Appendix G

Illicit Discharge Elimination Program (IDEP)

Protocol Manual

Illicit Discharge Elimination Program

Field Protocol Manual

Prepared by:

AECOM

November 2016

Valid Through April 1, 2025

Table of Contents

List of Figures

List of Tables

Appendices

A. Supplies and Equipment
B. pH Pen Calibration Instructions
C. Structure Numbering
D. MDEQ Fact Sheets
E. Sampler Schematics
F. Flow Measurement Methods
G. Contact Information
H. Material Safety Data Sheets
I. Paper Field Forms

Introduction

Phase II Illicit Discharge Elimination Requirements

The Michigan Department of Transportation (MDOT) has received a statewide Phase II stormwater permit (Permit NO. MI0057364) from the Michigan Department of Environment, Great Lakes, and Energy (EGLE). Under this permit, MDOT must implement the IDEP to the maximum extent practicable. The following minimum requirements listed in the statewide permit:

1. An available, up-to-date storm sewer system map identifying the following: the storm sewer system, location of all outfalls and points of discharge the permittee owns or operates in the regulated area, and the names and location of all surface waters of the state that receive discharges from the permittee's MS4. The map shall be retained by the permittee and made available to the Department upon request. The map shall be maintained and updated as outfalls and points of discharge are identified, constructed, and installed in accordance with Part I.A.2. of this permit.

2. A plan to detect and eliminate non-stormwater discharges to the permittee's MS4, including illegal dumping and spills. The plan includes the following:

   A procedure for identifying priority areas for field observations. The permittee shall conduct field observations in accordance with the procedure identifying the priority area(s) developed as part of the IDEP.

   A procedure for conducting field observations, field screening, and source investigations. The permittee shall conduct a field observation in accordance with the procedure during dry weather at least once during the term of the permit. Field screening and source investigation shall be conducted in accordance with the schedule in the procedure.

3. An employee training program that includes:

   Training on techniques for identifying illicit discharges and connections, including field observations, field screening, and source investigations; Training on procedures for reporting, responding to, and eliminating an illicit discharge or connection and the proper enforcement response; and

   A schedule and requirement for training at least once during the term of the permit for existing staff and within the first year of hire for new staff.

4. A procedure for IDEP evaluation and determining the overall effectiveness of IDEP.

What is a Point Source Discharge?

A Point Source Discharge (PSD) means a discharge from any discernible, confined, discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, or rolling stock where the runoff from the site is ultimately discharged to waters of the state.

What is a Point of Discharge?

A Point of Discharge (POD) is the location of a point source discharge where storm water is discharged directly into a separate storm sewer system.

What is an Illicit Connection?

An illicit connection means a physical connection to a municipal separate storm sewer system that primarily conveys non-storm water discharges other than uncontaminated groundwater into the storm sewer; or a physical connection not authorized or permitted by the local authority, where a local authority requires authorization or a permit for physical connections.

What is an Illicit Discharge?

An illicit discharge means any discharge to, or seepage into, a municipal separate storm sewer system that is not composed entirely of storm water or uncontaminated groundwater. Illicit discharges include non-stormwater discharges through pipes or other physical connections; dumping of motor vehicle fluids, household hazardous wastes, domestic animal wastes, or litter; collection and intentional dumping of grass clippings or leaf litter; or unauthorized discharges of sewage, industrial waste, restaurant wastes, or any other non-storm water waste directly into a separate storm sewer.

What are Acceptable Non-Stormwater Discharges?

Non-stormwater discharges do not need to be prohibited by the permittee unless they are identified as significant contributors of pollutants to the regulated stormwater drainage system. These non-stormwater discharges are defined as:

1) Water line flushing
2) Landscape irrigation runoff
3) Diverted stream flows
4) Rising groundwaters
5) Uncontaminated groundwater infiltration
6) Pumped groundwater (except for groundwater cleanups not specifically authorized by NPDES permits)
7) Discharges from potable water sources
8) Foundation drains
9) Air conditioning condensate
10) Irrigation water
11) Springs
12) Water from crawl space pumps
13) Footing drains
14) Lawn watering runoff
15) Water from non-commercial car washing
16) Flows from riparian habitats and wetlands
17) Residential swimming pool water and other dechlorinated swimming pool water providing any filter backwash water that is present is treated
18) Residual street wash waters
19) Discharges or flows from emergency firefighting activities

Purpose of this Protocol Manual

The purpose of this manual is to define the procedures for the IDEP plan. This manual provides the steps used to find and locate illicit connections and discharges. The primary steps are:

A. Planning
B. Preparation
C. Inventory phase fieldwork
D. Screening phase fieldwork
E. Post fieldwork
F. Source confirmation

Also discussed are notification requirements and procedures, contact information, structure numbering and health and safety issues.

Planning

Prior to beginning investigation planning, a copy of the PSD maps submitted with the permit application must be obtained. Storm sewer drainage maps should also be acquired, if available. Other valued information that may be collected, if applicable include:

- Land use maps
- Age of development
- CSO areas
- Depth of groundwater
- Areas of failing infrastructure
- Contact information

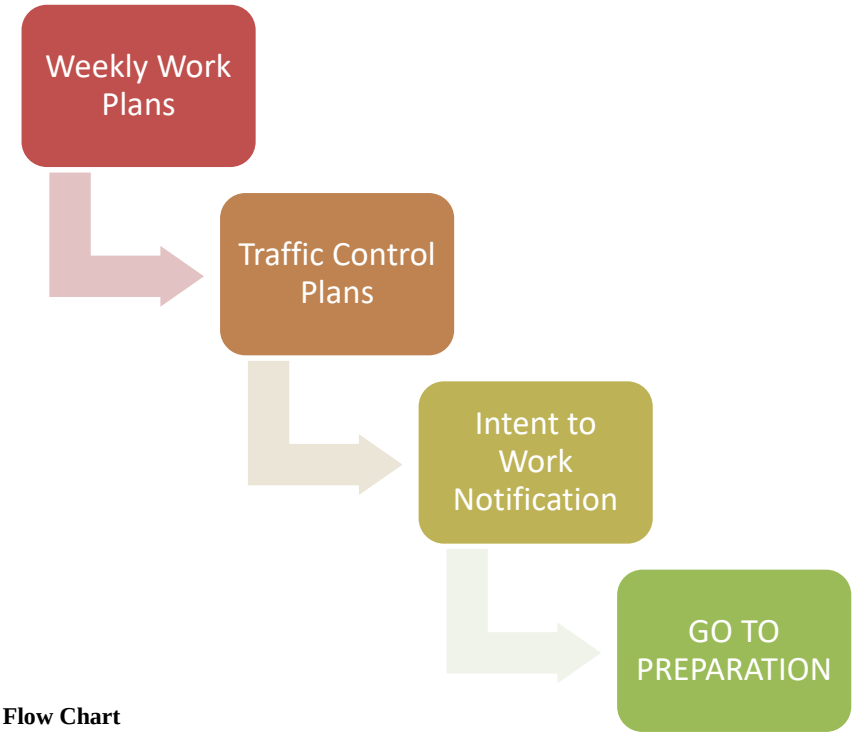


Figure 1 Planning Flow Chart

Weekly Work Plans

Weekly work plans should be developed to identify crew, PSDs or points to investigate for that day's work, and the roads where lane closures may be occurring. The weekly work plans should also remind the crew to confirm that the weather is appropriate and to check supplies.

Traffic Control Plans

Traffic Control must be conducted in accordance with the local traffic control requirements and individual company policy and procedures. Work required on the MDOT right of ways must follow the Michigan Manual of Uniform Traffic Control Devices.

Intent of Work Notification

Work conducted on MDOT right-of-ways requires the completion and submission of a "Five Day Advanced Notice" form to the MDOT Transportation Service Center five days prior to the field visit. Other jurisdictions may also have notification requirements that must be followed. If work is being conducted on private property, the landowner must also be notified. Local intent of work notifications must be followed.

The MDEQ will also be notified five days in advance of a field visit. Notification will be made via copy of the "Five-Day Advanced Notice" form or by e-mail to describe where work will be conducted on at least a monthly basis. Interim updates will be provided as needed.

Field Work Preparation

The preparation for field work includes three steps, shown in **Figure 2**.

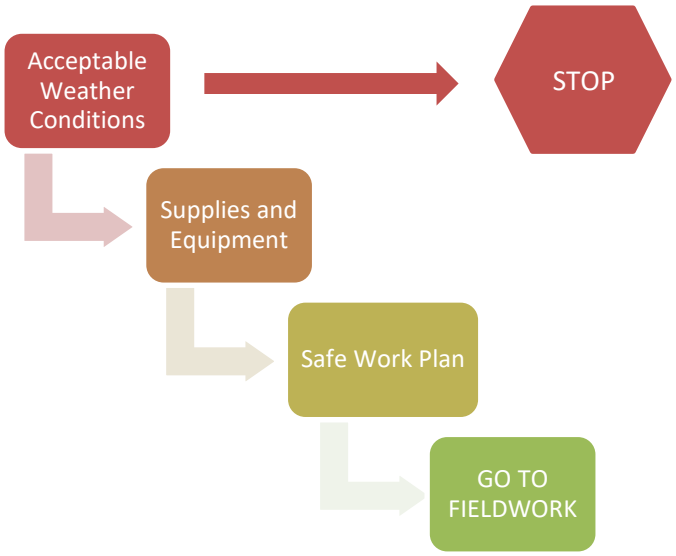


Figure 2 Preparation Flow Chart

Weather Conditions

Outfalls should be visited only during periods of dry weather to minimize the change of observing stormwater runoff in the storm sewer system. Generally, dry weather is defined as 72 hours of less than 0.10 inches of total precipitation.

Fieldwork, therefore, must be planned several days in advance based on the precipitation total and the forecast. The data should be checked prior to going into the field. This data can be obtained from www.accuweather.com.

Supplies and Equipment

Inventories of supplies and equipment should occur prior to scheduled fieldwork days to allow supply orders to be filled. A suggested list of supplies and equipment for visiting PSDs is located in Appendix A of this document.

Prior to field, the pH pen must be calibrated, and the thermometer checked. Measuring a known standard and adjusting the reading to correspond to the value of the known standard will calibrate the pH pen. The calibration instructions and procedures for using the pH pen are in **Appendix B** of this document. The thermometer should be verified daily by comparison with a certified thermometer. Each time the thermometer and pH pen are verified, the results must be recorded on a calibration log, provided in **Appendix B** of this document.

Safe Work Plan

The safety of employees during fieldwork should be a top priority. A form including safe practices for each of the tasks anticipated for the dry weather screening should be included in a safety tailgate form and a space for the signatures of employees agreeing to follow the plan should be developed prior to the start of any fieldwork.

Fieldwork- Structure Inventory

As described in **Figure 3,** upon arriving at the work site, the crew should set up traffic control devices to create a safe working environment. Once the traffic control devices are deployed, the safety plan should be reviewed and the PSD or structure to be investigated may be located and identified.

The structure inventory issued to the physical characteristics of the structure. These characteristics include, the type of structure, the size of the structure, and the number and size of conduits entering the structure. GPS coordinates for the structure will be automatically stored with each entry. Inventory data will be collected on a handheld device. An inventory should be completed for each PSD or structure visited. Only one inventory should be conducted per structure, therefore, subsequent visits will not require an inventory sheet to be completed, unless the structure has been altered.

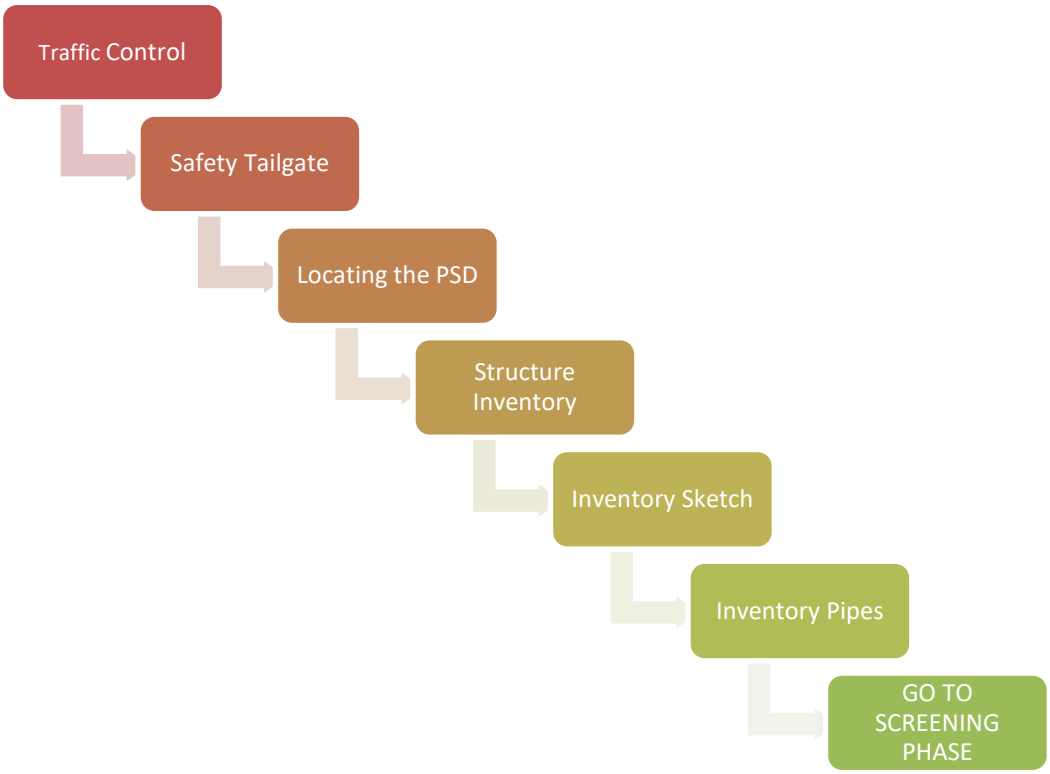


Figure 3 Fieldwork- Structure Inventory Flow Chart

Traffic Control

As specified previously, traffic control must be conducted in accordance with the local community's traffic control requirements and individual company policies and procedures. Work required on the MDOT ROW must follow the Michigan Manual of Uniform Traffic Control Devices.

Safety Tailgate

The safety of employees during fieldwork should be a top priority. The safety tailgate should begin with a review of the Safe Work Plan. All employees conducting field work should agree to the plan by signing the page. All additional site hazards identified once onsite shall be identified and documented in the safe work plan. Furthermore, if any safety incidents are identified during fieldwork, they should be documented in the Safe Work Plan.

Locating the PSD

Identifying the location of the PSD or structure in the field should be done by utilizing the PSD maps, submitted with the NPDES Phase II permit, in conjunction with municipal drainage system maps. If reliable latitude and longitude data is available, a GPS unit may be used to locate the PSD.

If a structure previously undocumented is identified and determined to be part of the MS4, then that structure should be numbered in accordance with the existing nomenclature and investigated. Likewise, structures being investigated within a PSD's drainage system should be numbered. That ID number should begin with the PSD's ID number and end with a number distinctive to that structure. A sample structure number system is provided in Appendix C of this document.

Structure Inventory

A sample inspection form to be used in the field is included in **Appendix I** of this document. Forms such as this may be created such that text and image information is available to input and edit from the field using smartphone devices. This method allows the data to be stored geo-spatially. All known and new outfalls should be added to the inventory during field inspections.

Fieldwork-Screening

Screening investigations on a PSD or pipe within a structure records physical observation, calculate flow rates, and take samples (if necessary).

Screenings may be repeated for structures if the results of previous screening suggest that an illicit connection may be present. In this scenario, a new inventory of the structure is not needed, but a new screening record must be made to show the results from that day's investigation. The observations, sample results, and flow measurements should be recorded.

