL) plan 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. Since 2002, the Kalamazoo River has had a TMDL for Phosphorus, As of December 2020, three
sub watersheds within the Kalamazoo River Watershed (KRW) has had a TMDL for *E. coli* and are as follows, Arcadia Creek, Davis Creek, and Portage Creek.

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

Several communities within the KRW 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 KRW are working on a watershed scale. By working on a watershed scale, communities can implement regional plans for permit compliance, saving money and reducing duplicate initiatives by neighboring communities. Focused public education at a regional scale has proven to be of great impact. Sampling and Monitoring remains done within individual MS4 permittees.

WMU is updating it's permit applications for October 2022, incorporating this TMDL plan for *E. coli*. This permit requires WMU to make progress in achieving the pollutant load reduction requirements in the TMDL. In addition, WMU is required to implement the monitoring plan to assess the effectiveness of the best management practices (BMPs) implemented in making progress towards achieving the TMDL.

Given the need to address the requirements in the TMDL, WMU has contracted with Kieser & Associates to Develop a E.coli monitoring and reporting plan for this permit cycle. The scope of work can be found in Attachment J. The scope of work may change depending on weather and sample results. WMU may delay the scope of work until the summer of 2024 due to permit issuance delays.

**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. WMU is responsible for BMPs as a part of their 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. Land cover in the Kalamazoo River watershed is 1,302,804 acres and is comprised of approximately 47% agriculture (dominated by corn and soybeans), 30% unmanaged terrestrial uplands (mostly secondary deciduous forest and successional old fields), 15% lakes and wetlands, and 8% urban. 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. Each MS4 will have individual goals and monitoring plans, but collaboratively plan to use public education to meet TMDL goals. The KRWG’s website is continually updated to provide new information about issues in our watershed, including TMDL information.

**BACKGROUND AND EFFORT - PHOSPHORUS**

Western Michigan University discharges storm water to the Kalamazoo River which has a TMDL for phosphorus. The TMDL anticipated implementation of the communities MS4 program as part of the storm water loading reductions to help achieve this limit. As such, storm water is part of the non-point source load allocation in the TMDL.

WMU’s priority is to continue with street sweeping / parking lot sweeping, catch basin cleaning and public education to reduce the Phosphorus loading to the maximum extent practical. WMU will continue its long-term solution for proven reduction of phosphorus levels by following the Stormwater Design Guidelines adopted on campus. See WMU’s Design Guidelines Division 33 for how WMU has reduced phosphorus levels by 50 percent.

**PHOSPHORUS MONITORING**

Since WMU has reached its goal of 50% reduction of phosphorus within its footprint sampling has not been prioritized. Instead WMU continues to use modeling and continued maintenance of completed BMP’s on campus. WMU has developed Stormwater Design guidelines for all campus projects that will continue to improve phosphorus reduction within the campus footprint.

WMU is committed to also helping the local community. As such, WMU has collaborated with local MS4’s and EGLE to form KSWG. The KSWG group has the following phosphorus monitoring plan:

EGLE staff has submitted a Targeted Monitoring Request for an additional sampling point to be added to the TMDL sampling conducted by an EGLE aquatic biologist monthly during the growing season every other year. The new location is just downstream of the Kalamazoo Urbanized Area on the Kalamazoo River. The plan is to utilize the data, collected by EGLE for reporting purposes under the TMDL plan. The goal would be to measure phosphorus trends over time, to determine if the Kalamazoo Area MS4s are successfully reducing phosphorus inputs.
BACKGROUND AND EFFORT – *E. coli*

As of December 2020, three sub watersheds within the Kalamazoo River Watershed (KRW) has had a TMDL for *E. coli* and are as follows, Arcadia Creek, Davis Creek, and Portage Creek. Western Michigan University discharges storm water to these creeks via WMU’s, and the City of Kalamazoo’s storm system with a TMDL for *E. Coli*.

The daily max in Michigan’s Water Quality Standards is 300 *E. Coli* per 100 mL from May 1 to October 31 (Total Body Contact criteria). When conducting in stream sampling, further investigation into sources is needed if the value is above 300. When conducting outfall sampling, Kalamazoo County MS4 communities are using 1,000 *E. Coli* per 100 mL as the criteria below which they are not doing further investigation in the current permit cycle. In other words, an *E. Coli* concentration of less than 1,000 *E. Coli* counts per 100 mL indicates no impairment of the creek was identified.

**ARCADIA CREEK *E. coli* SAMPLING**

WMU will conduct five weeks of *E. coli* sampling of Arcadia Creek during the recreation season (May 1-October 31) 2023. Up to two additional sampling events may occur for wet weather sampling if there are no wet weather events in the first five-week sample period. *E. coli* samples will be collected at the four County sampling locations used in the original TMDL listing. Coordinates and descriptions of the sites are provided in (Table 1). Sampling will occur once a week and representative grab samples (left, center, right) will be collected in sterile HDPE plastic bottles from each location per sampling event facing upstream at each sample site. Flow measurements and other field instrument measures will be collected at each monitoring site. Monitoring events will follow state-wide TMDL recommendations for sampling conditions, ensuring that timing will provide representative information for in-stream conditions during wet weather events as outlined below and consistent with other KSWG permits. Sampling will follow the WQS TBC criteria of 130 *E. coli* per 100 mL as a 30-day geometric mean and 300 *E. coli* per 100 mL as a daily maximum to protect the TBC use are the target levels for the TMDL reach. Samples will be processed according to USEPA 9223 Enzyme Substrate Method (Colilert-18) and will be processed within 6 hours of collection. To ensure samples do not exceed the upper limit of quantification of the substrate method, all samples will be run at a 10x dilution. This will give samples a quantification range of 10-24,196.0 MPN/100 mL. Samples will be processed and reported by Oakland University Environmental Analysis Laboratory and may also include DNA analyses of host-specific fecal targets if deemed appropriate.

This Sample monitoring plan will ensure that actual bacterial counts will be determined/reported, versus the original listing data that were reported as a capped number corresponding to a “greater than” exceedance criterion. As such, 2023 sampling results can be used to isolate potential source areas of bacterial loading that were otherwise entirely masked with the original 2010 and 2011 county sampling program. Sample sites consistently exceeding the State WQS may have further sampling done and could include DNA analyses to identify non-point sources of fecal pollution in the catchment.
Table 1. Proposed Instream locations for *E. coli* analysis based on previous TMDL sampling conducted by MDEQ/EGLE originally analyzed by the Kalamazoo Public Health Department.

<table>
<thead>
<tr>
<th>Sample Site ID</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>42.291945</td>
<td>-85.594031</td>
<td>Arcadia Creek - ARC-60</td>
</tr>
<tr>
<td>2</td>
<td>42.288753</td>
<td>-85.598663</td>
<td>Arcadia Creek - ARC-40</td>
</tr>
<tr>
<td>3</td>
<td>42.28388</td>
<td>-85.606679</td>
<td>Arcadia Creek- Oliver St. and Stadium Drive</td>
</tr>
<tr>
<td>4</td>
<td>42.273547</td>
<td>-85.618132</td>
<td>Arcadia Creek - ARC-10</td>
</tr>
</tbody>
</table>

**Targeted Outfalls for *E. coli* Sampling during Wet Weather**

WMU will sample targeted outfalls and streams during wet weather events. 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. 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. 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. See attachment J for WMU’s scope of work for E.coli Monitoring & Reporting in years 2023-2026.

**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
2018 includes a plan to conduct dry-weather screening of each prioritized MS4 outfall and point of discharge once every five years. The approved plan will be implemented again in 2024. If outfalls in TMDL are determined to have illicit discharges or connections during dry weather screening, extra sampling will be completed for the specific stream reach impairment because *E. coli* are not parameters that are evaluated in the IDEP. However, 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 *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 and/or in-stream monitoring. 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. 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.
**Public Education Plan Coordination**

Much of the pollution contributing to the degradation of the KRW is suspected to be coming from rural areas (i.e., agricultural land) that is outside of MS4 jurisdiction. The collaborative KRW Public Education Plan (PEP) performed through the KSWG 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 proposed by the KSWG, though recognizing detailed WMU applicable considerations noted above for the WMU MS4 permit footprint:

**Year 1:**
- Collect and analyze data regarding Phosphorus 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 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 Phosphorus and *E. coli* to water body to guide wet weather and IDEP sampling efforts.

**Year 2:**
- Conduct outfall sampling of *E. coli* at targeted discharge outfalls for Arcadia Creek, Davis Creek, and Axtell Creek in wet weather.
- Continue to implement prioritized BMPs to reduce pollutants entering MS4.
- Collect and analyze data regarding Phosphorus and *E. coli* from partners who performed in-stream or outfall water quality sampling in TMDL watersheds.
- Implement activities listed in the 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 Phosphorus and *E. coli* from partners who performed in-stream or outfall water quality sampling in TMDL watersheds.
• Implement activities listed in the 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 Phosphorus and E. coli from partners who performed in-stream or outfall water quality sampling in TMDL watersheds.
• Implement activities listed in the 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:

• Conduct outfall sampling of E. coli at targeted discharge outfalls for Arcadia Creek, Davis Creek, and Axtell Creek in wet weather to check for progress.
• 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 Phosphorus and E. coli from partners who performed in-stream or outfall water quality sampling in TMDL watersheds.
• Implement activities listed in the 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 the community’s Stormwater Management Plan (e.g., 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. The individual MS4 permittees identify structural and operational BMPs within their community and their operation and maintenance.
Non-point source pollution includes both agricultural and urban pollution sources that are commonly difficult to define and locate. Land cover in the Kalamazoo River watershed is 1,302,804 acres and is comprised of approximately 47% agriculture (dominated by corn and soybeans), 30% unmanaged terrestrial uplands (mostly secondary deciduous forest and successional old fields), 15% lakes and wetlands, and 8% urban. 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. WMU has otherwise fully demonstrated successful implementation and outcomes addressing the phosphorus TMDL needs and will share their experiences with other MS4s to help guide them toward similar successes.

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 KRW 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.

**PROCESS FOR UPDATING/REVISING THIS PROCEDURE**

This procedure shall be reviewed on an annual basis by the KSWG for any updates to improve effectiveness.

**References**


SWMP Attachment A

WMU EHS website and PEP partner website links
WMU EHS website and PEP partner website links

WMU Stormwater Management Program (SWMP) information can be accessed at the following website location:

http://esem.wmich.edu/waterweb.htm

WMU Public Education Plan (PEP) partner collaboration information can be accessed at the following website location:

http://kalamazooriver.org/

See Also:

https://wmich.edu/facilities/engineering/stormwater
https://wmich.edu/facilities/engineering/stormwater-accomplishments
https://gis.fm.wmich.edu/portal/apps/webappviewer/index.html?id=7ac78d7913234019958e13528bb4bad3 (Interactive map with Stormwater BMP locations and project summaries)
SWMP Attachment B

Facilities Management – Engineering Division
Stormwater Control Guidelines

Western Michigan University in its endeavor to meet our storm water discharge commitments has developed this Storm Water Management Guideline for new and redevelopment projects on University property.

The Design Guideline will be utilized on all new projects from this date forward by the University and its contracted Professionals.

Mr. Tim Thimmesch
Associate Vice President for Facilities Management
Western Michigan University

Effective Date

PART 1 – GENERAL GUIDELINES

The following guidelines have been established by Western Michigan University with the intent to meet best management practices for storm water management.

These guidelines are applicable to all projects on University property, including new and existing buildings, roads, sidewalks, and landscaping projects that disturb one acre or more, including projects less than one acre that are part of a larger common plan of development that encompasses one acre or more or where significant runoff is expected. These guidelines are also applicable to any new or redeveloped water quantity (flood control) projects. Any changes to the existing storm water runoff or the storm sewer system must be accomplished within the following guidelines and approved by the Office of Facilities Management – Engineering Division. Use the Checklist for Stormwater Design Standards to satisfy general guideline requirements.

Professional Service Contractors engaged in projects for the University shall follow, specify and include the requirements and practices identified in this Guideline in accordance with their Professional Services Agreement with the University.

PART 2 – DESIGN

The University will enforce the following design guidelines. Professional Service Contractor’s shall include in their designs and specifications the following:

1. No new outfalls or discharges to Arcadia Creek will be installed.
2. Existing outfall(s) and discharges will be maintained as necessary to operate at their existing capacities.
3. New building project sites and building redevelopment sites are designed to capture the 25-year, 24-hour storm event or greater with the goal to eliminate all storm water volume discharges post-development. Design guidelines will be reviewed with the engineers on a per-project basis to ensure conformance with a goal of zero stormwater runoff from new or redeveloped sites.

4. New and redeveloped sites are evaluated for the need for site-specific Best Management Practices (BMPs), to mitigate impacts from "hot spots" or areas of potential pollutant loading.

5. Effluent limits shall meet the State of Michigan "Water Quality Treatment Performance Standard" as listed below:
   a. Treatment of the first one inch of runoff from the entire site, and,
   b. BMP's shall be designed on a site-specific basis to reduce post development total suspended solids loadings by 80 percent or achieve a discharge concentration of total suspended solids not to exceed 80 milligrams per liter.
   c. For more information, see WMU Design Guidelines Section 33 Appendices for two additional documents: EGLE Post-Construction Storm Runoff Controls Program and EPA Supplemental Guide Appendix F.

6. Designs shall utilize retainage and detainage systems to minimize the impact on existing storm water system. Designs shall include maintainable sediment control.

7. All addition(s) and renovation(s) on campus shall require the use of computer modeling to determine and evaluate the design flow conditions of storm water systems and track changes to existing storm water system(s) downstream. Copies of these files are to be submitted to WMU Facilities Management – Engineering Division. These calculations shall include detention area sizing.

8. All additions and renovations project(s) on campus are required to provide electronic detailed site grading plans and specifications identifying: on-site drainage patterns, on site detention areas, storm drainage structure(s), pipe(s) with size and material selection, invert elevation(s), and geometric location(s) to WMU Facilities Management – Engineering Division.

9. Testing shall be specified and performed on all new project storm/sanitary drain systems to insure no cross connects are installed in the systems.

10. Streets and parking areas shall utilize runoff areas as much as can be accommodated to encourage infiltration.

11. Provide a written inspection and maintenance program for each BMP installed.

PART 3 – CONTRACTOR REQUIREMENTS

Construction documents shall include the following:

1. For sites with 1 acre or more of soil disturbance, or within 500 feet of a lake or stream, contractors are responsible to obtain a Soil Erosion and Sediment Control permit (SESC) from the local enforcing agency. For main campus, the City of Kalamazoo Department of Community Planning & Economic Development issues SESC permits.

2. A certified operator employed by or under subcontract of the contractor is required to perform soil erosion and sedimentation control inspections once per week and within 24 hours of a storm event for construction sites with 1 acre or more of disturbed soil with a point source discharge to waters of the state, in accordance with EGLE's Permit by Rule (R323.2190 National permit for storm water discharge from construction activity). Best practices shall be required of the contractor for dust control, and runoff during construction.
3. For sites with 5 acres or more of soil disturbance with a point source discharge to waters of the state, the Notice of Coverage (NOC) must be filed by the contractor via the MiEnviro Portal.
4. Coal tar emulsions to seal asphalt surfaces are not allowed.
5. Wastewater generated from cutting, grinding, drilling, or hydro-demolition of concrete without authorization under an NPDES wastewater discharge permit is not permitted.

PART 4 – TESTING AND DOCUMENTATION

Specifications shall require the following at the completion of the construction of the plumbing, storm drains, storm and sanitary systems.

1. Ensure by testing, the separation of the storm and sanitary systems.
2. Test reports documenting what was done, how it was done, the date it was accomplished, and the results. These reports shall be submitted to the University’s Facilities Management – Engineering Division office.

PART 5 – OPERATION AND MAINTENANCE

Routine maintenance shall be provided, and maintenance schedules developed and implemented that are adequate to maintain pollution removal effectiveness at design performance and to ensure that the controls are maintained in a condition to reduce to the maximum extent practicable, the contribution of pollutants to the surface waters of the State.

END OF APPENDIX
Facilities Management – Engineering Division
Checklist for Stormwater Design Standards

DESIGN

☐ No new outfalls or discharges to Waters of the State.

☐ Existing outfall(s) and discharges maintained as necessary to operate at their existing capacities.

☐ New building project sites and building redevelopment sites are designed to capture the 25-year, 24-hour storm event or greater with the goal to eliminate all storm water volume discharges post-development. Design guidelines reviewed with the engineers on a per-project basis to ensure conformance with a goal of zero stormwater runoff from new or redeveloped sites.

☐ New and redeveloped sites are evaluated for the need for site-specific Best Management Practices (BMPs), to mitigate impacts from “hot spots” or areas of potential pollutant loading.

☐ Project meets all channel protection criteria.
  
  o Maintain the post-development project site runoff volume and peak flow rate at or below pre-development levels for all storms up to 2-year, 24-hour event. Pre-development level means the runoff flow volume and rate for the last land use prior to the planned new development or redevelopment.
  
  o Compliance is determined by calculating the existing ("pre-development") and post-development runoff volume and rate for the 2-year, 24-hour and smaller storm events.
  
  o Use acceptable sources of rainfall data for calculations such as:
    ▪ Rainfall Frequency Atlas of the Midwest

☐ Effluent limits meet the State of Michigan “Water Quality Treatment Performance Standard” as listed below:

  o Treatment of the first one inch of runoff from the entire site
  
  o BMP’s designed on a site-specific basis to reduce post development total suspended solids loadings by 80 percent or achieve a discharge concentration of total suspended solids not to exceed 80 milligram per liter.
  
  o For more information, see WMU Design Guidelines Section 33 Appendices for two additional documents: EGLE Post-Construction Storm Runoff Controls Program and EPA Supplemental Guide Appendix F.

☐ Designs utilize retainage and detainage systems to minimize the impact on existing storm water system. Designs include maintainable sediment control.

☐ All addition(s) and renovation(s) on campus assessed via computer modeling to determine and evaluate the design flow conditions of storm water systems and track changes to existing storm water system(s) downstream. Copies of these files submitted to WMU Facilities Management – Engineering Division. These calculations include detention area sizing.
All additions and renovations project(s) on campus provide electronic detailed site grading plans and specifications identifying: on-site drainage patterns, on site detention areas, storm drainage structure(s), pipe(s) with size and material selection, invert elevation(s), and geometric location(s) to WMU Facilities Management – Engineering Division.

Testing specified and performed on all new project storm/sanitary drain systems to insure no cross connects are installed in the systems.

Streets and parking areas utilize runoff areas as much as can be accommodated to encourage infiltration.

Written inspection and maintenance program for each BMP installed.

Construction sites with 1-acre or more of soil disturbance inspected by a Construction Site Certified Operator.

CONTRACTOR REQUIREMENTS
1. For sites with 1 acre or more of soil disturbance, or within 500 feet of a lake or stream, contractors are responsible to obtain a Soil Erosion and Sediment Control permit (SESC) from the local enforcing agency. For main campus, the City of Kalamazoo Department of Community Planning & Economic Development issues SESC permits.

A certified operator employed by or under subcontract of the contractor is required to perform soil erosion and sedimentation control inspections once per week and within 24 hours of a storm event for construction sites with 1 acre or more of disturbed soil with a point source discharge to waters of the state, in accordance with EGLE’s Permit by Rule (R323.2190 National permit for storm water discharge from construction activity). Best practices shall be required of the contractor for dust control, and runoff during construction.

For sites with 5 acres or more of soil disturbance with a point source discharge to waters of the state, the Notice of Coverage (NOC) must be filed by the contractor via the MiEnviro Portal.

Coal tar emulsions to seal asphalt surfaces are not allowed.

Wastewater generated from cutting, grinding, drilling, or hydro-demolition of concrete without authorization under an NPDES wastewater discharge permit is not permitted.

TESTING AND DOCUMENTATION
Specifications shall require the following at the completion of the construction of the plumbing, storm drains, storm and sanitary systems.

Ensure by testing, the separation of the storm and sanitary systems.

Test reports documenting what was completed, how it was done, the date it was accomplished, and the results. These reports submitted to the University's Facilities Management – Engineering Division office.
OPERATION AND MAINTENANCE

☐ Routine maintenance provided, and maintenance schedules developed and implemented that are adequate to maintain pollution removal effectiveness at design performance and to ensure that the controls are maintained in a condition to reduce to the maximum extent practicable, the contribution of pollutants to the surface waters of the State.

END OF APPENDIX
SWMP Attachment C

Illicit Discharge Elimination Program (IDEP) - Field Inspection Form
WESTERN MICHIGAN UNIVERSITY
MS4 IDEP: Illicit Storm Water Outfalls and Points of Discharge Field Observation

Date: ___________________  Crew Initials: 1) ___________________  2) ___________________  3) ___________________

Time: ___________________  Weather: Rain within 48 hrs? Y / N

I. Location Information

Watercourse: Arcadia Creek / Other MS4 Operator

Outfall/ POD*: ___________________

Circle One

Comments: ___________________

(please provide general comments regarding nearby intersections, buildings, or landmarks for future reference)

II. Field Observations

Deposits/Stains on Structure or Bank: Y / N  Biology: Sheens / Algae / Slimes

Vegetative Condition: Clear / Normal Vegetation / Overgrown  Photo Taken: Y / N

Structural Condition: Good / Fair / Poor / Failing  Photo ID: __________

Comments: ___________________

III. Discharge Information (Circle all that apply)

Flow: yes / no  - If yes continue with this section & proceed to "Upstream Structures Section"

Source Identified to be ground water: Y / N  -If yes insert comments

Water Clarity: Clear / Cloudy / Opaque  Odor: None / Sewage / Rotten Eggs / Gas / Other:________

Water Color:_________________________  Floatables: None / Leaves / Sewage / Oil Sheen / Other:________

Sample Collected: Y / N  Sample Person (Initial): ________  Sample Received (Initial): ________

Comments: ___________________

IV. Upstream Structures for an Observed Discharge

Structure #: ___________________ (circle all that apply)  Flow yes / no

If Sample was Collected Explain: Structure # Sampled:________

Structure #: ___________________ Flow yes / no

Structure #: ___________________ Flow yes / no

Structure #: ___________________ Flow yes / no

Structure #: ___________________ Flow yes / no

Structure #: ___________________ Flow yes / no

V. Remarks

__________________________

__________________________

__________________________

continue any comments or remarks on back (ref by section #)

Utility_Storm_MS4 IDEP Inspection Form__2015 03.xlsx
SWMP Attachment D

WMU SWPPP Significant Material Inventory Summary Tables
<table>
<thead>
<tr>
<th>Section Listed in General Permit</th>
<th>Storage Areas / Activity Areas</th>
<th>Significant Materials</th>
<th>Exposure Method</th>
<th>Reasonable Potential Evaluation (high, medium, low)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Loading, unloading, and other material handling operations</td>
<td>Above ground fuel Tanks</td>
<td>Diesel fuel and unleaded gasoline</td>
<td>Spills</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Fuel pumps</td>
<td>Diesel fuel and unleaded gasoline</td>
<td>spills</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Soil and gravel bins</td>
<td>Top soil, sand, and gravel</td>
<td>spills</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Filling mower/equipment with fuels</td>
<td>Gasoline, diesel, vegetable oil</td>
<td>spills</td>
<td>Medium</td>
</tr>
<tr>
<td>2) Outdoor storage including secondary containment structures</td>
<td>Above ground fuel tanks</td>
<td>Diesel fuel and unleaded gasoline</td>
<td>Leaks</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Soil and gravel bins</td>
<td>Top soil, sand, and gravel</td>
<td>spills</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Gasoline, vegetable oil, and diesel can storage</td>
<td>Gasoline, vegetable and diesel fuel</td>
<td>leaks</td>
<td>High</td>
</tr>
<tr>
<td>3) Outdoor manufacturing or processing activities</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) Significant dust or particulate generating processes</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Discharge from vents, stacks, and air emission controls</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Section Listed in General Permit</td>
<td>Storage Areas / Activity Areas</td>
<td>Significant Materials</td>
<td>Exposure Method</td>
<td>Reasonable Potential Evaluation (high,medium,low)</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------------------------------</td>
<td>------------------------</td>
<td>----------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>6) On-site waste disposal practices</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>low</td>
</tr>
<tr>
<td>7) Maintenance and cleaning of vehicles, machines and equipment</td>
<td>Inside Campus Services</td>
<td>Oils, fuels</td>
<td>None</td>
<td>low</td>
</tr>
<tr>
<td>8) Areas of exposed and/or erodible soils</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>9) Sites of Environmental Contamination listed under Part 201</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>10) Areas of significant material residues</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>11) Areas where animals congregate (wild or domestic) and deposit wastes</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>12) Other areas where storm water may contact significant materials</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 1 – SIGNIFICANT MATERIAL INVENTORY AND DESCRIPTION OF INDUSTRIAL ACTIVITY OR SIGNIFICANT MATERIAL STORAGE AREAS

<table>
<thead>
<tr>
<th>Section Listed in General Permit</th>
<th>Storage Areas / Activity Areas</th>
<th>Significant Materials</th>
<th>Exposure Method</th>
<th>Reasonable Potential Evaluation (high, medium, low)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Loading, unloading, and other material handling operations</td>
<td>Maintenance shed</td>
<td>Oils, lubricants, gasoline</td>
<td>spills</td>
<td>low</td>
</tr>
<tr>
<td></td>
<td>Equipment and dry field Material storage area under bleachers in front of the Seelye Center</td>
<td>Granular Fertilizers, Turface water absorber, chalk, ice melt, rubber infield pellets. Equipment may contain gas or oils</td>
<td>spills</td>
<td>medium</td>
</tr>
<tr>
<td></td>
<td>Bill Brown Concourse storage room and equipment storage</td>
<td>Gasoline, pesticides, fungicides, salt, fertilizer, oils</td>
<td>spills</td>
<td>low</td>
</tr>
<tr>
<td>2) Outdoor storage including secondary containment structures</td>
<td>Equipment storage under west end bleachers</td>
<td>Leaking hydraulic lines, fuel tanks, run-off of lubricants oils from precipitation</td>
<td>None—Runoff from this area does not reach storm inlets</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>Lot 9 equipment – storage prohibited</td>
<td>Gasoline, Battery acid, oils</td>
<td>Spills, leaks</td>
<td>Low</td>
</tr>
<tr>
<td>3) Outdoor manufacturing or processing activities</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4) Significant dust or particulate generating processes</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5) Discharge from vents, stacks, and air emission controls</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 1 CONTINUED

<table>
<thead>
<tr>
<th>Section Listed in General Permit</th>
<th>Storage Areas / Activity Areas</th>
<th>Significant Materials</th>
<th>Exposure Method</th>
<th>Reasonable Potential Evaluation (high, medium, low)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6) On-site waste disposal practices</td>
<td>Dumpster at Maintenance Shop</td>
<td>Pesticides containers are triple rinsed and discarded in dumpster. Oil packets and containers. Used oil collected and transported to Garage for recycling.</td>
<td>spills</td>
<td>low</td>
</tr>
<tr>
<td>7) Maintenance and cleaning of vehicles, machines and equipment</td>
<td>Concrete pad under west end bleachers</td>
<td>Residues of fertilizer, pesticides, automotive fluids</td>
<td>None—Runoff from this area does not reach storm inlets</td>
<td>low</td>
</tr>
<tr>
<td>8) Areas of exposed and/or erodible soils</td>
<td>Track between west end bleacher at Waldo Stadium and Hyames Field</td>
<td>gravel</td>
<td>None—Runoff from this area does not reach storm inlets</td>
<td>low</td>
</tr>
<tr>
<td></td>
<td>Hillside behind maintenance shed</td>
<td>Soil</td>
<td>Storm erosion</td>
<td>medium</td>
</tr>
<tr>
<td>9) Sites of Environmental Contamination listed under Part 201</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10) Areas of significant material residues</td>
<td>Grandstands</td>
<td>Food traffic, soil, Beverage spills</td>
<td>Wash Water</td>
<td>low</td>
</tr>
<tr>
<td>11) Areas where animals congregate (wild or domestic) and deposit wastes</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12) Other areas where storm water may contact significant materials</td>
<td>Synthetic Turf in Waldo Stadium</td>
<td>Turf Gard field disinfectant</td>
<td>Spill</td>
<td>low</td>
</tr>
</tbody>
</table>
SWMP Attachment E