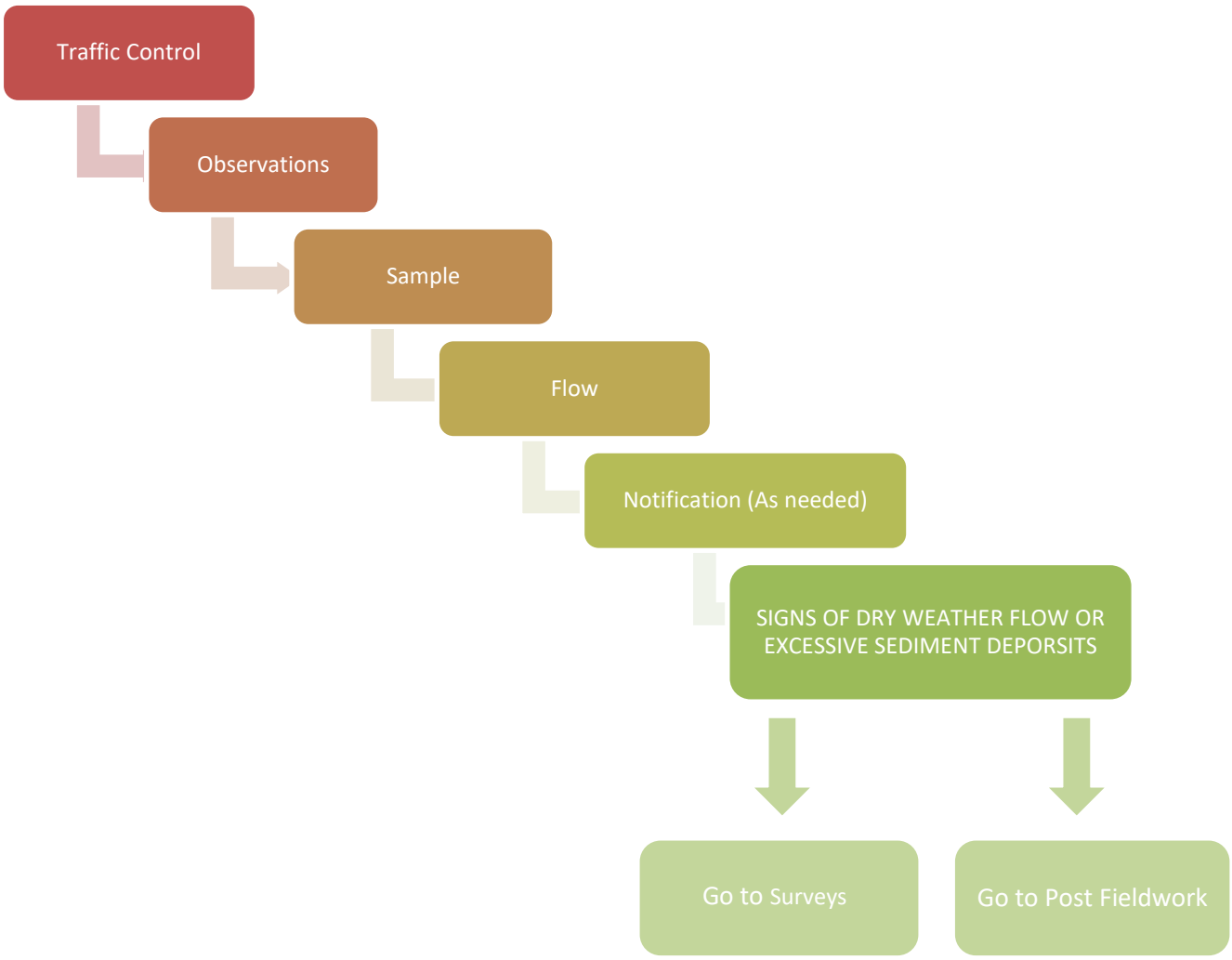


Figure 4 Fieldwork Flow Chart

Traffic Control

As previously specified, traffic control must be conducted in accordance with the local community's traffic control requirements and individual company policies and procedures. Work conducted on the MDOT right-of ways must follow the Michigan Manual of Uniform Traffic Control Devices.

Observations

Observation of a PSD or structure condition is a critical component to determining the likelihood of an illicit connection to the upstream drainage system and is the first step in field screening a site. Below is a list of observations that should be made and recorded every time a structure is visited.

Floatables

The occurrence of floatables in the storm sewer system can be one of the most defining pieces of evidence. Floatables can consist of a variety of items including oil sheens, sewage, and sanitary trash, such as toilet paper. If sewage and/or sanitary trash are observed in the storm sewer system, it is an indicator that a sanitary system is connected. Floatables may naturally occur, like those found in streams and rivers, including algae, bryozoans, pollen, and oil-like sheens, which may actually be bacteria. Additional information on naturally occurring floatables is presented in **Appendix D** of this report.

If floatables are observed in lakes or streams, an attempt to identify a relationship between these materials and nearby PSDs should be made. If it appears that the floatables are originating from a pipe or PSD, it could be a sign of an illicit discharge.

Dry Weather Flow

Dry weather flow can be a valuable observation when identifying systems with potential illicit connections and discharges. Dry weather flow is flow in the storm sewer system, even though is has not rained in several days. The presence of flow may suggest that there is an illicit connection or discharge and further investigation upstream will need to be conducted. Dry weather flow may not indicate a problem if the flow is originating from the non-stormwater discharges listed in the introduction section of this manual. If dry weather flow is not observed, other indicators as discussed below should be explored that could provide evidence of illicit connections or discharges.

If the initial field screening indicates that no flow is present yet there is evidence of toilet paper, staining, grease deposits, or excessive plant growth, it is assumed that an illicit discharge has occurred. Subsequently, further investigation of the drainage system should be conducted to identify the source of the material observed. A windshield survey should be filled out to locate any non-stormwater discharges such as lawn irrigation, car washing, and hydrant flushing.

If dry weather flow is not present, and deposit observations suggest the presence of an illicit connection then the conduit can be checked by using a sandbag which is placed so that it is blocking the lower part of the flow channel of the pipe or open channel in question. If the check is to be done in a manhole, secure the sandbag to a rope and lower into position to avoid confined space entries. For easy retrieval, secure the top of the rope to a manhole step or similar item. Sandbags should only remain in the conduit for a maximum of 1 to 2 days, and never when rain is forecasted. The site should be re-visited within 1 to 2 days looking for signs of intermittent flow, ponded water or deposits. If there is evidence of intermittent flow or deposits mentioned above, then further investigation of the stormwater sewer system should be conducted upstream until the source is isolated. This may involve repeating the sandbag method in

upstream structures. If dry weather flow or deposits are not observed in a manhole the source may be isolated in the previous sewer reach. Once the source is isolated it must be confirmed using source confirmation techniques discussed in Section G. If the source is not identified, investigations should continue until a source is found.

If there are no observations that suggest a structure has an illicit connection, but it appears as though intermittent flow is present, then the process described above should be used. If intermittent dry weather flow is present, then the system should be investigated further to identify the source. If intermittent dry weather flow is not identified then the sandbag should be removed, and report than an illicit connection is ruled out.

Odor

Strong chemical or sewage odors in a storm sewer may indicate a potential illicit connection or discharge. If odors are detected, one should look for other indicators including: floatables, dry weather flow, water color, and/or strains inside the manhole or pipes.

Foam

The occurrence of accumulations of foam in a storm sewer system may indicate an illicit connection or discharge. Form can be a natural occurrence in streams and lakes, but if the foam is concentrated around a storm sewer PSD, or appears to be originating from a PSD, it may be an indication of an illicit connection or discharge in that system. Additional information on foam is shown in **Appendix D** of this document.

Other Indicators

Other indicators, which may not be significant by themselves, can provide valuable additional evidence to the above indicators. These indicators include color, turbidity, the existence of stains or deposits, and the occurrence of excessive vegetation at the discharge point. The structural observations on the screening form are helpful for explaining sources of dry weather flow and do not necessarily indicate the presence of an illicit discharge.

Sample Collection

When dry weather flow is observed, a sample of the flow must be collected for chemical analysis. Samples of standing water should not be collected. The samples are tested at an analytical lab for fluoride, ammonia, hardness, detergents, and E-Coli. In the field, temperature and pH are taken for each sample and recorded on the screening form. Samples should be collected prior to flow measurements in order to ensure undisturbed samples. If the flow stream has a free fall discharge, the sample bottle may be held beneath the flow stream to fill the bottle. If the flow is in an open channel, a sterile disposable syringe may be used to draw a sample. If the channel cannot be reached, is too dangerous to get to or the conduit is in a manhole, a new, sterile disposable syringe with a pull string may be mounted on a grade rod or a vacuum pump sampler may be used to collect the sample. A diagram of this sampler is provided in Appendix E. In the case where a syringe with a pull string is necessary to take a sample, the following steps should be used to ensure proper sampling. A syringe should be opened and duct-taped to the end of a grade rod. The tip of the syringe must extend below the end of the rod. In order to operate the syringe, string must be tied to the pull section of the syringe and the protective cap from the syringe must be removed. To obtain a sample, lower the grade rod into the manhole with caution to avoid contact with the steps, rim, or walls or extend to the open channel. Care should be taken in collecting the water sample not to disturb sediment. Make sure the string is not twisted around the rod before pulling the string to fill the

syringe. It may take several attempts to fill the bottles, therefore, the bottles must be capped after each attempt.

A vacuum pump sampler may also be used to collect samples in areas unable to be accessed. A diagram of this type of sampler is provided in **Appendix E**. If a vacuum pump sampler is used, a new clean collection bottle must be used to collect each sample. Prior to removing the contaminated bottle and collecting a new sample, the sampler should be flushed with dry weather flow from the new sample site. Once 250-500 ml have been collected, the sampler may be considered flushed. At this point, the contaminated bottle must be removed, discarded, and replaced with a clean sterile bottle. A new sample may be collected for laboratory analysis.

Three different types of sample bottles need to be filled for each PSD location visited, if dry weather flow exists. The bacteria test sample should be taken first to reduce contamination. Next, the chemical parameter sample bottles should be taken followed by the sample measuring pH and temperature in the field.

When collecting a sample, EGLE Water Analysis Sample Collection Standards must be practiced. The EGLE Standard recommends that the bottle remain sealed until ready to collect the sample and avoid contact with the inside of cap or bottle. Make sure to fill the bottle to the bottom of the neck and that each container has the correct water analysis request form attached or in the same box as the sample bottle. Samples must be refrigerated during storage prior to shipment or delivery to the lab. Complete a chain-of-custody form for samples.

Field Testing

Temperature and pH are measured in the field immediately after the collection of a sample with a calibrated thermometer and pH pen. The calibration methods are in **Appendix B**.

Laboratory Testing

Prepared sample bottles from the laboratories are to be picked up prior to the screening activities. Water samples will be collected for both the chemical parameter tests and the microbiology tests, where possible, and sent to the respective laboratories for analysis. Samples must be kept on ice or refrigerated during storage prior to shipment or delivery to the lab. Microbiology tests have a hold time of 24 hours between the time when the sample is collected and when the sample needs to be at the laboratory, therefore, appropriate planning is needed.

Table 1 summarizes the chemical parameters being tested and corresponding bottle characteristics. Refer to the Contact Information chapter for names, addresses and phone numbers.

Table 1 Sample Parameter Information

Analyze	Test Method	Minimal Sample Size	Preservative	Hold Time
Ammonia	SM 2340C/EPA 130.2	150 mL	Sulfuric Acid (H_2S0_4)	28 days
E. Coli	EPA 340.2/300	100 mL	Thiosulfate	6 hours or as soon as possible
Fluoride	EPA 350.3	150 mL	None	28 days
Hardness	EPA 415.1/EPA 9060	150 mL	Nitric Acid (NHO_3)	6 months
Surfactant (Detergent)	SM 5540C	250 mL	None	2 days

Notes: Samples are grab samples.
A total of two bottles are to be collected for TOC per site.
Bottles are pre-prepared by the laboratory.

Flow Measurements

Dry weather flow rate measurements are intended to provide an estimate of the existing flow rate. Field crews should make an initial assessment regarding the level of effort required to estimate flows. If flow measurements require more than approximately 10 to 15 minutes to perform, a description of flow and depth measurement should be provided, or an alternate flow measurement, and/or sampling point should be identified. Flow estimates should not become the primary focus of the dry weather field screening activities. Flow measurements should be performed only after a water quality grab sample has been collected to avoid disturbing bottom sediments. The results will be recorded in the inspection form.

Three methods are outlined for estimating dry weather flow rates at field screening points. These methods include (1) measuring the time it takes to fill a bucket; (2) measuring area and velocity, and calculating flow as the cross-sectional area times the average velocity, and (3) measuring the depth, width, and slope of the channel and calculating the flow based on Manning's equation. **Appendix F** describes these flow measurement methods in more detail.

Notification

If the source to an obvious illicit connection or discharge is known (i.e. sanitary line connected to the storm sewer system), follow the procedures outlined above and immediate notify the municipality (see Notification section).

Fieldwork Surveys

The windshield survey and the catch basin survey are used to further investigate a drainage system and provide additional detail to support an action or result listed in the screening. These surveys are primarily used to identify the source of apparently inert dry weather flow or sediment. They can be used to either support an illicit, ruled-out determination or identify an illicit discharge.

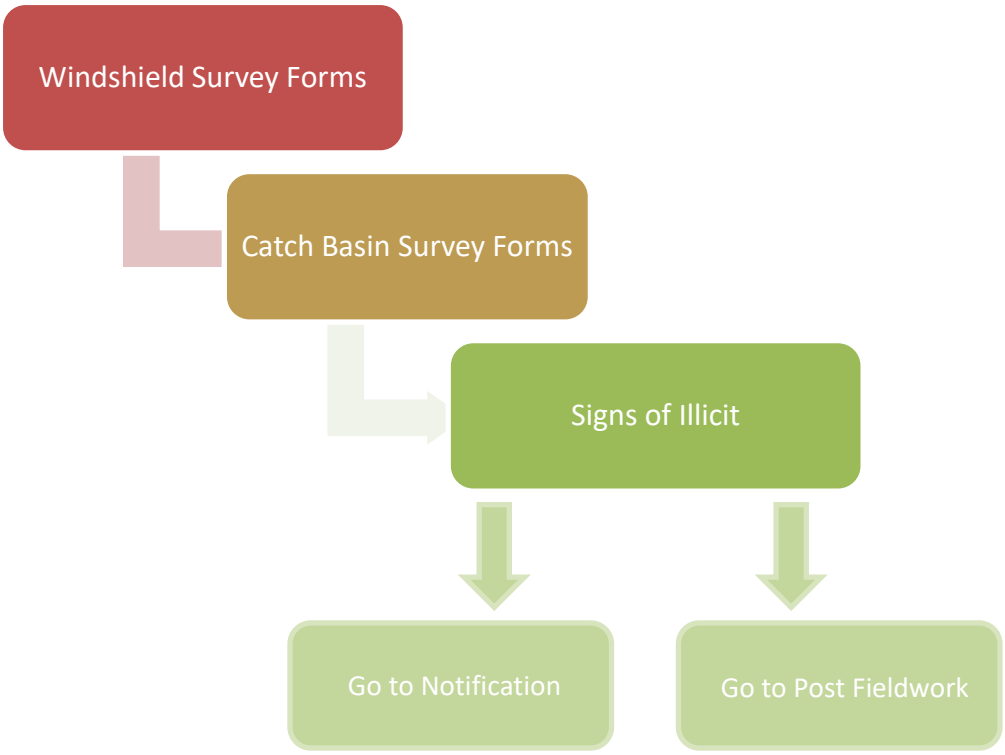


Figure 5 Fieldwork - Surveys

Windshield Survey Form

In situations where a PSD is observed to have dry weather flow, but visual observations and lab results suggest that an illicit connection is not present, further investigations should be conducted if the source of that water is unknown. Additionally, if an outfall is characterized as having excess sediment then additional investigations should be done to find the source of the sediment.

It is intended that the crew will drive through the drainage network looking for activities or conditions that are the source of the water or sediment. Such activities or conditions include lawn watering, car washing, fire hydrant flushing, non-contact cooling water, ground water, unswept streets, poorly maintained catch basins, broken pipes, and construction sites.

The purpose of the form is to document observations and thoughts throughout the drainages system that can support a result, action, or identify an illicit discharge or connection for a PSD, or individual pipe.

A windshield survey form is used to record the observations made from these additional investigations. An example of this form is shown in **Figure 6**.

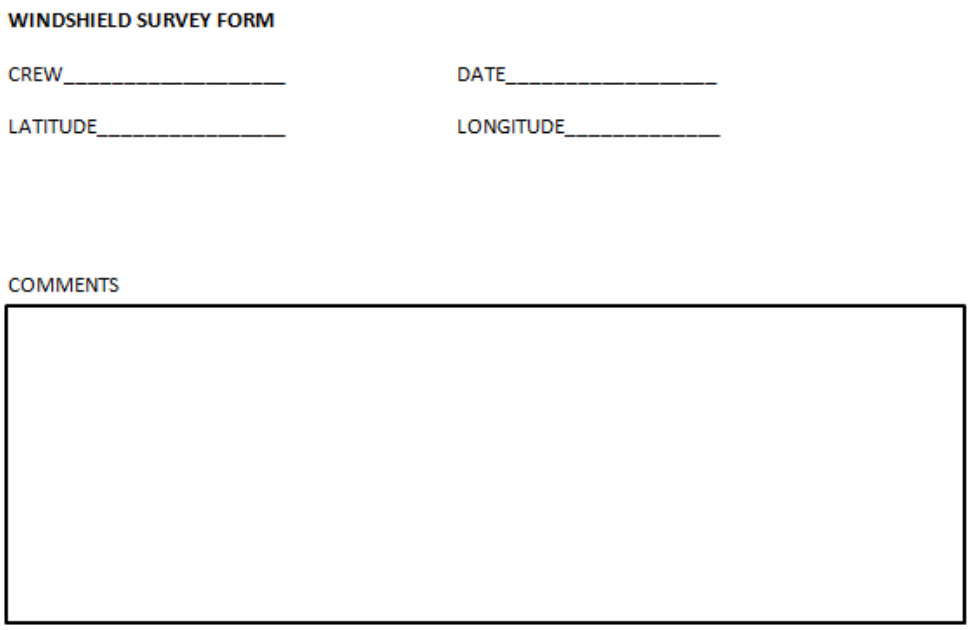


Figure 6 Windshield Survey Form

Catch Basin Survey Form

If an outfall is characterized as having excess sediment then not only should a windshield form be utilized, but a catch basin survey form, (example in **Figure 7**), should be used as well. A representative number of catch basins should be surveyed throughout the drainage system to determine if the sediment observed is a result of the lack of catch basin maintenance.

CATCH BASIN SURVEY FORM

CREW_____ DATE_____

LATITUDE_____ LONGITUDE_____

SOLIDS DEPTH _____

CASTING TO INVERT OF OUTLET PIPE_____

CASTING TO TOP OF SOLIDS_____

COMMENTS

Figure 7 Catch Basin Survey Form

Post Fieldwork

The steps Post Fieldwork are shown in **Figure 8**.

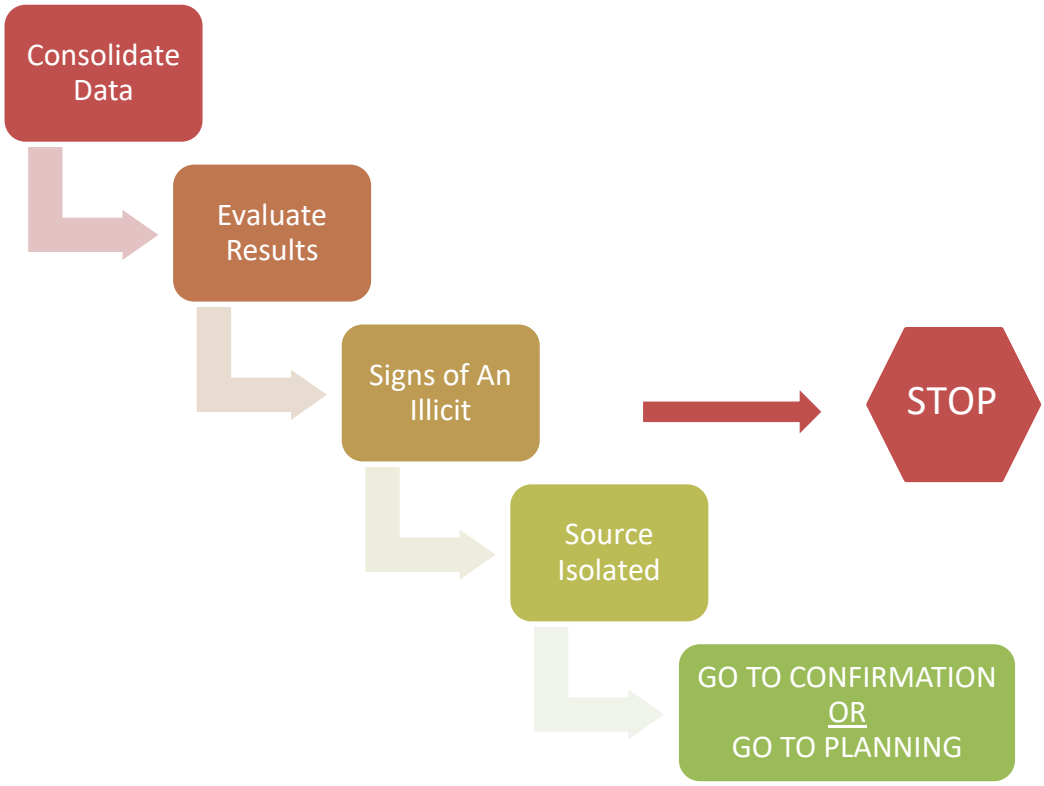


Figure 9 Post Fieldwork Flow Chart

Evaluate Results

Once the laboratory analysis is completed, the results are documented so a determination can be made regarding the likelihood of an illicit connection or discharge. **Table 2** shows the parameter cut-off limits for the chemical parameters being tested, which indicates whether the sample results are out of the "normal" range.

Table 2 Likely ranges of chemical parameters for illicit discharges

Parameter	**Illicit Likely**	**Illicit Unlikely**
Bacteriological (E.Coli)	>1000 colonies/100 mL	<1000 colonies/100 mL
Surfactants (Detergents)	>0.05 mg/L	<0.05 mg/L
Ammonia	>1.0 mg/L	<1.0mg/L
Fluoride	>0.5 mg/L	<0.5 mg/L
Water Temperature *	>Air Temp and ≤ 54°	< Air Temp and ≥ 54°
pH **	>9.0 or <6.3	<9.0 or >6.3
*See discussion of variability and assumptions provided below		

**The pH in stormwater is typically greater than 7.0, if the pH is less than 7.0 review other field observations for signs of an illicit connection.

Chemical parameters are only a portion of the decision in identifying the presence or absence of an illicit connection or discharge. The flow rate, visual observations, and the chemical results must be considered.

Temperature is a parameter that can be highly variable depending on the structure type, air temperature, solar radiation, and inputs into the system. Logic must be used when evaluating temperatures of dry weather flow. Typically, groundwater will be approximately 54 degrees. If temperatures fall below this level and air temperatures are not colder than 54 degrees, conduct further investigation. If dry weather flow temperatures are greater than outside air temperatures, conduct further investigation. Investigators should be aware of or look for sources of non-contact cooling water. If a structure is exposed to sunlight dry weather flow temperatures may exceed outside air temperatures, which may artificially suggest a potential problem. Use temperature in conjunction with observations and other parameter results to identify the presence or absence of an illicit connection or discharge.

Signs of an Illicit?

Based on the results evaluation, if an illicit connection or discharge is likely present, then further work is needed to isolate the source. **If the discharge appears to be of an emergency nature, contact the Pollution Emergency Alerting System (PEAS) at (800) 292-4706 to notify the EGLE of the emergency.** Use the windshield survey (**Figure 6**) to locate potential sources of water and sediment throughout the drainage area. If excessive sediment is a significant issue, conduct a catch basin survey (**Figure 7**) in addition to the windshield survey. If there is no indication of an illicit connection or discharge, then the investigation is closed and the Stormwater Program Manager is notified.

Source Isolated?

If the investigations results suggest that there is a potential illicit discharge within the drainage system, then follow-up investigations will be required. Tracking a potential illicit discharge through a sewer system is limited to the access points of the sewer system. Key points or confluences within the drainage area should be targeted and investigated using the methodology discussed in previous sections. Each visit to the drainage system where samples are taken, the outfall should also be investigated. Continue investigations until the problem is isolated between one or two stretches of pipe. Once the source has been isolated down to a specific reach, the work will become source confirmation.

Source Confirmation

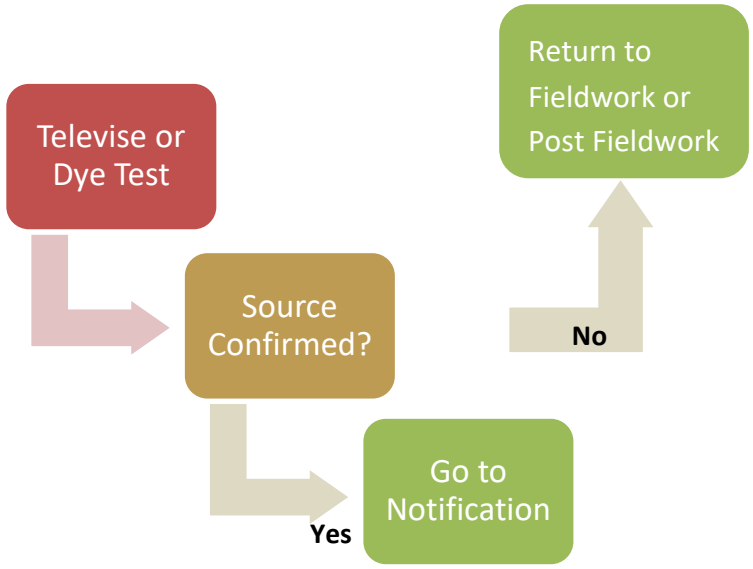


Figure 12 Source Confirmation flow chart

Televising and Dye Testing

An Illicit connection can be connected directly into the manhole or can be connected into the system between manholes, where visual observations of the illicit connection cannot be made. In these instances, televising the storm sewer line may be utilized. This method is also valuable when access to private property is not available to conduct dye testing.

Utilize dye testing to confirm the source of an illicit connection. The building owners and/or tenants must be contacted to acquire available building plans and to set up an appointment to conduct the site visit. This notification should be coordinated through the municipality. A permit must be submitted to the EGLE to obtain permission to dye test. Once the permit has been approved, the EGLE must be notified prior to dye testing and only approved dyes may be used. Additional notification to the local Health, Fire, and Police Departments may be required and should be coordinated through the local municipality.

Within two weeks of the field observation, a work plan for source investigation and response will be begun. Once complete, this work plan will be given to EGLE which outlines the plan for removal of the illicit connection or discharge. The schedule for elimination will depend on each situation.

Source Confirmed

If the source is not confirmed, additional fieldwork or dye testing will be necessary. If the source is identified, refer to the notification procedure section.

Notification

Notification of PSD

MDOT will thoroughly investigate any suspected connection within its ROW. If a probable source is determined, contact the property owner to begin a voluntary agreement to correct or eliminate the illicit connection/discharge. A drainage connection permit may be required if the discharge is allowable. The procedure for notifying the property owner and timeline for response is detailed in the Construction Permit Manual section 1512.71.

If the owner is unwilling to remove the illicit connection/discharge or the source is unknown and occurring outside of the MDOT ROW, notify the district EGLE Water Resources Division staff and the local health department as detailed in the Construction Permit Manual Section 1512.71. Provide assistance to EGLE and local authority staff as necessary.

Requirements

MDOT's statewide stormwater NPDES permit (Permit No. MI0057364) has the following requirements, under Part I, Section A, Number 2, for notification of additional PSDs identified, but not previously recorded:

Authorization from the Department is required to discharge storm water to a surface water of the state from a permittee owned or operated outfall or point of discharge identified, constructed, or installed after issuance but during the term of this permit and located within the permittee's regulated area as identified in the application. For each outfall or point of discharge identified, constructed, or installed after issuance but during the term of this permit, the permittee shall request authorization to discharge storm water by providing the following to the Department in a written request:

1. *whether the discharge is from an outfall or point of discharge;*
2. *the outfall or point of discharge identification number assigned by the permittee; the surface water of the state receiving the discharge from the outfall or point of discharge;*
3. *a certification statement that the outfall or point of discharge is within the permittee's regulated area as identified in the application;*
4. *a certification statement that the previously approved Storm Water Management Program (Part I.A.3. of this permit) includes best management practices (BMPs) to comply with the minimum requirements of the permit for the outfall or point of discharge; and*
5. *a certification statement that the previously approved Storm Water Management Program (Part I.A.3. of this permit) is being implemented in the regulated area served by the outfall or point of discharge, including having available an up-to-date storm sewer system map required in Part I.A.3.d.1) of this permit.*

Under Part I, Section A, Number 3 of the statewide permit are the minimum requirements for an illicit discharge elimination program (IDEP). These requirements are as follows:

Noncompliance Notification

Compliance with all applicable requirements set forth in the Clean Water Act, Parts 31 and 41 of the NREPA, and related regulations and rules is required. All instances of noncompliance shall be reported as follows:

Any noncompliance which may endanger health or the environment (including maximum and/or minimum daily concentration discharge limitation exceedances) shall be reported, verbally, within 24 hours from the time the permittee becomes aware of the noncompliance by calling the Department at the number 1-800-292-4706. A written submission shall also be provided via MiWaters (https://miwaters.deq.state.mi.us) within five (5) days.

The permittee shall report, in writing via MiWaters (https://miwaters.deq.state.mi.us), all other instances of noncompliance not described in a. above at the time monitoring reports are submitted; or, in the case of retained self-monitoring, within five (5) days from the time the permittee becomes aware of the noncompliance.

Reporting shall include: 1) a description of the discharge and cause of noncompliance; 2) the period of noncompliance, including exact dates and times, or, if not yet corrected, the anticipated time the noncompliance is expected to continue; and 3) the steps taken to reduce, eliminate, and prevent recurrence of the noncomplying discharge.

Untreated Sewage Discharge Notification

If untreated sewage or partially treated sewage is discharged from the drainage system, the permittee shall comply with MCL 324.3112a, including notification of the Department, the local health department, and one or more daily newspapers of general circulation within 24 hours after the discharge begins.

Illicit Removal Confirmation

Confirming the Removal of an Illicit Discharge

Once the removal of an illicit connection has been reported a follow up investigation should be conducted. The procedures should follow the methodology outlined in this manual beginning with Section D (Fieldwork—Screening) and continue until it can be reported to the Stormwater Program Manager that no illicit connection or discharge is present at that PSD.

IDEP Protocol Manual

Appendix A

Supplies and Equipment

Example Field Equipment and Supplies List

Traffic Safety

- Arrow Board
- Traffic Cones
- Safety Vest
- Truck

Inventory

- Manhole hook
- Grade Rod
- Survey Tape
- Folding Ruler
- Sledge Hammer
- Survey Wheel
- Smart Phone & Charger

Screening

- Stop Watch or Watch with Second Hand
- Water Marking Paste
- Grade Rod Fitted for Sample Removal. Disposable syringes mounted to grade rod with pull string and duct tape
- Disposable 60 mL Syringes
- pH Pen
- Thermometer
- Sample Bottles Laboratory (Automated Partial Chemistry)
- Sample Bottles from Health Department (Microbiology)
- Instrument Cleaning Supplies
- Cooler

Miscellaneous

- Camera, flash, film, 200 ASA color
- Mobile Phone and/or Pager
- Flash Light
- Mirror (for shining into manholes)
- Marking paint, case
- Storm Drainage Maps
- Phone Numbers (office staff, emergency)
- Permit to work in MDOT ROW
- Business Cards and/or Field Badge
- Metal detector
- Spray paint
- Two spades/shovels
- Truck log
- Accident/incident report form
- Insurance/registration
- Sunscreen and bug spray
- Antibacterial hand sanitizer (waterless)
- First Aid Kit
- Waders
- Fluorescent dye
- Corks, fish bobbers, etc.
- Pencils, pens, sharpener
- Daily field log to summarize activities

IDEP Protocol Manual

Appendix B

pH Pen Calibration Instructions

pH

Pocket Pal pH Tester

Range: 0-14 pH units

Procedure

1. Turn on unit
2. Remove protective cap from the bottom
3. Immerse the bottom of the Pocket Pal 1 to 3 ½ inches into the sample
4. Using the Pocket Pal, gently stir the sample for several seconds. After stirring and when the digital display stabilizes, read the pH value
5. Rinse the bottom of the Pocket Pal and replace the protective cap.
6. For faster response and longer test life, place several drops of DI water in the protective cap to prevent the glass bulb from drying out between uses.

Calibration

1. Prepare a pH 7.00 and a pH 4.00 of 10.00 buffer solution
2. Measure the pH using the tester
3. If necessary, adjust the Calibration Trimmer (small screws on back) until the reading corresponds to the pH of the buffer

Notes

- Soak the electrode tip in tap water for a few minutes each week to condition the electrode.
- If pH readings become erratic, replace the batteries
- Potassium chloride, used as a reference solution electrolyte, may deposit on the tester as a white precipitate. Although the precipitate is normal and does not affect performance, it may be removed with a damp cloth or tissue.

Calibration Log

Date	Person	Certified Thermo-meter Reading	Field Thermo-meter Reading	Thermometer ID/pH Instrument ID	Reference Standard (name and concentration)	Instrument Reading against Reference Standard		Comments
						Before Calibration	After Calibration	

IDEP Protocol Manual

Appendix C

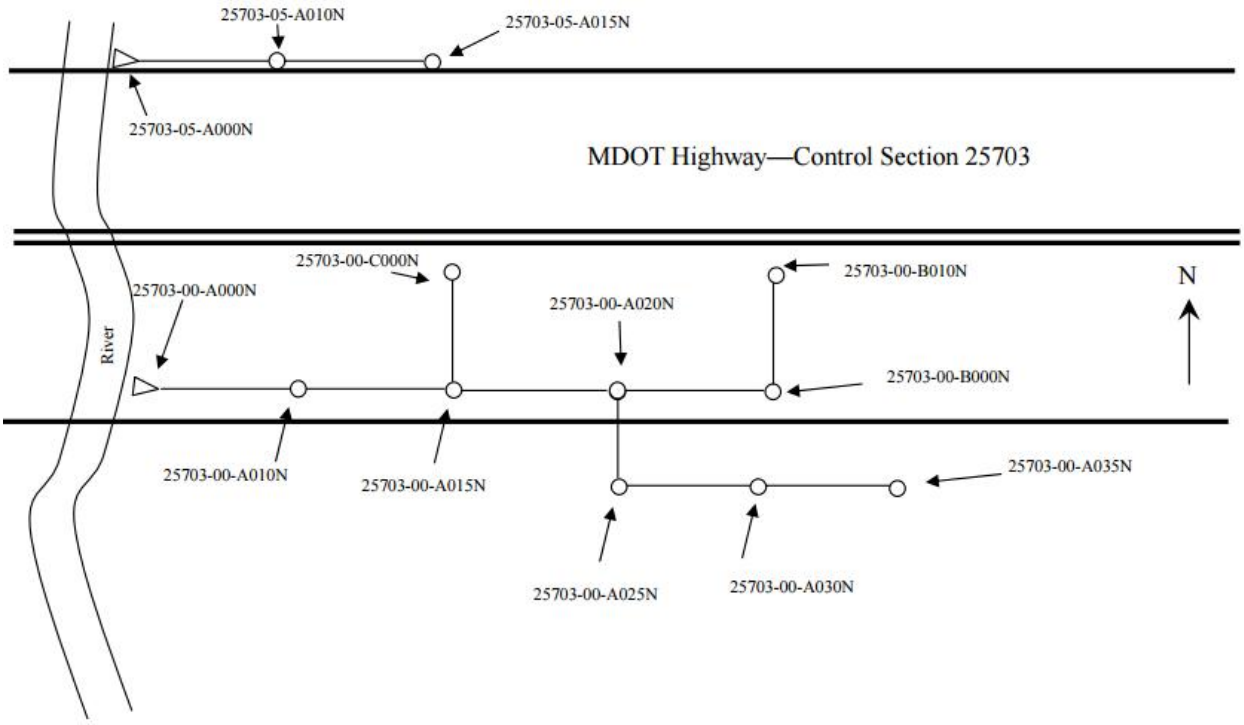
Structure Numbering

Each outfall has a unique identification number which is expressed as follows:

42072 - 01 - A000N

The first five digit number references the MDOT control section for that section of the state road. The next two to three digit number is the number assigned to the outfall, with the numbers increasing as the road stationing increases; generally in a west to east or south to north direction. In the final grouping, the first letter refers to the order of the branch in the drainage area with “A” being the primary or longest drainage branch, “B” the secondary branch and so on. The three digit number represents the structure within the drainage branch. The number increases for each structure in line in the drainage area beginning with the outfall (000). The final number letter represents whether or not the inspection site is a node. An “N” denotes a node, such as a manhole or a connection, and no notation refers to a point within an open channel.