WMU SWPPP Preventative Maintenance/Housekeeping Inspection Summary Tables
### TABLE 3 – DESCRIPTION OF PREVENTATIVE MAINTENANCE / ROUTINE HOUSEKEEPING INSPECTIONS

<table>
<thead>
<tr>
<th>Description of Area or Equipment</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above ground Storage Tanks</td>
<td>Inspect for leaks (stains, odors)</td>
</tr>
<tr>
<td></td>
<td>Check for external damage to tanks (dents, dings, paint scraped, graffiti)</td>
</tr>
<tr>
<td></td>
<td>Check fill area for spills or visual damage to connections</td>
</tr>
<tr>
<td></td>
<td>Check that padlocks are in place and locked</td>
</tr>
<tr>
<td></td>
<td>Inspect spill containment basin</td>
</tr>
<tr>
<td></td>
<td>Remove litter from area</td>
</tr>
<tr>
<td></td>
<td>Check vent piping for damage</td>
</tr>
<tr>
<td></td>
<td>Inspect for vegetation kept mowed within 10 feet</td>
</tr>
<tr>
<td></td>
<td>Check fuel line piping to assure not bent or damaged</td>
</tr>
<tr>
<td></td>
<td>Review leak test reports</td>
</tr>
<tr>
<td></td>
<td>Review alarm history report</td>
</tr>
<tr>
<td></td>
<td>Review Liquid Sensor report</td>
</tr>
<tr>
<td></td>
<td>Test alarm test operating button on leak detection system</td>
</tr>
<tr>
<td>Fuel Pumps</td>
<td>Inspect for leaks (stains, odors)</td>
</tr>
<tr>
<td></td>
<td>Inspect for spills and put down absorbent if necessary</td>
</tr>
<tr>
<td>Soil bins</td>
<td>Inspect for spills and sweep back into bins</td>
</tr>
<tr>
<td></td>
<td>Inspect area after heavy rains to ensure rains have not washed soils from bunkers</td>
</tr>
<tr>
<td>Gasoline can and vegetable oil storage</td>
<td>Inspect contents of storage cabinets for leaks or spills and around the exterior.</td>
</tr>
<tr>
<td>Catch basin CB2-1-0-7</td>
<td>Check for and clear debris</td>
</tr>
</tbody>
</table>

**Note:** WMU standard protocols require routine monthly inspections with the exception of winter months with heavy snow accumulation. Comprehensive inspections are conducted once every six months.
<table>
<thead>
<tr>
<th>Description of Area or Equipment</th>
<th>Tasks</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage area under Seelye bleachers</td>
<td>Clean up spilled materials</td>
<td>Monthly or as observed</td>
</tr>
<tr>
<td></td>
<td>Check and repair tears in bags</td>
<td>Monthly or as observed</td>
</tr>
<tr>
<td></td>
<td>Check and remove containers of significant materials that should not be stored under Seelye bleachers</td>
<td>Monthly or as observed</td>
</tr>
<tr>
<td></td>
<td>Inspect storm catch basins for debris/blockage</td>
<td>Monthly or as observed</td>
</tr>
<tr>
<td>Bill Brown Concourse</td>
<td>Inspect drains for blockage and debris. Check equipment for leaks and do not park over drains.</td>
<td>Monthly or as observed</td>
</tr>
<tr>
<td></td>
<td>Inspect storage room for spills and clean floors of debris</td>
<td>Monthly or as observed</td>
</tr>
<tr>
<td>Waldo Stadium field disinfectant and athletic field striping paint applications</td>
<td>Use products per manufacturer's instructions and inspect equipment for leaks. Apply when weather expected to be dry. Fill tanks in area with no contact to storm.</td>
<td>Each application.</td>
</tr>
<tr>
<td>Grandstand cleaning</td>
<td>Use water only for power washing</td>
<td>Each cleaning</td>
</tr>
<tr>
<td></td>
<td>Pick up debris</td>
<td>After each game</td>
</tr>
<tr>
<td>Lot 9</td>
<td>Prohibit storage of equipment and inspect catch basins</td>
<td>Monthly</td>
</tr>
<tr>
<td>Equipment storage and wash off area under west end bleachers</td>
<td>Inspect stored equipment and shed for leaks or spills</td>
<td>Monthly or as observed</td>
</tr>
<tr>
<td></td>
<td>Inspect area after heavy rains to ensure erosion has not developed to run to storm system</td>
<td>Monthly or as observed</td>
</tr>
<tr>
<td>Maintenance Shop area</td>
<td>Inspect storm catch basin for debris/blockage and clean up erosion from hillside</td>
<td>Monthly or as observed</td>
</tr>
<tr>
<td></td>
<td>Inspect for spills inside building that could be tracked outside</td>
<td>Monthly or as observed</td>
</tr>
<tr>
<td></td>
<td>Inspect dumpster area for spills, debris and closed lid</td>
<td>Monthly or as observed</td>
</tr>
<tr>
<td>Lawn equipment general</td>
<td>Inspect to maintain proper operation to prevent breakdowns</td>
<td>Annually or as needed.</td>
</tr>
</tbody>
</table>
SWMP Attachment F

WMU SWPPP Structural Control Summary Tables, Maps and Routine/Comprehensive Inspections Checklists
<table>
<thead>
<tr>
<th>Description of Structural Control</th>
<th>Location of Structural Control</th>
<th>Significant Materials intended to be managed</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double wall tanks and automatic leak detection on above ground storage tanks</td>
<td>Lot 95</td>
<td>Diesel fuel and gasoline</td>
<td>Campus Services- Fuel Service</td>
</tr>
<tr>
<td>Three-sided bins to control run-off for soil storage</td>
<td>Lot 95</td>
<td>Topsoil, sand, gravel</td>
<td>Landscape Service</td>
</tr>
<tr>
<td>Flammable liquid storage cabinet and vegetable oil storage</td>
<td>Lot 95</td>
<td>Gasoline, vegetable oil, and diesel fuel</td>
<td>Landscape Service</td>
</tr>
</tbody>
</table>
Table 7 - Routine and Comprehensive Inspection Checklist

Logistical/Landscaping Lot 95 Routine and Comprehensive Inspection for SWPPP

Inspected by: ___________________________ DATE: ___________________________

<table>
<thead>
<tr>
<th>AREAS INSPECTED</th>
<th>OBSERVATIONS</th>
<th>ACTION TAKEN (IF NEEDED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanks for leaks (stains, odors) or damage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inside fill area for spills or visual damage to connections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Padlocks in place and locked</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vent piping undamaged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel line piping not bent or damaged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leak test reports pass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm history report clear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid Sensor report pass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm test operating button tested on leak detection system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel pump area for leaks, leaks, or damage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 7 Continued

Logistical/Landscaping Lot 95 Routine and Comprehensive Inspection for SWPPP

<table>
<thead>
<tr>
<th>AREAS INSPECTED</th>
<th>OBSERVATIONS</th>
<th>ACTION TAKEN (IF NEEDED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front of bins clear of soil that could wash to catch basin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No leaks spills from containers in flammable storage cabinet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catch basin CB2-1-0-7 clear of debris</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review routine inspection checklists &amp; related documents, update if necessary (Comprehensive Inspection only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AREAS INSPECTED</td>
<td>OBSERVATIONS</td>
<td>ACTION TAKEN (IF NEEDED)</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Seelye storage free of spilled materials and leaking bags</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment under Seelye storage free of leaks/spills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seelye Storage free of unapproved storage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catch basins under Seelye CB1-3-0-4 and CB1-3-0-5 free of debris/blockage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bill Brown concourse drains clear of debris</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment/vehicles free of leaks and spills in Bill Brown concourse</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bill Brown storage room clear of spills and debris</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot 9 free of equipment storage that could leak/spill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lot 9 Catch basins CB2-1-4-1 and CB2-1-3-1 free of debris/blockage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment and shed contents free of leaks and spills under scoreboard bleachers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catch basins CB2-1-0-1 and CB2-1-0-2 near storage shed free of debris/blockage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance shed free of spills and leaks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shop Dumpster lid closed and area clear of spills/leaks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review routine inspection checklists &amp; related documents, update if necessary (Comprehensive Inspection only)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments:
SWMP Attachment G

WMU Stormwater BMP Maintenance Plan
Campus Stormwater Control Measures (SCMs) or Best Management Practices (BMPs)

MAINTENANCE PLAN

Prepared by:

KIESER & ASSOCIATES, LLC
536 E. Michigan Ave., Suite 300
Kalamazoo, MI 49007

March 27, 2023
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Introduction

This document provides an update to the compilation of maintenance recommendations prepared by Kieser & Associates, LLC (K&A) on behalf of Western Michigan University (WMU) in 2017. The implementation of the 2017 iteration of the maintenance plan has successfully guided management and maintenance to ensure the integrity of the stormwater controls are upkept. As such, the updated maintenance plan will include previous, successful recommendations and new recommendations for BMP’s not included in the original document. Table 1 provides a list of each implemented BMP identified by a BMP identification number and its respective attachment section of this report. The entirety of the WMU main campus treated by each stormwater BMP is provided in Figure 1. Available layout/design drawings for each stormwater control measure (SCM) location were provided by WMU to include in this documentation.

Adequate performance of SCMs requires not only proper installation, but also regular maintenance. Maintenance needs are best determined by adhering to an intentional inspection program that is specific to each SCM site. Routine inspections are an integral part of a stormwater maintenance program (e.g., litter/debris removal, erosion repair, sediment removal and vegetation management) and are necessary to ensure the long-term integrity and effectiveness of SCMs.

WMU staff must be familiar with the location, design specifications, maintenance procedures, and performance expectations of each SCM. It is strongly recommended that an inspection form or checklist is used for each inspection visit (refer to Attachment Q of this document). Logbooks are often used, but they need to include more information than merely the inspection date. Permitting authorities require self-inspections, and if they conduct a stormwater permit audit, they will want to see proof of inspections to document compliance. Permitting authorities may also wish to see inspection and maintenance documentation for each specific SCM. During the life of any SCM, several staff may be responsible for site inspection activities and documentation. Therefore, it is important to file and maintain adequate documentation of inspection dates, findings, and subsequent maintenance activities for all SCMs on campus.

It is recommended that WMU allocate both adequate time and resources for SCM inspections and necessary maintenance/repairs. Those responsible for inspecting and maintaining WMU SCMs should be familiar with their design layout and intended operation. This will help ensure that WMU staff can identify when SCMs require necessary maintenance work. Similarly, as site conditions and runoff patterns change with campus redevelopment or renovations over time, SCM designs may prove to be ineffective in controlling erosion and sedimentation. WMU inspection staff must have site-specific knowledge for each SCM site in order to be able to identify potential deficiencies in the future and ensure that necessary improvements are implemented.

The effectiveness of SCM self-inspection and maintenance programs will vary in accordance with the amount of time and resources allocated. When made a priority, inspections and necessary maintenance activities will further ensure that SCMs are
functioning properly and help prevent unintended discharges of nonpoint source stormwater pollutants.

**Table 1. Implemented BMP’s and Respective Load Reductions.**

<table>
<thead>
<tr>
<th>BMP ID#</th>
<th>WMU Stormwater BMP</th>
<th>Year Installed</th>
<th>BMP Description</th>
<th>TP Reduction (lbs/yr)</th>
<th>TSS Reduction (tons/yr)</th>
<th>TN Reduction (lbs/yr)</th>
<th>Runoff Volume (acft/yr)</th>
<th>Area Served (acres)</th>
<th>Maintenance Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Parking Lot 55</td>
<td>2008</td>
<td>Infiltration Basin</td>
<td>5.70 0.95 46.52 5.20 2.12 M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Western View (Krollwood) Apts.</td>
<td>2010</td>
<td>Infiltration Practices</td>
<td>4.60 1.50 76.04 8.50 4.40 O</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Parking Lot 23</td>
<td>2009</td>
<td>Detention Pond w/ Overflow</td>
<td>28.30 3.97 267.50 29.90 32.30 I</td>
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<td></td>
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<td></td>
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<tr>
<td>5</td>
<td>Lot 23 Basin Update (DEQ#2012-0502)</td>
<td>2014</td>
<td>On-site BMP Efficiency Monitoring</td>
<td>19.80 2.80 187.30 -- -- I</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td>Brown Hall</td>
<td>2006</td>
<td>Infiltration Basin</td>
<td>0.50 0.19 14.33 1.60 0.80 A</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>Road Fieldhouse Sidewalk</td>
<td>2006</td>
<td>Infiltration Practices</td>
<td>0.39 0.05 4.47 0.50 0.90 N</td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>Oliver Street Reconstruction</td>
<td>2009</td>
<td>Infiltration Practices</td>
<td>9.20 1.61 119.88 13.40 12.60 L</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>9</td>
<td>Hyames Baseball Field</td>
<td>2009</td>
<td>Infiltration Practices</td>
<td>0.80 0.10 8.95 1.00 0.10 G</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10</td>
<td>Parking Lot 95</td>
<td>2009</td>
<td>Infiltration Practices</td>
<td>9.50 1.59 75.15 8.40 5.31 K</td>
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<td></td>
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</tr>
<tr>
<td>11</td>
<td>BTR Park</td>
<td>2001</td>
<td>Infiltration Practices</td>
<td>123.50 24.10 1347.00 151.00 197.00 AE</td>
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</tr>
<tr>
<td>12</td>
<td>Drake Road Rain Garden</td>
<td>2010</td>
<td>Bioretention Raingardens</td>
<td>1.60 0.20 15.00 1.62 0.90 S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Parkview Rain Garden</td>
<td>2010</td>
<td>Bioretention Raingardens</td>
<td>1.27 0.20 11.76 1.32 0.75 AA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Howard/Stadium Apts (DEQ #2012-0502)</td>
<td>2011</td>
<td>Detention w/ Overflow &amp; Monitoring</td>
<td>176.00 26.50 1480.50 184.00 102.00 AF</td>
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<td>15</td>
<td>Goldsworth Valley Pond</td>
<td>2002</td>
<td>Wetpond</td>
<td>32.10 2.39 1717.72 192.00 149.10 E</td>
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<td>16</td>
<td>WMED Parking Lot Leaching Basins</td>
<td>1998</td>
<td>Infiltration Basin</td>
<td>10.30 2.00 75.00 2.10 1.71 AG</td>
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<tr>
<td>17</td>
<td>Schneider Basin - Site 2 (DEQ #2011-0030)</td>
<td>2013</td>
<td>Detention w/ Overflow</td>
<td>39.16 4.63 315.95 35.60 22.00 AB</td>
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<td>18</td>
<td>Chemistry Building</td>
<td>2007</td>
<td>Detention Pond w/ Overflow</td>
<td>14.90 1.93 166.40 18.60 10.70 C</td>
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<tr>
<td>19</td>
<td>Parking Lot 76</td>
<td>2000</td>
<td>Detention Pond w/ Overflow</td>
<td>20.40 3.37 171.77 19.20 8.80 AH</td>
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<td>20</td>
<td>Western View Phase II Apts</td>
<td>2013</td>
<td>Infiltration Practices</td>
<td>5.67 1.12 78.12 8.74 5.20 J</td>
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<td>21</td>
<td>College of Health &amp; Hum. Serv.</td>
<td>2003</td>
<td>Detention Pond</td>
<td>13.70 2.31 154.77 17.30 9.90 D</td>
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<tr>
<td>22</td>
<td>Cass_Ottowa Street Reconstruction</td>
<td>2009</td>
<td>Infiltration Practices</td>
<td>9.20 1.61 119.88 13.40 12.60 B</td>
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<td>23</td>
<td>North Sangren Hall</td>
<td>2003</td>
<td>Infiltration Practices</td>
<td>7.16 1.49 97.65 10.97 6.50 AJ</td>
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<td>24</td>
<td>Lawsson - Site 1 (DEQ#2011-0030)</td>
<td>2013</td>
<td>Detention w/ Overflow</td>
<td>3.00 0.60 40.30 4.50 2.50 W</td>
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<td>Lawsson - Site 3 (DEQ#2011-0030)</td>
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<td>Detention w/ Overflow</td>
<td>6.10 1.20 83.00 9.30 5.20 W</td>
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<td>26</td>
<td>Power Plant - Site 4 (DEQ#2011-0030)</td>
<td>2013</td>
<td>Streambank Stabilization</td>
<td>21.60 14.40 24.50 -- -- AK</td>
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<td>27</td>
<td>Lawsson - Site 5 (DEQ#2011-0030)</td>
<td>2013</td>
<td>Detention w/ Overflow</td>
<td>5.86 1.21 80.91 9.02 5.37 W</td>
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<td>28</td>
<td>Lot 23 Parking - Site 6 (DEQ#2011-0030)</td>
<td>2014</td>
<td>Infiltration Practices</td>
<td>2.07 0.36 1.93 13.50 0.78 AL</td>
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<td>29</td>
<td>Lot 10/Lot 12</td>
<td>2011</td>
<td>Infiltration Practices</td>
<td>0.38 0.10 2.40 0.30 0.60 AM</td>
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<td>30</td>
<td>East Campus Alumni Center</td>
<td>2015</td>
<td>Infiltration Practices</td>
<td>3.90 0.80 53.00 6.00 3.30 AN</td>
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<td>31</td>
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<td>2013</td>
<td>Bioretention Raingardens</td>
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<td>32</td>
<td>Western Heights Residence Halls</td>
<td>2015</td>
<td>Infiltration Practices</td>
<td>7.38 8.20 112.00 12.50 7.00 AC</td>
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<td>33</td>
<td>Howard Street / Stadium Drive</td>
<td>2013</td>
<td>Instream detention Ponds</td>
<td>55.90 8.40 516.00 57.70 26.95 F</td>
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<td>34</td>
<td>Goldsworth Valley Dining Hall</td>
<td>2015</td>
<td>Rain Garden/Infiltration Practices</td>
<td>3.10 0.60 42.00 4.70 2.60 U</td>
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<tr>
<td>35</td>
<td>Lot 54 Basin</td>
<td>2009</td>
<td>Detention w/ Overflow</td>
<td>8.40 1.70 104.00 12.90 7.20 X</td>
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<td>36</td>
<td>Western View Apartments Phase I</td>
<td>2011</td>
<td>Infiltration Practices</td>
<td>9 2 120 0.41 4.37 O</td>
<td></td>
<td></td>
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<tr>
<td>37</td>
<td>Goldsworth Valley Apartments</td>
<td>2015</td>
<td>Infiltration Practices</td>
<td>3 0.5 38 4.5 2 T</td>
<td></td>
<td></td>
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<tr>
<td>38</td>
<td>BTR Soccer Field Parking</td>
<td>2013</td>
<td>Subsurface infiltration</td>
<td>3 0.5 38 4.5 2 R</td>
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<tr>
<td>39</td>
<td>Sangren Hall</td>
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<td>Infiltration Practices</td>
<td>7.7 1.6 120 0.54 6.54 Z</td>
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<tr>
<td>40</td>
<td>Zhang Legacy</td>
<td>2013</td>
<td>Bioretention w/Overflow</td>
<td>3.3 0.7 45 5.05 2.8 AD</td>
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<tr>
<td>41</td>
<td>Heritage Hall</td>
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<td>Subsurface infiltration</td>
<td>3.9 0.8 45 6 3.34 V</td>
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<tr>
<td>42</td>
<td>Lot 97 Stormwater Pond</td>
<td>2012*</td>
<td>Bioretention w/Overflow</td>
<td>5.6 1.14 120 1.64 15.5 Y</td>
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<tr>
<td>43</td>
<td>French, Davis ETAL Detention Ponds</td>
<td>2021</td>
<td>Detention Ponds/ Infiltration</td>
<td>9.00 1.40 118.00 17.00 8.74 AP</td>
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<tr>
<td>44</td>
<td>Arcadia Flats Housing</td>
<td>2021</td>
<td>Subsurface infiltration/Bioretention</td>
<td>9.00 1.20 128.00 9.53 5.59 AQ</td>
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<tr>
<td>45</td>
<td>Student Center &amp; Loop Road</td>
<td>2021</td>
<td>Subsurface infiltration/Bioretention</td>
<td>8.00 1.60 108.00 11.66 5.33 AR</td>
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<td></td>
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</table>
Figure 1. WMU Drainage Area of Current BMP’s with associated area of Treatment
Attachment A

Brown Hall Stormwater Control Measures (SCMs) – BMP ID #5
Figure A-1. Project Area – Plan View of Brown Hall Stormwater Control Measures (Drawing file provided by WMU).
**Background**

An infiltration basin was installed when Brown Hall was re-constructed in 2006 on the main campus of WMU. The location of this SCM is illustrated on Figure A-1. The infiltration basin treats runoff primarily from the Brown Hall roof, with an estimated drainage area of 0.78 acres. The treatment volume of the infiltration basin is 0.043 acre-feet. This volume allows for capture and infiltration of 0.88 inches of precipitation, representing 91% of local rainfall events annually. Implementation of this SCM at Brown Hall has reduced the phosphorus load from this drainage area by 0.5 lbs/year.

Inspections and maintenance are required to achieve the intended function, benefits, and life of these stormwater controls. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of this SCM include, but are not limited to, the following:

**Basins and Structures**

1. Perform one annual inspection for sediment accumulation near each of the four stormwater outfalls discharging into the infiltration area. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

2. Following a large storm event or intense flows, inspect the basin for signs of erosion, especially near each of the four stormwater outfalls. Remove any trash or debris that might accumulate within the basin or near the overflow structure.

3. Remove any yard waste (leaves, branches, dead plants), trash or debris from the infiltration basin on a quarterly basis.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment B

Cass/Ottawa Street Stormwater Control Measures (SCMs) – BMP ID #21
Figure B-1. Project Area – Plan View of Cass/Ottawa Street Stormwater Control Measures (Drawing file provided by WMU).
Background

WMU installed stormwater controls involving infiltration practices during the reconstruction of Cass and Ottawa Streets in 2005. This work included two (2) infiltration basins, 36-inch diameter perforated pipe and four (4) six-foot diameter leaching basins installed near Ottawa Street and Oakland Drive. The treatment volume of this best management practice (BMP) is approximately 0.27 acre-feet, within a drainage area of 11.1 acres. This volume allows for capture and infiltration of 0.65 inches of precipitation, representing 85% of local rainfall events. A phosphorus load reduction of 7.2 lbs/yr resulted from this WMU BMP.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater BMP. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Basins and Structures

1. Perform one annual inspection for sediment accumulation in both infiltration basins and in storm sewer structures: Leaching Basin 5, Leaching Basin 6, Leaching Basin 7, Leaching Basin 8, and Catch Basin 13. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

2. Following a large storm event or intense flows, inspect each basin for signs of erosion. Remove any debris that might accumulate on outflow structure grates.

3. Remove any yard waste (leaves, branches, dead plants), trash or debris from each stormwater basin at least once per month.

Grass Swales

1. The two swales are intended to direct surface runoff from Cass Street to stormwater infiltration controls.

2. Inspect the vegetated swales annually for any signs of sediment accumulation that could cause clogging of the leaching basins or perforated infiltration piping. If sediment accumulation is observed, remove the accumulated sediment.

3. Following a large storm event or intense flows, inspect each swale for signs of erosion rills or gullies that could develop. Place additional fill soils and reseed the filled areas to ensure re-establishment of desired vegetation.
Concrete Spillways

1. Conduct one annual inspection of the five concrete spillways for any signs of erosion, settling or cracking. Repair any observed concerns to ensure long-term stability of stormwater controls.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment C

Chemistry Building Stormwater Control Measures (SCMs) – BMP ID #18
Figure C-1. Project Area – Plan View of Chemistry Building Stormwater Controls (Drawing file provided by WMU).
Background

A new chemistry building was constructed on the campus of WMU in 2007. During this work, a stormwater detention basin was installed west of the new building to treat stormwater runoff from approximately 10.65 acres of the surrounding area. This detention basin is capable of treating up to 1.51 acre-feet of stormwater and contains an overflow structure for volumes that exceed this capacity. All stormwater within the capacity of the detention basin is infiltrated. Based upon the land use within the drainage area and capture volume, local historic rainfall records suggest 3.04 inches of precipitation can be captured, accounting for 100% of rainfall events over the past 34 years. This detention basin reduces the total phosphorus load in the drainage area from 14.9 lbs/yr to 0.0 lbs/yr.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practice (BMP). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Vegetation

This stormwater treatment system uses native vegetation as an important part of the treatment process and as such, the system will require periodic maintenance.

**SPRING/FALL**

- Conduct a plant survey and compare the observed species to the list of species planted on site as seen in Table C-1 below. Evaluate health, abundance and diversity of vegetation. Make note of any wildlife (both desirable and nuisance) observed.

- Supplement with additional plants as needed if significant plant mortality (due to erosion, mechanical damage, natural causes etc.) has occurred.

- Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species identification.

- Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective cutting and/or hand removal techniques. Refer to **Target Exotic/Invasive Species List**. Remove the plant material from the site. This list will need to be updated as new species establish on site.

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Iris pseudacorus</em> 'Flore Pleno'</td>
<td>Double-flowered Yellow Flag Iris</td>
</tr>
<tr>
<td><em>Calamagrosis x acutiflora</em> 'Karl Foerster'</td>
<td>Karl Foerster Feather Reed Grass</td>
</tr>
<tr>
<td><em>Iris siberica</em> 'Ceaser's Brother'</td>
<td>Ceaser's Brother Siberian Iris</td>
</tr>
</tbody>
</table>

Table C-1. Vegetation list that was part of the Chemistry Building SCMs.
<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Pennisetum alopecuroides</em> 'Hameln'</td>
<td>Dwarf Fountain Grass</td>
</tr>
<tr>
<td><em>Rhus aromatica</em> 'Gro Low'</td>
<td>Gro Low Fragrant Sumac</td>
</tr>
<tr>
<td><em>Viburnum trilobum</em> 'Wentworth'</td>
<td>American Cranberrybush Viburnum</td>
</tr>
<tr>
<td><em>Miscanthus sinensis</em> 'Adagio'</td>
<td>Adagio Japanese Silver Grass</td>
</tr>
</tbody>
</table>

**Basins and Structures**

1. Perform one annual inspection for sediment accumulation in the stormwater basin and Catch Basin 46. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

2. Inspect Manhole-104 for sediment accumulation on a quarterly basis.

3. Following a large storm event or intense flows, inspect each basin for signs of erosion. Remove any debris that might accumulate on the two storm outfalls or the outflow structure grates.

4. Remove any yard waste (leaves, branches, dead plants), trash or debris from each stormwater basin on a quarterly basis.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment D

College of Health and Human Services Stormwater Control Measures (SCMs) - BMP ID #20
Figure D-1. Project Area – Plan View of CHHS Stormwater Control Measures (Drawing file provided by WMU).
**Background**

In 2003, WMU built a new building for the College of Health and Human Services. In addition to the building, a retention pond was installed to provide treatment of stormwater runoff from the surrounding area. The retention pond is located on the Oakland Drive Campus, west of parking lots 104 and 105. The drainage area of this SCM is 9.89 acres, and the runoff capture volume is approximately 2.2 acre-feet. Using these values, K&A determined that precipitation up to 4.04 inches (100% of historic annual rainfall events) can be captured by this retention pond. Phosphorus removal is also 100% effective, since all capture runoff is retained and infiltrated. The total phosphorus load from the drainage area has been effectively reduced from 13.7 lbs/yr to 0.0 lbs/yr.

Inspections and maintenance are required to achieve the intended function, benefits, and life of this SCM site. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

**Detention Basin**

1. Perform one annual inspection for sediment accumulation in the detention basin. Remove any accumulated sediment greater than 6 inches to ensure proper stormwater retention.

5. Following a large storm event or intense flows, inspect the basin for signs of erosion. Remove any debris that might accumulate within the basin.

6. Remove any yard waste (leaves, branches, dead plants), trash or debris from the detention basin on a quarterly basis.

7. Prevent undesired woody growth from growing in the detention basin. Control tree and bush growth annually by hand cutting.