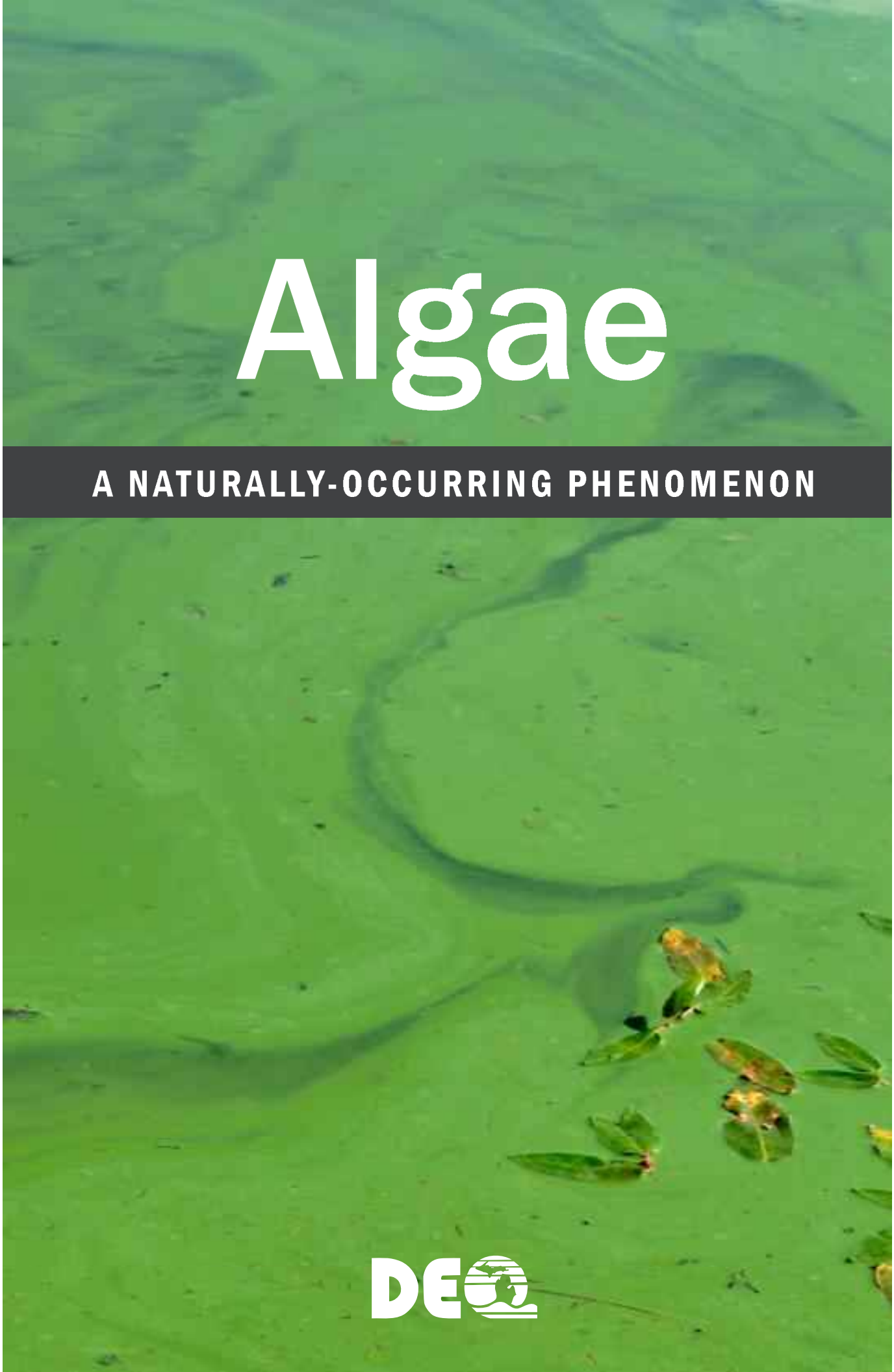
Example 1



IDEP Protocol Manual

Appendix D

MDEQ Fact Sheets



Algae

A NATURALLY-OCCURRING PHENOMENON

DEQ

Algae

A NATURALLY-OCCURRING PHENOMENON

The Department of Environmental Quality often receives complaints of the presence of scum on a lake, or that someone has dumped red, bright green, black or bluish-green paint, oil, or even antifreeze into a lake, river, or stream. This phenomenon is often due to the presence of algae rather than the discharge of some type of substance.

Algae are simple plants that live in oceans, lakes, rivers, ponds, and moist soil. Algae grow in many forms. Some are microscopic and consist of just one cell and others are made up of many cells that form strands or colonies. Algae are more simple than aquatic plants as they lack a true root, leaf, and stem system. Some algae species drift or swim, while others are attached to stones or aquatic plants in the water. All algae contain chlorophyll (a green pigment). They help purify the air and water by the process of photosynthesis.

Some algae multiply rapidly in polluted lakes and rivers. Thick layers of algae, called algal blooms, may form when nutrients (mainly phosphorus and nitrogen) build up in the water in amounts in excess of naturally-occurring nutrients. Fertilizers, pet waste, improperly functioning septic tanks, grass clippings, leaves, and other yard wastes are all sources of nutrients. The increased algae population sometimes upset the natural balance of life in water because during algae decomposition, oxygen is removed from the water and this may cause fish to die.

Algae are generally grouped according to color. The color is based upon the chlorophyll and other pigments found in the algae cells. Blooms of algae can give the water an unpleasant taste or odor, reduce clarity, and color the water body a vivid green, brown, yellow, or even red, depending on the species of algae.

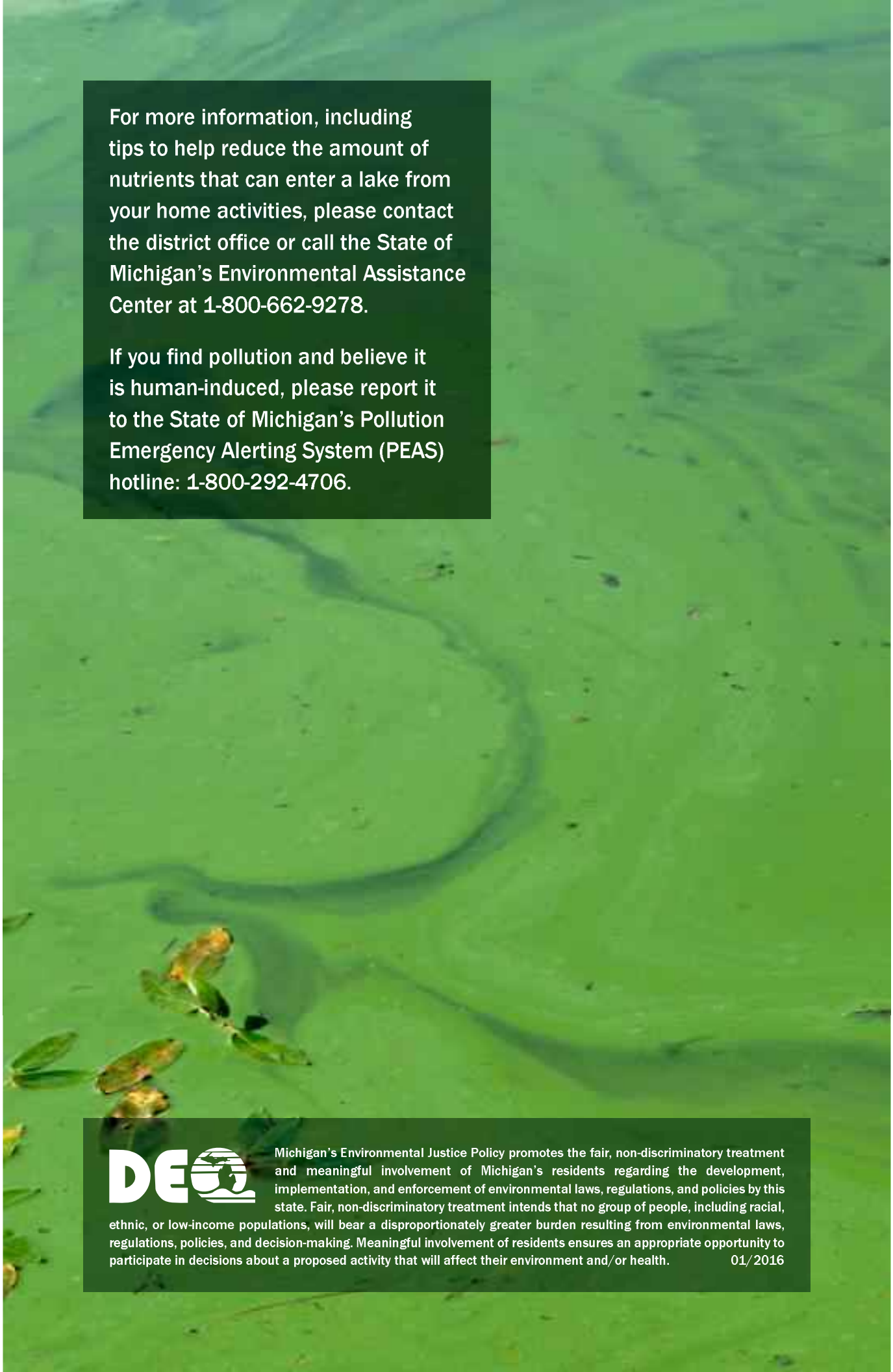
Blue-Green Algae

The cells of blue-green algae are different from the other algae. Most blue-green algae can be seen only with a microscope and often smell badly. Besides chlorophyll, they contain blue or red pigments. Although lakes with large numbers of blue-green algae usually appear blue-green in color, the combination of pigments can cause some blooms to appear reddish, brownish, or even black. Unlike other algae which use nitrogen available in the water, many blue-green algae species can use nitrogen from the air as a nutrient source. Due to this ability, blue-green algae blooms most often occur in late summer when the nitrogen in the water is often lower. A few species of blue-green algae form slippery, dark coatings on rocks along rivers and lakeshores. Some species of blue-green algae are toxic and can poison animals that drink water containing these organisms.

Notice the different color appearances due to pigments.

Green Algae

Green algae occur in fresh water in a free-floating form. Most species are microscopic and live in lakes, ponds, and streams. Large quantities of such algae may color an entire lake and appear like green paint. Green algae blooms are often found during early to mid-summer months. However, some lakes have been known to reflect a green color during a “whiting event” not related to algae bloom. This event does not produce thick surface algae mats.

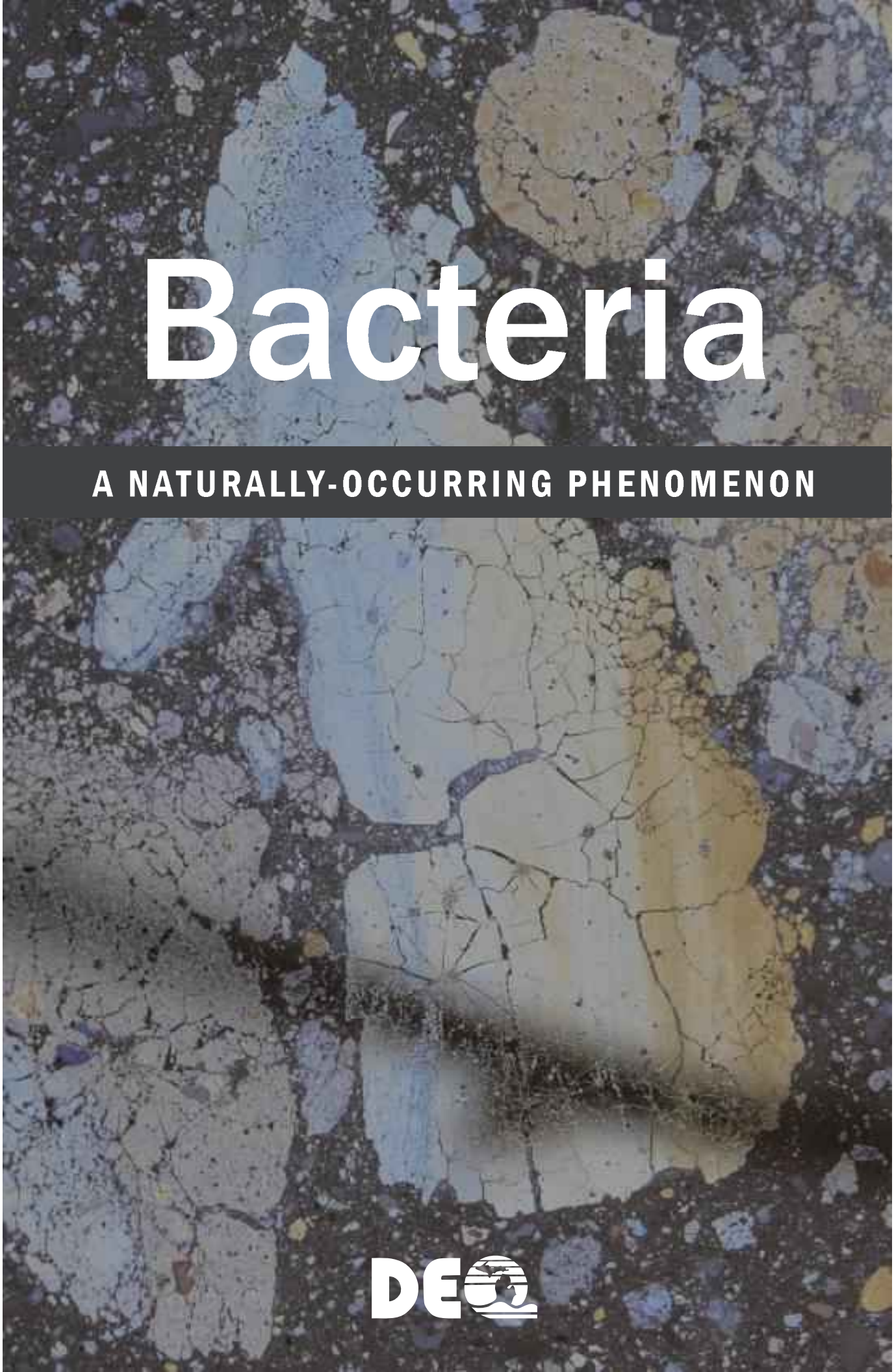


For more information, including tips to help reduce the amount of nutrients that can enter a lake from your home activities, please contact the district office or call the State of Michigan's Environmental Assistance Center at 1-800-662-9278.

If you find pollution and believe it is human-induced, please report it to the State of Michigan's Pollution Emergency Alerting System (PEAS) hotline: 1-800-292-4706.

DEQ

Michigan's Environmental Justice Policy promotes the fair, non-discriminatory treatment and meaningful involvement of Michigan's residents regarding the development, implementation, and enforcement of environmental laws, regulations, and policies by this state. Fair, non-discriminatory treatment intends that no group of people, including racial, ethnic, or low-income populations, will bear a disproportionately greater burden resulting from environmental laws, regulations, policies, and decision-making. Meaningful involvement of residents ensures an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health. 01/2016


Bacteria
A NATURALLY-OCCURRING PHENOMENON
DEQ

Bacteria

A NATURALLY-OCCURRING PHENOMENON

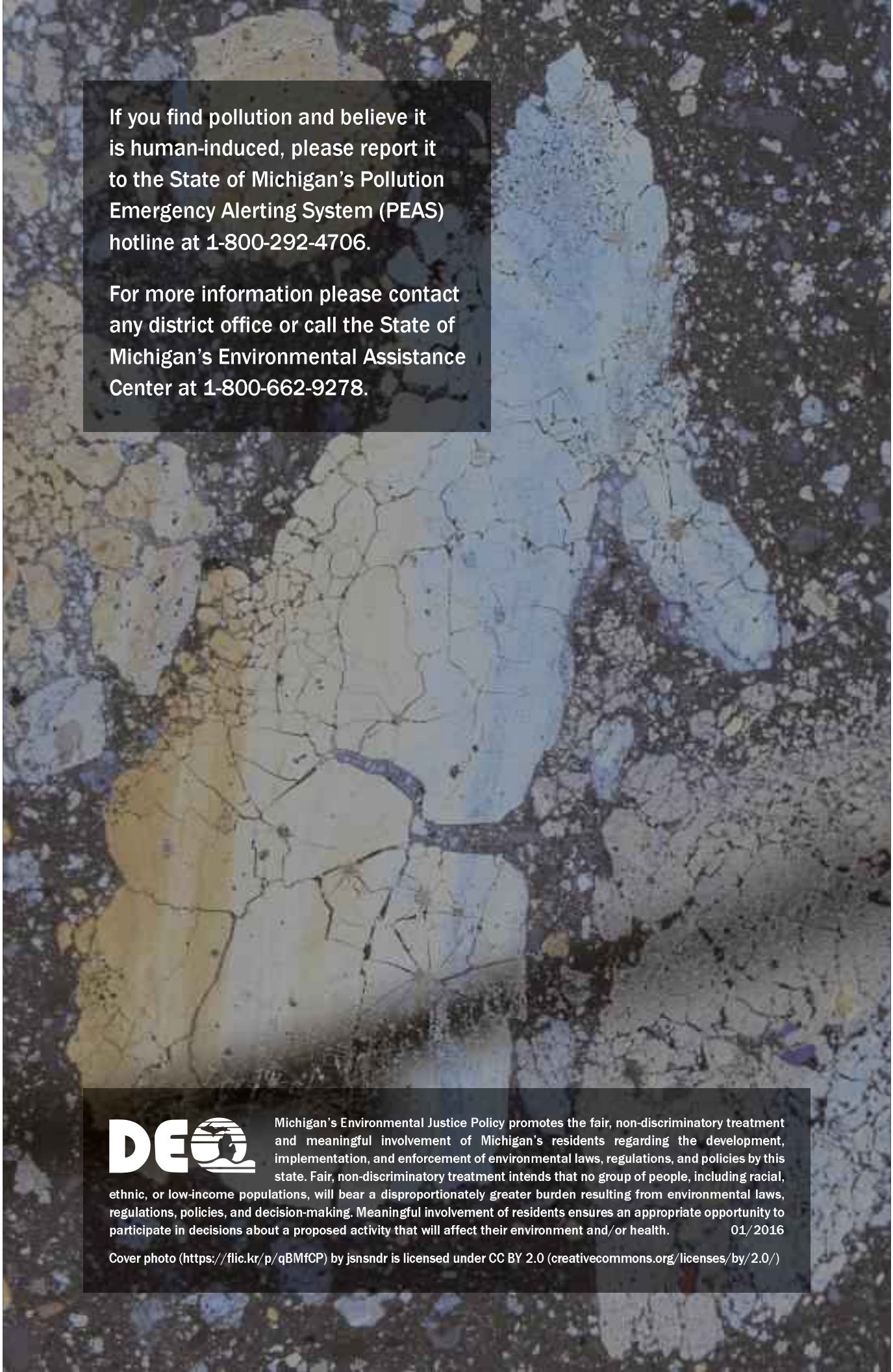
The Department of Environmental Quality often receives complaints claiming that “someone dumped paint or a rust-colored substance” or that there is an unnatural colored oil-like sheen in moist areas or in a water body. Some oil-like films, coatings, and slimes, although they may look bad, are natural phenomena. These phenomena are caused by single- celled organisms called bacteria.

Slimes, films, and rock coatings can be found anywhere that groundwater carry minerals such as iron, manganese, copper, and sulfur. Slimes, oil-like films, and rock coatings are often made by bacteria that are reacting to the presence of minerals in the water. Bacteria live in wet areas, including: on the water surface, in the water column, and in the lake sediment. Some bacteria are getting energy and some are performing other life functions by transforming minerals to different chemical forms. These bacteria are of no threat to human health and have been involved in the iron and manganese cycles for billions of years. Some bacteria are very useful because they remove harmful materials from water.

Notice the purple color (sulfur) and iron (brown)

Bacteria create oil-like films when they attach themselves to the water surface. Sunlight bounces off the films, giving them an oily appearance. To test the difference between a bacterial film and oil floating on the water, break the film. If the film stays broken, it is a natural bacterial film. If it flows back into place, it is petroleum, which indicates pollution.

Bacteria produce different color films, coatings, and slimes. Bacteria that precipitate (settle out of water as a solid) copper minerals may make turquoise blue films. Green and purple bacterial slimes may appear when sulfur is present, while white slimes occur in the presence of aluminum, sulfur, or calcium minerals. Iron bacteria produce brown or reddish-brown deposits.



If you find pollution and believe it is human-induced, please report it to the State of Michigan's Pollution Emergency Alerting System (PEAS) hotline at 1-800-292-4706.

For more information please contact any district office or call the State of Michigan's Environmental Assistance Center at 1-800-662-9278.

DEQ

Michigan's Environmental Justice Policy promotes the fair, non-discriminatory treatment and meaningful involvement of Michigan's residents regarding the development, implementation, and enforcement of environmental laws, regulations, and policies by this state. Fair, non-discriminatory treatment intends that no group of people, including racial, ethnic, or low-income populations, will bear a disproportionately greater burden resulting from environmental laws, regulations, policies, and decision-making. Meaningful involvement of residents ensures an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health. 01/2016

Bryozoan Colonies: A Naturally-Occurring Phenomena

The Department of Environmental Quality often receives complaints claiming that there are gelatinous balls, floating blobs and even "water boogers" some as large as basketballs on the lake shore or in a lake or pond. This phenomenon is due to the presence of bryozoans, also called moss animals.

Bryozoans are water animals that live in colonies made up of microscopically-connected individuals called zooids. Bryozoans are invertebrates (animals without backbones) that have a box-like or tube-shaped body, a U-shaped gut, and a cluster of tentacles to trap small particles of food. Worldwide, there are about 5,000 species of bryozoans.

Colonies of freshwater bryozoans form gelatinous ball-like masses and are commonly found in small farm ponds in water less than a meter in depth and in shallow eutrophic (nutrient enriched) lakes and open areas of swamps for brief periods. They have also been reported to wash up on shores of deep inland lakes after storms.

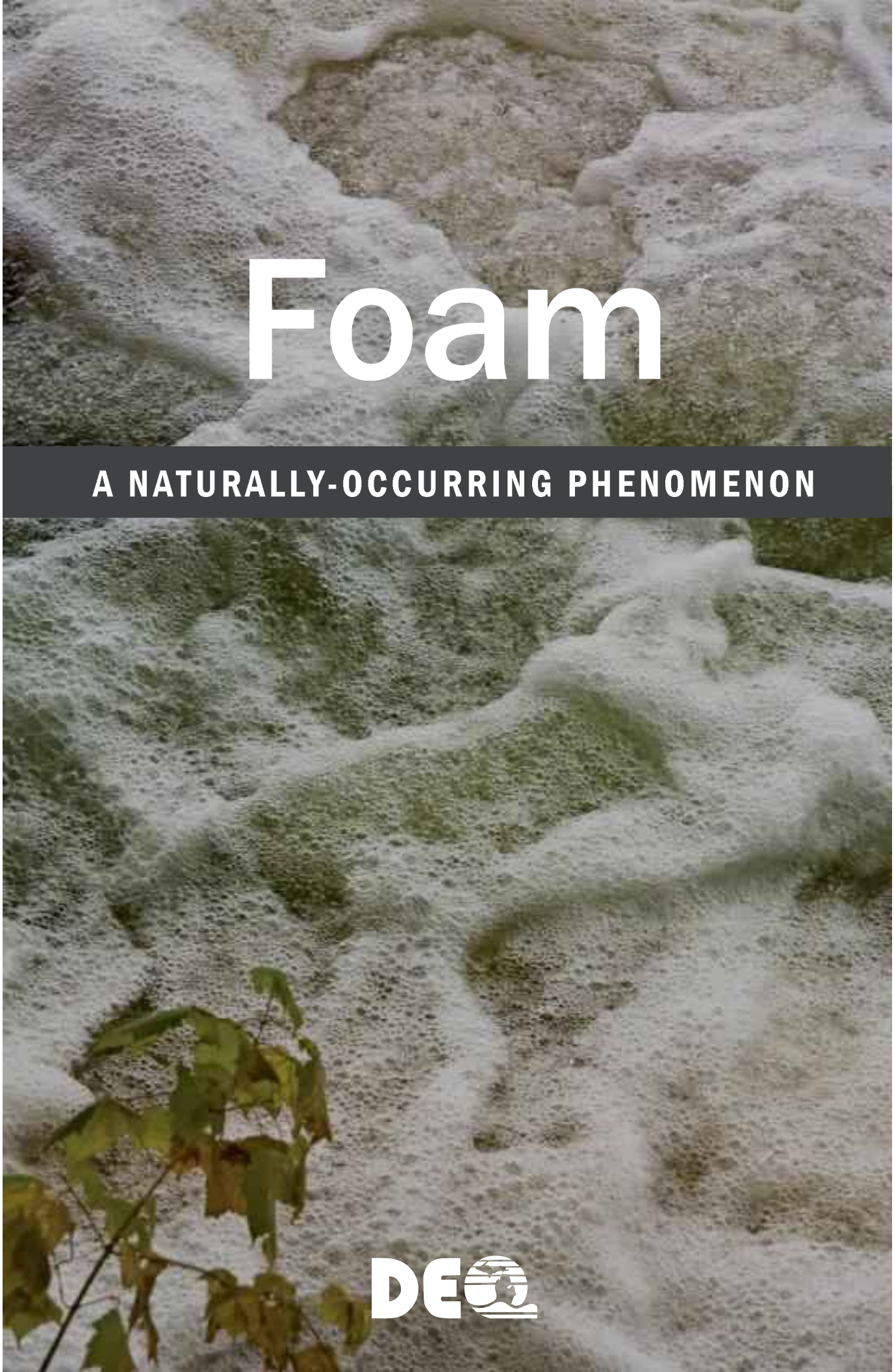
If you find pollution and believe it is human-induced, please report it to the State of Michigan's Pollution Emergency Alerting System (PEAS) hotline: 1-800-292-4706. For more information, please contact any Water Bureau district office or call the State of Michigan's Environmental Assistance Center at 1-800-662-9278.

This publication was developed through the cooperative efforts of the Environmental Science and Services Division and Water Bureau, Michigan Department of Environmental Quality, 800-662-9278.

PRINTED BY AUTHORITY OF PA 451 OF 1994
TOTAL NUMBER OF COPIES PRINTED: 6000
TOTAL COST: $454.50 COST PER COPY: $.303
DEQ Michigan Department of Environmental Quality

Bryozoan

Jennifer M. Granholm, Governor ◆ Steven E. Chester, Director



Foam

A NATURALLY-OCCURRING PHENOMENON

DEQ

Foam

A NATURALLY-OCCURRING PHENOMENON

The Department of Environmental Quality often receives complaints claiming that “someone discharged laundry detergents into the lake” or that there are suds on the river or stream. This phenomenon is often the result of natural processes, not environmental pollution. Foam can be formed when the physical characteristics of the water are altered by the presence of organic materials in the water.

The foam that appears along lakeshores is most often the result of the natural die-off of aquatic plants. Plants are made up of organic material, including oils (e.g., corn oil and vegetable oil). When the plants die and decompose, the oils contained in the plant cells are released and float to the surface. Once the oils reach the lake surface, wind and wave action pushes them to the shore. The concentration of the oil changes the physical nature of the water, making foam formation easier. The turbulence and wave action at the beach introduces air into the organically enriched water, which forms the bubbles.

Foam commonly occurs in waters with high organic content such as productive lakes, bog lakes, and in streams that originate from bog lakes, wetlands, or woody areas. Oftentimes, streams that originate from woody areas will have a brown tint in the water. The brown tint is often caused by the presence of tannin, which is a substance that gives wood its brown color. The tannin is released during the decomposition of wood along with other materials that cause foaming when they are introduced in water. It is quite common to find foam in dark-colored streams, especially during late fall and winter, when plant materials are decomposing in the water.

Naturally-occurring foam: on Stoney Creek in Southeast Michigan and on the Grand River in the Jackson area.

Some foam in water can indicate pollution. When deciding if the foam is natural or caused by pollution, consider the following:

- **Wind direction or turbulence:** Natural foam occurrences on the beach coincide with onshore winds. Often, windrows of foam can be found along a shoreline and streaks of foam may form on open waters during windy days. Natural occurrences in rivers can be found downstream of a turbulent site.
- **Proximity to a potential pollution source:** Some entities such as the textile industry, paper production facilities, oil industries, and fire fighting activities work with materials that cause foaming in water. If these materials are released to a water body in large quantities, they can cause foaming. In addition, the presence of silt in water, such as from a construction site can cause foam.
- **Composition:** Presence of decomposing plants or organic material in the water.
- **Feeling:** Natural foam is usually persistent, light, not slimy to the touch.

If you find pollution and believe it is human-induced, please report it to the State of Michigan's Pollution Emergency Alerting System (PEAS) hotline at 1-800-292-4706.

For more information please contact any district office or call the State of Michigan's Environmental Assistance Center at 1-800-662-9278.

DEQ

Michigan's Environmental Justice Policy promotes the fair, non-discriminatory treatment and meaningful involvement of Michigan's residents regarding the development, implementation, and enforcement of environmental laws, regulations, and policies by this state. Fair, non-discriminatory treatment intends that no group of people, including racial, ethnic, or low-income populations, will bear a disproportionately greater burden resulting from environmental laws, regulations, policies, and decision-making. Meaningful involvement of residents ensures an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health. 01/2016

Pollen:
A Naturally-Occurring Phenomena

Pollen from plants, especially trees like pine and cottonwood, can be found in the late spring and in summer floating on and settling in surface waters. This naturally occurring phenomenon can look like a film on the water or appear as discolored pockets in the water. Pollen has been reported to the Michigan Department of Environmental Quality as yellow paint, white paint, oil, scum, and even sludge. This phenomenon is caused by plant pollen that is distributed onto the water where it sticks and collects.

Tree pollen on and in water.

Pollen consists of tiny grains that are produced in flowering and cone-bearing plants. Pollen grains of different plant species vary in shape, size, and surface features. Most pollen grains are round or oblong and range from 15 micrometers to more than 200 micrometers wide. (Ten thousand micrometers equal one centimeter). Every grain has an outer shell, which may be smooth or wrinkled or covered with spines or knobs. This shell prevents the inner cells from drying out.

The wind has a major role in carrying pollen for plant reproduction as it blows pollen from one flower or cone to another. Plants such as maize and wheat, which are pollinated by wind, produce vast amounts of pollen–a maize plant can produce more than 18 million pollen grains. Wind pollinated plants include many trees, various crops, grasses, and nettles. The wind may carry pollen grains 90 miles or farther from the plant. On some windy days, you can actually watch the pollen being carried from trees, especially evergreens.

Some airborne particles that collect in water can indicate pollution. When deciding if the phenomenon is natural or caused by pollution, consider the following:

Pollen washing ashore.

- Time of year: allergy season (especially spring and summer) usually coincides with this phenomenon.
- Oil sheen: no oil sheen will be visible, only a film may appear.
- Staining: pollen usually will not stain porous material.
- Wind direction: pollen will be found downwind of the plant source. It will accumulate on the ground and on everything around, including cars and in mud puddles.
- Feeling of substance: pollen should feel course, not slimy to the touch.

If you find pollution and believe it is human-induced, please report it to the State of Michigan's Pollution Emergency Alerting System (PEAS) hotline at 1-800-292-4706. For more information please contact any district office or call the State of Michigan's Environmental Assistance Center at 1-800-662-9278.

Special thanks and credit to Mary Hollinger, photographer, Huntingtown, Maryland.

This publication was developed by the Michigan Department of Environmental Quality, 800-662-9278.

Pollen

DEQ

Whiting Events
(Calcium Carbonate Precipitate):
A Naturally-Occurring Phenomena

The Department of Environmental Quality often receives complaints claiming that someone dumped a white milky substance into the lake. In some lakes, a naturally-occurring phenomenon makes the color of the water change from clear blue to gray or milky white. This phenomenon is often the result of natural processes, not environmental pollution.

The cause for this whiting phenomenon is the precipitation (coming out of the water as a solid) of calcium carbonate. Calcium carbonate is a white, crystalline mineral that is widely distributed in nature and is the main ingredient in limestone, marble, coral, calcite, and chalk. Whiting events occur in lakes with very high concentrations of calcium carbonate (hard water lakes) during early summer. As the calcium carbonate precipitates, it forms chalky white clouds underwater and rains calcium carbonate on the lake bottom. When the calcium carbonate particles consolidate on the lake bottom, they form a soft rock called marl.

Marl from lake bottom (left) and calcite (large crystalline rock on right).

In the summers of 1998 and 1999, NASA's satellite captured images of a mysterious flush of color that spread across Lake Michigan (please refer to the photo on the cover). The color change was attributed to either a whiting event or an algae bloom.

Some white material in water can indicate pollution. When deciding if the milky appearance is natural or caused by pollution, consider the following:

- Proximity to a potential pollution source. Some industries such as mining, metal cutting, salt processing, and paper manufacturing have materials that can cause water to appear milky when released into the environment. A defined waste stream into the lake could indicate a pollutant source, while a sudden change of color from within the lake may indicate a whiting event.
- The time of year. Whiting events most often occur in early to mid-summer.
- A simple field test. Gather white particles by filtering some of the lake water through a fine filter. Next, place a drop of vinegar on the filtered white particles. Bubbling or fizzing will occur in the presence of calcium carbonate. This is the same reaction that would occur if you put vinegar on baking soda.