**Drainage Swale**

1. The drainage swale is intended to direct surface runoff from the outfall serving Ottawa Street to the catch basin.

2. Inspect the swale quarterly for any signs of erosion rills or gullies that could develop into larger problems. If erosive conditions are observed, place additional fill soils and reseed the filled areas.

3. Following a large storm event or intense flows, inspect the swale for signs of erosion rills or gullies that could develop as sediment can accumulate within the catch basin. If sediment accumulation is observed within the catch basin, remove the accumulated sediment.
Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment E

Goldsworth Valley Pond Stormwater Control Measures (SCMs) – BMP ID #15
Figure E-1. Project Area – Plan View of Goldsworth Valley Pond Stormwater Control Measures (Drawing file provided by WMU).
**Background**

Goldsworth Valley Pond (GV Pond) was originally created in the 1960's in a low-lying area of the WMU campus. The pond was constructed to serve as an aesthetic centerpiece on campus, in addition to providing stormwater detention for approximately 150 acres of campus. GV Pond is located south of the Valley dormitories along Goldsworth Drive. Over the decades, the health of the pond declined significantly due to high pollutant (especially nutrient) loads from 12 stormwater outfalls and resultant algal growth. In 2002, WMU implemented improvements to the pond and increased the treatment/capture volume to 17.7 acre-feet. Improvements included modification of the pond outflow structure, carp removal, and native shoreline vegetative buffers. As a result, the total phosphorus load was further reduced by 37.3 lbs/yr. The increased volume of the GV Pond allows for capture of a rainfall event of up to 2.97 inches, representing nearly 100% of local precipitation events over a 34-year reference record for local rainfall.

Inspections and maintenance are required to achieve the intended function, benefits, and life of this SCM site. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of these SCMs include, but are not limited to, the following:

**Vegetation**

This SCM uses native shoreline vegetative buffers as an important part of the treatment process and as such, the system will require periodic maintenance.

**SPRING**

- Mow native vegetation buffer to 6 inches in early spring (when first green begins to appear) to inhibit the establishment of non-desirable species and woody vegetation. Remove the mown vegetation from the site (to prevent nuisance algal growth).

- In the late spring, conduct a plant inventory and map general locations of species. Based on this survey and mapped plant community, create management areas based on the species that dominate each area. Update the management plan, accordingly.

- Compare the observed species from the plant survey to the list of species originally planted on site (refer to Table E-1). Evaluate health, abundance and diversity of native plant species. Make note of any wildlife (both desirable and nuisance) observed.

- Supplement with additional native regional plants/plugs/seeds as needed if significant plant mortality (due to erosion, mechanical damage, natural causes etc.) has occurred.

- Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer
to Target Exotic/Invasive Species List within Attachment P). Physically remove these plant material remnants from the site for proper disposal. This list will need to be updated as new species establish on site.

- Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species identification.

- If conditions allow, a controlled burn on the riparian buffer zone would allow for effective control of non-desirable species and promote a healthy plant community. The riparian buffer should be burned in sections (¼ to ½ of each area at a time) to allow refuge for wildlife. Burn when green is first appearing on vegetation (typically in early April). Burn each half every 3-5 years.

- Install and maintain patches of native shrubs to provide refuge for resident duck populations. Recommended species include: chokeberry (*Aronia prunifolia*), buttonbush (*Cephalanthus occidentalis*), silky dogwood (*Cornus amomum*), spicebush (*Lindera benzoin*), swamp rose (*Rosa palustris*), and American elder (*Sambucus canadensis*).

**SUMMER**

- Conduct a plant inventory and map general locations of species. Evaluate health, abundance and diversity of native plants. Make note of any wildlife observed (both desirable and nuisance).

- Supplement with additional native regional plants/plugs/seeds as needed if significant plant mortality (due to erosion, mechanical damage, natural causes etc.) has occurred.

- Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer to Target Exotic/Invasive Species List within Attachment P). Physically remove these plant material remnants from the site for proper disposal. This list will need to be updated as new species establish on site.

- Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species identification.

**FALL**

- Conduct a plant inventory and map general locations of species. Compare the observed species to the list of species originally planted on site (refer to Table E-1). Evaluate health, abundance and diversity of native plants. Make note of any wildlife (both desirable and nuisance) observed.

- Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer to Target Exotic/Invasive Species List within Attachment P). Physically remove
these plant material remnants from the site. This list will need to be updated as new species establish on site.

- Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species identification.

**Table E-1. Vegetation originally planted at Goldsworth Valley Pond in 2002-2003.**

<table>
<thead>
<tr>
<th>Scientific Name</th>
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</tr>
</thead>
<tbody>
<tr>
<td><em>Acorus calamus</em></td>
<td>Sweet Flag</td>
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<tr>
<td><em>Allium cernuum</em></td>
<td>Nodding Wild Onion</td>
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<tr>
<td><em>Alnus rugosa</em></td>
<td>Speckled Alder</td>
</tr>
<tr>
<td><em>Andropogon gerardi</em></td>
<td>Big Bluestem Grass</td>
</tr>
<tr>
<td><em>Anemone patens</em></td>
<td>Pasque Flower</td>
</tr>
<tr>
<td><em>Apocynum androsaemifolium</em></td>
<td>Spreading Dogbane</td>
</tr>
<tr>
<td><em>Asclepias incarnata</em></td>
<td>Marsh Milkweed</td>
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<tr>
<td><em>Aster laevis</em></td>
<td>Smooth Aster</td>
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<tr>
<td><em>Aster novae-angliae</em></td>
<td>New England Aster</td>
</tr>
<tr>
<td><em>Aster umbellatus</em></td>
<td>Tall Flat Top White Aster</td>
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<td><em>Iris versicolor</em></td>
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<td><em>Juncus effusus</em></td>
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<td><em>Juncus torreyi</em></td>
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<td><em>Koeleria macrantha</em></td>
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<tr>
<td><em>Zizia aurea</em></td>
<td>Golden Alexanders</td>
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**Possible Substitutions (may or may not have been installed)**

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<td>Round Leaved Ragwort</td>
</tr>
<tr>
<td><em>Smilacina stellata</em></td>
<td>Starry Solomon Seal</td>
</tr>
</tbody>
</table>
Note: The above possible substitutions were identified in WMU records, but may not have been installed.

Pond/Structures

1. Goldsworth Valley Pond along Goldsworth Drive is designed to both retain and detain stormwater runoff.

2. Following a large storm event or intense flows, inspect the pond and surrounding area for signs of erosion. Remove any debris that might accumulate within the pond or on the pond perimeter.

3. Prevent grass clippings from entering or washing off into the pond to impede nuisance algal growth.

4. Remove any yard waste (leaves, branches, dead plants), trash or debris from Goldsworth Valley Pond at least once per month.

5. Prevent undesired woody growth from growing in the pond. Control tree and bush growth annually by hand cutting.

6. During large storm events, or periods of intense flows, inspect all outfalls to ensure they are not obstructed. Obstructions will cause flooding.

7. Inspect the concrete/masonry condition of the outflow structure annually for signs of cracks, displacement, spalling, joint failures, and water tightness. Implement repairs if these or other concerns are present.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment F

Howard Street/Stadium Drive Stormwater Control Measures (SCMs) – BMP ID #33
Figure F-1. Project Area – Plan View of Howard/Stadium Stormwater Controls (Sheet 13 - from plans by Kieser & Associates, LLC).
Figure F-38. Project Area – Plan View of Howard/Stadium Stormwater Controls (Sheet 14 - from plans by Kieser & Associates, LLC).

WESTERN MICHIGAN UNIVERSITY
Maintenance Plans – Howard St./Stadium Dr. – BMP ID #33

KIESER & ASSOCIATES, LLC
Figure F-3. Project Area – Plan View of Howard/Stadium Stormwater Controls (Sheet 15 - from plans by Kieser & Associates, LLC).
Figure F-4. Project Area – Plan View of WMU Power Plant Stormwater Controls (Sheet 16 - from plans by Kieser & Associates, LLC).
**Background**

A series of detention ponds near the corner of Howard Street and Stadium Drive provides treatment of stormwater runoff from approximately 26.95 acres from the WMU Oakland Drive campus area and WMU Stadium Drive apartments. In addition to on-campus runoff, an additional 75.6 acres of off-campus urban residential drainage areas are also served by these SCMs. The hydraulic treatment capacity of this stormwater system reflects a 79% capture of annual storm events (based on 30-year local rainfall records). The estimated phosphorus load reduction for this project amounts to 55.9 lbs/yr.

Inspections and maintenance are required to achieve the intended function, benefits, and life of these SCMs. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of these stormwater controls include, but are not limited to, the following:

**Vegetation**

This stormwater treatment system uses native vegetation as an important part of the treatment process and as such, the vegetation will require periodic maintenance. Five primary seed mixes were utilized at the Howard Street/Stadium Drive stormwater treatment system:

1) Midwestern riparian mix (WS2)
2) Midwestern basic wetland basin mix (WP5)
3) Midwestern short stature wetland basin mix (WP6)
4) Midwestern short stature bioswale mix (WP7)
5) Modified Midwestern short stature prairie erosion control seed mix (DP4)

An additional mix, 6) Custom Island mix (ISLAND) was applied to the raised “island” areas within the bioretention area within the power plant property. Refer to design drawing sheets 17-20 within Attachment F-1 for copies of the final landscape plans. The WP5 and WP6 mixes are intended for wet conditions and were used in the sediment forebay and wetpond areas, respectively. The WS2 and WP7 mixes, designed for transitional wet/dry environments, were sewn in the riparian areas between the wetpond and bioswale and in the bioswale areas, respectively. The DP4 mix was selected for dry conditions and was utilized along the upper slopes of the sediment forebay, wetponds and bioswale areas. A full copy of these seed mix species are provided in Attachment F-1. The seed supplier was Heartland Restoration Services of Fort Wayne, Indiana.

**2013 and 2014 - Vegetative Maintenance**

- In the late spring, conduct a plant inventory inspection, document and map general locations of species observed.
- Compare the observed species from the plant inventory inspection to the list of species planted on site (see Attachment F-1). Evaluate the health, abundance and
diversity of observed native plants. Make note of any wildlife (both desirable and nuisance) observed.

- Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer to Target Exotic/Invasive Species List provided in Attachment P). Physically remove all harvested plant materials from the site. This target exotic/invasive species list will need to be revised and updated as new species may establish onsite.

- Supplement with additional native regional plants/plugs/seeds as needed if significant plant mortality (e.g., due to erosion, mechanical damage, natural causes) has occurred.

- Areas planted with WS2, WP7, DP4 and ISLAND seed mixes should be mown in early July to a height just above that of the target native species. If landscape services crews are unable to identify the target native species, mowing to a height of 6 inches is acceptable. A second mowing to the height specified above (i.e., just above the target native species) should occur about 4 weeks following the initial mowing. Areas planted with these seed mixes should be mown again in late September, to the specified height.

**2015 and beyond - Vegetative Maintenance**

**Spring**

- In areas where aesthetics are a concern, mow berms and outer slopes of sediment forebay, wetpond, and the entire bioretention basin to the ground in early spring (when first green begins to appear) to inhibit the establishment of non-desirable species and woody vegetation. Where aesthetics are not a primary concern, mow these areas to the ground every 2-3 years. Physically remove the mown vegetation from the site.

- In the late spring, conduct a plant inventory inspection, document and map general locations of species observed. Based on this inventory inspection and mapped plant community, create management areas based on the species that dominate each area. Encourage diversity and microhabitats through varying mowing times in spring, summer and fall taking into consideration previously observed wildlife. Revise and update the management plan, accordingly.

- Compare the observed species from the plant inventory inspection to the list of species planted on site (see Attachment F-1). Evaluate the health, abundance and diversity of observed native plants. Make note of any wildlife (both desirable and nuisance) observed.

- Supplement with additional native regional plants/plugs/seeds as needed if significant plant mortality (e.g., due to erosion, mechanical damage, natural causes) has occurred.

- Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species observed.
o Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer to Target Exotic/Invasive Species List provided in Attachment P). Physically remove all harvested plant materials from the site. This target exotic/invasive species list will need to be revised and updated as new species may establish onsite.

o If conditions allow, a controlled burn of the outer slope areas of the sediment forebay and the entire bioretention area would allow for effective control of non-desirable species and promote a healthy plant community. The areas should be burned in sections (¼ to ½ of each area at a time) to allow refuge for established wildlife. Conduct initial burns when green is first appearing on vegetation (early April). Burn each section every 3-5 years.

o Install and maintain patches of native shrubs to provide refuge for resident duck populations. Recommended species are: chokeberry (Aronia prunifolia), buttonbush (Cephalanthus occidentalis), silky dogwood (Cornus amomum), spicebush (Lindera benzoin), swamp rose (Rosa palustris), and American elder (Sambucus canadensis).

**Summer**

o Conduct a plant inventory inspection, document and map general locations of species observed. Evaluate health, abundance and diversity of native plants. Make note of any wildlife observed (both desirable and nuisance).

o Supplement with additional native regional plants/plugs/seeds as needed if significant plant mortality (e.g., due to erosion, mechanical damage, natural causes) has occurred.

o Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species identified.

o Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer to Target Exotic/Invasive Species List provided in Attachment P). Physically remove all harvested plant materials from the site. This target exotic/invasive species list will need to be revised and updated as new species may establish onsite.

**Fall**

o Conduct a plant inventory inspection, document and map general locations of species observed. Evaluate health, abundance and diversity of native plants. Make note of any wildlife observed (both desirable and nuisance).

o Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species identified.
o Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer to Target Exotic/Invasive Species List provided in Attachment P). Physically remove all harvested plant materials from the site. This target exotic/invasive species list will need to be revised and updated as new species may establish onsite.

o Harvest a portion of the wetland vegetation (in sediment forebay and wetponds) as needed (generally every five years) to reduce plant biomass and nutrient release from decaying vegetation. This is particularly important in heavily-infested cattail and reed stands. Physically remove all harvested plant materials from the site.

**Diversion Structure**

1. The diversion structure (Manhole-O) is an existing City of Kalamazoo storm sewer structure fitted with a cast-in-place concrete base and synthetic wood diversion weir sill (refer to Figure F-1). The internal weir diverts all first-flush stormwater runoff to the vegetated swale and sediment forebay of the larger treatment system. Stormwater flows from large rainfall events can overtop the weir and bypass the treatment system for discharge into Arcadia Creek via the existing City storm sewer infrastructure.

2. Inspect Manhole-O for sediment accumulation on a quarterly basis. Remove accumulated sediment behind the internal weir on the base of the manhole. Sediment accumulation behind the weir can cause a reduction in flows routed to the treatment system and increase the occurrence of overtopping flows bypassed to Arcadia Creek.

3. The diversion weir is adjustable. The weir height allows for the intentional bypass of intense flows (during heavy rain events) that exceed the treatment system capacity. Before making an adjustment to the weir height, consult with a Professional Engineer regarding the need for adjustment.

**Diversion Swale**

1. The diversion swale is intended to direct surface runoff from Howard Street and the WMU Howard Street Apartments to the sediment forebay (refer to Figures F-1 and F-2).

2. Following a large storm event or intense flows, inspect the swale for signs of erosion rills or gullies that could develop into larger problems. Inspections should begin at the riprap outlet area of the stormwater diversion piping and proceed toward the sediment forebay. Note any areas that may require preventative restoration or stabilization. Replace any riprap that may become displaced.

3. As part of routine annual inspections, inspect the drainage swale leading to the sediment forebay for any signs of erosion rills or gullies that could develop into larger...
problems. If erosive conditions are observed, place additional fill soils and reseed the filled areas (using native seed mix WP-5 from Heartland Restoration Services, Inc., Fort Wayne, Indiana).

**Sediment Forebay**

1. Inspect the riprap apron of the forebay inlet for any signs of erosion following a large storm event or intense flows. Replace any riprap that may become displaced. If holes occur in filter fabric (beneath the rip rap), repair immediately by overlaying damaged fabric with new material and replacing riprap or other erosion resistant material consistent with the original design.

2. Remove any accumulated trash or debris from the forebay area monthly.

3. Inspect the slow release discharge pipe frequently. Clear any trash or accumulated sediment away from the pipe inlet if observed. The slow release discharge pipe is intended to drain accumulated stormwater within 48-hours after each rainfall event. If standing water persists greater than 6-inches in depth, there may be a blockage of the slow release discharge pipe.

4. Inspect the stone materials of the forebay outlet for displacement following a large storm event or intense flows. Repair any signs of erosion at the forebay outlet.

5. Inspect the interior forebay berm for any signs of erosion rills or gullies that could develop. Place additional fill soils and reseed the filled areas (below elevation 834, use WP-5 seed mix; above elevation 834, use DP-4 seed mix).

6. Inspect for sediment accumulation. Remove accumulated sediment when it reaches 6-inch depth, or if accumulation is causing the outlet stone to become compromised by potential for clogging.

7. Check frequently for burrowing animals, as these pose a threat to long-term berm integrity. If discovered, remove the burrowing animals, replace all disturbed berm soils, and reseed.

**Wetponds**

1. Inspect the slow release discharge piping frequently. Clear any trash or accumulated sediment away from the pipe inlets if observed. The slow release discharge piping is intended to drain accumulated stormwater within 48-hours after each rainfall event. If standing water persists greater than 6-inches in depth, there may be a blockage of the slow release discharge piping.

2. Remove any accumulated trash and debris from Wetpond 1 and Wetpond 2 and surrounding area monthly. Remove any floating debris.
3. Inspect the interior wetpond berms for any signs of erosion rills or gullies that could develop. Place additional fill soils and reseed the filled areas (below elevation 833, use WP-6 seed mix; above elevation 833, use DP-4 seed mix).

4. Perform weeding of non-desirable species (invasive or exotic) before they produce and release seeds. Routine, quarterly weeding will assure a diversity of native vegetation and will allow for dense establishment.

5. Remove any yard waste (leaves, branches, dead plants), trash or debris from the Wetpond 1 outflow structure grates and surrounding no-mow areas monthly.

6. During large storm events, or periods of intense flows, inspect the all outflow grates to ensure they are not obstructed. Obstructions on the top grates of the forebay wetpond outflow structures will cause the emergency spillways to become the primary exit for pond outflow during large, prolonged storms. As implied by the description, the emergency spillway is not intended for routine outflow conditions, but rather for emergency situations only.

7. Inspect the concrete/masonry condition of each outflow structure annually for signs of cracks, displacement, spalling, joint failures, and water tightness. Implement repairs if these or other concerns are present.

**Drainage Spillway**

1. Conduct semi-annual inspections of the Wetpond 2, bioretention creek inlet and creek outlet drainage spillways for any signs of erosion, settling or cracking (refer to Figures F-3 and F-4). Repair any observed concerns to ensure long-term stability.

**Streambank**

1. Streambank repairs were part of the stormwater control project on the south side of Stadium Drive, upstream of the WMU power plant property (refer to Figure F-3).

2. Following a large storm event or intense flows, inspect the streambanks upstream of the WMU power plant for signs of erosion. Remove any debris that might accumulate along the streambank.

3. Remove any yard waste (leaves, branches, dead plants), trash or debris from the streambank at least once per month.

**Floodplain/Bioretention Basin**
1. The stormwater bioretention basin along Arcadia Creek within the WMU power plant property (refer to Figure F-4) is designed to enhance the floodplain as well as retain stormwater runoff.

2. Perform one annual inspection for sediment accumulation the stormwater basin. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

3. Following a large storm event or intense flows, inspect the inlet and outlet riprap areas and the stormwater basin for signs of erosion. Remove any debris that might accumulate within the basin.

4. Remove any yard waste (leaves, branches, dead plants), trash or debris from the stormwater basin at least once per month. Remove any floating debris within the micropools.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment F-1

Howard Street/Stadium Drive Native Seed Mixes
Attachment F-1
Howard Street/Stadium Drive Stormwater Controls
Target Native Species

1) **Midwestern Riparian Seed Mix (WS2)**

   Approximate mix weight 73 lb/acre with 46 native seeds/sq. ft.
   13.9% Grasses/Sedges/Rushes; 5.4% Forbs; 80.7% Temporary Cover Grasses

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<th>Common Name</th>
</tr>
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<tbody>
<tr>
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</tr>
<tr>
<td>Carex frankii</td>
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<td>Redtop</td>
</tr>
<tr>
<td>Agrostis alba palustris</td>
<td>Creeping Bent Grass</td>
</tr>
<tr>
<td>Avena sativa</td>
<td>Seed Oats</td>
</tr>
<tr>
<td>Lolium multiflorum</td>
<td>Annual Rye Grass</td>
</tr>
</tbody>
</table>
2) **Midwestern Basic Wetland Basin Seed Mix (WP5)**

NOTE: eliminate Silphium perfoliatum Cup Plant

Approximate mix weight 53 lb/acre, with 108 native seeds/sq. ft.  
26.5% Grasses/Sedges/Rushes; 15.2% Forbs; 58.3% Temporary Cover Grasses

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>% Seed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grasses, Sedges, and Rushes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carex frankii</td>
<td>Frank's Sedge</td>
<td></td>
</tr>
<tr>
<td>Carex stipata</td>
<td>Stalk Grain Sedge</td>
<td></td>
</tr>
<tr>
<td>Carex vulpinoidea</td>
<td>Fox Sedge</td>
<td></td>
</tr>
<tr>
<td>Eleocharis palustris</td>
<td>Creeping Spikrush</td>
<td></td>
</tr>
<tr>
<td>Juncus effusus</td>
<td>Soft Rush</td>
<td></td>
</tr>
<tr>
<td>Leersia oryzoides</td>
<td>Rice Cut Grass</td>
<td></td>
</tr>
<tr>
<td>Panicum virgatum</td>
<td>Switch Grass</td>
<td></td>
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<tr>
<td>Scirpus atrovirens</td>
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<td>Scirpus cyperinus</td>
<td>Woolgrass</td>
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<tr>
<td>Scirpus validus</td>
<td>Softstem Bulrush</td>
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<tr>
<td><strong>Forbs</strong></td>
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<td></td>
</tr>
<tr>
<td>Alisma subcordatum</td>
<td>Water Plantain</td>
<td></td>
</tr>
<tr>
<td>Asclepias incarnata</td>
<td>Marsh Milkweed</td>
<td></td>
</tr>
<tr>
<td>Bidens cernua</td>
<td>Nodding Bur Marigold</td>
<td></td>
</tr>
<tr>
<td>Ludwigia alternifolia</td>
<td>Bushy Seedbox</td>
<td></td>
</tr>
<tr>
<td>Lycopus americanus</td>
<td>American Bugleweed</td>
<td></td>
</tr>
<tr>
<td>Penthorum sedoides</td>
<td>Ditch Stonecrop</td>
<td></td>
</tr>
<tr>
<td>Senna hebecarpa</td>
<td>Wild Senna</td>
<td></td>
</tr>
<tr>
<td>Verbena hastata</td>
<td>Blue Vervain</td>
<td></td>
</tr>
<tr>
<td>Vernonia gigantea</td>
<td>Tall Ironweed</td>
<td></td>
</tr>
<tr>
<td><strong>Temporary Cover Grasses</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agrostis alba</td>
<td>Redtop</td>
<td></td>
</tr>
<tr>
<td>Agrostis alba palustris</td>
<td>Creeping Bent Grass</td>
<td></td>
</tr>
<tr>
<td>Avena sativa</td>
<td>Seed Oats</td>
<td></td>
</tr>
</tbody>
</table>
3) Midwestern Short Stature Wetland Basin Seed Mix (WP6)

Approximate mix weight 68 lb/acre, with 136 native seeds/sq. ft.
32.2% Grasses/Sedges/Rushes; 26.0% Forbs; 41.8% Temporary Cover Grasses

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>% Seed</th>
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</thead>
<tbody>
<tr>
<td><strong>Grasses, Sedges, and Rushes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carex frankii</td>
<td>Frank's Sedge</td>
<td></td>
</tr>
<tr>
<td>Carex hystericina</td>
<td>Porcupine Sedge</td>
<td></td>
</tr>
<tr>
<td>Carex normalis</td>
<td>Spreading Oval Sedge</td>
<td></td>
</tr>
<tr>
<td>Carex stipata</td>
<td>Stalk Grain Sedge</td>
<td></td>
</tr>
<tr>
<td>Carex tribuloides</td>
<td>Blunt Broom Sedge</td>
<td></td>
</tr>
<tr>
<td>Carex vulpinoidea</td>
<td>Fox Sedge</td>
<td></td>
</tr>
<tr>
<td>Eleocharis palustris</td>
<td>Creeping Spikrush</td>
<td></td>
</tr>
<tr>
<td>Elymus virginicus</td>
<td>Virginia Wild Rye</td>
<td></td>
</tr>
<tr>
<td>Juncus effusus</td>
<td>Soft Rush</td>
<td></td>
</tr>
<tr>
<td>Juncus torreyi</td>
<td>Torrey's Rush</td>
<td></td>
</tr>
<tr>
<td>Leersia oryzoides</td>
<td>Rice Cut Grass</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Forbs</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alisma subcordatum</td>
<td>Water Plantain</td>
<td></td>
</tr>
<tr>
<td>Bidens cernua</td>
<td>Nodding Bur Marigold</td>
<td></td>
</tr>
<tr>
<td>Euthamia graminifolia</td>
<td>Flat-top Fragrant Goldenrod</td>
<td></td>
</tr>
<tr>
<td>Gentiana andrewsii</td>
<td>Fringe-top Bottle Gentian</td>
<td></td>
</tr>
<tr>
<td>Iris virginica shrevei</td>
<td>Blue Flag Iris</td>
<td></td>
</tr>
<tr>
<td>Lobelia siphilitica</td>
<td>Great Blue Lobelia</td>
<td></td>
</tr>
<tr>
<td>Ludwigia alternifolia</td>
<td>Bushy Seedbox</td>
<td></td>
</tr>
<tr>
<td>Lycopus americanus</td>
<td>American Bugleweed</td>
<td></td>
</tr>
<tr>
<td>Mimulus ringens</td>
<td>Monkey Flower</td>
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<tr>
<td>Penthorum sedoides</td>
<td>Ditch Stonecrop</td>
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<tr>
<td>Pycnanthemum virginianum</td>
<td>Mountain Mint</td>
<td></td>
</tr>
<tr>
<td>Rudbeckia fulgida</td>
<td>Showy Black-eyed Susan</td>
<td></td>
</tr>
<tr>
<td>Sagittaria latifolia</td>
<td>Broad-leaf Arrowhead</td>
<td></td>
</tr>
<tr>
<td>Zizia aurea</td>
<td>Golden Alexanders</td>
<td></td>
</tr>
</tbody>
</table>

| Temporary Cover Grasses         |                              |        |
| Agrostis alba                   | Redtop                       |        |
| Agrostis alba palustris         | Creeping Bent Grass          |        |
| Avena sativa                    | Seed Oats                    |        |

4) Midwestern Short Stature Bioswale Seed Mix (WP7)
Approximate mix weight 72 lb/acre, with 61 native seeds/sq. ft.
12.7% Grasses/Sedges/Rushes; 7.8% Forbs; 79.5% Temporary Cover Grasses

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
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<tbody>
<tr>
<td><strong>Grasses, Sedges, and Rushes</strong></td>
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<tr>
<td>Calamagrostis canadensis</td>
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<tr>
<td>Carex frankii</td>
<td>Frank's Sedge</td>
</tr>
<tr>
<td>Carex granularis</td>
<td>Meadow Sedge</td>
</tr>
<tr>
<td>Carex normalis</td>
<td>Spreading Oval Sedge</td>
</tr>
<tr>
<td>Carex shortiana</td>
<td>Short's Sedge</td>
</tr>
<tr>
<td>Carex stipata</td>
<td>Stalk Grain Sedge</td>
</tr>
<tr>
<td>Carex tribuloides</td>
<td>Blunt Broom Sedge</td>
</tr>
<tr>
<td>Carex vulpinoidea</td>
<td>Fox Sedge</td>
</tr>
<tr>
<td>Elymus virginicus</td>
<td>Virginia Wild Rye</td>
</tr>
<tr>
<td>Leersia oryzoides</td>
<td>Rice Cut Grass</td>
</tr>
</tbody>
</table>