If you find pollution and believe it is human-induced, please report it to the State of Michigan's Pollution Emergency Alerting System (PEAS) hotline at 1-800-292-4706. For more information please contact any Water Bureau district office or call the State of Michigan's Environmental Assistance Center at 1-800-662-9278.

Special thanks and credit to Larry Bean, rock collector, Livonia, Michigan.

This publication was developed through the cooperative efforts of the Environmental Science and Services Division and Water Bureau, Michigan Department of Environmental Quality, 800-662-9278.

Printed by a GREAT PRINTER

Printed on Recycled Paper

PRINTED BY AUTHORITY OF PA 451 OF 1994
TOTAL NUMBER OF COPIES PRINTED: 6000
TOTAL COST: $454.50 COST PER COPY: $.303
DEQ Michigan Department of Environmental Quality

Whiting Events

DEQ

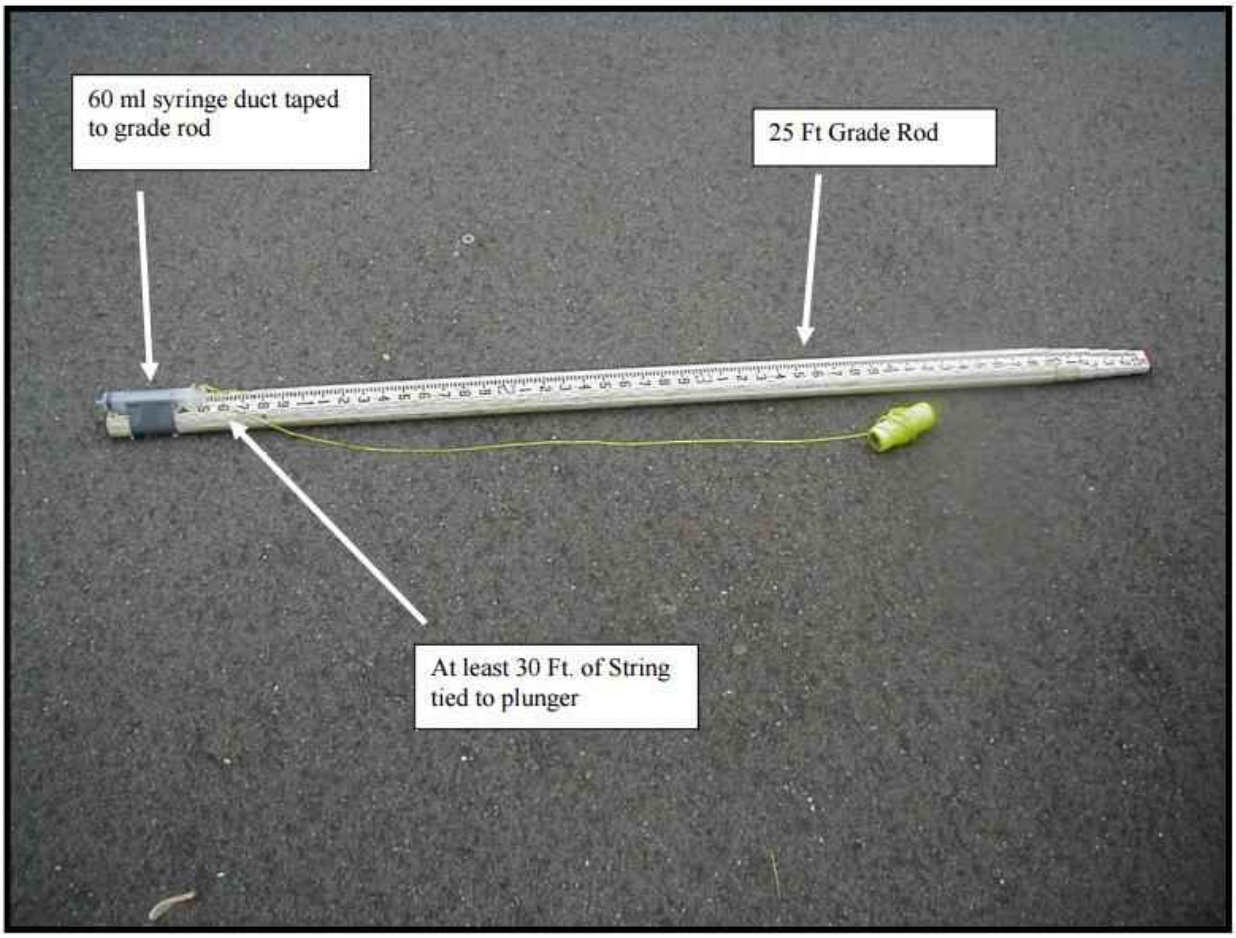
Jennifer M. Granholm, Governor ◆ Steven E. Chester, Director

IDEP Protocol Manual

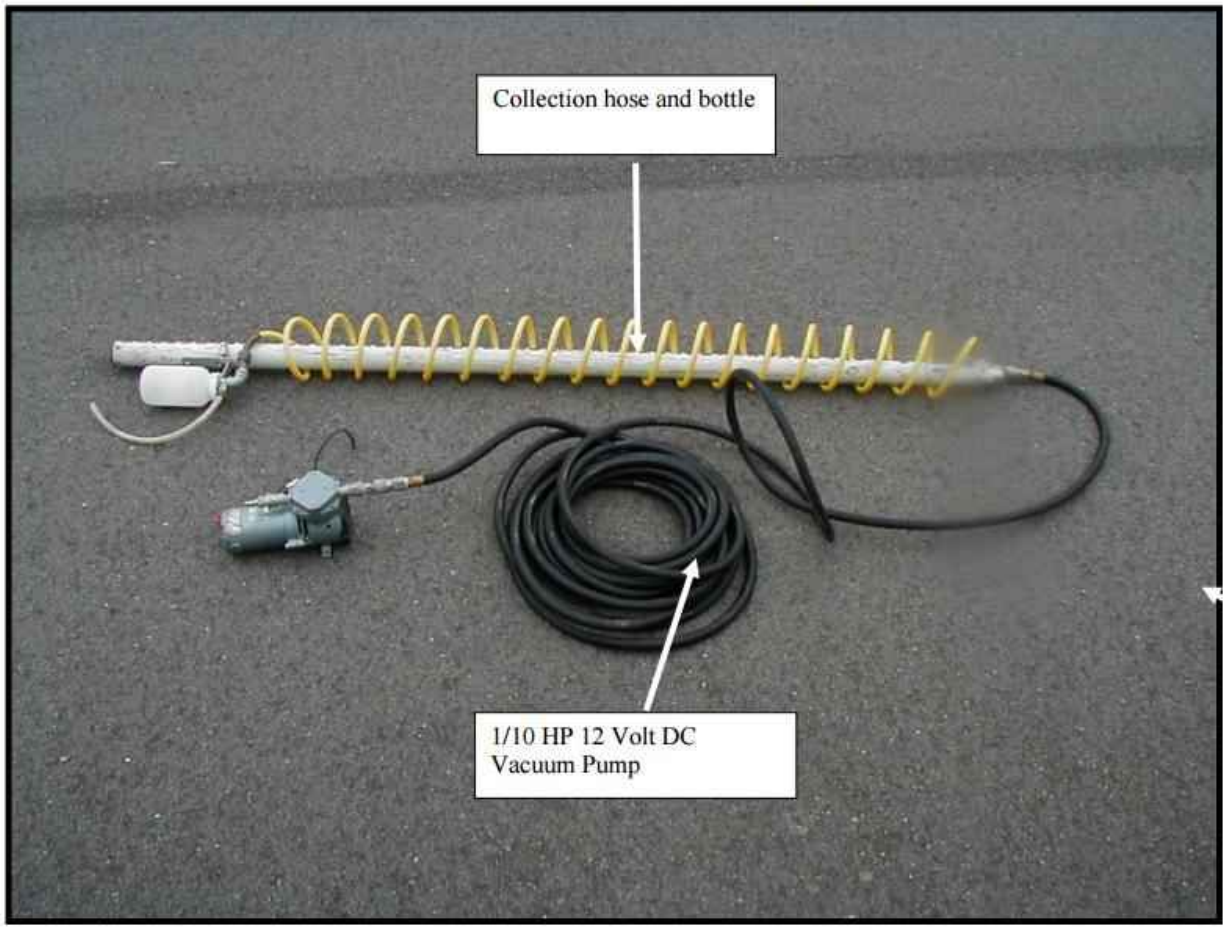
Appendix E

Sample Schematics

SYRINGE SAMPLER



VACUUM PUMP SEWER SAMPLER



IDEP Protocol Manual

Appendix F

Flow Measurement Methods

Bucket Method

This method is typically limited to locations where there is free fall of water at the discharge point. The free fall must be high enough and concentrated along a narrow area so that a calibrated container can be positioned to collect the flow.

Equipment Needed:

1. Wide mouthed container(s) (bucket) graduated in known volume increments.
2. Stopwatch.

Procedure:

1. Place container under flow discharge point so that entire flow is collected.
2. Measure the time it takes to fill the bucket to a known volume.
3. Record the time duration and the volume.
4. Repeat Steps 1 through 3 at least once. Repeat steps at least twice, if the results vary by more than 20 percent.
5. Calculate the average time.
6. Compute the flow rate as follows: (Calculations to be done in the office). Q = V/t where: Q = flow rate V = volume t = time required
7. Convert the calculated flow rate to liters per second.

Area/Velocity Method

The second method for estimating flow requires channel measurements. The cross-sectional area of the flowing water and velocity must be estimated. This method should be used to estimate flow rates in pipes or channels where a significant, measurable, or steady velocity is observed and cross-sectional measurements can be readily obtained. The channel measurements can be fairly accurately measured for pipes of a known diameter. However, open channel measurements will generally rely on estimates of a top and bottom width. Velocity measurements will be performed using floats and a stopwatch. Channel pipe flow calculations will be performed in the office.

Equipment Needed:

1. Depth Measurement Rod.
2. Tape Measure.
3. Float(s). These might include corks, fishing bobbers, wooden sticks, sticks and leaves, Cheerios, orange peel, or popcorn. If the float is not recoverable, then only objects that are non-objectionable in streams should be used.
4. Stopwatch.

Procedure:

1. Locate a relatively uniform section of the channel/pipe between 3 to 10 feet long.
2. Mark off a known length of the channel/pipe using available objects, such as rocks or sticks. If the site is at a manhole, the diameter (typically 4 feet) of the manhole can be used as the travel

length. If the PSD location is at the end of a pipe and the PSD is accessible, a yardstick can be placed into the pipe or measure the length of a pipe section with a tape measure or folding ruler.

3. Use the stopwatch to measure the time required in seconds for a float to travel the marked off distance. If conditions are windy, it is desirable to have a float that is partially submerged. The float can be inserted upstream and timed as it passes the starting point. If swirls or eddies are observed, or if the flow depth is not very deep, this technique may not be applicable.
4. Step No. 3 should be repeated at least twice. If the velocity measurements vary by more than 20 percent a fourth measurement should be performed. The measurements should be averaged after dropping outliers.
5. Measurements to calculate the cross-sectional area of the discharge should be obtained. For flow in a pipe, measure the depth of flow and the size of the pipe (if the pipe is other than round, sufficient measurements are needed to fully describe the shape of the pipe). For flow in a natural channel, measure the depth of flow, the bottom width of the channel, and the width of the channel at the flow surface.
6. Calculate the cross-sectional area of the flow. Calculations are to be done in the office. The following equations or (for partially filled circular pipes) may be used.
    - Rectangular Pipes: area = width * depth
    - Trapezoidal Channels: area = (top width + bottom width)/2 * depth
    - Circular Pipes :

$$A = \frac{d^2}{4}(\theta - \sin(\theta) * \cos(\theta))$$

$$\theta = cos^{-1}\left(1 - \frac{2y}{d}\right) * \frac{\pi}{180}$$

    - where: A = Area
    - d = diameter of pipe
    - y = depth of flow

7. Calculate the flow rate and express the result in units of liters per second. Calculations are to be done in the office. Flow = Area * Velocity

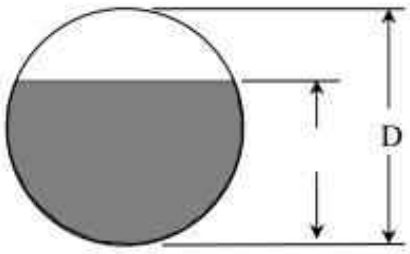
Table F-1 Area of Partial Filled Round Pipe

Diameter(in)	8	10	12	15	18	24	27	30	36	42	48	54	60
Diameter(ft)	0.67	0.83	1.0	1.3	1.5	2.0	2.3	2.5	3.0	3.5	4.0	4.5	5.0
Depth (ft)	Area (sf)												
0.05	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03
0.10	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09
0.15	0.06	0.07	0.07	0.08	0.09	0.11	0.11	0.12	0.13	0.14	0.15	0.16	0.17
0.20	0.09	0.10	0.11	0.13	0.14	0.16	0.17	0.18	0.20	0.22	0.23	0.25	0.26
0.25	0.12	0.14	0.15	0.17	0.19	0.23	0.24	0.26	0.28	0.31	0.33	0.35	0.37
0.30	0.15	0.18	0.20	0.23	0.25	0.30	0.32	0.33	0.37	0.40	0.43	0.46	0.48
0.40	0.22	0.26	0.29	0.34	0.38	0.45	0.48	0.51	0.56	0.61	0.65	0.70	0.74
0.50	0.28	0.34	0.39	0.46	0.52	0.61	0.66	0.70	0.77	0.84	0.91	0.97	1.02
0.60	0.33	0.42	0.49	0.58	0.66	0.79	0.85	0.91	1.01	1.10	1.18	1.26	1.33
0.70		0.49	0.59	0.71	0.81	0.98	1.06	1.13	1.25	1.37	1.48	1.58	1.67
0.80		0.54	0.67	0.83	0.96	1.17	1.27	1.35	1.51	1.66	1.79	1.91	2.03
0.90			0.74	0.95	1.11	1.37	1.49	1.59	1.78	1.96	2.12	2.26	2.40
1.00			0.79	1.05	1.25	1.57	1.71	1.83	2.06	2.27	2.46	2.63	2.80
1.10				1.14	1.39	1.77	1.93	2.08	2.35	2.59	2.81	3.01	3.20
1.20				1.21	1.52	1.97	2.16	2.33	2.64	2.92	3.17	3.40	3.62
1.30					1.63	2.16	2.38	2.58	2.94	3.25	3.54	3.81	4.06
1.40					1.72	2.35	2.60	2.83	3.23	3.59	3.92	4.22	4.50
1.50					1.77	2.53	2.82	3.08	3.53	3.94	4.30	4.64	4.95
1.60						2.69	3.02	3.32	3.83	4.29	4.69	5.07	5.42
1.70						2.85	3.22	3.55	4.13	4.64	5.09	5.50	5.89
1.80						2.98	3.41	3.78	4.43	4.99	5.48	5.94	6.36
1.90						3.08	3.58	4.00	4.72	5.33	5.88	6.38	6.85
2.00						3.14	3.73	4.21	5.01	5.68	6.28	6.83	7.33
2.10							3.86	4.40	5.29	6.03	6.68	7.28	7.83
2.20							3.95	4.58	5.56	6.37	7.08	7.73	8.32
2.30								4.72	5.82	6.70	7.48	8.18	8.82
2.40								4.84	6.06	7.03	7.87	8.63	9.32
2.50								4.91	6.29	7.35	8.26	9.07	9.82
2.60									6.51	7.66	8.65	9.52	10.32
2.70									6.70	7.96	9.02	9.96	10.82
2.80									6.87	8.25	9.40	10.40	11.31

Diameter(in)	8	10	12	15	18	24	27	30	36	42	48	54	60
2.90									7.00	8.52	9.76	10.84	11.81
3.00									7.07	8.78	10.11	11.26	12.30
3.10										9.01	10.45	11.68	12.79
3.20										9.22	10.78	12.10	13.27
3.30										9.40	11.09	12.50	13.75
3.40										9.54	11.38	12.89	14.22
3.50										9.62	11.66	13.27	14.68
3.60											11.91	13.64	15.13
3.70											12.14	13.99	15.58
3.80											12.33	14.33	16.01
3.90											12.48	14.64	16.43
4.00											12.57	14.94	16.84
4.10												15.21	17.23
4.20												15.45	17.61
4.30												15.65	17.96
4.40												15.82	18.30
4.50												15.90	18.61
4.60													18.90
4.70													19.15
4.80													19.37
4.90													19.54
5.00													19.63

Table F-2 Area and Hydraulic Radius for Various Flow Depths

y/D	A/D^2	R/D	y/D	A/D^2	R/D	y/D	A/D^2	R/D
0.01	0.0013	0.0066	0.36	0.2546	0.1978	0.71	0.5964	0.2975
0.02	0.0037	0.0132	0.37	0.2642	0.2020	0.72	0.6054	0.2987
0.03	0.0069	0.0197	0.38	0.2739	0.2062	0.73	0.6143	0.2998
0.04	0.0105	0.0262	0.39	0.2836	0.2102	0.74	0.6231	0.3008
0.05	0.0147	0.0326	0.40	0.2934	0.2142	0.75	0.6319	0.3017
0.06	0.0192	0.0389	0.41	0.3032	0.2182	0.76	0.6405	0.3024
0.07	0.0242	0.0451	0.42	0.3130	0.2220	0.77	0.6489	0.3031
0.08	0.0294	0.0513	0.43	0.3229	0.2258	0.78	0.6573	0.3036
0.09	0.0350	0.0575	0.44	0.3328	0.2295	0.79	0.6655	0.3039
0.10	0.0409	0.0635	0.45	0.3428	0.2331	0.80	0.6736	0.3042
0.11	0.0470	0.0695	0.46	0.3527	0.2366	0.81	0.6815	0.3043
0.12	0.0534	0.0755	0.47	0.3627	0.2401	0.82	0.6893	0.3043
0.13	0.0600	0.0813	0.48	0.3727	0.2435	0.83	0.6969	0.3041
0.14	0.0668	0.0871	0.49	0.3827	0.2468	0.84	0.7043	0.3038
0.15	0.0739	0.0929	0.50	0.3927	0.2500	0.85	0.7115	0.3033
0.16	0.0811	0.0986	0.51	0.4027	0.2531	0.86	0.7186	0.3026
0.17	0.0885	0.1042	0.52	0.4127	0.2562	0.87	0.7254	0.3018
0.18	0.0961	0.1097	0.53	0.4227	0.2592	0.88	0.7320	0.3007
0.19	0.1039	0.1152	0.54	0.4327	0.2621	0.89	0.7384	0.2995
0.20	0.1118	0.1206	0.55	0.4426	0.2649	0.90	0.7445	0.2980
0.21	0.1199	0.1259	0.56	0.4526	0.2676	0.91	0.7504	0.2963
0.22	0.1281	0.1312	0.57	0.4625	0.2703	0.92	0.7560	0.2944
0.23	0.1365	0.1364	0.58	0.4724	0.2728	0.93	0.7612	0.2921
0.24	0.1449	0.1416	0.59	0.4822	0.2753	0.94	0.7662	0.2895
0.25	0.1535	0.1466	0.60	0.4920	0.2776	0.95	0.7707	0.2865
0.26	0.1623	0.1516	0.61	0.5018	0.2799	0.96	0.7749	0.2829
0.27	0.1711	0.1566	0.62	0.5115	0.2821	0.97	0.7785	0.2787
0.28	0.1800	0.1614	0.63	0.5212	0.2842	0.98	0.7816	0.2735
0.29	0.1890	0.1662	0.64	0.5308	0.2862	0.99	0.7841	0.2666
0.30	0.1982	0.1709	0.65	0.5404	0.2881	1.00	0.7854	0.2500
0.31	0.2074	0.1756	0.66	0.5499	0.2900			
0.32	0.2167	0.1802	0.67	0.5594	0.2917			
0.33	0.2260	0.1847	0.68	0.5687	0.2933			
0.34	0.2355	0.1891	0.69	0.5780	0.2948			
0.35	0.2450	0.1935	0.70	0.5872	0.2962			



Manning's Equation

Manning's equation can be used under certain circumstances to provide an estimate of the flow rate without velocity measurements. Manning's equation requires measurements of the channel cross-section, depth of flow, and slope of the channel, and a roughness coefficient, n, must be estimated. Manning's equation should only be used where the cross-section of the channel or pipe is uniform, the slope and roughness of the channel can be estimated, where measurements are taken at the upstream end of a uniformly sloping channel, and where flow discharges freely with no backwater or impoundment due to a downstream condition. Slope of the channel should either be taken off as-builts or should be surveyed.

Equipment Needed:

1. Tape measure and/or depth measuring rod.

Procedure:

1. Measurements to calculate the cross-sectional area of the discharge should be obtained. For flow in a pipe, measure the depth of flow and the size of the pipe (if the pipe is other than round, sufficient measurements are needed to fully describe the shape of the pipe). For flow in a natural channel, measure the depth of flow, the bottom width of the channel, and the width of the channel at the flow surface.
1. Additional observations should include information to determine Manning's roughness coefficient. If possible, photographs should be taken of channel to help select the Manning roughness coefficients.
2. Calculate flows using the Manning equation. Calculations are to be done in the office. The Manning equation is:

$$Q = \frac{cl}{n} * A^{\frac{5}{3}} * P_w^{-\frac{2}{3}} * \sqrt{S}$$

Rectangular Channels

$$A = by$$

$$P_{w=} b + 2y$$

Trapezoid Channels

$$A = \frac{y(b + B)}{2}$$

$$P_w = b + 2\sqrt{y^2 + \left(\frac{B - b}{2}\right)^2}$$

Circular Channels

$$A = \frac{d^2}{4}(\theta - \sin(\theta) * \cos(\theta))$$

$$P_w = \theta d$$

$$\theta = cos^{-1}\left(1 - \frac{2y}{d}\right) * \frac{\pi}{180}$$

Where:

Q= flow (fps)

c1= 1.0 for cms, 1.39 for cfs

n= Manning's roughness coefficient

A=Area (square feet)

$P_{w=}$ Wetted Perimeter (ft)

S = Channel Slope (ft/ft)

y = depth of water (ft)

d= diameter (ft)

b = bottom width (ft)

B= top width (width at water surface) (ft)

Table F-3 Typical Manning's Roughness Coefficient Values

Description	n
A. Closed Conduits Flowing Partly Full	
Cast Iron	
Coated	0.013
Uncoated	0.014
Corrugated Metal	
Subdrain	0.019
Storm drain	0.024
Concrete	
Culvert	0.013
Sewer	0.014
Clay	
Vitrified sewer	0.013
B. Lined or Built-up Channels	
Concrete	
Trowel Finish	0.013
Float Finish	0.015
Finished, with gravel on bottom	0.017
Unfinished	0.017
Concrete bottom float finished with sides of	
Dressed stone in mortar	0.017
Random stone in mortar	0.020
Cement rubble masonry	0.025
Gravel bottom with sides of	
Formed concrete	0.020
Random stone in mortar	0.023
Dry rubble or rip-rap	0.033
Asphalt	
Smooth	0.013
Rough	0.016
C. Excavated or Dredged	
Earth, straight and uniform	
Clean, recently completed	0.018
Clean, after weathering	0.022
Gravel, uniform section, clean	0.025
With short grass, few weeds	0.027
Earth, winding and sluggish	
No vegetation	0.025
Grass, some weeds	0.030
Dense weeds or aquatic plants in deep channels	0.035
Earth bottom and rubble sides	0.030
Stony bottom and weedy banks	0.035
Cobble bottom and clean sides	0.040
Channels not maintained, weeds and brush uncut	
Dense weeds, high as flow depth	0.080
Clean bottom, brush on sides	0.050

Source: Open-Channel Hydraulics by Ven Te Chow, Ph.D. 1959

IDEP Protocol Manual

Appendix G

Contact Information

The following contact information is offered for this project.

Name	**Contact Information**	**Responsibilities**
Chris Potvin	Michigan Department of Transportation 425 W Ottawa St Lansing, MI 48933 517-225-2171	MDOT Stormwater Program Manager, Primary MDOT Contact
Dan DeVaun	AECOM 10850 Traverse Highway, Suite 3365 Traverse City, MI 49684 231-932-7592	Senior Water Resources Engineer, Primary AECOM Contact

IDEP Protocol Manual

Appendix H

Material Safety Data Sheet

Material Safety Data Sheet

Section 1. Product and Company Identification

Product Name **Nitric Acid**

Product Code NX0409

Manufacturer EM Science
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Effective Date **3/22/2002**

For More Information Call

856-423-6300 Technical Service
Monday-Friday: 8:00 AM - 5:00 PM

In Case of Emergency Call

800-424-9300 CHEMTREC (USA)
613-996-6666 CANUTEC (Canada)
24 Hours/Day: 7 Days/Week

Synonym None.

Material Uses Laboratory Reagent

Chemical Family Inorganic acid.

Section 2. Composition and Information on Ingredients

Component	CAS #	% by Weight
NITRIC ACID	7697-37-2	100

+Section 3. Hazards Identification

Physical State and Appearance Liquid. (Yellowish.)

Emergency Overview

DANGER !
POISON !
STRONG OXIDIZER.
CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE.
VAPOR REDUCES OXYGEN AVAILABLE FOR BREATHING.
MAY BE FATAL IF INHALED OR SWALLOWED.
CAUSES SEVERE RESPIRATORY TRACT, EYE AND SKIN BURNS.
CAUSES DAMAGE TO THE FOLLOWING ORGANS: LUNGS, MUCOUS MEMBRANES, RESPIRATORY TRACT, SKIN, EYE, LENS OR CORNEA, TEETH.

Routes of Entry	Absorbed through skin. Inhalation. Ingestion.

Potential Acute Health Effects

Eyes	Hazardous in case of eye contact (corrosive). Causes eye burns.
Skin	Corrosive to skin on contact.
Inhalation	Extremely hazardous in case of inhalation (lung corrosive). Do not breathe vapor or mist. May be fatal if inhaled. Inhalation of vapors may cause dizziness, an irregular heartbeat, narcosis, nausea or asphyxiation.
Ingestion	Extremely hazardous in case of ingestion. May be fatal if swallowed.

Potential Chronic Health Effects

Carcinogenic Effects	This material is not known to cause cancer in animals or humans.

Additional information See Toxicological Information (section 11)

Medical Conditions Aggravated by Overexposure:	Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4. First Aid Measures

Eye Contact	Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.
Skin Contact	In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Inhalation	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion	If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Section 5. Fire Fighting Measures

Flammability of the Product	Non-flammable.
Auto-ignition Temperature	Not applicable.
Flash Points	Not applicable.
Flammable Limits	Not available.
Products of Combustion	Not applicable.
Fire Hazards in Presence of Various Substances	Not applicable.
Explosion Hazards in Presence of Various	**Risks of explosion of the product in presence of static discharge:** No.

Substances	**Risks of explosion of the product in presence of mechanical impact:** No.
Fire Fighting Media and Instructions	Not applicable.
Protective Clothing (Fire)	Not applicable.
Special Remarks on Fire Hazards	Not available.
Special Remarks on Explosion Hazards	Not available.

Section 6. Accidental Release Measures

Small Spill and Leak	Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.
Large Spill and Leak	Stop leak if without risk. Cover with DRY earth, DRY sand or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.
Spill Kit Information	The following EM SCIENCE SpillSolv (TM) absorbent is recommended for this product: SX1310 Acid Treatment Kit

Section 7. Handling and Storage

Handling	Handle and open container with care. Avoid contact with combustible materials. Do not breathe vapor or mist. Do not ingest. Do not get in eyes, on skin or clothing. After handling, always wash hands thoroughly with soap and water.
Storage	Keep container tightly closed. Handle and open container with care. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles.

+Section 8. Exposure Controls/Personal Protection

Engineering Controls	Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.
Personal Protection	
Eyes	Face shield.
Body	Full suit.
Respiratory	Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Hands	Gloves.
Feet	Boots.

Personal Protection in Case of a Large Spill	Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Product Name	**Exposure Limits**
NITRIC ACID	**ACGIH (United States, 1994).** STEL: 10 mg/m3 STEL: 4 ppm TWA: 5.2 mg/m3 TWA: 2 ppm **NIOSH REL (United States, 1994).** STEL: 10 mg/m3 STEL: 4 ppm TWA: 5 mg/m3 Period: 10 hour(s). TWA: 2 ppm Period: 10 hour(s). **OSHA Final Rule (United States, 1989).** STEL: 10 mg/m3 STEL: 4 ppm TWA: 5 mg/m3 TWA: 2 ppm **National Authority for Occupational Safety/Health (Ireland, 1999).** STEL: 10 mg/m3 STEL: 4 ppm OEL: 5 mg/m3 OEL: 2 ppm

+Section 9. Physical and Chemical Properties

Odor	ACRID; SUFFOCATING
Color	Colorless to light yellow.
Physical State and Appearance	Liquid. (Yellowish.)
Molecular Weight	63.02 g/mole
Molecular Formula	H-N-O3
pH	Not available.
Boiling/Condensation Point	83.94°C (183.1°F)

Melting/Freezing Point	-41.06°C (-41.9°F)
Specific Gravity	1.49 (Water = 1)
Vapor Pressure	0.3 kPa (2.6 mmHg) (@ 20°C)
Vapor Density	>1 (Air = 1)
Odor Threshold	2 ppm
Evaporation Rate	Not available.
LogKow	Not available.
Solubility	Soluble in water.

+Section 10. Stability and Reactivity

Stability and Reactivity	The product is stable.
Conditions of Instability	Container explosion may occur under fire conditions or when heated.
Incompatibility with Various Substances	Reactive with combustible materials, organic materials, metals, acids, alkalis.
Rem/Incompatibility	Not available.
Hazardous Decomposition Products	NOx
Hazardous Polymerization	Will not occur.

+Section 11. Toxicological Information

RTECS Number:

	Nitric Acid	QU5900000, QU5775000

Toxicity	Acute toxicity of the vapor (LC50): 76 ppm 4 hour(s) [Rat].
Chronic Effects on Humans	Not available.
Acute Effects on Humans	Corrosive to eyes and skin. May be fatal if swallowed.
Synergetic Products (Toxicologically)	Not available.
Irritancy	Draize Test: Not available.
Sensitization	Not available.
Carcinogenic Effects	This material is not known to cause cancer in animals or humans.
Toxicity to Reproductive	Tests on laboratory animals for reproductive effects are cited in Registry of Toxic Effects on Chemical

System	Substances (RTECS).
Teratogenic Effects	Not available.
Mutagenic Effects	Not available.

+Section 12. Ecological Information

Ecotoxicity	Not available.
BOD5 and COD	Not available.
Toxicity of the Products of Biodegradation	The products of degradation are less toxic than the product itself.

Section 13. Disposal Considerations

EPA Waste Number	D002 D001
Treatment	Specified technology- Neutralize to pH 6-9. Contact your local permitted waste disposal site (TSD) for permissible treatments sites. ALWAYS CONTACT PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS. ALWAYS CONTACT PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

Section 14. Transport Information

DOT Classification	Proper Shipping Name: NITRIC ACID Hazard Class: 8 UN number: UN2031 Packing Group: II RQ: 1000 lbs. (453.6 kg)
TDG Classification	Not available.
IMO/IMDG Classification	Proper Shipping Name: NITRIC ACID Hazard Class: 8 UN number: UN2031 Packing Group: II RQ: 1000
ICAO/IATA Classification	Not available.

Section 15. Regulatory Information

U.S. Federal Regulations	TSCA 8(b) inventory: NITRIC ACID SARA 302/304/311/312 extremely hazardous substances: NITRIC ACID

SARA 302/304 emergency planning and notification: NITRIC ACID

SARA 302/304/311/312 hazardous chemicals: NITRIC ACID

SARA 311/312 MSDS distribution - chemical inventory - hazard identification: NITRIC ACID: fire, reactive, immediate health hazard

SARA 313 toxic chemical notification and release reporting: Nitric Acid

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: Nitric Acid

Clean air act (CAA) 112 accidental release prevention: Nitric Acid

Clean air act (CAA) 112 regulated flammable substances: No products were found.

Clean air act (CAA) 112 regulated toxic substances: Nitric Acid

WHMIS (Canada)

CLASS C: Oxidizing material.
Class D-1B: Material causing immediate and serious toxic effects (TOXIC).
CLASS E: Corrosive liquid.

CEPA DSL: Nitric Acid

This product has been classiifed in accordance with the hazard criteria of the Controlled Product Regulations and the MSDS contains all required information.

International Regulations

EINECS

Nitric Acid 231-714-2

DSCL (EEC)

R8- Contact with combustible material may cause fire.
R35- Causes severe burns.

International Lists

Australia (NICNAS): Nitric Acid

Japan (MITI): Nitric Acid

Korea (TCCL): Nitric Acid

Philippines (RA6969): Nitric Acid

China: No products were found.

State Regulations

Pennsylvania RTK: Nitric Acid: (environmental hazard, generic environmental hazard)
Massachusetts RTK: Nitric Acid
New Jersey: Nitric Acid

California prop. 65: No products were found.

Section 16. Other Information

National Protection Association (U.S.A.)	**Fire**	**Health**	**0**	**Fire Hazard**
			4OXY1	**Reactivity**
				Specific Hazard

Changed Since Last + Revision

Notice to Reader

The statements contained herein are based upon technical data that EM Industries believes to be reliable, are offered for information purposes only and as a guide to the appropriate precautionary and emergency handling of the material by a properly trained person having the necessary technical skills. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use, storage and disposal of these materials and the safety and health of employees and customers and the protection of the environment. EM INDUSTRIES MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE, WITH RESPECT TO THE INFORMATION HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS.

Material Safety Data Sheet

+ Section 1. Product and Company Identification

Product Name **Sulfuric Acid, GR**

Product Code SX1244

Manufacturer EM Science
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Effective Date **11/27/2001**

For More Information Call

856-423-6300 Technical Service
Monday-Friday: 8:00 AM - 5:00 PM

In Case of Emergency Call

800-424-9300 CHEMTREC (USA)
613-996-6666 CANUTEC (Canada)
24 Hours/Day: 7 Days/Week

Synonym OIL OF VITRIOL

Material Uses Analytical reagent.

Chemical Family Acid.