**Forbs**

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidens cernua</td>
<td>Nodding Bur Marigold</td>
</tr>
<tr>
<td>Echinacea purpurea</td>
<td>Purple Coneflower</td>
</tr>
<tr>
<td>Euthamia graminifolia</td>
<td>Flat-top Fragrant Goldenrod</td>
</tr>
<tr>
<td>Gentiana andrewsii</td>
<td>Fringe-top Bottle Gentian</td>
</tr>
<tr>
<td>Lobelia siphilitica</td>
<td>Great Blue Lobelia</td>
</tr>
<tr>
<td>Penstemon digitalis</td>
<td>Foxglove Beard Tongue</td>
</tr>
<tr>
<td>Pycnanthemum virginianum</td>
<td>Mountain Mint</td>
</tr>
<tr>
<td>Rudbeckia fulgida</td>
<td>Showy Black-eyed Susan</td>
</tr>
<tr>
<td>Rudbeckia hirta</td>
<td>Black-eyed Susan</td>
</tr>
<tr>
<td>Tradescantia ohiensis</td>
<td>Ohio Spiderwort</td>
</tr>
<tr>
<td>Verbena stricta</td>
<td>Hoary Vervain</td>
</tr>
<tr>
<td>Zizia aurea</td>
<td>Golden Alexanders</td>
</tr>
</tbody>
</table>

**Temporary Cover Grasses**

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrostis alba palustris</td>
<td>Creeping Bent Grass</td>
</tr>
<tr>
<td>Avena sativa</td>
<td>Seed Oats</td>
</tr>
<tr>
<td>Lolium multiflorum</td>
<td>Annual Rye Grass</td>
</tr>
</tbody>
</table>

5) **Modified Midwest Short Stature Prairie Erosion Control Seed Mix (DP4)**

NOTE: eliminate Bouteloua curtipendula Side Oats Grama
Approximate mix weight 87 lb/acre with 105 native seeds/sq.ft.  
20.8% Grasses/Sedges/Rushes; 10.0% Forbs; 69.2% Temporary Cover Grasses

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
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</tr>
<tr>
<td>Carex bicknellii</td>
<td>Bicknell's Sedge</td>
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<tr>
<td>Elymus virginicus</td>
<td>Virginia Wild Rye</td>
</tr>
<tr>
<td>Schizachyrium scoparium</td>
<td>Little Bluestem</td>
</tr>
<tr>
<td><strong>Forbs</strong></td>
<td></td>
</tr>
<tr>
<td>Asclepias syriaca</td>
<td>Common Milkweed</td>
</tr>
<tr>
<td>Coreopsis lanceolata</td>
<td>Sand Coreopsis</td>
</tr>
<tr>
<td>Echinacea purpurea</td>
<td>Purple Coneflower</td>
</tr>
<tr>
<td>Penstemon digitalis</td>
<td>Foxglove Beard Tongue</td>
</tr>
<tr>
<td>Rudbeckia hirta</td>
<td>Black-eyed Susan</td>
</tr>
<tr>
<td>Solidago nemoralis</td>
<td>Gray Goldenrod</td>
</tr>
<tr>
<td>Verbena stricta</td>
<td>Hoary Vervain</td>
</tr>
<tr>
<td>Zizia aurea</td>
<td>Golden Alexanders</td>
</tr>
<tr>
<td><strong>Temporary Cover Grasses</strong></td>
<td></td>
</tr>
<tr>
<td>Agrostis alba</td>
<td>Redtop</td>
</tr>
<tr>
<td>Avena sativa</td>
<td>Seed Oats</td>
</tr>
<tr>
<td>Lolium multiflorum</td>
<td>Annual Rye Grass</td>
</tr>
</tbody>
</table>

6) **Custom Seed Mix (ISLAND)**

**NOTE:** eliminate Silphium perfoliatum Cup Plant
<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grasses, Sedges, and Rushes</strong></td>
<td></td>
</tr>
<tr>
<td>Elymus villosus</td>
<td>Silky wild rye</td>
</tr>
<tr>
<td>Elymus virginicus</td>
<td>Virginia wild rye</td>
</tr>
<tr>
<td>Elymus riparius</td>
<td>Riverbank wild rye</td>
</tr>
<tr>
<td>Hystrix patula</td>
<td>Bottlebrush Grass</td>
</tr>
<tr>
<td><strong>Forbs</strong></td>
<td></td>
</tr>
<tr>
<td>Bidens cernua</td>
<td>Nodding Beggars-Ticks</td>
</tr>
<tr>
<td>Eupatorium purpureum</td>
<td>Purple Joe Pye Weed</td>
</tr>
<tr>
<td>Eupatorium rugosum</td>
<td>White Snakeroot</td>
</tr>
<tr>
<td>Lobelia cardinalis</td>
<td>Cardinal flower</td>
</tr>
<tr>
<td>Lysimachia ciliata</td>
<td>Fringed loosestrife</td>
</tr>
<tr>
<td>Rudbeckia laciniata</td>
<td>Cut-leaf Coneflower</td>
</tr>
<tr>
<td>Rudbeckia triloba</td>
<td>Brown-eyed Susan</td>
</tr>
<tr>
<td>Verbesina alternifolia</td>
<td>Wingstem</td>
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<tr>
<td>Vernonia gigantean</td>
<td>Tall ironweed</td>
</tr>
<tr>
<td>Zizia aurea</td>
<td>Golden Alexander</td>
</tr>
<tr>
<td><strong>Temporary Cover Grasses</strong></td>
<td></td>
</tr>
<tr>
<td>Agrostis alba palustris</td>
<td>Creeping Bent Grass</td>
</tr>
<tr>
<td>Avena sativa</td>
<td>Seed Oats</td>
</tr>
<tr>
<td>Lolium multiflorum</td>
<td>Annual Rye Grass</td>
</tr>
</tbody>
</table>
Attachment G

Hyames Baseball Field Stormwater Control Measures (SCMs) – BMP ID #8
**Background**

Improvements to the WMU baseball field bleachers in 2009 included the installation of stone trenches and perforated piping to provide stormwater infiltration. These SCMs are located near the intersection of Oliver Street and Stadium Drive. Approximately 0.11 acres of land contributes stormwater runoff to this BMP. Based upon limited design and sizing information, approximately 0.011 acre-feet of stormwater runoff is captured. Local precipitation records reveal that rainfall events up to 1.41 inch would be captured, or 97% of annual rainfall events. The phosphorus load from within the drainage area is reduced by 0.8 lbs/yr as a result.

*No drawing files or further information could be provided by WMU for preparation of site-specific maintenance recommendations. Generally speaking, WMU staff should inspect for sediment accumulation within any upstream catch basin or manhole structures leading to the infiltration stone trenches and the perforated storm sewer piping to prevent clogging of these structures in the future.*
Attachment H

Kohrman Hall and RCVA Stormwater Control Measures (SCMs) – BMP ID #3
Figure H-1. Project Area – Plan View of Kohrman Hall and RCVA Stormwater Control Measures (Drawing file provided by WMU).
**Background**

In 2007, WMU installed a system of sub-surface stormwater chambers south of Kohrman Hall to provide storage and infiltration of stormwater runoff. Nearby storm sewers were diverted into the storage system, which was designed to capture a volume of 2.27 acre-feet (equivalent to a 25-year storm event) with an approximated drainage area of 12.45 acres. Rainfall events up to 3.22 inches are captured, and a volume reduction effectiveness of 100% was confirmed. Because this SCM is designed to store and infiltrate all stormwater within the drainage area, the phosphorus removal effectiveness is also 100%. Similar to the Kohrman Hall project, WMU installed storm sewer chambers near the Richmond Center for the Visual Arts (RCVA) to capture 0.24 acre-feet of runoff (equivalent to a 25-year storm event). This SCM is located under the sidewalk south of the RVCA and has an approximate drainage area of 1.47 acres. Rainfall events up to 2.61 inches are captured by this sub-surface storage/infiltration system. Based upon local rainfall analyses, this SCM is 100% effective in reducing generated runoff volumes. The overall phosphorus load reduction for both Kohrman and RCVA SCMs was determined to be 23.1 lbs/yr.

Inspections and maintenance are required to achieve the intended function, benefits, and life of these stormwater controls. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of these SCMs include, but are not limited to, the following:

**Storm Sewer Structures**

1. Perform a quarterly inspection for sediment accumulation in the storm sewer structures Manhole-100, Manhole 101, Manhole-102, Manhole-103, Manhole-107, Manhole-108, and the five inspection ports. Remove accumulated sediment.

2. Perform a quarterly inspection for sediment accumulation in trench drain. Remove any accumulated sediment or debris.

3. Following a large storm event or intense flows, inspect the trench drain for signs of erosion. Remove any debris that may block flow through the drain.

**Water Quality Modules**

1. The steps listed here are an overview of the maintenance required on the Hancor Water Quality Units. See the attached guide from Hancor for further details (refer to Attachment H-1).

2. Perform a quarterly inspection of the two Water Quality Units for sediment build-up or structural damages to the diversion structure or weir. Remove sediment when the sediment depth is approximately 25% of the diameter of the unit. Perform necessary repairs.
3. After large storm events or intense flows, inspect the two Water Quality Units for sediment accumulation or damage to the diversion structure or weir. Repair damages and remove accumulated sediment.

4. Annually clean the two Water Quality Units by pumping and pressure washing the Sediment Chamber and Oil Chamber.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment H-1

Hancor Water Quality Units - Inspection and Maintenance
**Description / Basic Function**

The Hancor Water Quality Unit harnesses the proven concepts utilized in municipal sewage treatment systems and transforms it into a compact Water Quality Unit.

The unit is ideal for storm water applications including gas stations and fast food restaurants; this system gives you a highly effective BMP solution to meet EPA requirements.

**Risers**

The Hancor Water Quality Unit consists of two risers. A 24" riser is centered over Sediment and Oil Chambers. These two risers provide access to the individual chambers of the Storm Water Quality Unit for maintenance and inspection. Entry into the WQU should be considered an OSHA confined space and appropriate guidelines should be followed.

**Maintenance Overview**

The purpose of maintaining a clean and obstruction free Water Quality Unit is to ensure the system performs its intended function. A build up of debris in excess of the design storage volume could reduce the efficiency of the system.

A company specializing in such activities should perform inspection and maintenance of the Water Quality Unit.

**Inspection / Maintenance Frequency for the Hancor Water Quality Unit**

- Inspected quarterly (4 times a year) and after major storm events.
- Cleaned (pumped and pressure washed) a minimum of once a calendar year
- Site or surrounding site conditions may require more inspections and maintenance
Inspection

An inspection should be performed when the system is installed. This allows the owner to measure the invert prior to accumulation of sediment. This survey will allow the monitoring of sediment build-up without entering the system, thereby eliminating the need for confined space entry. Documentation of pre-inspection data should be captured.

Procedures

1. In the By-Pass Structure inspect for blockage. Inspect the diversion structure and weir for damage and sediment buildup. Any damage should be repaired and sediment should be removed as required.
2. On the Water Quality Unit, locate the risers. The risers will be 24" in diameter.
3. Remove the lid of each riser. It is recommend that this be done one at a time as an open riser is not left exposed during inspection or maintenance of the other risers.
4. In the 24" riser over the Sediment Chamber, inspect the amount of floatable debris. Then measure the sediment buildup with a measuring device such as a Sludge Judge®. Also inspect that the inlet pipe does not have any blockage. Blockage inspection is better suited after unit is vacuumed. Any confined space entry would be done through this riser and OSHA requirements must be followed.
5. In the 24" riser over the Oil Chamber, measure / inspect the oil depth.
6. Inspect structure and components for any damage.
7. Replace all riser lids.

Maintenance

Cleaning should be performed if sediment volume has reduced the storage area by 20% or if the depth of sediment has reached approximately 25% of the diameter of the structure. (See Table 1 for cleanout depth information). Furthermore, the system may need cleaning in the event a spill of a foreign substance enters the unit.

Inspection Procedures (Measuring Sediment Depth)

1. Lower measuring device into sediment riser of unit.
2. Read measurement at ground surface.
3. Subtract the current measurement reading from the distance between the ground surface to the invert of the SWQU (obtained when unit was first installed or is clean).
4. Compare calculated difference to the respective value in Table 1. If resulting value is equal to or greater than the respective value on the Table 1, maintenance shall be performed. The figure below illustrates the inspection procedure.

Table 1  Sediment Depth at Cleanout

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Diameter (in)</th>
<th>Sediment Depth (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3620WQ</td>
<td>36</td>
<td>9</td>
</tr>
<tr>
<td>3640WQ</td>
<td>36</td>
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<tr>
<td>4220WQ</td>
<td>42</td>
<td>10</td>
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<tr>
<td>4240WQ</td>
<td>42</td>
<td>10</td>
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<tr>
<td>4820WQ</td>
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<td>6020WQ</td>
<td>60</td>
<td>15</td>
</tr>
<tr>
<td>6040WQ</td>
<td>60</td>
<td>15</td>
</tr>
</tbody>
</table>
Cleaning Procedures

1. Insert vacuum hose into By-Pass Structure and pump out. Inspect By-Pass Structure for any damage.
2. Insert vacuum hose into 24" riser and pump out the Sediment Chamber. Pressure wash this Chamber if needed. Inspect for any damage. Inspect the inlet pipe for any blockage. Also inspect weir plate for damage.
3. Insert vacuum hose into other 24" riser. This will pump out the Oil Chamber. Inspect for any structural damage. Pressure wash this Chamber if needed.
4. Refill water quality unit with water.
5. Replace all riser lids.

The owner or operator is responsible for meeting all federal, state, and local laws and regulations during the maintenance and cleanout operations.

Material Disposal

Owners are responsible for complying with all federal, state, and local regulations when disposing of material collected from the stormwater quality unit. Water and sediment from cleanout procedures should not be dumped into sanitary sewer.
Attachment I

Lot 23 Stormwater Control Measures (SCMs) – BMP ID #4
Figure I-1. Project Area – Plan View of WMU Lot 23 Stormwater Control Measures (SCMs).
Background

During the summer of 2009, an area of Parking Lot 23 was demolished and a slow-release detention pond was constructed near Arcadia Creek, southwest of the remaining parking lot. Stormwater calculations for this project were completed by K&A during the design process in 2009. The approximate drainage area of this SCM is 32.27 acres, with an estimated volume capacity of 1.94 acre-feet. The treatment volume of this SCM allows it to capture rain events up to 1.16 inches, representing 95% of rainfall events based upon evaluation of local annual precipitation records. However, since this SCM contains a slow-release outflow into Arcadia Creek, the entire stormwater volume is treated, but not retained. A nutrient removal effectiveness of 50% was used for evaluation of this SCM (LID Manual, 2010). The resulting phosphorus removal is 28.3 lbs/yr resulting from this SCM site.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the SCM. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the SCM include, but are not limited to, the following:

Vegetation

This stormwater treatment system uses natural vegetation as an important part of the treatment process and as such, the system will require periodic maintenance.

Two primary seed mixes were utilized at the Lot 23 stormwater treatment system: 1) midwestern short stature prairie mix (DP4), and 2) midwestern short stature wetland basin mix (WP6). The DP4 and WP6 mixes are intended for dry and wet conditions (respectively), and were sewn on the top and outer banks of the berms and on the inside of the wetpond/forebay areas (respectively). Species lists are in Attachment I-1. The seed supplier was Heartland Restoration Services of Fort Wayne, Indiana.

SPRING

- In areas where aesthetics are a concern, mow berms and outer slopes of sediment forebay and wetpond, to the ground in early spring (when first green begins to appear) to inhibit the establishment of non-desirable species and woody vegetation. Where aesthetics are not a primary concern, mow these areas to the ground every 2-3 years. Remove the mown vegetation from the site.

- In the late spring, conduct a plant inventory and map general locations of species. Based on this survey and mapped plant community, create management areas based on the species that dominate each area. Encourage diversity and microhabitats through varying mowing times in spring, summer and fall. Update the management plan, accordingly.
o Compare the observed species from plant survey to the list of species planted on site (see attachment I-1). Evaluate health, abundance and diversity of native plants. Make note of any wildlife (both desirable and nuisance) observed.

o Supplement with additional native regional plants/plugs/seeds as needed if significant plant mortality (due to erosion, mechanical damage, natural causes etc.) has occurred.

o Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species identification.

o Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer to Target Exotic/Invasive Species List within Appendix P). Remove the plant material from the site. This list will need to be updated as new species establish on site.

o If conditions allow, a controlled burn of the berm and outer slope areas would allow for effective control of non-desirable species and promote a healthy plant community. The berm area should be burned in sections (one half of the area at a time) to allow refuge for wildlife. Burn when green is first appearing on vegetation (early April). Burn each half every 3-5 years.

o Install and maintain patches of native shrubs to provide refuge for resident duck populations. Recommended species are: chokeberry (Aronia prunifolia), buttonbush (Cephalanthus occidentalis), silky dogwood (Cornus amomum), spicebush (Lindera benzoin), swamp rose (Rosa palustris), and American elder (Sambucus canadensis).

SUMMER

o Conduct a plant inventory and map general locations of species. Evaluate health, abundance and diversity of native plants. Make note of any wildlife observed (both desirable and nuisance).

o Supplement with additional native regional plants/plugs/seeds as needed if significant plant mortality (due to erosion, mechanical damage, natural causes etc.) has occurred.

o Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species identification.

o Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer to Target Exotic/Invasive Species List within Appendix P). Remove the plant material from the site. This list will need to be updated as new species establish on site.

FALL

o Conduct a plant inventory and map general locations of species. Compare the observed species from plant survey to the list of species planted on site (see
Attachment I-1). Evaluate health, abundance and diversity of native plants. Make note of any wildlife (both desirable and nuisance) observed.

- Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species identification.

- Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer to Target Exotic/Invasive Species List within Appendix P). Remove the plant material from the site. This list will need to be updated as new species establish on site.

- Harvest a portion of the wetland vegetation as needed (generally every five years) to reduce plant biomass and nutrient release from decaying vegetation. This is particularly important in heavily-infested cattail and reed stands.

**Diversion Structure**

1. The diversion structure is a pre-cast, reinforced concrete structure and is fitted with an aluminum hatch for access. Keep the aluminum hatch locked at all times to prevent any unauthorized access.

2. The diversion structure has one primary outlet (10” pipe to sediment forebay) and one secondary bypass outlet (36” pipe to existing storm sewer infrastructure) discharging directly to Arcadia Creek.

3. The diversion structure is fitted with an adjustable weir plate. The weir plate allows for the intentional bypass of intense flows (during heavy rain events) that exceed the treatment system capacity (1.5 inches of rain in 24 hours). Before making an adjustment to the weir height, consult with a Professional Engineer regarding the need for adjustment.

4. Inspect the ground surface of the piping run between the diversion structure and the sediment forebay inlet quarterly for any signs of slope instability or groundwater seeping. This piping run was anchored into the slope using metal stakes and rebar (every 5 feet) to prevent pipe movement. Any signs of slope instability should be documented and discussed with a Professional Engineer.

**Sediment Forebay**

1. Inspect the riprap apron of the forebay inlet for any signs of erosion following a large storm event or intense flows. Replace any riprap that may become displaced. If holes occur in filter fabric (beneath the rip rap), repair immediately by overlaying damaged fabric with new material and replacing riprap or other erosion resistant material consistent with the original design.
2. Remove any accumulated trash or debris from the forebay area monthly.

3. Inspect the stone materials of the forebay outlet for displacement following a large storm event or intense flows. Repair any signs of erosion at the forebay outlet.

4. Inspect the interior forebay berm for any signs of erosion rills or gullies that could develop. Place additional fill soils and reseed the filled areas.

5. Inspect for sediment accumulation. Remove accumulated sediment when it reaches 6-inch depth, or if accumulation is causing the outlet stone to become compromised by potential for clogging.

6. Check frequently for burrowing animals, as these pose a threat to long-term berm integrity. If discovered, remove the burrowing animals, replace all disturbed berm soils, and reseed.

**Wetpond**

1. Inspect the slow release discharge pipe frequently. Clear any trash or accumulated sediment away from the pipe inlet if observed.

2. Remove any accumulated trash and debris from the wetpond and surrounding area monthly. Remove any floating debris within the micropools.

3. Perform weeding of non-desirable species (invasive or exotic) before they produce and release seeds. Routine, quarterly weeding will assure a diversity of native vegetation and will allow for dense establishment.

4. Remove any yard waste (leaves, branches, dead plants), trash or debris from the wetpond outflow structure grate and surrounding no-mow areas monthly.

5. During large storm events, or periods of intense flows, inspect the outflow grate to ensure it is not obstructed. Obstructions on the top grate of the wetpond outflow structure will cause the emergency spillway to become the primary exit for pond outflow during large, prolonged storms. As implied by the description, the emergency spillway is not intended for routine outflow conditions, but rather for emergency situations only.

6. Inspect the concrete/masonry condition of the wetpond outflow structure annually for signs of cracks, displacement, spalling, joint failures, and water tightness. Implement repairs if these or other concerns are present.

**Wetpond Berms**

1. Inspect after significant storm events (2 inches or greater) and at least quarterly to identify repair and maintenance needs.
2. Inspect the outer toe of the pond berms quarterly. If there are wet areas or seeps at the outside toe of the berm, it could be an indication of a serious problem. Seek assistance from a Professional Engineer to evaluate any suspected seepage.

3. Inspect the entire southern berm toe along the former parking lot curb. Ensure that the remaining curb is capable of draining berm runoff and direct rainfall via the two existing curb cut spillways. Note any signs of undercutting along the entire length of the remaining curb.

4. Inspect all berms for signs of erosion rills or gullies that could develop into larger problems on the berms and emergency spillway. Place additional fill soils and reseed the filled areas. Prompt repairs may be required in some cases.

5. Conduct spot elevation checks on the top of all perimeter berms at least semi-annually during the first two years to observe and correct for any potential settlement. Following the first two years, conduct spot elevation checks as needed to verify any visual appearance of berm settling. Top of berm elevations should be within 0.25 feet (or 3 inches) of the 837.5 feet design elevation. Settlement of the berms can result in a loss of freeboard and may increase the risk of a berm failure in the future if not addressed.

6. Check frequently for burrowing animals, as these pose a threat to long-term berm integrity. If discovered, remove the burrowing animals, replace all disturbed berm soils, and reseed.

7. Maintain a vigorous, native vegetation cover on all berms and on the emergency spillway. Conduct monthly vegetation surveys (through the initial growing season, June - September 2010) to document and ensure plants are establishing well at the site. It is anticipated that the initial germination period for the native species will occur during the month of June 2010. Perform weeding of non-desirable species (invasive or exotic) before they produce and release seeds. Routine, quarterly weeding will assure a diversity of native vegetation and will allow for dense establishment.

8. Prevent undesired trees and brush from growing on the berms and in the spillway areas. Control tree and bush growth annually by hand cutting, or mowing. Avoid damaging native vegetation with herbicide sprays.

9. Operate mowing and other equipment on slopes in accordance with machinery operation manual.

**Vegetated Swale**

1. This swale is intended to drain surface runoff from the southeastern access drive (from Lot 73) into the wetpond.

2. During the initial growing season (May - September 2010), inspect the vegetated swale entering the wetpond monthly for any signs of erosion rills or gullies that could
develop into larger problems. If erosive conditions are observed, place additional fill soils and reseed the filled areas.

3. Conduct semi-annual inspections of the vegetated swale following the first year of operation in 2010. Look for any damage caused by wheeled traffic still utilizing the access drive. Place additional fill soils and reseed the filled area if necessary.

**Concrete Swale**

1. This swale is intended to drain surface runoff from the outer berm and a portion of the remaining Lot 23 asphalt surface.

2. Conduct semi-annual inspections of the concrete for signs of cracks, displacement, spalling, or settling. Implement repairs if these or other concerns are present.

**Drainage Spillway**

1. This drainage spillway was repaired as part of this stormwater project, due to extreme erosion and undercutting of the parking lot curb. Conduct semi-annual inspections of the drainage spillway for any signs of erosion, settling or cracking. Repair any observed concerns to ensure long-term stability.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment I-1

Lot 23 Target Native Species
### Target Native Species

1) **Midwestern Short Stature Wetland Basin Seed Mix (WP6)**

Approximate mix weight 68 lb/acre, with 136 native seeds/sq. ft.  
32.2% Grasses/Sedges/Rushes; 26.0% Forbs; 41.8% Temporary Cover Grasses

#### Grasses, Sedges, and Rushes

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>% Seed</th>
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<tbody>
<tr>
<td>Carex frankii</td>
<td>Frank's Sedge</td>
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<tr>
<td>Carex hystericina</td>
<td>Porcupine Sedge</td>
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<tr>
<td>Carex normalis</td>
<td>Spreading Oval Sedge</td>
<td></td>
</tr>
<tr>
<td>Carex stipata</td>
<td>Stalk Grain Sedge</td>
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<tr>
<td>Carex tribuloides</td>
<td>Blunt Broom Sedge</td>
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<tr>
<td>Carex vulpinoidea</td>
<td>Fox Sedge</td>
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</tr>
<tr>
<td>Eleocharis palustris</td>
<td>Creeping Spikrush</td>
<td></td>
</tr>
<tr>
<td>Elymus virginicus</td>
<td>Virginia Wild Rye</td>
<td></td>
</tr>
<tr>
<td>Juncus effusus</td>
<td>Soft Rush</td>
<td></td>
</tr>
<tr>
<td>Juncus torreyi</td>
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<td></td>
</tr>
<tr>
<td>Leersia oryzoides</td>
<td>Rice Cut Grass</td>
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#### Forbs

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<th>Common Name</th>
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<tr>
<td>Alisma subcordatum</td>
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<tr>
<td>Bidens cernua</td>
<td>Nodding Bur Marigold</td>
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<tr>
<td>Euthamia graminifolia</td>
<td>Flat-top Fragrant Goldenrod</td>
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<tr>
<td>Gentiana andrewsii</td>
<td>Fringe-top Bottle Gentian</td>
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<tr>
<td>Iris virginica shrevei</td>
<td>Blue Flag Iris</td>
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<tr>
<td>Lobelia siphilitica</td>
<td>Great Blue Lobelia</td>
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<tr>
<td>Ludwigia alternifolia</td>
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<td>Lycopus americanus</td>
<td>American Bugleweed</td>
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<tr>
<td>Mimulus ringens</td>
<td>Monkey Flower</td>
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<tr>
<td>Penthorum sedoides</td>
<td>Ditch Stonecrop</td>
</tr>
<tr>
<td>Pycnanthemum virginianum</td>
<td>Mountain Mint</td>
</tr>
<tr>
<td>Rudbeckia fulgida</td>
<td>Showy Black-eyed Susan</td>
</tr>
<tr>
<td>Sagittaria latifolia</td>
<td>Broad-leaf Arrowhead</td>
</tr>
<tr>
<td>Zizia aurea</td>
<td>Golden Alexanders</td>
</tr>
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</table>

#### Temporary Cover Grasses

<table>
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<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrostis alba</td>
<td>Redtop</td>
</tr>
<tr>
<td>Agrostis alba palustris</td>
<td>Creeping Bent Grass</td>
</tr>
<tr>
<td>Avena sativa</td>
<td>Seed Oats</td>
</tr>
</tbody>
</table>
2) **Modified Midwest Short Stature Prairie Erosion Control Seed Mix (DP4)**

*NOTE:* eliminate *Bouteloua curtipendula* Side Oats Grama

Approximate mix weight 87 lb/acre with 105 native seeds/sq.ft.
20.8% Grasses/Sedges/Rushes; 10.0% Forbs; 69.2% Temporary Cover Grasses

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
</tr>
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<tbody>
<tr>
<td><strong>Grasses, Sedges, and Rushes</strong></td>
<td></td>
</tr>
<tr>
<td>Carex bicknellii</td>
<td>Bicknell's Sedge</td>
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<td>Elymus virginicus</td>
<td>Virginia Wild Rye</td>
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<tr>
<td>Schizachyrium scoparium</td>
<td>Little Bluestem</td>
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<tr>
<td><strong>Forbs</strong></td>
<td></td>
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<td>Asclepias syriaca</td>
<td>Common Milkweed</td>
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<tr>
<td>Coreopsis lanceolata</td>
<td>Sand Coreopsis</td>
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<tr>
<td>Echinacea purpurea</td>
<td>Purple Coneflower</td>
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<tr>
<td>Penstemon digitalis</td>
<td>Foxglove Beard Tongue</td>
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<tr>
<td>Rudbeckia hirta</td>
<td>Black-eyed Susan</td>
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<tr>
<td>Solidago nemoralis</td>
<td>Gray Goldenrod</td>
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<tr>
<td>Verbena stricta</td>
<td>Hoary Vervain</td>
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<tr>
<td>Zizia aurea</td>
<td>Golden Alexanders</td>
</tr>
</tbody>
</table>

| **Temporary Cover Grasses**      |                              |
| Agrostis alba                    | Redtop                       |
| Avena sativa                     | Seed Oats                    |
| Lolium multiflorum               | Annual Rye Grass             |
Attachment J

Western View Apartments Phase II Stormwater Control Measures (SCMs) – BMP ID #19
Leaching Basins (12)
Cleanout (10)
Leaching Basin Cleanout (10)

Western View Apartments

HOWARDST

WESTERN MICHIGAN UNIVERSITY
Stormwater Control Measures
Maintenance Plans – Western View Phase II – BMP ID #19

KIESER & ASSOCIATES, LLC
Figure J-1. Project Area – Plan View Phase II Western View Apartments Stormwater Controls (Drawing file provided by WMU).
Background

Stormwater runoff from a new student apartment complex constructed between Knollwood Ave and Howard St. is being treated with twelve leaching basins and subsurface detention and infiltration structures. This best management practice (BMP) treats approximately 8.83 acres of land and has a treatment volume of approximately 0.63 acre-feet.

Inspections and maintenance are required to achieve the intended function, benefits, and life of theses stormwater controls. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Basins and Structures

1. Perform one annual inspection for sediment accumulation in the twelve leaching basins (Leaching Basin 1-12) and in storm sewer structures. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

2. Inspect the ten sanitary cleanout points annually for any signs of sediment accumulation that could cause blockages. If sediment accumulation deeper than 6" is observed, remove the accumulated sediment.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment K

Lot 95 Stormwater Control Measures (SCMs) – BMP ID #9
Figure K-1. Project Area – Plan View of Lot 95 Stormwater Control Measures (Drawing file provided by WMU)

WESTERN MICHIGAN UNIVERSITY
Stormwater Control Measures
Maintenance Plans – Lot 95 – BMP ID #9

KIESER & ASSOCIATES, LLC
**Background**

In 2009, WMU re-constructed a section of Oliver Street and parking lot 95 on the Oakland Drive Campus of WMU. These SCMs are located north of the Campus Services Building. New storm sewer installed in this area included nine (9) 6' diameter leaching basins and 36" diameter perforated pipe. Stormwater calculations resulted in an estimated volume of 0.18 acre-feet, and a drainage area of 5.31 acres. Rainfall events up to 0.57 inches are captured, and K&A determined a SCM effectiveness of 83%. The phosphorus load from this drainage area is reduced by 9.5 lbs/year resulting from these SCMs.

Inspections and maintenance are required to achieve the intended function, benefits, and life of these stormwater controls. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of these SCMs include, but are not limited to, the following:

**Basins and Structures**

1. Perform one annual inspection for sediment accumulation in both basins storm sewer structures: Catch Basin 6, Catch Basin 7, Catch Basin 9, Catch Basin 10, Catch Basin 11, Catch Basin 12, Catch Basin 13, Catch Basin 14, Catch Basin 15, and Catch Basin 16. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment L

Oliver Street Stormwater Control Measures (SCMs) – BMP ID #7
Figure L-1. Project Area – Plan View of Oliver Street Stormwater Control Measures (Drawing file provided by WMU).
Background

WMU installed infiltration practices during road reconstruction of Oliver Street in 2009. These SCMs were installed near the intersection of Oliver Street and Stadium Drive. Infiltration practices included 48” diameter perforated pipe and 6’ diameter leaching basins (2). The treatment volume of these SCMs is approximately 0.043 acre-feet, with a drainage area of 1.45 acres. At this location, 0.66 inches of precipitation can be treated, representing 86% of rainfall events. K&A determined a phosphorus load reduction of 2.0 lbs/yr resulting from this WUM SCM implementation project.

Inspections and maintenance are required to achieve the intended function, benefits, and life of these stormwater controls. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of these stormwater controls include, but are not limited to, the following:

Basins and Structures

1. Perform one annual inspection for sediment accumulation in both infiltration basins and in storm sewer structures: Catch Basin 3, Catch Basin 4, and Leaching Basin 5. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment M

Lot 55 Stormwater Control Measures (SCMs) – BMP ID #1
Figure M-1. Project Area – Plan View of Lot 55 Stormwater Controls (Drawing file provided by WMU).
Background

In 2008, WMU re-constructed the parking lot north of the Goldsworth Valley III dormitories and took the opportunity to install stormwater infiltration practices. This drainage area is also part of the overall, larger Goldsworth Valley Pond SCM drainage area, but was evaluated separately. Perforated pipe (48" diameter) was installed in a stone trench beneath the parking lot, in addition to four (4) 6-foot diameter leaching basins. All stormwater within this SCM drainage area is infiltrated. Stormwater calculations resulted in an estimated design volume of 0.21 acre-feet, and a drainage area of 2.12 acres. Rainfall events up to 1 inch are captured, and a corresponding effectiveness was calculated to provide a 97% volume reduction. The phosphorus load from this drainage area was reduced by 5.72 lbs/year resulting from this implementation project.

Inspections and maintenance are required to achieve the intended function, benefits, and life of these stormwater controls. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the SCMs include, but are not limited to, the following:

Basins and Structures

1. Catch Basin 5 has a 12" overflow to the infiltration area. This can be accessed by Manhole-7.

2. Perform one annual inspection for sediment accumulation in both infiltration basins and in storm sewer structures: Leaching Basin 1, Leaching Basin 3, Leaching Basin 4, Catch Basin 5, and the stormwater basin. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

3. Following a large storm event or intense flows, inspect each basin for signs of erosion. Remove any trash or debris that might accumulate on outflow structure grates.

4. Remove any yard waste (leaves, branches, dead plants), trash or debris from each stormwater basin on a quarterly basis.

5. Perform one annual inspection for sediment accumulation and erosion at the two outfalls in the stormwater basin. If sediment accumulation is observed, remove the accumulated sediment.

6. Following a large storm event or intense flows, inspect each outfall for signs of erosion or sediment accumulation. Remove any debris that might accumulate near outfall structures.
Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment N

Read Field Stormwater Control Measures (SCMs) – BMP ID #6
Figure N-1. Project Area – Plan View of SRC/Read Field House Stormwater Control Measures (Drawing file provided by WMU).
Background

WMU replaced the sidewalk on the north side of Read Field House in 2006 and installed 6” diameter perforated under-drains beneath the new porous concrete sidewalk. The capture volume of perforated pipe is approximately 0.003 acre-feet, treating a drainage area of 0.86 acres. Local precipitation records reveal that rainfall events of 0.08 inch would be captured, or only 35% of annual rainfall events. Infiltration through this best management practice (BMP) has therefore reduced the phosphorous load in the drainage area by 0.4 lbs/year.

Inspections and maintenance are required to achieve the intended function, benefits, and life of these stormwater controls. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of this SCM include, but are not limited to, the following:

Porous Concrete

1. Perform annual maintenance on the porous concrete by either vacuum sweeping or pressure washing.

2. Inspect Manhole-22 for sediment accumulation. Remove sediment when access to Manhole-22 becomes restricted.

3. Remove any accumulated trash or debris from the porous concrete monthly.

4. Following a rain storm event inspect to determine if surface ponding is observed. If ponding occurs, perform vacuum sweeping or pressure washing, or both. Remove any debris that might accumulate on the porous surface.

5. When performing landscaping surrounding the area, do not place materials such as mulch, sand and topsoil on the porous concrete. To avoid clogging, the landscape should be designed to route runoff away from the porous concrete.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment O

Western View Apartments Stormwater Control Measures (SCMs) – BMP ID #2 & #36
Figure O-1. Project Area – Plan View of Western View Apartments Stormwater Controls (Drawing file provided by WMU).
Background

New Student apartments were constructed on the main campus of WMU in 2010-2011. During construction, 36" diameter perforated drainage pipe and leaching basins were installed beneath both new parking lots near the apartments. These SCMs are located west of the Miller Auditorium parking garage along Knollwood Avenue. This drainage area is also part of the larger Kohrman, RCVA, and Lot 23 BMP drainage areas, but was evaluated separately. Stormwater calculations and construction drawings confirmed a drainage area of 4.37 acres, and a capture volume of 0.41 acre-feet. Stormwater runoff calculations revealed that a rainfall event up to 1.44 inches can be captured, reducing annual runoff volumes by 97% within the drainage area. The phosphorus load reduction calculated in this drainage area was 9.0 lbs/yr.

Inspections and maintenance are required to achieve the intended function, benefits, and life of these stormwater controls. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of these SCMs include, but are not limited to, the following:

Basins and Structures

1. Perform one annual inspection for sediment accumulation of the thirteen leaching basins (Leaching Basin 1-13) and in storm sewer structures. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

2. Inspect the thirteen sanitary cleanout points annually for any signs of sediment accumulation that could cause blockages. If sediment accumulation deeper than 6" is observed, remove the accumulated sediment.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment P

Target Exotic Species Removal
Attachment P
~Target Exotic/Invasive Species Removal List~

The following pages identify suggested management practices for the invasive/exotic species commonly found in lakeshore areas in Michigan. This can be used as a guide for identifying and minimizing invasive species within your native planting areas.

- Yellow rocket (*Barbarea vulgaris*)
- Spotted knapweed (*Centaurea maculosa*)
- Thistle (*Cirsium sp.*)
- Queen Anne’s lace (*Daucus carota*)
- Purple loosestrife (*Lythrum salicaria*)
- Sweet clover (*Melilotus sp.*)
- Reed canary grass (*Phalaris arundinacea*)
- Reed (*Phragmites australis*)
- Curled dock (*Rumex crispus*)

See the following pages for management recommendations specific to each invasive plant.
Yellow rocket (*Barbarea vulgaris*) -

This species grows 1-2 feet in height and is a mid-spring to early-summer bloomer. Each yellow flower is up to 1/3-inch across, consisting of 4 yellow petals.

Hand pulling and removal from the site prior to seed head formation in the spring/summer is recommended.
Spotted knapweed (*Centaurea maculosa*)-

Spotted knapweed grows 2-4 feet in height and flowers from July to August. Flowers are pink to light purple.

For small, isolated occurrences, hand-pulling and mowing prior to seed production in August is recommended. Remove the plant from the site if observed.
**Thistle (Cirsium sp.)**

A number of invasive thistle species frequently colonize disturbed sites in dry or wet habitats. They can be an aggressive and undesirable species due to the sharp, thorny leaves and stems associated with these plants. Thistles generally grow to 1-5 feet in height with magenta-colored flowers appearing in mid-summer.

Digging and removal from the site prior to dropping of seeds in late summer is essential. Spot treatment of the herbicide glyphosate can also be effective. Use either the aquatic formulation (trade name Rodeo) near water or Roundup in upland locations. Apply at the pre-bud stage in the spring and when plants are actively growing in the fall.
Queen Anne’s Lace (*Daucus carota*)-

Queen Anne’s lace can grow up to three feet in height with finely-divided leaves, a deep tap roots, and flat white flowers. Flowering occurs from May to October.

Hand digging to remove the root system is an effective control method.
Purple loosestrife (Lythrum salicaria)-

This species will dominate an area in a very short period of time. This plant can grow up to six feet in height and has an angular, four-sided stem. Use caution to not confuse this species with blue vervain (Verbena hastata), which is typically shorter and has a more slender violet-colored flower while purple loosestrife has a showier magenta-colored flower head appearing in mid to late summer.

One method of removal for small infestations of purple loosestrife involves digging up all roots, bagging the plants and removing from the area. Once a seedbank is established in the soils, purple loosestrife will continue to grow on site. Plants should be removed as soon as possible before seed heads form in late July or early August. Each mature plant can produce as many as 2 million seeds.

The herbicide glyphosate (trade name Roundup or Rodeo for aquatic locations) is also effective for spot removal of purple loosestrife. The herbicide should be applied to individual plants between July and September. Rodeo is formulated for use near surface water sites.

Be Careful!...

Purple Loosestrife (Remove!)  Blue Vervain (Save!)
White and yellow sweet clovers (*Melilotus alba* and *Melilotus officinalis*)-

These clovers bloom in the summer with either small white or yellow flowers. Growing between 3-8 feet in height, they have 3 finely-divided leaflets per leaf.

For small patches, hand pull in May before flower development. In large, dense colonies cutting stems close to the ground with a hand-held scythe is effective if done after leaves on the lower stems have died (before flowering occurs) and up to early stages of flowering (before seeds form).
Reed canary grass (*Phalaris arundinacea*)-

This grass can form monocultures in wetland areas, providing very little value to wildlife. It grows 3-6 feet tall and has hollow stems up to ½ inch wide, with reddish coloring near the top. Flower heads are visible in June and July.

For large stands, mowing twice per year in mid-June and early October, can provide some control and allow for natives to compete. A burning regime can also be effective, if feasible, with suggested times of late spring, mid-summer and mid-fall. Spot treatment of glyphosate (trade name Roundup or Rodeo for aquatic locations) can also be effective for smaller infestations.
Common Reed (*Phragmites australis australis*)-

There are both a native and invasive species of Common Reed found in Michigan. Unlike the native species, the invasive species forms dense monocultures that outcompete other native vegetation. The invasive reed can reach up to 20 feet in height, while the native reed typically reaches 6.5 feet. Flower heads of the invasive are bigger, appear earlier and last longer into the season than the native flower. Native reeds have red **vertical** stems while the invasive reeds can exhibit red **horizontal** stems.

Early detection and removal of this species is critical. The root system can grow up to 50 feet in just one season. Cut the stems between August and October, after the seed heads have developed but prior to the first frost. Put a drop of the aquatic formulation of the herbicide glyphosate (trade name Rodeo) into the cut stem. Remove the cut stems and dispose of the plant material off site.

Be Careful!...
**Curled Dock (Rumex crispus)**

This species grows up to five feet in height, spreads aggressively and has a deep taproot. It grows to three feet in height and has small green flowers appearing in mid-summer. It is distinguished later in the growing season by rusty-brown colored seeds.

Curled dock can be removed by digging the plant out at least two inches below the ground surface and removing the plant from the site. Plants should be removed in mid-late summer from the site before seed heads dry and fall off during removal.

Spot treatment with glyphosate herbicide (trade name Roundup or Rodeo for aquatic sites) is also an effective control measure.
Attachment Q

SCM Inspection Checklist
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<td>Riprap / Apron Problems</td>
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### OUTLET CHARACTERISTICS

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### PERFORMANCE

#### General Problems: (check all that apply)

- Trash / debris problems
- Inappropriate water ponding
- Incorrect flow paths (bypass)
- Trees or embankments
- Erosion at embankments
- Failing structural components
- Erosion within treatment areas
- Vegetation concerns

#### Other

- Inappropriate water ponding

### WILDLIFE HABITAT

#### Evidence of: (check all that apply)

- Animal burrows
- Geese / ducks / other
- Deer
- Other
- Mosquitoes
- Other

### VEGETATION

#### Vegetative Health: (check all that apply)

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**Follow-up Maintenance Required:** (list all that applies)

**Additional Notes:**
Attachment R

B.T.R. Soccer Fields Stormwater Control Measures (SCMs) – BMP ID #38
Figure R-1. Project Area – Plan View of B.T.R. Soccer Field Parking Lot Stormwater Control Measures (Drawing file provided by WMU).
Background

The WMU soccer complex, part of the WMU Business, Technology and Research (B.T.R.) Park, added an additional 120-space, paved parking lot to the facility in 2013. A subsurface infiltration system was installed below the paved parking area to infiltrate runoff.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practices (BMPs). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Storm Sewer Structures

The storm water system consists of a number of structures that will require periodic maintenance to function properly.

Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events: (1 hour per visit)**
  - Inspect each basin for signs of erosion. **Corrective action should be taken upon discovery.** Remove large debris.

- **Annually: (1 visit at 1 hours per visit)**
  - Inspect storm sewer structures Catch Basins 12 and 13, and Leaching Basins 15 and 16. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.
  - Inspect manholes for signs of cracking or corrosion. **Determine cause of damage. Report and repair as needed.**

Subsurface Detention/Infiltration Structures

The underground stormwater infiltration structure is designed to fill with stormwater during storm events and allow storm water to infiltrate.

Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events: (1 hour per visit)**
  - Inspect the unit for clogged pipes, sediment accumulation or damage. **Follow manufacturer’s operations and maintenance guidelines for removal of debris and trapped sediments.**

- **Annually: (1 visit at 2 hours per visit)**
  - Inspect the unit for sediment accumulation or damage. **Follow manufacturer’s operations and maintenance guidelines for removal of trapped sediments.**
  - Inspect inlet structures for sediment accumulation or damage.
- **Determine cause of damage. Report and repair as needed.**

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment S

Drake Road Rain Garden Stormwater Control Measures (SCMs) – BMP ID #12
Figure S-1. Plan View of Drake Road Rain Garden Stormwater Control Measures (Drawing file provided by WMU).
Background

The Drake Road rain garden, completed in 2010, infiltrates storm water from the Asylum Lake Drake Road parking lot and surrounding area. The new stormwater control will accommodate 1.62 ac-ft of annual runoff from approximately 0.90 acres. Nonpoint source pollutant loads will be reduced by 1.6 lbs TP/yr and 472 lbs TSS/yr.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practice (BMP). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Bioretention Rain Garden

This bioretention rain garden uses natural vegetation and infiltration as an important part of the treatment process and as such, the system will require periodic maintenance. Care should be taken to prevent soil compaction within the basin during maintenance activities.

Maintenance Schedule and Estimated Hours to Complete

- Following major storm events: (0.5 hour per visit)
  - Inspect side slopes, inflow, outflow and two rip rap apron structures for signs of erosion. **Corrective action should be taken upon discovery.**
  - Remove large debris.

- As needed:
  - Prune and weed to maintain appearance. (6 visits at 1 hours per visit)
  - Remove trash and debris. (3 visits at 0.5 hour per visit)
  - Replace vegetation. (1 visit at 1 hours per visit)

- Annually in spring:
  - Cut back previous year’s vegetation and remove accumulated debris. (1 visit at 2 hours per visit)
  - Cut back volunteer woody vegetation and/or careful application of appropriate herbicide. (1 visit at 1 hour per visit)
  - Inspect for channelization in bottom of basin. Re-vegetate if channelization is minor. Energy dissipation may be required if channelization is major. (1 visit at 0.5 hours per visit)

- Annually in fall:
  - Inspect inflow, outflow, two rip rap apron structures and basin for sediment buildup. Remove sediment and debris exceeding 4” if infiltration performance is affected. (1 visit at 0.5 hours per visit)
  - Inspect side slopes for erosion. **Corrective action should be taken upon discovery.** (1 visit at 0.5 hour per visit)
• **Less frequent maintenance (every 2-3 years):**
  - Aerate and dethatch bottom of basin. *(1 visit at 2 hours per visit)*
  - Replace mulch. *(1 visit at 1 hour per visit)*
  - Test soil pH if plants are showing signs of stress. *(1 visit at 0.5 hr per visit)*

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment T

Goldsworth Valley Apartments Parking Lot Stormwater Control Measures (SCMs) – BMP ID #37
Figure T-1. Project Area – Plan View of Goldsworth Valley Apartments Parking Lot Stormwater Control Measures (Drawing file provided by WMU).
Background

Parking lot improvements were completed at the WMU Goldsworth Valley Apartments in 2015. A subsurface infiltration system was installed below the paved parking area to infiltrate runoff.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practices (BMPs). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Storm Sewer Structures

The storm water system consists of a number of structures that will require periodic maintenance to function properly.

Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events: (1 hour per visit)**
  - Inspect each basin for signs of erosion. **Corrective action should be taken upon discovery.** Remove large debris.

- **Annually: (1 visit at 1 hours per visit)**
  - Inspect storm sewer structure **Man Hole 107.** Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.
  - Inspect manholes for signs of cracking or corrosion. **Determine cause of damage. Report and repair as needed.**

Subsurface Detention/Infiltration Structures

The underground stormwater infiltration structure is designed to fill with stormwater during storm events and allow storm water to infiltrate.

Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events: (1 hour per visit)**
  - Inspect the unit for clogged pipes, sediment accumulation or damage. **Follow manufacturer’s operations and maintenance guidelines for removal of debris and trapped sediments.**

- **Annually: (1 visit at 2 hours per visit)**
  - Inspect the unit for sediment accumulation or damage. **Follow manufacturer’s operations and maintenance guidelines for removal of trapped sediments.**
Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
 Attachment U

Goldsworth Valley Dining Hall Center Stormwater Control Measures (SCMs) – BMP ID #34
Figure U-1. Project Area – Plan View of Valley Dining Hall Center Stormwater Control Measures (Drawing file provided by WMU).
Background

Construction for a new dining hall began in 2015 and was completed in 2016 on the north side of the Goldsworth Valley detention pond. Consistent with WMU stormwater policy, this new campus development includes stormwater treatment considerations associated with this area of disturbance. The new stormwater controls include subsurface detention/infiltration and a bioretention rain garden that will accommodate a 25-year storm from approximately 2.6 acres. Since the dining hall project is located within the Goldsworth Valley detention pond drainage area, all resulting stormwater reductions directly benefit the water quality of the pond (immediately downstream). Based upon information provided by WMU, these stormwater controls will provide annual pre-treatment of 3.1 lbs TP and 0.6 tons of sediment to the Goldsworth Valley detention pond.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practices (BMPs). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Storm Sewer Structures

The storm water system consists of a number of structures that will require periodic maintenance to function properly.

Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events: (1 hour per visit)**
  - Inspect each basin for signs of erosion. Corrective action should be taken upon discovery. Remove large debris.
  - Inspect the trench drain for signs of erosion. Corrective action should be taken upon discovery. Remove any debris that may block flow through the drain.

- **Quarterly: (4 visits at 0.5 hour per visit)**
  - Inspect trench drain. Remove any accumulated sediment or debris.

- **Annually: (1 visit at 2 hours per visit)**
  - Inspect storm sewer structures Manhole 3, Manhole 4, Manhole 9, SO-1, SO-2, SO-3 and Catch Basin 7 and the five under drain inspection ports. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.
  - Clear underdrain piping of sediment and debris when conveyance capacity is plugged. Obstructions shall be removed from cleanouts without disturbing the filter media.
  - Inspect swirl chamber and remove sediment accumulation.
  - If sediment build up requires maintenance, schedule WMU service contractor to conduct removal.
Subsurface Detention Structures

The underground stormwater detention structure is designed to fill with stormwater during storm events and slowly release the stormwater.

Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events: (1 hour per visit)**
  - Inspect the unit for clogged pipes, sediment accumulation or damage to diversion structure. **Follow manufacturer’s operations and maintenance guidelines for removal of debris and trapped sediments.**

- **Annually: (1 visit at 2 hours per visit)**
  - Inspect the unit for sediment accumulation or damage to diversion structure. **Follow manufacturer’s operations and maintenance guidelines for removal of trapped sediments.**
  - Inspect manholes for signs of cracking or corrosion. **Determine cause of damage. Report and repair as needed.**

Bioretention Rain Garden

This bioretention rain garden uses natural vegetation and infiltration as an important part of the treatment process and as such, the system will require periodic maintenance. **Care should be taken to prevent soil compaction within the basin during maintenance activities.**

Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events: (0.5 hour per visit)**
  - Inspect side slopes and inlet structure for signs of erosion. **Corrective action should be taken upon discovery.**
  - Remove large debris.

- **As needed:**
  - Prune and weed to maintain appearance. **(6 visits at 2 hours per visit)**
  - Remove trash and debris. **(3 visits at 0.5 hour per visit)**
  - Replace vegetation. **(1 visit at 2 hours per visit)**

- **Annually in spring:**
  - Cut back previous year’s vegetation and remove accumulated debris. **(1 visit at 2 hours per visit)**
  - Cut back volunteer woody vegetation and/or careful application of appropriate herbicide. **(1 visit at 1 hour per visit)**
  - Inspect for channelization in bottom of basin. Re-vegetate if channelization is minor. Energy dissipation may be required if channelization is major. **(1 visit at 0.5 hours per visit)**
• **Annually in fall:**
  - Inspect inflow structure and basin for sediment buildup. Remove sediment and debris exceeding 4” if infiltration performance is affected. *(1 visit at 0.5 hours per visit)*
  - Inspect side slopes for erosion. **Corrective action should be taken upon discovery.** *(1 visit at 0.5 hour per visit)*

• **Less frequent maintenance (every 2-3 years):**
  - Aerate and dethatch bottom of basin. *(1 visit at 2 hours per visit)*
  - Replace mulch. *(1 visit at 1 hour per visit)*
  - Test soil pH if plants are showing signs of stress. *(1 visit at 0.5 hr per visit)*

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment V

Heritage Hall Stormwater Control Measures (SCMs) – BMP ID #41
Figure V-1. Project Area – Plan View of Heritage Hall Stormwater Control Measures (Drawing file provided by WMU).
Background

As part of the new WMU East Campus Heritage Hall Alumni Center along Oakland Drive, a subsurface detention/infiltration system was installed in 2015 to capture and infiltrate stormwater runoff for storm events up to a 25-year return frequency (approximately 4.45 inches of rainfall). The capacity of this subsurface infiltration system allows for treatment of 6 acre-feet of annual stormwater runoff and removal of an estimated 3.9 lbs TP and 0.8 tons of TSS each year.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practices (BMPs). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Storm Sewer Structures

The storm water system consists of a number of structures that will require periodic maintenance to function properly.

Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events:** *(1 hour per visit)*
  - Inspect each basin for signs of erosion. **Corrective action should be taken upon discovery.** Remove large debris.

- **Annually:** *(1 visit at 2 hours per visit)*
  - Inspect storm sewer structures Catch Basin 201, 202, 203, and 204. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.
  - Inspect manholes for signs of cracking or corrosion. **Determine cause of damage. Report and repair as needed.**

Subsurface Detention/Infiltration Structures

The underground stormwater infiltration structure is designed to fill with stormwater during storm events and allow storm water to infiltrate.

Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events:** *(1 hour per visit)*
  - Inspect the unit for clogged pipes, sediment accumulation or damage to flow splitter/diversion structure. **Follow manufacturer’s operations and maintenance guidelines for removal of debris and trapped sediments.**

- **Annually:** *(1 visit at 2 hours per visit)*
- Inspect the unit for sediment accumulation or damage to flow splitter/diversion structure. **Follow manufacturer’s operations and maintenance guidelines for removal of trapped sediments.**
- Inspect manholes for signs of cracking or corrosion. **Determine cause of damage. Report and repair as needed.**

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment W

Lawson Sites Stormwater Control Measures (SCMs) – BMP ID #24, 25, and 27
Figure W-1. Project Area – Plan View of Lawson Parking Lots 63 & 75 Stormwater Control Measures
Figure W-2. Project Area – Plan View of Lawson Parking Lot 64 Stormwater Control Measures

WESTERN MICHIGAN UNIVERSITY
Stormwater Control Measures
Maintenance Plans – Lawson Sites – BMP ID #24, 25, and 27

KIESER & ASSOCIATES, LLC
Figure W-3. Project Area – Plan View of Lawson Parking Lot 70 Stormwater Control Measures
Background

A 2015 State of Michigan 319 project funded stormwater BMPs for five sites on WMU’s campus. Three of the sites were located near the Lawson Ice Arena.

Site 1 - Lawson Ice Arena - Lots 63 & 75
Two stormwater detention basins were constructed on the west side of Lawson Ice Arena in 2013 to treat runoff from Hussey Drive and surrounding parking lots 63 and 75 (refer to Figure W-1). The Lawson Ice Arena is within the most upstream area of WMU campus and therefore presented an opportunity to remove and treat stormwater that would otherwise discharge directly into Arcadia Creek and pass through the remaining WMU campus footprint (as well as the Kalamazoo Christian H.S. BMP site completed in 2007). These new detention areas, including slow-release outflows (between 36 and 48-hr detention), serve to treat stormwater runoff of approximately 4.5 acre-feet/yr from a 2.5-acre drainage area (combined total). In all, a rainfall event up to 3.29 inches could be captured by these two basins, which would reflect nearly 100% of local precipitation events based on 43 years of historic data. Stormwater pollutant load reductions associated with these detention areas amount to 3 lbs TP and 0.6 tons TSS per year.

Site 3 - Lawson Ice Arena - Lots 63 & 64
This BMP (in total, Basin D) includes a sediment forebay and wetpond near the northwest corner of Stadium Drive and Howard Street to provide treatment of runoff from Lots 63 and 64 drainage areas (refer to Figure W-2). The drainage area associated with this BMP is 5.17 acres, and the two basins provide a combined 0.9 acre-feet of storage volume. These Site 3 improvements capture runoff from rainfall events up to 3.32 inches (between a 5-yr and 10-yr storm event), representing 97% of local precipitation events (based on historic records). Nonpoint source pollutant loads will be reduced by 6.1 lbs TP/yr and 1.2 tons TSS/yr.

Site 5 - Lawson Ice Arena and Lot 70
Two stormwater treatment detention ponds were constructed near the southwest corner of the Lawson Ice Arena (refer to Figure W-3) in 2013. These detention areas, including slow-release outflows (between 36 and 48-hr detention), serve to treat stormwater runoff from a 5.4-acre drainage area including the arena and parking lot 70. A rainfall event up to 1 inch is captured by this BMP project, which represents 93% of local precipitation events (based on historic records). Stormwater flows in excess of 1 inch rainfalls will be passed on through an emergency outflow structure. These combined improvements will reduce nonpoint stormwater pollutants by 5.9 lbs TP/yr and 1.2 tons TSS/yr. The annual stormwater volume treated by these detention stormwater controls is 9 acre-feet/yr.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practices (BMPs). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Storm Sewer Structures
The storm water system consists of a number of structures that will require periodic maintenance to function properly.

**Maintenance Schedule and Estimated Hours to Complete**

- **Annually: (1 visit at 2 hours per visit)**
  - **Site 1**
    - Inspect storm sewer structures Diversion Manhole A, Manhole B, and Catch Basin 2. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures. Inspect the three stone rip rap aprons for signs of erosion, accumulated sediment and trash.
  - **Site 3**
    - Inspect storm sewer structures Diversion Manhole C, Manhole D, Catch Basin 14, Catch Basin 17, and Catch Basin 20. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures. Inspect the four stone rip rap aprons for signs of erosion, accumulated sediment and trash.
  - **Site 5**
    - Inspect storm sewer structure Manhole E. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures. Inspect the five stone rip rap aprons for signs of erosion, accumulated sediment and trash.
  - If sediment build up requires maintenance, schedule WMU service contractor to conduct removal.
  - If erosive conditions require maintenance, schedule WMU service contractor to conduct repairs.
  - Inspect manholes for signs of cracking or corrosion. **Determine cause of damage. Report and repair as needed.**

**Detention Basins (Site 1 and Site 5)**

The four detention basins at Site 1 and Site 5 use natural vegetation and infiltration as an important part of the treatment process and as such, the systems will require periodic maintenance. **Care should be taken to prevent soil compaction within the basins during maintenance activities.**

**Maintenance Schedule and Estimated Hours to Complete**

- **Following major storm events: (1 hour per visit)**
  - Inspect side slopes and inlet structures for signs of erosion. **Corrective action should be taken upon discovery.**
  - Remove large debris.

- **As needed:**
  - Remove trash and debris. **(4 visits at 1 hour per visit)**
• **Annually in spring:**
  o Mow the basins to the ground in early spring (when first green begins to appear) to inhibit the establishment of non-desirable species and woody vegetation. Remove mown vegetation from the basins. *(1 visit at 2 hours per visit)*
  o Grazing may be used in areas dominated by warm-season grasses and deep-rooted perennials. Caution should be used in areas dominated by cool-season grasses and shallow-rooted plants that may have roots pulled out by grazers.
  o Inspect for channelization in bottom of basins. Re-vegetate if channelization is minor. Energy dissipation may be required if channelization is major. *(1 visit at 0.5 hours per visit)*

• **Annually in fall:**
  • Inspect inflow structures and basins for sediment buildup. Remove sediment and debris exceeding 4” if infiltration performance is affected. *(1 visit at 1 hours per visit)*
  • Inspect side slopes for erosion. **Corrective action should be taken upon discovery.** *(1 visit at 1 hour per visit)*

**Sediment Forebay and Wetpond (Site 3)**

The sediment forebay and wetpond at Site 3 use natural vegetation and infiltration as important parts of the treatment process and as such, the systems will require periodic maintenance. **Care should be taken to prevent soil compaction within the basins during maintenance activities.**

**Maintenance Schedule and Estimated Hours to Complete**

• **Following major storm events:** *(1 hour per visit)*
  o Inspect side slopes and inlet structures for signs of erosion. **Corrective action should be taken upon discovery.**
  o Remove large debris.

• **As needed:**
  o Remove trash and debris. *(4 visits at 1 hour per visit)*
  o Harvest a portion of the wetland vegetation (in sediment forebay and wetpond) as needed (generally every 3-5 years) to reduce plant biomass and nutrient release from decaying vegetation. This is particularly important in heavily-infested cattail and reed stands. Remove all harvested materials from the site. *(2 hours per visit)*

• **Annually in spring:**
  o Mow the berms and outer slopes of the forebay and wetpond to the ground in early spring (when first green begins to appear) to inhibit the establishment of non-desirable species and woody vegetation. Remove mown vegetation from the site. *(1 visit at 1 hours per visit)*
Grazing may be used in areas dominated by warm-season grasses and deep-rooted perennials. Caution should be used in areas dominated by cool-season grasses and shallow-rooted plants that may have roots pulled out by grazers.

- Inspect for channelization in bottom of basins. Re-vegetate if channelization is minor. Energy dissipation may be required if channelization is major. *(1 visit at 0.5 hours per visit)*

- **Annually in fall:**
  - Inspect inflow structures and basins for sediment buildup. Remove sediment and debris exceeding 4” if infiltration performance is affected. *(1 visit at 1 hour per visit)*
  - Inspect side slopes for erosion. **Corrective action should be taken upon discovery.** *(1 visit at 1 hour per visit)*

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment X

Lot 54 - Valley Two Stormwater Control Measures (SCMs) – BMP ID #35
Figure X-1. Project Area – Plan View of Lot 54 Stormwater Control Measures
Background

The retention pond near the Valley Two Parking Lot #54 was designed to divert storm water runoff from the parking lot and the Westwood Drive and Gilkison Avenue neighborhoods to the north, totaling 7.2 acres. All of this storm water runoff was previously directed into the Goldsworth Valley Pond retention. The new stormwater control serves to capture a volume of 12.98 acre-feet of annual stormwater runoff. Nonpoint source pollutant loads will be reduced by 8.5 lbs TP/yr and 3,424 lbs TSS/yr.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practices (BMPs). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Storm Sewer Structures

The storm water system consists of a number of structures that will require periodic maintenance to function properly.

Maintenance Schedule and Estimated Hours to Complete

- Following major storm events: (0.5 hour per visit)
  - Inspect each basin for signs of erosion. Corrective action should be taken upon discovery. Remove large debris.

- Annually: (1 visit at 0.5 hours per visit)
  - Inspect storm sewer structures Catch Basin 1795 and Catch Basin 2435. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.
  - If sediment build up requires maintenance, schedule WMU service contractor to conduct removal.
  - Inspect manholes for signs of cracking or corrosion. Determine cause of damage. Report and repair as needed.

Retention Pond

The retention pond uses natural vegetation and infiltration as an important part of the treatment process and as such, the system will require periodic maintenance. Care should be taken to prevent soil compaction within the basin during maintenance activities.

Maintenance Schedule and Estimated Hours to Complete

- Following major storm events: (0.5 hour per visit)
  - Inspect side slopes, inlet and outlet structures for signs of erosion.
o **Corrective action should be taken upon discovery.**
  o Remove large debris.

- **As needed:**
  o Mow to maintain appearance. *(6 visits at 1 hours per visit)*
  o Remove trash and debris. *(3 visits at 0.5 hour per visit)*

- **Annually in spring:**
  o Inspect for channelization in bottom of basin. Re-vegetate if channelization is minor. Energy dissipation may be required if channelization is major. *(1 visit at 0.5 hours per visit)*

- **Annually in fall:**
  - Inspect inflow and outflow structures and basin for sediment buildup. Remove sediment and debris exceeding 4” if infiltration performance is affected. *(1 visit at 0.5 hours per visit)*
  - Inspect side slopes for erosion. **Corrective action should be taken upon discovery.** *(1 visit at 0.5 hour per visit)*

- **Less frequent maintenance (every 2-3 years):**
  o Aerate and dethatch bottom of basins. *(1 visit at 2 hours per visit)*

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment Y

Lot 97 Stormwater Control Measures (SCMs) – BMP ID #42
Figure Y-1. Project Area – Plan View of Lot 97 Stormwater Control Measures
**Background**

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practices (BMPs). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

**Storm Sewer Structures**

The storm water system consists of a number of overflow structures that will require periodic maintenance to function properly.

**Maintenance Schedule and Estimated Hours to Complete**

- **Following major storm events: (0.5 hour per visit)**
  - Inspect each basin for signs of erosion or for obstructive objects. **Corrective action should be taken upon discovery.** Remove large debris.

- **Annually: (1 visit at 0.5 hours per visit)**
  - Inspect storm sewer structures Catch Basin 1719 and Catch Basin 1720. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.
  - If sediment build up requires maintenance, schedule WMU service contractor to conduct removal.
  - Inspect inlet for signs of cracking or corrosion. **Determine cause of damage. Report and repair as needed.**
Attachment Z

North Sangren Hall Stormwater Control Measures (SCMs) – BMP ID #39
Figure Z-1. Project Area – Plan View of North Sangren Hall Stormwater Control Measures

WESTERN MICHIGAN UNIVERSITY
Stormwater Control Measures
Maintenance Plans – N Sangren Hall – BMP ID #39

KIESER & ASSOCIATES, LLC
Background

Construction for Sangren Hall on Rankin Avenue began in 2010 and was completed in 2012. Consistent with WMU stormwater policy, this new campus development includes stormwater treatment considerations associated with this 6.54 acre area of disturbance. The new stormwater controls include subsurface detention/infiltration, porous pavement and trench drains that will serve to capture a volume of 23,737 ft³ of stormwater from a 1-inch storm event. Nonpoint source pollutant loads will be reduced by 7.7 lbs TP/yr and 1.6 tons TSS/yr.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practices (BMPs). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Storm Sewer Structures

The stormwater system consists of a number of structures that will require periodic maintenance to function properly.

Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events:** *(1 hour per visit)*
  - Inspect each basin for signs of erosion. **Corrective action should be taken upon discovery.** Remove large debris.
  - Inspect the two trench drain for signs of erosion. **Corrective action should be taken upon discovery.** Remove any debris that may block flow through the drain.

- **Quarterly:** *(4 visits at 0.5 hour per visit)*
  - Inspect the two trench drains. Remove any accumulated sediment or debris.

- **Annually:** *(1 visit at 1 hours per visit)*
  - Inspect storm sewer structures Manhole 3, Manhole 4, and the two under drain inspection ports. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.
  - Clear under drain piping of sediment and debris when conveyance capacity is plugged. Obstructions shall be removed from cleanouts without disturbing the filter media.
  - If sediment build up requires maintenance, schedule WMU service contractor to conduct removal.

Subsurface Detention Structures

The underground stormwater detention structure is designed to fill with stormwater during storm events and slowly release the stormwater.

Maintenance Schedule and Estimated Hours to Complete
Following major storm events: *(1 hour per visit)*
- Inspect the unit for clogged pipes, sediment accumulation or damage to diversion structure. **Follow manufacturer’s operations and maintenance guidelines for removal of debris and trapped sediments.**

**Annually: (1 visit at 2 hours per visit)**
- Inspect the unit for sediment accumulation or damage to diversion structure. **Follow manufacturer’s operations and maintenance guidelines for removal of trapped sediments.**
- Inspect manholes for signs of cracking or corrosion. **Determine cause of damage. Report and repair as needed.**

### Porous Pavement

Following major storm events: *(0.5 hour per visit)*
- Inspect porous pavement for surface ponding during and after rain events. If ponding occurs, perform vacuum sweeping or pressure washing, or both. Remove any debris that might accumulate on the porous surface.

Annually: *(1 visit at 0.5 hours per visit)*
- Inspect porous pavement for surface ponding during and after rain events. If ponding occurs, perform vacuum sweeping or pressure washing, or both. Remove any debris that might accumulate on the porous surface.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment AA

Parkview Rain Garden Stormwater Control Measures (SCMs) – BMP ID #13
Figure AA-1. Project Area – Plan View of Parkview Rain Garden Stormwater Control Measures
Background

The Parkview rain garden, completed in 2010, infiltrates storm water runoff from the Asylum Lake Parkview Avenue parking lot and surrounding area. The new stormwater control will accommodate 1.35 ac-ft of annual runoff from approximately 0.75 acres. Nonpoint source pollutant loads will be reduced by 1.3 lbs TP/yr and 393 lbs TSS/yr.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practices (BMPs). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Bioretention Rain Garden

This bioretention rain garden uses natural vegetation and infiltration as an important part of the treatment process and as such, the system will require periodic maintenance. Care should be taken to prevent soil compaction within the basin during maintenance activities.

Maintenance Schedule and Estimated Hours to Complete

- Following major storm events: (0.5 hour per visit)
  - Inspect side slopes, inflow and outflow structures for signs of erosion. Corrective action should be taken upon discovery.
  - Remove large debris.

- As needed:
  - Prune and weed to maintain appearance. (6 visits at 1 hours per visit)
  - Remove trash and debris. (3 visits at 0.5 hour per visit)
  - Replace vegetation. (1 visit at 1 hours per visit)

- Annually in spring:
  - Cut back previous year’s vegetation and remove accumulated debris. (1 visit at 2 hours per visit)
  - Cut back volunteer woody vegetation and/or careful application of appropriate herbicide. (1 visit at 1 hour per visit)
  - Inspect for channelization in bottom of basin. Re-vegetate if channelization is minor. Energy dissipation may be required if channelization is major. (1 visit at 0.5 hours per visit)

- Annually in fall:
  - Inspect inflow and outflow structures and basin for sediment buildup. Remove sediment and debris exceeding 4” if infiltration performance is affected. (1 visit at 0.5 hours per visit)
  - Inspect side slopes for erosion. Corrective action should be taken upon discovery. (1 visit at 0.5 hour per visit)
• **Less frequent maintenance (every 2-3 years):**
  - Aerate and dethatch bottom of basin. *(1 visit at 2 hours per visit)*
  - Replace mulch. *(1 visit at 1 hour per visit)*
  - Test soil pH if plants are showing signs of stress. *(1 visit at 0.5 hr per visit)*

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment AB

Schneider Hall Stormwater Control Measures (SCMs) – BMP ID #17
Figure AB-1. Project Area – Plan View of Schneider Hall Detention Basin Stormwater Control Measures
**Background**

In 2013, improvements were made to the BMP Schneider Hall parking lot detention pond constructed in 1989. The existing outflow structure was raised and the vegetation within the treatment area was modified. This increased the treatment volume from 0.12 acre-feet to 1.03 acre-feet (reflecting a 758% increase in water volume). These changes would allow for treatment of a 0.80-inch rainfall event representing 89% of average annual precipitation based on 34 years of historic data. This stormwater basin is already part of the Goldsworth Valley detention pond drainage area so that any overflows discharged from the Schneider basin would ultimately be captured within the Goldsworth Valley detention pond. The resulting pre-treatment reductions associated with the Schneider Basin upgrade amount to 39 lbs TP/yr and 4.6 tons TSS/yr. These reductions serve to improve the observed water quality conditions within the Goldsworth detention pond.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practices (BMPs). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

**Retention Pond**

The retention pond uses natural vegetation and infiltration as an important part of the treatment process and as such, the system will require periodic maintenance. **Care should be taken to prevent soil compaction within the basin during maintenance activities.**

**Maintenance Schedule and Estimated Hours to Complete**

- **Following major storm events**: *(0.5 hour per visit)*
  - Inspect side slopes, inlet and outlet structures for signs of erosion.
  - Corrective action should be taken upon discovery.
  - Remove large debris.

- **As needed**:
  - Mow to maintain appearance. *(6 visits at 1 hours per visit)*
  - Remove trash and debris. *(3 visits at 0.5 hour per visit)*

- **Annually in spring**:
  - Inspect for channelization in bottom of basin. Re-vegetate if channelization is minor. Energy dissipation may be required if channelization is major. *(1 visit at 0.5 hours per visit)*

- **Annually in fall**:
  - Inspect inflow and outflow structures and basin for sediment buildup. Remove sediment and debris exceeding 4” if infiltration performance is affected. *(1 visit at 0.5 hours per visit)*
• Inspect side slopes for erosion. **Corrective action should be taken upon discovery.**
  
  *(1 visit at 0.5 hour per visit)*

• **Less frequent maintenance (every 2-3 years):**
  
  o Aerate and dethatch bottom of basins. *(1 visit at 2 hours per visit)*

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment AC

Western Heights Stormwater Control Measures (SCMs) – BMP ID #32
Figure AC-1. Project Area – Plan View of Western Heights Residence Hall Stormwater Control Measures
Background

As part of the new WMU Western Heights Residence Halls Project, stormwater control measures intercept 100% of the 1-inch runoff volume from approximately seven acres of contributing area and direct it to prefabricated underground stormwater detention/infiltration chambers. These new underground infiltration areas will serve to capture a volume of 12.5 acre-feet of annual stormwater runoff. Nonpoint source pollutant loads will be reduced by 7.4 lbs TP/yr and 8.2 tons TSS/yr.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practices (BMPs). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Storm Sewer Structures

The storm water system consists of a number of structures that will require periodic maintenance to function properly.

Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events:** *(1 hour per visit)*
  - Inspect each basin for signs of erosion. **Corrective action should be taken upon discovery.** Remove large debris.
  - Inspect the trench drain for signs of erosion. **Corrective action should be taken upon discovery.** Remove any debris that may block flow through the drain.

- **Quarterly:** *(4 visits at 0.5 hour per visit)*
  - Inspect trench drain. Remove any accumulated sediment or debris.

- **Annually:** *(1 visit at 2 hours per visit)*
  - Inspect storm sewer structures Manhole 3, Manhole 12, Manhole 21, Catch Basin 2, Catch Basin 16, Catch Basin 18, Catch Basin 31, Catch Basin 33 and the two under drain inspection ports. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.
  - Clear underdrain piping of sediment and debris when conveyance capacity is plugged. Obstructions shall be removed from cleanouts without disturbing the filter media.
  - If sediment build up requires maintenance, schedule WMU service contractor to conduct removal.
  - Inspect manholes for signs of cracking or corrosion. **Determine cause of damage. Report and repair as needed.**

Subsurface Detention/Infiltration Structures
The underground stormwater infiltration structures are designed to fill with stormwater during storm events and allow storm water to infiltrate.

**Maintenance Schedule and Estimated Hours to Complete**

- **Following major storm events:** *(1 hour per visit)*
  - Inspect the units for clogged pipes, sediment accumulation or damage to flow splitter/diversion structure. **Follow manufacturer’s operations and maintenance guidelines for removal of debris and trapped sediments.**

- **Annually:** *(1 visit at 2 hours per visit)*
  - Inspect the units for sediment accumulation or damage to flow splitter/diversion structure. **Follow manufacturer’s operations and maintenance guidelines for removal of trapped sediments.**
  - Inspect manholes for signs of cracking or corrosion. **Determine cause of damage. Report and repair as needed.**

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment AD

Zhang Legacy Stormwater Control Measures (SCMs) – BMP ID #40
Figure AD-1. Project Area – Plan View of Zhang Legacy Collection Stormwater Control Measures
Background

Construction for the Zhang Legacy Center began in July 2012 and was completed in 2013 on the Oakland Drive Campus. Consistent with WMU stormwater policy, this new campus development includes stormwater treatment considerations associated with this area of disturbance. The new stormwater controls include subsurface detention/infiltration and three bioretention rain gardens that will serve to capture a volume of 5.05 acre-feet of annual stormwater runoff. Nonpoint source pollutant loads will be reduced by 3.3 lbs TP/yr and 0.7 tons TSS/yr.

Inspections and maintenance are required to achieve the intended function, benefits, and life of the stormwater best management practices (BMPs). Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the practice include, but are not limited to, the following:

Storm Sewer Structures

The storm water system consists of a number of structures that will require periodic maintenance to function properly.

Maintenance Schedule and Estimated Hours to Complete

- Following major storm events: (1 hour per visit)
  - Inspect each basin for signs of erosion. Corrective action should be taken upon discovery. Remove large debris.

- Annually: (1 visit at 2 hours per visit)
  - Inspect storm sewer structures Diversion Manhole with Weir R5, Diversion Manhole with Weir R7 and Stormceptor Chamber R6. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.
  - If sediment build up requires maintenance, schedule WMU service contractor to conduct removal.
  - Inspect manholes for signs of cracking or corrosion. Determine cause of damage. Report and repair as needed.

Subsurface Detention/Infiltration Structure

The underground stormwater infiltration structure is designed to fill with stormwater during storm events and allow storm water to infiltrate.

Maintenance Schedule and Estimated Hours to Complete

- Following major storm events: (2 hour per visit)
o Inspect the units for clogged pipes, sediment accumulation or damage to flow splitter/diversion structure. Follow manufacturer’s operations and maintenance guidelines for removal of debris and trapped sediments.

- **Annually**: (1 visit at 2 hours per visit)
  o Inspect the units for sediment accumulation or damage to flow splitter/diversion structure. Follow manufacturer’s operations and maintenance guidelines for removal of trapped sediments.
  o Inspect manholes for signs of cracking or corrosion. Determine cause of damage. Report and repair as needed.

### Bioretention Rain Gardens

This three bioretention rain gardens use natural vegetation and infiltration as an important part of the treatment process and as such, the systems will require periodic maintenance. **Care should be taken to prevent soil compaction within the basins during maintenance activities.**

#### Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events**: (1 hour per visit)
  o Inspect side slopes and inlet structures for signs of erosion. Corrective action should be taken upon discovery.
  o Remove large debris.

- **As needed**:
  o Prune and weed to maintain appearance. (6 visits at 2 hours per visit)
  o Remove trash and debris. (3 visits at 0.5 hour per visit)
  o Replace vegetation. (1 visit at 2 hours per visit)

- **Annually in spring**:
  o Cut back previous year’s vegetation and remove accumulated debris. (1 visit at 2 hours per visit)
  o Cut back volunteer woody vegetation and/or careful application of appropriate herbicide. (1 visit at 1 hour per visit)
  o Inspect for channelization in bottom of basins. Re-vegetate if channelization is minor. Energy dissipation may be required if channelization is major. (1 visit at 0.5 hours per visit)

- **Annually in fall**:
  - Inspect inflow structures and basins for sediment buildup. Remove sediment and debris exceeding 4” if infiltration performance is affected. (1 visit at 0.5 hours per visit)
  - Inspect side slopes for erosion. Corrective action should be taken upon discovery. (1 visit at 0.5 hour per visit)
- **Less frequent maintenance (every 2-3 years):**
  - Aerate and dethatch bottom of basins. *(1 visit at 2 hours per visit)*
  - Replace mulch. *(1 visit at 1 hour per visit)*
  - Test soil pH if plants are showing signs of stress. *(1 visit at 0.5 hr per visit)*

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment AE

Business Technology and Research (BTR) Park – BMP ID #10
Background

The BTR Park was developed to provide a separate campus for the WMU College of Engineering and Applied Sciences. The campus is located south of the Parkview Avenue and Drake Road intersection in Kalamazoo, Michigan. This property is located within the West Fork Portage Creek subwatershed encompassing 164 acres that was previously farmland.

Upon development, the BTR park was designed to retain and infiltrate all stormwater runoff generated on-site. A permanent pond was installed surrounding the College of Engineering and Applied Science Building, and a series of retention ponds were installed throughout the BTR Park circa 2002. Retention ponds are artificial ponds that maintain a pool of water at all times. This helps keep suspended solids like sediment from entering the hydrologic system. Detention ponds are artificial ponds that are designed to hold stormwater runoff temporarily and allow it to infiltrate more slowly. Native vegetation is planted in and around the pond to assist with stabilizing soils and filtering sediment particles.

Inspections and maintenance are required to achieve the intended function, benefits, and life of these SCMs. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of these stormwater controls include, but are not limited to, the following:
**Vegetation**

This stormwater treatment system uses native vegetation as an important part of the treatment process and as such, the vegetation will require periodic maintenance. Five primary seed mixes are generally utilized in the stormwater treatment system:

6) Midwestern riparian mix (WS2)
7) Midwestern basic wetland basin mix (WP5)
8) Midwestern short stature wetland basin mix (WP6)
9) Midwestern short stature bioswale mix (WP7)
10) Modified Midwestern short stature prairie erosion control seed mix (DP4)

An additional mix, 6) Custom Island mix (ISLAND) was applied to the raised “island” areas within the bioretention area within the power plant property. The WP5 and WP6 mixes are intended for wet conditions and were used in the sediment forebay and wetpond areas, respectively. The WS2 and WP7 mixes, designed for transitional wet/dry environments, were sewn in the riparian areas between the wetpond and bioswale and in the bioswale areas, respectively. The DP4 mix was selected for dry conditions and was utilized along the upper slopes of the sediment forebay, wetponds and bioswale areas. A full copy of these seed mix species on a similar SCM project on Westerns main campus, are provided in Attachment F-1.

**Vegetative Maintenance**

**Spring**

- In areas where aesthetics are a concern, mow berms and outer slopes of sediment forebay, wetpond, and the entire bioretention basin to the ground in early spring (when first green begins to appear) to inhibit the establishment of non-desirable species and woody vegetation. Where aesthetics are not a primary concern, mow these areas to the ground every 2-3 years. Physically remove the mown vegetation from the site.

- In the late spring, conduct a plant inventory inspection, document and map general locations of species observed. Based on this inventory inspection and mapped plant community, create management areas based on the species that dominate each area. Encourage diversity and microhabitats through varying mowing times in spring, summer and fall taking into consideration previously observed wildlife. Revise and update the management plan, accordingly.

- Compare the observed species from the plant inventory inspection to the list of species planted on site (see similar site on Attachment F-1). Evaluate the health, abundance and diversity of observed native plants. Make note of any wildlife (both desirable and nuisance) observed.

- Supplement with additional native regional plants/plugs/seeds as needed if significant plant mortality (e.g., due to erosion, mechanical damage, natural causes) has occurred.
o Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species observed.

o Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer to Target Exotic/Invasive Species List provided in Attachment P). Physically remove all harvested plant materials from the site. This target exotic/invasive species list will need to be revised and updated as new species may establish onsite.

o If conditions allow, a controlled burn of the outer slope areas of the sediment forebay and the entire bioretention area would allow for effective control of non-desirable species and promote a healthy plant community. The areas should be burned in sections (¼ to ½ of each area at a time) to allow refuge for established wildlife. Conduct initial burns when green is first appearing on vegetation (early April). Burn each section every 3-5 years.

o Install and maintain patches of native shrubs to provide refuge for resident duck populations. Recommended species are: chokeberry (Aronia prunifolia), buttonbush (Cephalanthus occidentalis), silky dogwood (Cornus amomum), spicebush (Lindera benzoin), swamp rose (Rosa palustris), and American elder (Sambucus canadensis).

**Summer**

o Conduct a plant inventory inspection, document and map general locations of species observed. Evaluate health, abundance and diversity of native plants. Make note of any wildlife observed (both desirable and nuisance).

o Supplement with additional native regional plants/plugs/seeds as needed if significant plant mortality (e.g., due to erosion, mechanical damage, natural causes) has occurred.

o Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species identified.

o Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer to Target Exotic/Invasive Species List provided in Attachment P). Physically remove all harvested plant materials from the site. This target exotic/invasive species list will need to be revised and updated as new species may establish onsite.

**Fall**

o Conduct a plant inventory inspection, document and map general locations of species observed. Evaluate health, abundance and diversity of native plants. Make note of any wildlife observed (both desirable and nuisance).

o Locate and remove any volunteer woody vegetation establishing onsite by mechanical or chemical control methods, depending on species identified.

o Remove non-desirable species (invasive or exotic) before they produce and release seeds by selective mowing, cutting, and/or hand removal techniques (refer to Target Exotic/Invasive Species List provided in Attachment P). Physically remove all harvested plant materials from the site. This target exotic/invasive species list will need to be revised and updated as new species may establish onsite.
plant materials from the site. This target exotic/invasive species list will need to be revised and updated as new species may establish onsite.

- Harvest a portion of the wetland vegetation (in sediment forebay and wetponds) as needed (generally every five years) to reduce plant biomass and nutrient release from decaying vegetation. This is particularly important in heavily-infested cattail and reed stands. Physically remove all harvested plant materials from the site.

**Diversion Structure**

1. Inspect manholes or diversion structures for sediment accumulation on a quarterly basis. Remove accumulated sediment behind the internal weir on the base of the manhole. Sediment accumulation behind the weir can cause a reduction in flows routed to the treatment system and increase the occurrence of overtopping flows.

2. The diversion weir is adjustable. The weir height allows for the intentional bypass of intense flows (during heavy rain events) that exceed the treatment system capacity. Before making an adjustment to the weir height, consult with a Professional Engineer regarding the need for adjustment.

**Diversion Swale**

1. Following a large storm event or intense flows, inspect any swales for signs of erosion rills or gullies that could develop into larger problems. Inspections should begin at the riprap outlet area of the stormwater diversion piping and proceed toward the sediment forebay. Note any areas that may require preventative restoration or stabilization. Replace any riprap that may become displaced.

2. As part of routine annual inspections, inspect the drainage swales leading to the sediment forebaya for any signs of erosion rills or gullies that could develop into larger problems. If erosive conditions are observed, place additional fill soils and reseed the filled areas).

**Sediment Forebays**

1. Inspect the riprap apron of the forebay inlet for any signs of erosion following a large storm event or intense flows. Replace any riprap that may become displaced. If holes occur in filter fabric (beneath the rip rap), repair immediately by overlaying damaged fabric with new material and replacing riprap or other erosion resistant material consistent with the original design.

2. Remove any accumulated trash or debris from the forebay area monthly.

3. Inspect the slow release discharge pipe frequently. Clear any trash or accumulated sediment away from the pipe inlet if observed. The slow release discharge pipe is intended to drain accumulated stormwater within 48-hours after each rainfall event. If standing water persists greater than 6-inches in depth, there may be a blockage of the slow release discharge pipe.
4. Inspect the stone materials of the forebay outlet for displacement following a large storm event or intense flows. Repair any signs of erosion at the forebay outlet.

5. Inspect the interior forebay berm for any signs of erosion rills or gullies that could develop. Place additional fill soils and reseed the filled areas (below elevation 834, use WP-5 seed mix; above elevation 834, use DP-4 seed mix).

6. Inspect for sediment accumulation. Remove accumulated sediment when it reaches 6-inch depth, or if accumulation is causing the outlet stone to become compromised by potential for clogging.

7. Check frequently for burrowing animals, as these pose a threat to long-term berm integrity. If discovered, remove the burrowing animals, replace all disturbed berm soils, and reseed.

**Wetponds**

1. Inspect the slow release discharge piping frequently. Clear any trash or accumulated sediment away from the pipe inlets if observed. The slow release discharge piping is intended to drain accumulated stormwater within 48-hours after each rainfall event. If standing water persists greater than 6-inches in depth, there may be a blockage of the slow release discharge piping.

2. Remove any accumulated trash and debris from Wetponds and surrounding areas monthly. Remove any floating debris.

3. Inspect the interior wetpond berms for any signs of erosion rills or gullies that could develop. Place additional fill soils and reseed the filled areas (below elevation 833, use WP-6 seed mix; above elevation 833, use DP-4 seed mix).

4. Perform weeding of non-desirable species (invasive or exotic) before they produce and release seeds. Routine, quarterly weeding will assure a diversity of native vegetation and will allow for dense establishment.

5. Remove any yard waste (leaves, branches, dead plants), trash or debris from the Wetponds outflow structure grates and surrounding no-mow areas monthly.

6. During large storm events, or periods of intense flows, inspect the all outflow grates to ensure they are not obstructed. Obstructions on the top grades of the forebay wetpond outflow structures will cause the emergency spillways to become the primary exit for pond outflow during large, prolonged storms. As implied by the description, the emergency spillway is not intended for routine outflow conditions, but rather for emergency situations only.
7. Inspect the concrete/masonry condition of each outflow structure annually for signs of cracks, displacement, spalling, joint failures, and water tightness. Implement repairs if these or other concerns are present.

**Drainage Spillway**

2. Conduct semi-annual inspections of the Wetponds bioretention creek inlet and creek outlet drainage spillways for any signs of erosion, settling or cracking (refer to Figures F-3 and F-4). Repair any observed concerns to ensure long-term stability.

**Streambank**

4. Following a large storm event or intense flows, inspect the streambanks within the system. Remove any debris that might accumulate along the streambank.

5. Remove any yard waste (leaves, branches, dead plants), trash or debris from the streambank at least once per month.

**Floodplain/Bioretenion Basin**

6. Perform one annual inspection for sediment accumulation the stormwater basins. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

7. Following a large storm event or intense flows, inspect the inlet and outlet riprap areas and the stormwater basin for signs of erosion. Remove any debris that might accumulate within the basin.

8. Remove any yard waste (leaves, branches, dead plants), trash or debris from the stormwater basin at least once per month. Remove any floating debris within the micropools.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment AF

Howard/Stadium Apartments – BMP ID #14
Background

In 2011, a large-scale stormwater treatment system was constructed near the corner of Howard Street and Stadium Drive, directly adjacent to the WMU Stadium Drive Apartments as an MDEQ grant-funded project. This multi-jurisdictional treatment system is located on shared MDOT right-of-way and WMU property.

The system serves to treat first-flush stormwater runoff from a combined total of 102 acres of City of Kalamazoo, WMU and MDOT land uses (covering both BMP ID #s 14 & 33, respectively) while reconnecting under-utilized adjacent floodplain areas through the same treatment. This stormwater system is a series of wet detention ponds sized to capture a 1.92-inch rainfall event and volume of 3.15 acre-feet. Detention Ponds are artificial ponds designed to hold stormwater runoff temporarily, and allow it to more slowly infiltrate to the natural waterway. Detention ponds also may contain a sediment forebay which collects higher amounts of large particles of sediment before the main pool filters out smaller sediment particles.

Swales, gradually sloped ditches for directing drainage water flow, are also placed along the project area to control stormwater flow.

Native vegetation is planted in and around the area to assist with stabilizing soils and filtering particles.
**Riprap**, a permanent cover of rock placed over a filter layer, is used to stabilize inlet and outlet flow areas, as well as detention and retention pond areas.

*Site image of vegetation growth in detention pond (2017).*

Care and maintenance are needed to ensure that the bioretention area functions properly. Invasive vegetation is removed, though routine mowing. Monitoring data revealed that the Howard/Stadium stormwater control measures were effectively removing 99% of all first-flush stormwater runoff from these 102 acres, providing the following benefits:

**Retention Pond**

The retention pond uses natural vegetation and infiltration as an important part of the treatment process and as such, the system will require periodic maintenance. **Care should be taken to prevent soil compaction within the basin during maintenance activities.**

**Maintenance Schedule and Estimated Hours to Complete**

- Following major storm events: *(0.5 hour per visit)*
- Inspect side slopes, inlet and outlet structures for signs of erosion.
  - **Corrective action should be taken upon discovery.**
  - Remove large debris.

- **As needed:**
  - Mow to maintain appearance. *(6 visits at 1 hours per visit)*
  - Remove trash and debris. *(3 visits at 0.5 hour per visit)*

- **Annually in spring:**
  - Inspect for channelization in bottom of basin. Re-vegetate if channelization is minor. Energy dissipation may be required if channelization is major. *(1 visit at 0.5 hours per visit)*

- **Annually in fall:**
  - Inspect inflow and outflow structures and basin for sediment buildup. Remove sediment and debris exceeding 4” if infiltration performance is affected. *(1 visit at 0.5 hours per visit)*
  - Inspect side slopes for erosion. **Corrective action should be taken upon discovery.** *(1 visit at 0.5 hour per visit)*

- **Less frequent maintenance (every 2-3 years):**
  - Aerate and dethatch bottom of basins. *(1 visit at 2 hours per visit)*

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment AG

WMED Parking Lot Leaching Basins – BMP ID #16
Background

In 1998, two leaching basins were installed during re-construction of the Kalamazoo Center for Medical Studies which has since been renamed to the Western Michigan University Homer Stryker M.D. School of Medicine.

Infiltration Basins

Infiltration systems are water storage systems that are designed to hold stormwater runoff temporarily, and allow it to more slowly travel to the natural body of water. Infiltration basins remove fine sediment and the pollutants associated with them. The approximate drainage area contributing to these basins is 1.71 acres. Rainfall events up to 0.11 inches are captured, an effective volume reduction of 42% for annual rain events.

Figure AG-1  Current overview of WMed parking lot, reconstructed in 1998.
Supporting the System:
Native vegetation is planted around the intakes as a buffer/filter strip to assist with filtering coarse sediment particles.
Leaching basins provide another step in the process of filtration and separation of sediment from stormwater flow.

Care and maintenance are needed to ensure that the basin functions properly. The leaching basins are checked routinely and after major storms for signs of sediment and debris build up or damage that could reduce their effectiveness.

Inspections and maintenance are required to achieve the intended function, benefits, and life of these stormwater controls. Western Michigan University is responsible to establish and implement an inspection and maintenance program. Items to inspect and maintain during the design life of the SCMs include, but are not limited to, the following:

Basins and Structures

1. Perform one annual inspection for sediment accumulation in infiltration basins and in storm sewer structures: Leaching Basins and any the stormwater basin. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.
2. Following a large storm event or intense flows, inspect each basin for signs of erosion. Remove any trash or debris that might accumulate on outflow structure grates.

3. Remove any yard waste (leaves, branches, dead plants), trash or debris from each stormwater basin on a quarterly basis.

4. Perform one annual inspection for sediment accumulation and erosion at the two outfalls in the stormwater basin. If sediment accumulation is observed, remove the accumulated sediment.

5. Following a large storm event or intense flows, inspect each outfall for signs of erosion or sediment accumulation. Remove any debris that might accumulate near outfall structures.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
**Background**

In 2000, a retention pond was installed near parking lot 76 prior to the construction of the Western View Apartments in 2012. The retention pond is located at the south end of lot 76 along Howard Street.

![Overview of parking lot 76 after construction in 2007.](image)

**Retention Pond**

Retention ponds are artificial ponds that maintain a pool of water at all times. This helps keep suspended solids like sediment from entering the hydrologic system. Existing topographic contours suggest this BMP is capable of treatment volumes up to 1.34 acre-feet. This volume is equivalent to a rainfall event of 2.60 inches, which represents 100% of all rain events based on local historic precipitation records dated back to 1983.

**Supporting the Pond:**
Native vegetation is planted in and around the pond to assist with stabilizing soils and filtering sediment particles. Outflow structures provide for the detention function, as water flows from these discharge points to the Arcadia Creek after time elapsed in the pond for sediments to settle out.

Overview of parking lot 76 and the Western View Apartments (2017).

Care and maintenance are needed to ensure that the pond remains clear of debris and woody overgrowth. The outflow structures are also checked routinely and after major storms for signs of damage that could reduce their effectiveness.

Maintenance Schedule and Estimated Hours to Complete

- Following major storm events: (0.5 hour per visit)
  - Inspect side slopes, inlet and outlet structures for signs of erosion.
  - Corrective action should be taken upon discovery.
  - Remove large debris.

- As needed:
  - Mow to maintain appearance. (6 visits at 1 hours per visit)
  - Remove trash and debris. (3 visits at 0.5 hour per visit)
• **Annually in spring:**
  - Inspect for channelization in bottom of basin. Re-vegetate if channelization is minor. Energy dissipation may be required if channelization is major. *(1 visit at 0.5 hours per visit)*

• **Annually in fall:**
  - Inspect inflow and outflow structures and basin for sediment buildup. Remove sediment and debris exceeding 4” if infiltration performance is affected. *(1 visit at 0.5 hours per visit)*
  - Inspect side slopes for erosion. **Corrective action should be taken upon discovery.** *(1 visit at 0.5 hour per visit)*

• **Less frequent maintenance (every 2-3 years):**
  - Aerate and dethatch bottom of basins. *(1 visit at 2 hours per visit)*

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment AI

Power Plant Bioretention – BMP ID #22
Background

A floodplain bioretention area was constructed along Arcadia Creek within the WMU Robert M. Beam Power Plant property south of Stadium Drive. This work was completed in 2011 as part of the upstream MDEQ grant-funded project (DEQ #2008-0018) near the Howard/Stadium Drive intersection.

![Figure AI-1 Before (left) and after (right) BMP implementation in 2011.](image)

Bioretention Rain Gardens

Bioretention Rain Gardens are garden features specifically designed to slow and filter stormwater. Unique design elements include grading of the garden area and selection of native plants, compost/mulch layers and oil/gravel layers. Some rain gardens may also have underdrains or impervious liners. This off-line bioretention area serves to create additional floodplain connectivity during smaller, more frequent storm events. The estimated annual stormwater volume treated by this system is 33.5 acre-feet.

Supporting the Gardens:

Native vegetation is planted around the intakes as a buffer/filter strip to assist with filtering coarse sediment particles.
Care and maintenance are needed to ensure that the bioretention area functions properly. Invasive vegetation is removed, though routine mowing is typically avoided.

Maintenance Schedule and Estimated Hours to Complete

- **Following major storm events**: (0.5 hour per visit)
  - Inspect side slopes, inlet and outlet structures for signs of erosion.
  - **Corrective action should be taken upon discovery**.
  - Remove large debris.

- **As needed**:
  - Mow to maintain appearance. (6 visits at 1 hours per visit)
  - Remove trash and debris. (3 visits at 0.5 hour per visit)

- **Annually in spring**:
  - Inspect for channelization in bottom of basin. Re-vegetate if channelization is minor. Energy dissipation may be required if channelization is major. *(1 visit at 0.5 hours per visit)*

- **Annually in fall**:
  - Inspect inflow and outflow structures and basin for sediment buildup. Remove sediment and debris exceeding 4” if infiltration performance is affected. *(1 visit at 0.5 hours per visit)*
  - Inspect side slopes for erosion. **Corrective action should be taken upon discovery**. *(1 visit at 0.5 hour per visit)*
• **Less frequent maintenance (every 2-3 years):**
  o Aerate and dethatch bottom of basins. *(1 visit at 2 hours per visit)*

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment AJ

North Sangren Hall – BMP ID #23
**Background**

North Sangren Hall features a green roof for treatment of a portion of the stormwater falling on the building. While the roof-top garden provides additional stormwater retention and insulation for the building, the majority of stormwater from North Sangren Hall is treated by a supplementary infiltration system.

![Figure AJ-1 Site overview of Sangren Hall prior to reconstruction (2007).](image)

**Infiltration Systems & Green Roofs**

Green roofs are garden features specifically designed to capture stormwater and maintain some of the lost vegetative footprint of the building. Unique design elements include waterproofing, impervious liners, insulation, light weight growth media, and appropriate native vegetation. All stormwater runoff entering the treatment system is directed to underground storage and infiltration basins with a footprint of approximately 14,835 square feet. Infiltration basins are water storage systems that are designed to hold stormwater runoff temporarily, and allow it to more slowly travel to the natural waterbody. Infiltration basins remove fine sediment and the pollutants associated with them. This project also includes the installation of a 30-foot-wide porous pavement parking section, amounting to a total of 11,400 square feet.
Supporting the System:

Porous pavement, or pervious pavement, consists of asphalt, concrete, or paver blocks made from a variety of materials that allow for infiltration of stormwater through rather than across the paved area.

Care and maintenance are needed to ensure that the basin functions properly. The leaching and infiltration basins are checked routinely and after major storms for signs of debris build up or damage that could reduce their effectiveness.

Basins and Structures

1. Perform one annual inspection for sediment accumulation in the twelve leaching basins and in storm sewer structures. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

2. Inspect the sanitary cleanout points annually for any signs of sediment accumulation that could cause blockages. If sediment accumulation deeper than 6" is observed, remove the accumulated sediment.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer.
Attachment AK

Power Plant – Site 4 – BMP ID #26
Background

Streambank soil stabilization efforts were completed for the WMU Robert M. Beam Power Plant using native vegetation along 150 feet of Arcadia Creek. This streambank stabilization riparian buffer project was part of the MDEQ grant-funded project (DEQ #2011-0030).

Figure AK-1 On-site images of before (right) and after(left) streambank stabilization efforts.

Streambank Soil Stabilization

Streambank soil stabilization is generally accomplished through the planting of a riparian buffer. If peak stormwater flows are too strong, streambank stabilization efforts will not be effective and young plants will be swept away by strong currents before they can become well established. Upstream stormwater improvements from previous work at Kalamazoo Christian H.S. (1.3 acre-ft), WMU Lot 23 (2.5 acre-ft), WMU Howard-Stadium Apartments (3.5 acre-ft) and the Lawson Ice Arena Sites 1, 3 and 5 (1.65 acre-ft) significantly reduce wet-weather flows through this stretch of Arcadia Creek creating ideal conditions to stabilize these streambanks. In total, these other projects provide approximately 9 acre-ft of upstream stormwater treatment since 2007.

Supporting the System:

Riparian buffers are strips of land along the stream banks that are left in a natural state and set aside from other uses.

Native vegetation is planted along the riparian buffer to assist with stabilizing soil sediment.
Care and maintenance are needed to ensure that the vegetated area functions properly. Invasive vegetation is removed, though routine mowing is typically avoided.
Attachment AL

Lot 23 Parking – Site 6 – BMP ID #28
Background

A stormwater parking BMP was constructed in 2014 on the east side of WMU Lot 23 to treat runoff from the existing 0.78-acre parking area. This work was also part of the MDEQ grant-funded project (DEQ #2011-0030). The treatment of stormwater runoff from this parking area presented an opportunity to remove and treat stormwater that would otherwise discharge directly to Arcadia Creek. In 2009, this parking area had been reduced by approximately 50% to implement a stormwater detention BMP serving 32 acres of campus (via a U.S. EPA Targeted Watershed Grant). However, the remaining parking area still required treatment.

Infiltration Systems

The edge of this parking area received catch basin sediment structures to trap and collect suspended sediments. Additionally, a linear stone infiltration trench and perforated pipe serves to collect and infiltrate stormwater. Infiltration basins are water storage systems that are designed to hold stormwater runoff temporarily, and allow it to more slowly travel to the natural body of water.

Infiltration basins remove fine sediment and the pollutants associated with them.

Supporting the System:
Vegetated swales, gradually sloped ditches for directing drainage water flow, serve a temporary overflow storage function. Perforated pipe allows for holding large volumes of water underground and gradually releasing it for further filtration. Stone infiltration trenches provide another step in the process of filtration and separation of sediment from stormwater flow.

Before (left) and after (right) BMP implementation.

Care and maintenance are needed to ensure that the system functions properly. The area is checked routinely and after major storms for signs of sediment and debris build up or damage that could reduce BMP effectiveness.

Basins and Structures

1. Perform one annual inspection for sediment accumulation in the twelve leaching basins and in storm sewer structures. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

2. Inspect the sanitary cleanout points annually for any signs of sediment accumulation that could cause blockages. If sediment accumulation deeper than 6” is observed, remove the accumulated sediment.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.
Attachment AM

Lot 10/ Lot 12 – BMP ID #29
Background

This BMP project was completed by WMU as a retrofit infiltration project to existing storm sewers serving drainage from parking lots near the Waldo Stadium Press Box. A subsurface infiltration trench was installed in 2011.

Figure AM-1 Before (top) and after (bottom) BMP implementation in 2011.
Infiltration Systems

The volume of storage provided by this BMP is 480 cubic feet and accommodates approximately 20% of a 1-inch rain event. Infiltration systems like this are water storage systems that are designed to hold stormwater runoff temporarily, and allow it to more slowly travel to the natural body of water.

Supporting the System:
Native Vegetation is planted around the intakes as a buffer/filter strip to assist with filtering coarse sediment particles. Infiltration trenches provide another step in the process of filtration and separation of sediment from stormwater flow.

Care and maintenance are needed to ensure that the trenches functions properly. The intakes are checked routinely and after major storms for signs of sediment and debris build up or damage that could reduce their effectiveness.

Basins and Structures

1. Perform one annual inspection for sediment accumulation in the twelve leaching basins and in storm sewer structures. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

2. Inspect the sanitary cleanout points annually for any signs of sediment accumulation that could cause blockages. If sediment accumulation deeper than 6” is observed, remove the accumulated sediment.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.
Attachment AN

East Campus Alumni Center – BMP ID #30
Background

Serving the East Campus Alumni Center along Oakland Drive, a combination of a subsurface detention/infiltration system and retaining walls were installed in 2015 to capture and infiltrate stormwater runoff and prevent erosion as part of the WMU Total maximum daily load (TMDL) goal.

![Figure AN-1 Before (left) and after (right) construction of the East Campus Alumni Center.](image)

Infiltration Systems

This infiltration system serves a 3.30-acre drainage area and accommodates storm events up to approximately 4.45 inches. Infiltration systems are water storage systems that are designed to hold stormwater runoff temporarily, and allow it to more slowly travel to the natural body of water. Infiltration basins remove fine sediment and the pollutants associated with them.

Supporting the System:

Native vegetation is planted around the basin intakes as a buffer/filter strip to assist with filtering coarse sediment particles.

Retaining wall structures are built within drainage systems to manage stormwater and reduce erosion by creating terracing and levels of landscape beds to fit with sloped areas and create a strong barrier.
Care and maintenance are needed to ensure that the basin functions properly. The leaching basins are checked routinely and after major storms for signs of sediment and debris build up or damage that could reduce their effectiveness.

Basins and Structures

1. Perform one annual inspection for sediment accumulation in the twelve leaching basins and in storm sewer structures. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

2. Inspect the sanitary cleanout points annually for any signs of sediment accumulation that could cause blockages. If sediment accumulation deeper than 6” is observed, remove the accumulated sediment.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.
Zhang Legacy Collections – BMP ID #31 will be combined with Attachment AD BMP ID #40. Attachment AO BMP #40 will be updated to Lot 97 bioretention pond.
Background

The WMU Zhang Legacy Collections Center building was constructed in 2013 and included provisions for on-site stormwater treatment serving 2.8 acres north of the Oakland Drive and Howard Street intersection.

![Figure AO-1 Before (left) and after (right) BMP implementation in 2011.]

Infiltration Systems & Bioretention Rain Gardens

Stormwater controls installed at this location included a combination of bioretention and a large underground detention/infiltration area. Bioretention rain gardens are garden features specifically designed to slow and filter stormwater. Unique design elements include grading of the garden area and native plant, compost/mulch and soil/gravel selections. Some rain gardens may also have underdrains or impervious liners. Infiltration basins are water storage systems that are designed to hold stormwater runoff temporarily, and allow it to more slowly travel to the natural waterbody. Infiltration basins remove fine sediment and the pollutants associated with them.

Supporting the Systems:

Native vegetation is planted around the basin intakes as a buffer/filter strip to assist with filtering coarse sediment particles.

Riprap, a permanent cover of rock placed over a filter layer, is used to stabilize inlets to the infiltration and supporting pretreatment areas.
Care and maintenance are needed to ensure that the basin functions properly. The leaching and infiltration basins are checked routinely and after major storms for signs of debris build up or damage that could reduce their effectiveness.

**Basins and Structures**

1. Perform one annual inspection for sediment accumulation in the twelve leaching basins and in storm sewer structures. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

2. Inspect the sanitary cleanout points annually for any signs of sediment accumulation that could cause blockages. If sediment accumulation deeper than 6” is observed, remove the accumulated sediment.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.
Attachment AP

French, Davis ETAL Detention Ponds – BMP ID #43
**Background**

French/Davis/Zimmerman residence halls were demolished to make way for the South Campus Masterplan. Two detention basins were designed and installed in the footprint of the old residence halls in 2022.

![Figure AO-1 Legacy Collections Schematic](image)

**Description**

The BMP detains water on site and slowly releases it to the subsoil or receiving storm sewer, lessening the burden on the receiving sewer. The BMP also treats the stormwater by filtering out sediments and phosphorus.

The BMP was designed as a dry detention pond. It was fit into the original basement footprint of the demolished buildings to limit excavation required to construct the ponds. The ponds collect runoff from a large portion of the campus area and provide stormwater management capacity for future development in this area of campus.
Maintenance of dry ponds includes removal and disposal of sediment, trash and debris and erosion repair. Annual evaluation of the overflow structures is also recommended. Dry Detention Basins achieve medium to coarse particulate pollutant removal by temporarily ponding water, recharging groundwater and also provide flood control with detention storage. These detention basins help protect adjacent buildings including Read Arena from flooding by capturing and storing runoff from the adjacent campus areas.

**Basins and Structures**

1. Perform one annual inspection for sediment accumulation in the stormwater basin and Catch Basin 46. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.
2. Inspect Manhole-for sediment accumulation on a quarterly basis.
3. Following a large storm event or intense flows, inspect each basin for signs of erosion. Remove any debris that might accumulate on the two storm outfalls or the outflow structure grates.
4. Remove any yard waste (leaves, branches, dead plants), trash or debris from each stormwater basin on a quarterly basis.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.

If you are unsure whether a problem exists, please contact a Professional Engineer
Attachment AQ

Arcadia Flats Housing – BMP ID #44
Background

In the South Neighborhood Housing old residence halls were demolished to make way for the South Campus Masterplan. In 2021 new residence halls, Arcadia Flats Housing, were built. A subsurface infiltration system was designed and installed in the footprint of the old residence halls Serving to capture and infiltrate stormwater runoff and prevent erosion as part of the WMU Total maximum daily load (TMDL) goal.

Figure AQ-1 Schematic of Arcadia Flats Housing

Infiltration Systems

This infiltration system serves a 5.59-acre drainage area and accommodates storm events up to approximately 4.45 inches. Infiltration systems are water storage systems that are designed to hold stormwater runoff temporarily, and allow it to more slowly travel to the natural body of water. Infiltration basins remove fine sediment and the pollutants associated with them.
Supporting the System:

Care and maintenance are needed to ensure that the basin functions properly. The leaching basins are checked routinely and after major storms for signs of sediment and debris build up or damage that could reduce their effectiveness.

**Basins and Structures**

1. Perform one annual inspection for sediment accumulation in the twelve leaching basins and in storm sewer structures. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

2. Inspect the sanitary cleanout points annually for any signs of sediment accumulation that could cause blockages. If sediment accumulation deeper than 6" is observed, remove the accumulated sediment.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.
Attachment AR

Student Center & Loop Road – BMP ID #45
**Background**

A new Student Center and Loop Road was built in 2021/2022 as part of the South Campus Masterplan Renovation. Subsurface infiltration / Bioretention and Green Roof practices were incorporated to capture and infiltrate stormwater runoff and prevent erosion as part of the WMU Total maximum daily load (TMDL) goal.

![Figure AR-1 Construction of the Student Center and Loop Road.](image)

**Infiltration Systems**

This infiltration system serves a 5.33-acre drainage area and accommodates storm events up to approximately 4.45 inches. Infiltration systems are water storage systems that are designed to hold stormwater runoff temporarily and allow it to more slowly travel to the natural body of water. Infiltration basins remove fine sediment and the pollutants associated with them.

**Supporting the System:**

- **Native vegetation** is planted around the basin intakes as a buffer/filter strip to assist with filtering coarse sediment particles.
- **Retaining wall structures** are built within drainage systems to manage stormwater and reduce erosion by creating terracing and levels of landscape beds to fit with sloped areas and create a strong barrier.
Care and maintenance are needed to ensure that the basin functions properly. The leaching basins are checked routinely and after major storms for signs of sediment and debris build up or damage that could reduce their effectiveness.

**Basins and Structures**

1. Perform one annual inspection for sediment accumulation in the twelve leaching basins and in storm sewer structures. Remove any accumulated sediment greater than 6 inches to ensure proper infiltration and to prevent sediment transport to other downstream structures.

2. Inspect the sanitary cleanout points annually for any signs of sediment accumulation that could cause blockages. If sediment accumulation deeper than 6” is observed, remove the accumulated sediment.

Always keep detailed, written records for this site pertaining to all inspection visits, maintenance needs and work completed for future reference.
Storm Water Catch Basin Inspection & Cleaning Procedure
All stormwater management systems, whether gray or green, require maintenance. Appropriate operation and maintenance activities ensure that stormwater practices will continue to function properly and yield expected water quality and environmental benefits, protect public safety, meet legal standards, and protect communities' financial investment (EPA Reference). Structural and operational BMPs are necessary to remove pollutants. Operational BMPs include proper cleaning of the road and catch basins. Street sweeping and catch basin cleaning should be considered together to maximize pollutant removal, especially in TMDL areas.

**Catch Basins**

Catch basins are included in storm sewer system designs as a best management practice to remove pollutants such as gravel, sand, oils, and organic material carried by storm water runoff. Catch basins are designed to capture the pollutants in a sump, which may vary in depth depending on the design. The solids captured in the sump may have elevated concentrations of metals from street runoff or drainage from industrial, commercial and residential properties. In order to maintain the effectiveness of the catch basin, the sump must be regularly inspected and cleaned. The Department of Environment, Great Lakes and Energy (EGLE) Water Resources Division (WRD) and Materials Management Division (MMD) oversee environmental regulations pertaining to this activity. The Michigan Occupational Safety and Health Administration (MIOSHA) within the Department of Labor and Economic Opportunity oversees confined space entry and other worker health and safety standards. (EGLE Catch Basin Guidance)

Operational Best Management Practices (BMPs) for catch basin and street sweeping residuals are a necessary part of the Stormwater Management Plan required by the National Pollutant Discharge Elimination System Permit for the discharge of Stormwater from a Municipal Separate Storm Sewer System (MS4) and good practice for municipalities throughout the state. This guidance provides information on developing an appropriate operation and maintenance schedule; however, specifics of the contributing area should be considered to maximize water quality protection.

**Catch Basin Cleaning**

Catch basins are equipped with a sump to retain pollutants from the contributing area. Resuspension and discharge of sediment previously collected in the catch basin sump may occur if the sump is too full. In general, the more frequently catch basin sumps are cleaned out, the better the pollutant removal efficiency.

1. **Catch basins should be inspected annually to identify issues in a timely manner. At a minimum, catch basins should be inspected at least once every three years and the sump cleaned when 30-40% full, unless a more frequent schedule is necessary to ensure proper treatment capacity is maintained within the sump.**
2. Catch basin inspections and cleaning should be well documented.

3. Wastes generated from catch basin cleaning shall be properly disposed.

Some areas may need more frequent inspections. Catch basins near construction activities (roadway construction, residential, commercial, or industrial development or redevelopment) or high-use areas should be inspected and cleaned more frequently if inspections find excessive sediment or debris loadings.

The preferred method of material removal from catch basin sumps is using a vacuum truck. Waste generated from catch basin cleaning activities cannot be discharged back into the storm sewer system. This discharge is not authorized per Part 31, Water Resources Protection (Part 31) of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA) and is therefore illegal. The combined solid and liquid waste stream from cleaning storm sewers systems, including catch basin sumps, is legally defined as “liquid industrial by-product” pursuant to Part 121, Liquid Industrial By-Products (Part 121) of NREPA. If an environmental spill were captured by a storm sewer system, the material in the storm sewer system could be a hazardous waste pursuant to the Part 111, Hazardous Waste Management (Part 111) of the NREPA and subject to additional management requirements.

When cleaning catch basin sumps, it is important to conduct a visual inspection prior to the cleaning. This is necessary to ensure the water in the sump has not been contaminated and qualifies to be managed as a liquid industrial by-product. If contamination is expected based on a visual inspection (visible sheen, discoloration, turbidity, obvious odor, etc.), a grab sample should be collected and analyzed before handling the materials and generating a waste. While waiting for the sample analysis, efforts to prevent stormwater from entering the storm sewer system should be taken. For additional details on performing visual inspections, see the EPA Storm Water Management Fact Sheet on Visual Inspections. For additional details on sampling and determining if a material is hazardous or not, please see the EGLE Waste Characterization Guidance.

More information regarding options recommended for handling liquid industrial by-products generated from catch basin cleaning activities can be found here.

**Catch Basin Waste Handling**

The following are options recommended for handling liquid industrial by-products generated from catch basin cleaning activities:

1) Have the liquid industrial by-product transported to drying beds to separate the solids and liquids. This is usually performed at a publicly owned treatment plant or at
a privately-owned permitted facility where the liquid portion of the waste stream is separated from the solids and treated prior to discharge. Once dry, the solids should be disposed in a licensed solid waste landfill in accordance with Part 115.

2) Request permission from the local wastewater treatment plant operator to discharge the combined solid/liquid waste into the sanitary system. Most treatment plants will require pre-treatment prior to the discharge. All applicable local ordinance provisions must be followed.

3) When conducting catch basin cleaning activities where the above options are not available, the following method can be used after the water in the sump is confirmed to be uncontaminated.

   a. Using a sump pump, or any other pumping mechanism, remove the majority of water in the sump of the basin without disturbing the solid material below. Do not use pumps connected to the vactor truck’s holding tank.
   b. The clear water may then be directly discharged to one of the following:
      ➢ Municipal Sanitary system (with prior approval from local sewer authority).
      ➢ Application to the ground adjacent to the catch basin may be allowed on a site-specific basis. To learn more about this option, contact the WRD, Groundwater Discharge Program at 517-290-9607.
   c. The remaining liquid/solid in the sump should be collected with a vactor truck and disposed of off-site in accordance with Parts 115 or 121.

The owner of the storm sewer system is responsible for meeting the liquid industrial by-products generator requirements under Part 121, even if the catch basins are cleaned out by a private contractor. See the Liquid Industrial By-Products Generator guidance for more details on the generator requirements for handling liquid industrial by-products.

**Sweeping**

Street sweeping involves the use of specialized equipment to remove litter, loose gravel, soil, pet waste, vehicle debris and pollutants, dust, de-icing chemicals, and industrial debris from streets, parking lots, and other impervious infrastructure. If a street or parking lot does not have any storm drains and curbs (just sheet flow to a vegetated swale or ditch), it may not need to be swept. Street sweeping equipment can consist of a truck or truck-like vehicle equipped with multiple brushes, pick-up deflector, holding bin, water sprayer, vacuum nozzle and filter, or a combination of some or all of these features. Hand sweeping is not a preferred option but can be acceptable in certain circumstances.

Sweeping is recommended at least four times per year. Street sweeping in some areas may decrease the frequency in which Catch Basins need to be cleaned. Street sweeping activities are also subject to the above solid waste requirements.

It is recommended to perform street sweeping:
1. After heavy rainstorms at locations where sediment is present on the streets.
2. At locations adjacent to construction sites where sediment has left the site and entered the street.
3. At least once during the fall to collect leaves and keep them out of the sewer system.
4. At least once during the early spring to collect sand, deicing material, and winter debris left behind during snow melt.

Note: Street sweeping activities are also subject to the above catch basin waste handling requirements.

**Types of Sweepers**

Street sweeping effectiveness is a function of sweeping frequency, number of passes per sweeping, equipment speed and pavement conditions. Street sweepers must be operated at the proper equipment design speed and ensure proper maintenance.

Below are two examples of types of street sweepers:

- Mechanical broom street sweepers are effective in removing heavier debris such as sand or gravel and less effective at picking up finer material. Mechanical broom sweepers are used in the construction industry. Mechanical broom sweepers are ideal for the heavy build-up encountered after flooding or even a yearly spring cleanup. Mechanical Broom Sweepers are great for road clean-up following big construction and milling projects.

- Regenerative air/vacuum sweepers are green sweepers that combine sustainability with efficiency. A regenerative air sweeper features air-blast capability, large gutter brooms, a heavy-duty suction hose and a large hopper. It is a powerful, versatile sweeper that can remove debris, dirt, and trash. Its fuel efficiency and large water tank enables the user to get more cleaning done without frequent stops in order to refuel, dump or re-water the truck. These sweepers are frequently used to remove trash, fine dirt, rocks, gravel, and leaves from parking lots. ([Let's Choose the Correct Sweeping Equipment to do the Job](atlanticsweeping.com))
SWMP Attachment I

Dry Weather Stormwater Monitoring Plan
To: Keith Pung  
EHS Specialist, Human Resources  
Date: May 15, 2023

From: John Jacobson, PE, Senior Project Engineer  
Mark Kieser, Senior Scientist  
cc: Project Files

RE: Dry Weather Stormwater Monitoring Plan Recommendations for 2023 WMU MS4 Illicit Discharge Elimination Plan (IDEP) and Catch Basin (CB) Monitoring

Overview:

K&A was authorized to support WMU for developing and implementing a dry weather survey approach for their permitted MS4 outfalls under their IDEP as well as monitor catch basins in areas untreated by Best Management Practices (BMPs). The K&A scope includes the following tasks.

1. Review the new 2023 MS4 permit and reassess permit-related requirements and any EGLE-specified requirements for dry weather screening to revise the existing proposed scope to be shared with EGLE as WMU’s “Plan of Assessment”. This plan will be used to tacitly elicit EGLE support/feedback for the approach in advance of undertaking actual field assessments.
2. Prioritize outfalls based on Task 1 and identify the location of each outfall to be monitored.
3. Perform dry-weather screening of identified outfalls, following adapted SOPs, including sample collection and analysis as needed. Monitor catch basins in areas untreated by Best Management Practices (BMP) on campus.
4. Initial reporting, including identification of follow-up screenings needed, and perform follow up screenings.
5. Reporting, to include any recommendations for additional illicit connections testing and timetable of testing that may need to be undertaken.

This memorandum presents information on Tasks 1 and 2 in the following sections:  
Dry weather stormwater monitoring requirements per their MS4 IDEP  
History of WMU discharge monitoring, Dry Weather Monitoring Recommendations, and Illicit Discharge Observations - Outline for Completing Field Observation Form

Dry Weather Stormwater Monitoring – WMU MS4-Kalamazoo Illicit Discharge Elimination Plan (IDEP):
WMU’s IDEP provides the procedure to monitor 34 WMU Outfall and Points of Discharges and 6 internal outfalls at the Goldsworth Valley Pond, as identified in the 2023 NPDES permit for WMU MS4-Kalamazoo with the continuation of the permit renewal. The permit requires that the discharges be monitored once during the 5-year permit duration. This plan proposes to monitor 10 outfalls each year between 2023 to 2027. (NOTE: All tables and figures referenced herein appear at the end of narrative text beginning on page 5.

Along with the IDEP monitoring of the WMU Outfall and Points of Discharge it has been requested to monitor catch basins in areas untreated by Best Management Practices (BMP) on campus. Of WMUs 619.6 acres of main campus area the drainage from 488.0 acres (79%) are being treated by BMPs. The drainage in the 131.6 acres (21%) that do not flow through BMP treatment appears to be located in drainage areas adjacent to the outfalls and points of discharge. Therefore, WMU proposes to monitor seven (7) catch basins from untreated areas in proximity to the outfalls and points of discharge, monitored each year of the permit duration, to assess the efforts needed to clean the catch basins. Statistically if an untreated area has sediment greater than 40% of the available storage within the monitored catch basins, the area will be flagged to have the catch basins within that area cleaned. Table 2 attach identifies the catch basins and the year to be monitored.

History of Discharge Monitoring:

Two historical monitoring elements have taken place on the WMU MS4-Kalamazoo system. Under the last MS4 permit cycle in 2013, 63 outfalls and onsite points were monitored with 7 points showing dry weather flows. All 7 points were investigated and found to be irrigation flow or groundwater flow. No illicit discharges were detected. Also, many of the points observed in this 2013 monitoring have on-site detention basins and/or do not flow outside the WMU MS4 system.

For the second monitoring effort in 2017, Western Michigan University received the Asset Management program for its stormwater implemented as part of the Asset management and Wastewater (SAW) program. The 2017 report by Prein & Newhof provided the following relevant conditions of the 93,432 lineal feet of storm sewer system with 869 manholes and 487 catch basins (WMU_util_P130019_Stormwater Sytem Evaluation_Final_2017531; Page 5 )

2.2.2.3 Summary of Storm Sewer Pipe Conditions
No significant defects were found that warranted follow-up CCTV inspection. Pipes owned by another entity, such as the City of Kalamazoo, were not given Risk of Failure ratings.

2.2.2.4 Structural Conditions
The storm sewer pipes were found in generally good structural condition.

2.2.2.5 Infiltration Observations
Infiltration was observed in a few of the storm system pipes and manholes but no significant sources of infiltration were observed.
2.2.2.6 Roots and Debris

Minimal intrusion from roots were observed and debris typical for storm sewer systems such as leaves, sticks, and various trash items were observed in many locations. Any pipes found with roots and debris should be added to WMU’s cleaning schedule.

Dry Weather Monitoring Recommendations:

Based on historical sampling evidence and the 2017 SAW report, the WMU MS4-Kalamazoo system appears free of any illicit discharges. As the system is fully owned and maintained by WMU and any improvements to the system must have oversight by WMU, no current or future illicit discharges are expected. However, due to the requirement of the MS4 permit, a monitoring schedule is recommended in Table 1 that includes the list of WMU MS4 outfalls and Points of Discharge to be examined. The table assumes that WMU will be required to inspect all of these outfalls and points of discharge as outlined in the permit.

Figure 2 provides a map of outfalls and points of discharge. Figure 3 shows Dry Weather Screening Locations for Goldsworth Valley Pond.

The following summary identifies 10 outfalls recommended for observations in each of the four years from permit year 1 to 4.

<table>
<thead>
<tr>
<th>Year for Observation</th>
<th>Outfalls/Points of Discharge</th>
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<tr>
<td>Year 1</td>
<td>Goldsworth Valley Pond: CB-1776 DC-900 and CB-3058</td>
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<td>Arcadia Creek Outfalls: DC-892, DC-898, CB-1730</td>
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<td>Arcadia Creek Outfalls: DC-924</td>
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<td>Untreated Catch Basin Inspections See Table 2</td>
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</table>
Illicit Discharge Observations - Outline for Completing Field Observation Form:

We recommend following inspection considerations…information upon inspection (see Attachment A for the MS4 IDEP Inspection Form_2023).

Types of Outfalls: Collect photographs

Safety during inspection: Watch for/be aware of: poison ivy, slips and trips, pinched fingers lifting manhole covers, ticks, sunscreen, confined spaces, vehicle traffic

Equipment: Storm sewer system maps, orange safety cones, GPS, mirror, manhole hooks, cones, hammer, pencil, paper, tape measure, camera, WMU ID

PPE: Long pants, work gloves, steel-toed shoes, fluorescent vest, safety glasses, waders

Outfall Survey Form: Complete all lines

Watercourse would be Arcadia Creek, Goldsworth Valley Pond, or City of Kalamazoo If submerged, move upstream to all connected structures.

Abnormal odors
   Chlorine, sewage, fuel
Abnormal visual
   Cloudy, oily, sudsy
Normal visual
   Ily Sheen, Sudsy

What if you have a flow?  
Follow upstream to all of the connected structures to confirm source

What if you do not have a flow 
Check no flow and skip the rest of III and all of IV

Procedure for working in or near vehicle traffic 
Identify structures in right of way ahead of time and develop plan
How many lanes will be blocked?
Consider asking assistance from DPS
Consider a flag man to stop traffic in narrowing to one lane
Advance warning 200 feet for 25 mph zone

What if you have a submerged outfall?
Note any evidence of flow occurring. If flow, proceed upstream to identify

Confined Space Training – Be aware of confined space requirements and do not proceed without training.
Table 1. WMU MS4 Outfalls and Points of Discharge

Outfall - means discharge point from an MS4 directly to a Surface Water of the State.
Point of Discharge - means discharge from an MS4 to an MS4 owned or operated by another public body.

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<th>Count</th>
<th>Facility ID</th>
<th>MS4 Definition</th>
<th>Receiving Water</th>
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SWMP Attachment J

E.coli Wet Weather Stormwater Monitoring & Reporting
OVERVIEW

Based on a review of the State of Michigan listing criteria for *E. coli* impairments for Arcadia Creek, the listing cites Kalamazoo County Health and Community Services Department, Environmental Health Division creek sampling data from a single-year’s dataset from 2010 whereby there were only 3 dates sampled at 4 stations. Though state TMDL guidance requires a minimum of five sampling events to assess partial and total body contact recreation for a listing, County sampling in both 2010 and 2011 (the latter with four sampling events) does show sufficient justification for the listing. Notable, however, is that these data are from over a decade ago. Due to the age of the data, K&A recommends a full re-assessment of Arcadia Creek’s *E. coli* TMDL prior to outfall assessments. If Arcadia Creek is in compliance, then a delisting may be in order with such evidence suggesting removal of *E. coli* monitoring for WMU stormwater outfalls. This could also potentially justify removal of MS4 requirements requiring *E. coli* monitoring.

K&A proposes the following tasks to re-examine the TMDL listing conditions as well as conduct additional WMU stormwater outfall monitoring as related to EGLE requests, MS4 permit considerations and 2023 instream findings.

Task 1. 2023 Arcadia Creek Monitoring.

**Purpose:** K&A will replicate the original *E. coli* TMDL monitoring of Arcadia Creek that was performed in 2010-2011. This will provide data to assess whether the original listing is still valid. If not, there may be justification to remove *E. coli* monitoring requirements from future MS4 monitoring and not conduct such monitoring in 2024 and 2025.

- a. K&A will monitor Arcadia creek at the 4 locations used to create the original TMDL listing that are listed in WMU SWMP 23’.
  - Monitoring will consist of 5 dry weather events and 2 wet weather events.
- b. K&A will analyze the results and create an annual report of the findings.
Task 2. 2024 Outfall Monitoring.

Purpose: If the results from 2023 indicate that the original TMDL listing is still justified, then K&A initiate outfall monitoring as defined in the WMU SWMP 23’. K&A will start with the 4 outfall sites that encompass the other outfall locations. If these outfalls are in compliance, then there is justification to not monitor the additional outfalls outlined in 2025 monitoring as follows:
   a. If E. coli is found in exceedance in Task 1, K&A will monitor 4 outfall locations over two wet weather events in the following outfall locations:
      i. STOMH-195; STODC-898; 912; 924
   b. Up to 2 additional miscellaneous wet weather sampling events will be conducted to identify potential sources of E. coli by traveling upstream of the outfall and collecting samples for analysis. This may also include DNA testing if deemed appropriate.
   c. K&A will analyze the results and create an annual report of the findings.

Task 3. 2025 Outfall Monitoring.

Purpose: If results from 2024 indicate exceedances, then K&A monitor remaining outfall locations in accordance with the MS4 permit.
   a. If the E. coli is found in exceedance, K&A will monitor 7 outfall locations over two wet weather events in the following outfall locations:
      a. STODC-888; 891; 892; 893; 907; 910; 911
   b. K&A will conduct up to 2 additional miscellaneous wet weather sampling events to identify potential sources of E. coli by traveling upstream of the outfall and collecting samples for analysis. This may also include DNA testing if deemed appropriate.
   c. K&A will analyze results and create an annual report of the 2025 findings.

Task 4. 2026 Final Report. K&A will create a final report summarizing the three years of findings.

Task 5. Client Coordination. This task includes anticipated interaction with the client and/or EGLE as necessary to communicate approaches, discuss findings, consider sampling program modifications/needs, and discuss the final report.

Contingency Task 6. If deemed appropriate/necessary, extra DNA marker testing, or extra E. coli monitoring beyond Task 1-3 sampling efforts will be covered by this contingency task.

BUDGET

Depending on 2023 monitoring results, future years’ efforts may be greatly diminished if E. coli is not appearing in sampling results.
SCHEDULE

Attachment 2 includes the proposed project schedule whereby Arcadia Creek monitoring efforts would begin in June 2023.
<table>
<thead>
<tr>
<th>Task Description</th>
<th>2023</th>
<th></th>
<th>2024</th>
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<th>2025</th>
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<th>2026</th>
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<tbody>
<tr>
<td>1a. 2023 Creek Monitoring E. coli</td>
<td></td>
<td>Aug</td>
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<td>1b. 2023 Annual Report</td>
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<td>May</td>
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<td>2a. 2024 Outfall Monitoring</td>
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<td>June</td>
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<td>2b. 2024 Misc. Monitoring</td>
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<td>May</td>
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<td>June</td>
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<tr>
<td>2c. 2024 Annual Report</td>
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<td>Aug</td>
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<td>June</td>
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<td>3a. 2025 Outfall Monitoring</td>
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<td>May</td>
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<td>3b. Misc. Monitoring</td>
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<td>3c. 2025 Annual Report</td>
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<td>4. 2026 Final Report</td>
<td></td>
<td>Aug</td>
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<tr>
<td>5. Client Coordination</td>
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<td>May</td>
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<tr>
<td>6. Contingency Sampling</td>
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<td>Aug</td>
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</table>
**Attachment K – PUBLIC EDUCATION PROGRAM (PEP)**

**STORM WATER MANAGEMENT PROGRAM (SWMP)**

**PROGRAM ELEMENTS, TASKS AND DELIVERABLES**

<table>
<thead>
<tr>
<th>Topic Number</th>
<th>PEP Topic</th>
<th>Delivery Mechanism / Methodology</th>
<th>Timetable</th>
<th>Evaluation / Measured Element</th>
<th>Measurable Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Promote public responsibility in the applicant’s watershed</td>
<td>A representative of the MS4 community or agency participates in the TMDL, Kalamazoo Area Stormwater Working Group or other active group with education activities.</td>
<td>As Needed</td>
<td>Meeting attendance and participation in TMDL, KASWG or another applicable active group</td>
<td>Education topic / documents are reviewed, revised, updated, or replaced and promoted at a minimum of once per permit cycle. Effectively reach the targeted audience within the community and collectively in all of Kalamazoo County. Goal is to have an outreach campaign with an average of 20,000 impressions a month, a click through rate (CTR) equal or above the national average.</td>
</tr>
<tr>
<td>2</td>
<td>Inform and educate the public about the connection of the MS4 to area waterbodies and the potential impacts discharges could have on surface waters of the state.</td>
<td>Provide related documents on the community’s website and/or links to centralized web page containing related topic. Utilize social media platforms (Facebook, Townsquare Media, etc.) to direct people to website and/or document location. The intent is to cover 2 of the 9 topics (topics 1-9) per year. Once the topic is available for promoting to the public and linked to the necessary website(s), the community or stormwater working group will utilize social media platform(s) to direct people to the material.</td>
<td>The topic is covered once per permit cycle (once per 5 years)</td>
<td>Educational document on the community’s website and/or centralized web page Social media platform was used to direct people to the education document(s) Snapshots (photos) or copies of social media posts.</td>
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<tr>
<td>3</td>
<td>Educate the public on illicit discharges and promote public reporting of illicit discharges and improper disposal of materials into the MS4</td>
<td>Provide related documents on the community’s website and/or links to centralized web page containing related topic. Utilize social media platforms (Facebook, Townsquare Media, etc.) to direct people to website and/or document location. The intent is to cover 2 of the 9 topics (topics 1-9) per year. Once the topic is available for promoting to the public and linked to the necessary website(s), the community or stormwater working group will utilize social media platform(s) to direct people to the material.</td>
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<td>4</td>
<td>Promote preferred cleaning materials and procedures for car, pavement, and power washing.</td>
<td>Provide related documents on the community’s website and/or links to centralized web page containing related topic. Utilize social media platforms (Facebook, Townsquare Media, etc.) to direct people to website and/or document location. The intent is to cover 2 of the 9 topics (topics 1-9) per year. Once the topic is available for promoting to the public and linked to the necessary website(s), the community or stormwater working group will utilize social media platform(s) to direct people to the material.</td>
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<td>5</td>
<td>Inform and educate the public on proper application and disposal of pesticides, herbicides, and fertilizers.</td>
<td>Provide related documents on the community’s website and/or links to centralized web page containing related topic. Utilize social media platforms (Facebook, Townsquare Media, etc.) to direct people to website and/or document location. The intent is to cover 2 of the 9 topics (topics 1-9) per year. Once the topic is available for promoting to the public and linked to the necessary website(s), the community or stormwater working group will utilize social media platform(s) to direct people to the material.</td>
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<tr>
<td>6</td>
<td>Promote proper disposal practices for grass clippings, leaf litter, and animal wastes that may enter into the MS4.</td>
<td>Provide related documents on the community’s website and/or links to centralized web page containing related topic. Utilize social media platforms (Facebook, Townsquare Media, etc.) to direct people to website and/or document location. The intent is to cover 2 of the 9 topics (topics 1-9) per year. Once the topic is available for promoting to the public and linked to the necessary website(s), the community or stormwater working group will utilize social media platform(s) to direct people to the material.</td>
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<td>7</td>
<td>Identify and promote the availability, location, and requirements of facilities for collection or disposal of household hazardous waste, travel trailer sanitary wastes, chemicals, yard wastes, and motor vehicle fluids</td>
<td>Provide related documents on the community’s website and/or links to centralized web page containing related topic. Utilize social media platforms (Facebook, Townsquare Media, etc.) to direct people to website and/or document location. The intent is to cover 2 of the 9 topics (topics 1-9) per year. Once the topic is available for promoting to the public and linked to the necessary website(s), the community or stormwater working group will utilize social media platform(s) to direct people to the material.</td>
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<td>8</td>
<td>Inform and educate the public on proper septic system care and maintenance, and how to recognize system failure</td>
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<tr>
<td>9</td>
<td>Educate the public on and promote the benefits of green infrastructure and Low Impact Development.</td>
<td>Provide related documents on the community’s website and/or links to centralized web page containing related topic. Utilize social media platforms (Facebook, Townsquare Media, etc.) to direct people to website and/or document location. The intent is to cover 2 of the 9 topics (topics 1-9) per year. Once the topic is available for promoting to the public and linked to the necessary website(s), the community or stormwater working group will utilize social media platform(s) to direct people to the material.</td>
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<tr>
<td>10</td>
<td>Identify and educate commercial, industrial, and institutional entities likely to contribute pollutants to storm water runoff.</td>
<td>Visit facilities (as necessary) for personal education.</td>
<td>As Needed</td>
<td>Number of facilities visited, and number of employees educated.</td>
<td>Facilities are aware of where their on-site storm water goes.</td>
</tr>
<tr>
<td>1-10</td>
<td>Public Education delivery mechanism (Public Survey)</td>
<td>To be determined by Storm Water Program Manager. This may include Facebook or other social media outlet, newspaper publications, post card mailings, or other delivery mechanism. Perform survey in year 1 or 2 to establish baseline. Perform survey in year 4 or 5 to measure change.</td>
<td>Perform survey in year 1 or 2 to establish baseline. Perform survey in year 4 or 5 to measure change.</td>
<td>Webpage and Facebook metrics for KSWG and community websites, if available.</td>
<td>Obtain new ideas on how to reach out and educate residents. Evaluate responses to previous delivery mechanism to determine if it reached the target audience. Increase in the number of respondents with correct answers to storm water questions.</td>
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</tbody>
</table>