Section 2. Composition and Information on Ingredients

Component	CAS #	% by Weight

+ Section 3. Hazards Identification

Physical State and Appearance	Liquid. (Clear viscous liquid.)
Emergency Overview	DANGER! POISON! MAY BE FATAL IF INHALED OR SWALLOWED. CAUSES SEVERE EYE AND SKIN BURNS. CAUSES RESPIRATORY TRACT BURNS. OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. CAUSES DAMAGE TO THE FOLLOWING ORGANS: LUNGS, MUCOUS MEMBRANES, RESPIRATORY TRACT, SKIN, EYE, LENS OR CORNEA, TEETH.
Routes of Entry	Absorbed through skin. Eye contact. Inhalation. Ingestion.

Potential Acute Health Effects

Eyes	Extremely hazardous in case of eye contact (corrosive). Causes severe eye burns.
Skin	Extremely hazardous in case of skin contact (corrosive). Skin contact produces severe burns.
Inhalation	Extremely hazardous in case of inhalation. May be fatal if inhaled. Hazardous in case of inhalation (lung corrosive).
Ingestion	Extremely hazardous in case of ingestion. May be fatal if swallowed.

Potential Chronic Health Effects

Eyes	Extremely hazardous in case of eye contact (corrosive). Causes severe eye burns.
Skin	Extremely hazardous in case of skin contact (corrosive). Skin contact produces severe burns.
Inhalation	Extremely hazardous in case of inhalation. May be fatal if inhaled. Hazardous in case of inhalation (lung corrosive).
Ingestion	Extremely hazardous in case of ingestion. May be fatal if swallowed.

Potential Chronic Health Effects

Carcinogenic Effects	Classified A2 (Suspected for human.) by ACGIH.

Additional information See Toxicological Information (section 11)

Medical Conditions Aggravated by Overexposure:	Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4. First Aid Measures

Eye Contact	Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.
Skin Contact	In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Inhalation	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion	If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Section 5. Fire Fighting Measures

Flammability of the Product	Non-flammable.
Auto-ignition Temperature	Not applicable.
Flash Points	Not applicable.
Flammable Limits	Not applicable.
Products of Combustion	Not available.
Fire Hazards in Presence of Various Substances	Flammable in presence of combustible materials
Explosion Hazards in Presence of Various Substances	**Risks of explosion of the product in presence of static discharge:** No. **Risks of explosion of the product in presence of mechanical impact:** No.
Fire Fighting Media and Instructions	Do not use water or foam.
Protective Clothing (Fire)	Wear MSHA/NIOSH approved self-contained breathing apparatus or equivalent and full protective gear.
Special Remarks on Fire Hazards	Flammable hydrogen gas may be produced on prolonged contact with metals such as aluminum, tin, lead and zinc.
Special Remarks on Explosion Hazards	Not available.

Section 6. Accidental Release Measures

Small Spill and Leak	Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: **Neutralize the residue with a dilute solution of sodium carbonate.**
Large Spill and Leak	Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. **Neutralize the residue with a dilute solution of sodium carbonate.** Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.
Spill Kit Information	The following EM SCIENCE SpillSolv (TM) absorbent is recommended for this product: SX1310 Acid Treatment Kit

+ Section 7. Handling and Storage

Handling	Store in tightly closed container. Avoid contact with combustible materials. Do not ingest. Do not get in eyes, on skin, or on clothing. Avoid breathing vapors or spray mists.
Storage	Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles.

Section 8. Exposure Controls/Personal Protection

Engineering Controls	Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.
Personal Protection	
Eyes	Face shield.
Body	Full suit.
Respiratory	Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Hands	Gloves.
Feet	Boots.
Personal Protection in Case of a Large Spill	Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Product Name	**Exposure Limits**
SULFURIC ACID	**AUVA (Austria, 1995).**
	Spitzenbegrenzung: 2 mg/m3 8 times per shift, Period: 5 minute(s).
	MAK: 1 mg/m3
	Belgium Minister of Labour (Belgium, 1998).
	VCD: 3 mg/m3
	VL: 1 mg/m3
	BAUA (Germany, 1997).
	Spitzenbegrenzung: 1 mg/m3
	MAK: 1 mg/m3
	DK-Arbejdstylsinet (Denmark, 1996).
	GV: 1 mg/m3
	Tyterveyslaitos (Finland, 1998).
	STEL: 3 mg/m3
	TWA: 1 mg/m3
	INRS (France, 1996).
	VLE: 3 mg/m3
	VME: 1 mg/m3

National Authority for Occupational Safety/Health (Ireland, 1999).
OEL: 1 mg/m3
Arbeidsinspectie (Netherlands, 1999).
TGG 8 uur: 1 mg/m3
N-Arbeidstylsinet (Norway, 1996).
AN: 1 mg/m3
AFS (Sweden, 1996).
KTV: 3 mg/m3
NGV: 1 mg/m3
EH40-OES (United Kingdom (UK), 1997).
TWA: 1 mg/m3
ACGIH (United States, 1996).
STEL: 3 mg/m3
TWA: 1 mg/m3
NIOSH REL (United States, 1994).
TWA: 1 mg/m3 Period: 10 hour(s).
OSHA Final Rule (United States, 1989).
TWA: 1 mg/m3

Section 9. Physical and Chemical Properties

Odor	Odorless.
Color	Colorless.
Physical State and Appearance	Liquid. (Clear viscous liquid.)
Molecular Weight	98.08 g/mole
Molecular Formula	H2-O4-S
pH	Acidic.
Boiling/Condensation Point	290.05°C (554.1°F)
Melting/Freezing Point	-10°C (14°F)
Specific Gravity	1.84 (Water = 1)
Vapor Pressure	0.1 kPa (1 mmHg) (@ 20°C)
Vapor Density	Not available.
Odor Threshold	>1 ppm
Evaporation Rate	<1

LogKow	Not available.
Solubility	Soluble in water.

Section 10. Stability and Reactivity

Stability and Reactivity	The product is stable.
Conditions of Instability	Not available.
Incompatibility with Various Substances	Extremely reactive or incompatible with reducing agents, combustible materials, organic materials, metals, acids, alkalis, moisture.
Rem/Incompatibility	Not available.
Hazardous Decomposition Products	Not available.
Hazardous Polymerization	Will not occur.

Section 11. Toxicological Information

RTECS Number:

	Sulfuric Acid	WS5600000

Toxicity	Acute oral toxicity (LD50): 2140 mg/kg [Rat]. Acute toxicity of the vapor (LC50): 320 mg/m3 2 hour(s) [Mouse].
Chronic Effects on Humans	**CARCINOGENIC EFFECTS**: Classified A2 (Suspected for human.) by ACGIH.
Acute Effects on Humans	Extremely hazardous in case of eye contact (corrosive). Causes severe eye burns. Extremely hazardous in case of skin contact (corrosive). Skin contact produces severe burns. Extremely hazardous in case of inhalation. May be fatal if inhaled. Hazardous in case of inhalation (lung corrosive). Extremely hazardous in case of ingestion. May be fatal if swallowed.
Synergetic Products (Toxicologically)	Not available.
Irritancy	Draize Test (Rabbit): Eyes: 5 mg/30s. Reaction: Severe.
Sensitization	Not available.
Carcinogenic Effects	Classified A2 (Suspected for human.) by ACGIH.
Toxicity to Reproductive System	Tests on laboratory animals for reproductive effects are cited in Registry of Toxic Effects on Chemical Substances (RTECS).
Teratogenic Effects	Not available.
Mutagenic Effects	Tests on laboratory animals for mutagenic effects are cited in Registry of Toxic Effects of Chemical Substances (RTECS).

Section 13. Disposal Considerations

EPA Waste Number D002

Treatment Specified Technology - Neutralize to pH 6-9. Contact your local permitted waste disposal site (TSD) for permissible treatment sites. Always contact a permitted waste disposal (TSD) to assure compliance with all current local, state, and Federal Regulations.

Section 14. Transport Information

DOT Classification Not available.

TDG Classification Not available.

IMO/IMDG Classification Not available.

ICAO/IATA Classification Not available.

Section 15. Regulatory Information

U.S. Federal Regulations TSCA 8(b) inventory: SULFURIC ACID

SARA 302/304/311/312 extremely hazardous substances: SULFURIC ACID
SARA 302/304 emergency planning and notification: SULFURIC ACID
SARA 302/304/311/312 hazardous chemicals: SULFURIC ACID
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: SULFURIC ACID: reactive, Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard
SARA 313 toxic chemical notification and release reporting: SULFURIC ACID

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: SULFURIC ACID

Clean air act (CAA) 112 accidental release prevention: No products were found.

Clean air act (CAA) 112 regulated flammable substances: No products were found.

Clean air act (CAA) 112 regulated toxic substances: No products were found.

WHMIS (Canada) CLASS C: Oxidizing material.
Class D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).
CLASS E: Corrosive liquid.
CEPA DSL: SULFURIC ACID

International Regulations

EINECS SULFURIC ACID 231-639-5

DSCL (EEC) R35- Causes severe burns.

International Lists Australia (NICNAS): SULFURIC ACID

Japan (MITI): SULFURIC ACID

Korea (TCCL): SULFURIC ACID

Philippines (RA6969): SULFURIC ACID

China: No products were found.

State Regulations

Pennsylvania RTK: SULFURIC ACID: (environmental hazard, generic environmental hazard)
Massachusetts RTK: SULFURIC ACID
New Jersey: SULFURIC ACID
California prop. 65: No products were found.

Section 16. Other Information

National Fire Protection Association (U.S.A.)

Health 0 **Fire Hazard**

3 2 **Reactivity**

W **Specific Hazard**

Changed Since Last Revision +

Notice to Reader

The statements contained herein are based upon technical data that EM Industries believes to be reliable, are offered for information purposes only and as a guide to the appropriate precautionary and emergency handling of the material by a properly trained person having the necessary technical skills. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use, storage and disposal of these materials and the safety and health of employees and customers and the protection of the environment. EM INDUSTRIES MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE, WITH RESPECT TO THE INFORMATION HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS.

Appendix H

Environmental Emergency Spill Response Guidance Document

Michigan Department of Transportation	GUIDANCE DOCUMENT	IDENTIFIER	EFFECTIVE DATE
		10169	03/06/2020
		SUPERSEDES	DATED
		10169	12/05/2012
RESPONSIBLE ORGANIZATION:	Safety and Security Administration		
SUBJECT:	Environmental Emergency Spill Response		

PURPOSE

- To protect the safety of Michigan Department of Transportation (MDOT) workers and the traveling public when encountering a release/spill of hazardous materials in MDOT right of way (ROW).
- To provide guidelines when responding to or discovering a release/spill of hazardous materials in MDOT ROW.

INFORMATION

An employee may discover a release, spill or abandoned tank(s)/drum(s) on MDOT ROW or be requested to provide assistance to the incident commander during an environmental emergency spill response, such as emergency traffic control devices. Information contained in this guidance document will assist the employee involved in a discovery or response situation. Appropriate actions should be based on the scope of the incident.

DEFINITIONS

- **Hazardous Material**: A substance or material, including a hazardous substance, that has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, or property when transported in commerce, and that has been so designated.
- **Incident Commander**: The person responsible for all aspects of an emergency response, including quickly developing incident objectives, managing all incident operations, and application of resources, as well as responsibility for all persons involved.

  Note: For spills, the incident commander is responsible on site for organizing and implementing the cleanup operations.

ACRONYMS

- ROW Right of way
- EGLE Michigan Department of Environment, Great Lakes, and Energy
- PEAS Pollution Emergency Alert System
- EPA United States Environmental Protection Agency

PROCEDURE

Responsibility	Action
Employee	1. The first priority is personal safety. Move a safe distance outside incident, approximately one-half mile minimum.
	2. For severe injuries or emergency situation, immediately contact 911.
	3. For leaking hazardous material or unknown material, call 911.
	4. Do not remove any hazardous material item(s) from the scene.

Employee (continued)

5. If necessary and/or possible, place barricades or warning devices around the area to keep the public away from the incident and protect the integrity of the scene.
6. Refer to MDOT Environmental Emergency Spill Response Flowchart.
7. Notify Safety and Security Administration at 517-241-1697, your supervisor, and appropriate region personnel of the discovery or response situation as soon as practical.
8. If you are in a discovery situation, notify the local fire department and the PEAS number at 800-292-4706.
9. Assist incident commander as requested. Remember your personal safety is first priority and you should not expose yourself to a harmful substance and/or situation.
10. If you have access to a camera and can do so safely, take photos of the incident.
11. Document information about the release, spill or container(s) and complete MDOT Form 1506, Notification of Traffic/Roadway Incident or Major Event. Promptly provide information, photos, and/or form to Safety and Security Administration.
12. If you discover an unknown container or abandoned tank, notify the PEAS number at 800-292-4706 and your supervisor.
13. Assist MDOT region resource staff as requested.

Supervisor

1. Ensure field employees receive training on this guidance document and the Environmental Emergency Spill Response Flowchart.
2. Upon notification by employee of a situation, confirm employee is a safe distance from the spill or item and assist in making necessary contacts listed above.
3. Monitor situation with employee and, if it appears to be escalating, coordinate MDOT involvement with Safety and Security Administration and MDOT executive leadership.

Safety and Security Administration

1. Coordinate MDOT involvement with employee and/or region personnel and provide technical assistance as necessary.
2. Coordinate MDOT involvement with state agencies as necessary.
3. Notify Federal Highway Administration if situation meets reporting criteria and provide follow-up as necessary.

Safety and Security Administration (continued)

4. Notify MDOT executive leadership if applicable and provide follow-up/coordination as necessary.
5. Notify Michigan State Police Emergency Management and Homeland Security Division if situation meets reporting criteria and coordinate response efforts.
6. Provide training and outreach to MDOT employees and regions regarding environmental emergency spill response procedures and best practices.

CLEANUP OPERATIONS

- The liable party for the release/spill of the hazardous material is obligated to pay for cleanup operations, including traffic control and/or other cleanup costs.
- EGLE has regulatory authority to oversee and coordinate cleanup efforts, identify liable party or parties, and identify potential cleanup funds if necessary.
- Contractors may provide emergency response and cleanup work (see Permit Procedures below).
- Local governments or federally recognized Native American tribes may be eligible through the EPA for up to $25,000 per incident for costs that they incur in performing temporary emergency response measures.

PERMIT PROCEDURES

All contractors working within the ROW for cleanup operations must follow current MDOT permitting processes. A list of contractors that have MDOT annual permits to complete emergency response and cleanup work is available from the Real Estate Support Area, Utilities Coordination and Permits Section. Any contractor can respond; however, the MDOT permit process must be followed before contractors without an annual permit may work within the MDOT ROW.

RESOURCES

Many resources are available to effectively remediate an environmental spill. All field employees should be familiar with and have on site the MDOT Environmental Emergency Spill Response Flowchart and related safety topic available from the MDOT Safety and Security Administration.

Another resource is the *Emergency Response Guidebook,* commonly referred to as the ERG. This guidebook is used by first responders, such as firefighters, police officers, and ambulance personnel, when responding to a transportation emergency involving hazardous materials. It may be used by MDOT employees when spilled hazardous material(s) can be identified.

OTHER

If an employee becomes injured or ill as a result of the incident, complete MDOT Form 0003, Injury and Illness Incident Report.

Questions regarding this document should be directed to Safety and Security Administration at 517-241-1697 or MDOT-SafetyAdmin@Michigan.gov.

Approved: _____ _____

Paul C. Ajegba, P.E.
Director

Date

IDEP Protocol Manual

Appendix I

Field Forms

ILLICIT DISCHARGE INSPECTION FORM

Pipe/Oufall Location and Description: _____

Drainage Basin _____

Basin Area _____

Outfall Size/Pipe Type: _____

Outfall Type: _____

SITE PHOTO HERE

☐ Is pipe/outfall active?

Screening Location: _____ **Inspector's Names:** _____ **Date/Time of Inspection:** _____

Date & Amount of Last Rainfall: _____ **Ambient Temperature:** _____ °F **Water Temperature:** _____

OUTFALL SCREENING RESULTS

OBSERVATION		SAMPLE RESULTS		(Follow-up Level)
Color:		**pH:**		(6.0>sample>9.0)
Odor:		**Ammonia:**		mg/L (sample≥0.1)
Turbidity:		**Detergent:**		mg/L (sample≥0.50)
Floatables:		**Fluoride:**		mg/L (sample≥0.25)
Surface Sheen:		**Potassium:**		mg/L (sample≥3.1)

FLOW/DISCHARGE ESTIMATE

Velocity: Slow (<2 ft/s) ☐ Moderate (<2-5 ft/s) ☐ Fast (>5 ft/s) ☐

Water Level in Pipe/Channel: _____ inches

Additional Comments/Observations:

☐ Is pipe/outfall active?

Screening Location: _____ **Inspector's Names:** _____ **Date/Time of Inspection:** _____

Date & Amount of Last Rainfall: _____ **Ambient Temperature:** _____ °F **Water Temperature:** _____ °F

OUTFALL SCREENING RESULTS

OBSERVATION		SAMPLE RESULTS		(Follow-up Level)
Color:		**pH:**		(6.0>sample>9.0)
Odor:		**Ammonia:**		mg/L (sample≥0.1)
Turbidity:		**Detergent:**		mg/L (sample≥0.50)
Floatables:		**Fluoride:**		mg/L (sample≥0.25)
Surface Sheen:		**Potassium:**		mg/L (sample≥3.1)

FLOW/DISCHARGE ESTIMATE

Velocity: Slow (<2 ft/s) ☐ Moderate (<2-5 ft/s) ☐ Fast (>5 ft/s) ☐

Water Level in Pipe/Channel: _____ inches

Additional Comments/Observations: