Illicit Discharge Detection & Elimination (IDDE) On-going Field Screening Program

Prepared for:
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INTRODUCTION

BACKGROUND

Under Wisconsin Pollutant Discharge Elimination System (WPDES) Permit No. WI-S050075-1 (also known as the General Storm Water Discharge Permit hereafter referred to as the "Permit"), the Wisconsin Department of Natural Resources (WDNR) requires that the City of Manitowoc (City) develop a program to detect and remove illicit connections and discharges to the municipal separate storm sewer system. The Permit was issued to the City of Manitowoc on October 11, 2006 (Permit Start Date).

In July of 2009, the City conducted their initial field screening at all major outfalls as required under Permit Condition 2.3.2. Of the 210 total outfalls in the City, a total of 55 outfalls were identified by the City as "major outfalls". These 55 outfalls were screened following the same general procedures as outlined in Section B of this document. The 2009 initial field screening will be documented in a separate report and submitted to the WDNR. A summary of the 2009 outfall screening is as follows:

- Field screening of the 55 outfalls discovered the following:
    - 38 outfalls were dry or did not have enough flow to sample
    - 17 outfalls were active (wet with enough flow to sample)
- Watershed/basin distribution of the 17 active outfalls is as follows:
    - 11 of the active outfalls were tributary to the Manitowoc River
    - 4 of the active outfalls were tributary to the Little Manitowoc River
    - 2 of the active outfalls were tributary to Lake Michigan
- Results of the chemical field screening for active outfalls is as follows:
    - 8 outfalls returned no detectable chemical levels
    - 3 outfalls returned detectable chlorine levels (all at 0.3 mg/l or less)
    - 6 outfalls returned detectable detergent levels (all at < 0.5 mg/l)
    - 0 outfalls returned detectable copper levels
    - 0 outfalls returned detectable phenol levels

ON-GOING FIELD SCREENING PROGRAM OVERVIEW

Based on the initial field screening effort and other discussions, the City has developed an On-going Field Screening Program as outlined in Section 1 of this document for the remainder of the term of the permit as required under Permit Condition 2.3.3.

Additionally, the City has in place the "City of Manitowoc Illicit Discharge Procedures Guide" for responding to known or suspected illicit discharges and spills. Included in this document in Section 2 are the general On-going Field Screening Procedures and in Section 3 are the Follow-up Field Screening and Investigation Procedures. These sections provide guidance for conducting routine outfall screening as well as investigating potential illicit discharges.

1.0 ON-GOING FIELD SCREENING PROGRAM

Permit Condition 2.3.3 requires an on-going field screening of outfalls during the term of the Permit. Outfalls that will be evaluated on an on-going basis and the field screening frequency shall be identified. Consideration shall be given to hydrological conditions, total drainage area of the site, population density of the site, traffic density, age of the structures or buildings in the area, history of the area, and land use types. A description of this on-going field screening program shall be submitted to the department within 36 months of the start date (October 11, 2009) and implemented within 48 months of the start date (October 11, 2009).

Based on the 2009 initial field screening of the City's 55 major outfalls and from other discussions, the City has developed the following On-going Field Screening Program elements:

1.1 On-Going Field Screening for the Remainder of the Initial Permit Term (2010/2011)

Over the remaining two years of the initial permit, the City will screen the remaining 155 outfalls.

The initial field screening revealed that the majority of active major outfalls were along the Manitowoc River. This could be due to age, condition, or depth of system. Based on this finding, it is recommended that the remainder of the outfalls along the Manitowoc River (estimated at approximately 60 minor outfalls) be screened in 2010. The rest of the minor outfalls (95) would be screened in 2011.

Following the completion of the on-going screening for the initial term of the permit in 2011, the City will evaluate the findings for all field screening efforts conducted and update the continued field screening approach as needed.

1.2 Initial On-going Field Screening for Future Permit Cycles

For future Permit cycles, the City has established an initial approach of screening all of the MS4 outfalls during the 5-year Permit cycle. To accomplish this, the City has been divided into five geographic field screening zones guided by watershed divides. A map depicting the five zones is contained in Appendix A. The City has more detailed maps that show information such as outfalls and storm sewer systems for use in the field screening and follow-up processes. Outfall screening year/zone name and first year next future permit cycle is as follows:

- Year 1/Zone 1 (2012) - Based on the initial field screening which identified that active major outfalls were along the Manitowoc River, the Manitowoc River – East, with 50 total outfalls, is identified as the first zone for future screening. This is also the zone that contained the highest number of detectable chemical levels.

- Year 2/Zone 2 (2013) - The Manitowoc River – West, with 40 total outfalls, is identified as the second zone for future screening, prioritized based on the initial field screening.

- Year 3/Zone 3 (2014) - The Little Manitowoc River is the largest of all zones with 58 total outfalls and is identified as the third zone.

- Year 4/Zone 4 (2015) - The Lake Michigan North is the smallest of the zones with 19 outfalls and is identified as the fourth zone. (Because this is the zone with the smallest number of outfalls requiring screening, it is also an opportunity to catch up if the City was unable to complete all outfalls in the prior year(s), or to start early on the last zone.)

- Year 5/Zone 5 (2016) - The final area is the Lake Michigan South/Silver Creek zone, with 43 outfalls.

The future Permit screening approach may be modified if the 2010 and 2011 screening or other findings reveal ways to improve the program.

1.3 Supplemental Annual Field Screening

In addition to the on-going field screening approaches identified above, the City will re-screen any outfalls that are placed on a "watch" list.

The purpose of the development of a "watch" list and the re-screening effort is to identify outfalls that are outliers to the conditions generally observed throughout the City based on the initial outfall screening. This will allow the City to document if the conditions observed at the subject outfall change over time and to determine if the conditions present warrant further follow-up screening and investigation even though they do not exceed the initial follow-up levels described in Section 3 of this report.

The City reserves the right to identify outfalls annually that they feel merit placement on the "watch" list. Where practicable, the City will develop and consistently apply criteria to placing outfalls on the "watch" list.

Example criteria may include:

- Visual/physical outlier characteristics such as unusual odor, color, turbidity or other parameters as listed on the Inspection Form

- Chemical outlier characteristics such as outfalls that had at least 50% of any one of the initial follow-up levels listed in Table 3-1 of Section 3 in this document for the Field Analysis (chemical tests for Chlorine, Detergents, Copper and Phenols) or other visual or reported conditions the City feels warrants investigation.

Based on the example criteria list above, the 2009 initial (major outfall) field screening might identify Outfalls LR16-OUT2 and R55-OUT2 for visual/physical outlier characteristics (color) and Outfall "R31-OUT 7" would meet the criteria for a chemical test result of at least 50% of the initial follow-up level with a detergents result of < 0.5 mg/L (where 50% of the initial follow-up level of 0.50 mg/L is 0.25 mg/L for detergents).

1.4 On-going Field Screening Protocols

- For all outfalls screened, the City will use a field screening form similar to the example field screening form in Appendix B.

- On-going field screening activities will generally follow the procedures in Section 2 of this document.

- Outfalls that meet one or more of the conditions listed in Table 3-1 of Section 3 in this document will be investigated following the general guidance in Section 3 of this document.

1.5 Measurable Goals

- Develop and submit the on-going field screening program to the WDNR within 36 months of the Permit start date (October 11, 2009). ***Submitted to WDNR on September 14, 2009.***

- Implement the on-going field screening program within 48 months of the Permit start date (October 11, 2010).

- Document the on-going field screening program in annual reports to the WDNR.

2.0 FIELD SCREENING PROCEDURES

2.1 Initial Field Screening Permit Requirements

The Permit requires the City of Manitowoc to conduct initial field screening at all major outfalls during dry weather periods within 36 months of the start date, to then develop an on-going field screening program within 36 months of the start date, and to implement that program within 48 months of the start date. At a minimum, field screening shall be documented and include:

- Visual observations in accordance with Permit Condition 2.3.2.1

  "Visual Observation - A narrative description of visual observations including color, odor, turbidity, oil sheen or surface scum, flow rate and any other relevant observations regarding the potential presence of non-storm water discharges or illicit dumping."

- Field Analysis in accordance with Permit Condition 2.3.2.2

  "Field Analysis - If flow is observed, a field analysis shall be conducted to determine the presence of illicit non-storm water discharges or illicit dumping. The field analysis shall include sampling for pH, total chlorine, total copper, total phenol and detergents, unless the permittee elects instead to use detergent, ammonia, potassium and fluoride as the indicator parameters. Other alternative indicator parameters may be authorized by the Department in writing."

2.2 Equipment

The field screening crew should have on hand the proper equipment to conduct safe, timely, and accurate investigations. The equipment required to conduct annual and follow-up investigations may vary slightly depending on screening location (outfall or other structure), weather conditions, and the screening kit being used.

The field screening crew should conduct an annual review of the current field screening equipment for condition and identify additional equipment needs based on experience in the field. Typical screening equipment includes, but is not limited to the following:

- System mapping
- Data collection forms, writing instruments and clipboard
- Watch
- Safety equipment (see Section 2.3 for typical list)
- Measuring tape (for outfall sizing)
- Digital camera
- Sample collection jar/device
- Waste disposal bottle/container
- Sample collection pole and bucket (in anticipation of hard to reach sample sites)
- Test kits (for portable/on-site field screening)
- Sampling instruments (such as pH meter for on-site screening)
- Sample jars (for samples identified for laboratory testing – if necessary)
- Cooler and ice (to transport samples for lab testing – if necessary)

- Manhole lid lifter/pick, sledge hammer, shovel, mirror/flash light if in manholes/structures
- Optional equipment may include a GPS device, electronic data collector or field laptop computer

2.3 Safety and Training

As with all public works activities, proper training on the use of equipment and general safety on the job is important. The field crew should review and be familiar with the field screening procedures, equipment, and situations present in the field. New staff should always be accompanied by experienced staff. Training needs should be reviewed annually for any changes or additions necessary to safely and efficiently conduct the field screening and follow-up investigations.

Depending on screening methodology, testing materials, and screening location, safety equipment will vary. A project-specific safety plan is recommended including identification of hazards and location of medical facilities and should be reviewed annual with the field crew and other persons responsible for field safety. For normal outfall reconnaissance and screening, safety equipment generally includes, but is not limited to the following:

- first aid kit (bandages, gauze, disinfectant, scissors, tape, etc.)
- insect repellant (if needed)
- cell phone(s) (and/or radios)
- rubber gloves
- rubber boots/waders
- steel toe boots
- safety glasses
- safety vests
- hard hats
- floatation device(s) (if working from a canoe, wading streams, or working near fast flowing waters)
- traffic cones and vehicle safety light for working in or near streets

If confined space entry is required during routine of follow-up investigations, additional training, equipment (including gas detector, tripod, and other identified devices), and personnel will be required as directed by the City's confined space standard operating procedure.

2.4 Proposed Field Screening Procedures for Initial and On-going Screening

The field screening analysis will follow the guidelines of NR 216.07(3)(i) and the Permit (Visual Observation and Field Analysis (if flow is present)). Field screening will be conducted during dry weather periods (typically at least 72 hours after a rainfall event totaling 0.10 inches or greater). An Outfall Inspection Form will be used to document the field screening (a sample form is attached to this document).

Field screening points shall, where possible, be located downstream of any source of suspected illicit activity. Field screening points shall be located where practicable at the outfall, farthest downstream manhole, or other accessible location downstream in the system. Safety of personnel and accessibility of the location shall be considered in making this determination.

Field screening shall include a Visual Observation of color, odor, turbidity, floatable matter (including oil sheen or surface scum), deposits and stains, vegetation, damage to outfall structures, flow rate and other relative observations regarding the potential presence of non-storm water discharges or illicit dumping. Table 2-1 provides some visual characterization interpretation guidance.

If sufficient flow is observed, the City will conduct a Field Analysis to determine the potential presence of illicit non-storm water discharges or illicit dumping. The field analysis will consist of testing a grab sample

using a field test kit. The samples will not be taken from submerged outlets or structures. If submerged outlets/structures are encountered, sampling will be conducted at the nearest un-submerged upstream point. The test kit will provide approximate readings for pH, total chlorine, total copper, total phenol and detergents (surfactants). The City can instead elect to use detergent, ammonia, potassium, and fluoride as the indicator parameters as allowed in the Permit. Other alternative indicator parameters may be authorized by the WDNR in writing.

Table 2-1

Visual Characterization Interpretation (1)

PARAMETER	INTERPRETATION
Odor	*sewage:* smell associated with stale sanitary wastewater, especially in pools near outfall. *sulfur ("rotten eggs"):* industries that discharge sulfide compounds or organics (meat packers, canneries, dairies, etc.). *oil and gas:* petroleum refineries or many facilities associated with vehicle maintenance or petroleum product storage *rancid-sour:* food preparation facilities (restaurants, hotels, etc.).
Color	*cloudy:* sanitary wastewater, concrete or stone operations, fertilizer facilities, automotive dealers. *opaque:* food processors, lumber mills, metal operations, pigment plants.
Turbidity	*cloudy:* sanitary wastewater, concrete or stone operations, fertilizer facilities, automotive dealers. *opaque:* food processors, lumber mills, metal operations, pigments plants.
Floatable Matter	*oil sheen:* petroleum refineries or storage facilities and vehicle service facilities. (2) *sewage:* sanitary wastewater.
Deposits and Stains	*sediment:* construction site erosion. *oily:* petroleum refineries or storage facilities and vehicle service facilities.
Vegetation	*excessive growth:* food product facilities *inhibited growth:* high stormwater flows, beverage facilities, printing plants, metal product facilities, drug manufacturing, petroleum facilities, vehicle facilities and automobile dealers.
Damage to Outfall Structures	*concrete cracking, concrete spalling, industrial flows, metal corrosion:* industrial flows

(1) Adapted from "Table 3: Physical Observation Parameters and Likely Associated Flow Sources (Pitt, 2001)" of "Techniques for Identifying and Correcting Illicit and Inappropriate Discharges Task #2 Technical Memorandum".

(2) Some naturally occurring phenomenon can be mistaken for the presence of oil. A quick way to distinguish between oil-related materials and natural residue is to disturb the area in question. If it breaks up into 'platelets' it is a natural material. If it returns to cover the area of disturbance without breaking up, it is probably an oil related product.

2.5 Quality Assurance/Quality Control (QA/QC) Procedures

When it comes to quality assurance and quality control, there is no substitute for field staff with proper training and experience. Taking care to follow the test kit procedures, not scrape the outfall pipe or structures are all details that can aid in obtaining reliable results. Additional QA/QC components include the following:

- Keep checklists of equipment and conduct calibration of field equipment as required
- Maintain field data collection forms, maps, and equipment in a centralized location
- Repeating screening/test results after recorded to confirm values

- If an unusually high test results are obtained, take an immediate second confirmation test
- If field notes are transcribed into an electronic database or table, have a second person (if possible one of the original field persons) review the transcription
- If follow-up investigations result in the isolation of one or more contaminants that are expected to result in action against a property owner, consideration should be given to utilizing a laboratory and standard chain of custody procedures

3.0 FOLLOW-UP FIELD SCREENING AND INVESTIGATION PROCEDURES

Permit Condition 2.3.4 requires that the City develop procedures to respond to known or suspected illicit discharges. The City has created the "City of Manitowoc Illicit Discharge Procedures Guide" that contains a Spill and Illicit Discharge Procedure Manual and a Spill and Illicit Discharge Response Guidance Document. Overall direction and procedures should be taken from that document.

The following represents supplemental procedures for conducting follow-up field screening and investigation of potential illicit discharges. (If notification or response times are referenced and do not match those of the City's aforementioned guidance document, the Guidance Document shall take precedence.)

3.1 Conditions to Trigger Additional IDDE Investigations

The City will investigate portions of the MS4 that, based on field screening or other information, indicate a reasonable potential for containing illicit discharges or other sources of non-storm water discharges. Comparison with other outfall results and historical findings will be used in follow-up investigation decision making.

A potential trigger for follow-up investigations may include chemical analysis results or other indicators outside of the expected ranges. A list of chemical test parameters and initial follow-up levels or conditions is presented in Table 3-1.

Positive chemical test results do not necessarily indicate the presence or lack of an illicit discharge. Permitted industrial storm water discharges or other permitted non-storm water discharges may be present or illicit discharges may be masked by excessive clear water flows. They are, however, used to compare one outfall level to another, used to develop history on an outfall (i.e. establish baseline levels) and serve as potential indicators of illicit discharges.

Table 3-1

IDDE Screening Parameters and Guidance Thresholds

PARAMETER	INITIAL FOLLOW-UP LEVEL OR CONDITION
pH	sample < 6.0 SU sample > 9.0 SU
Color	abnormal color present
Turbidity	turbidity present
Surface Sheen	oil sheen present
Odor	sanitary or other abnormal odor present
Detergents	Sample > 0.5 mg/L
Total Residual Chlorine	Sample > 1.0 mg/L
Phenols	Sample $\geq$ 0.1 mg/L
Total Copper	Sample > 0.2 mg/L

3.2 Supplemental Procedures for IDDE Investigation

For those outfalls identified in the field chemical analysis or identified by other information as having a reasonable potential for containing illicit discharges or other sources of unallowable non-storm water discharges, the City will attempt to locate the source of the potential illicit discharge. The following procedure will generally be followed:

The suspect outfall will be re-screened for the parameter(s) of concern to verify the continued presence of the suspect parameter(s). Typically, only the parameter(s) of concern will be screened for.

The field screening crew will follow the storm drainage system upstream to the next accessible upstream manhole or storm sewer junction to confirm the presence of flow and parameter(s) of interest. This procedure will be continued using storm sewer system mapping until the suspect parameter(s) is isolated to the extent practicable. The field screening crew may skip to MS4 junctions of other areas of interest such as permitted industrial sites or suspected areas of the system to expedite the follow-up investigation. The field crew will take note of surface conditions that may aid in the identification of suspect sources (wet gutters, streets or other surfaces).

Once the location is isolated (if possible), the crew will search for obvious visual signs of illicit connections and discharges by conducting a “windshield survey”. The survey includes photographing the surrounding area including buildings, observing business types, and other items of interest. Other items of interest can include, but are not limited to outdoor storage areas, staining, or other potential signs of illicit discharges or dumping. Inlets and catch basins, if present, may be inspected for the presence of discolored water, staining, or other indications of non-storm water discharges and may include direct chemical testing of sumps. No internal entry of any business is included in this effort. The results of the survey will be shared with City staff at a meeting for discussion of potential sources and recommended next steps.

Following the “windshield survey”, building records may be researched to identify potential cross connections. Letters may be sent to property owners in the area notifying them of the findings and investigation, requesting their assistance, and/or notifying them of further potential actions including discussions with the property owners and other investigative methods which may or may not require access to the property.

If no immediate source is apparent after visual and desktop review, the City will consider other methods to identify the discharge such as leak detection, sewer system televising, dye water testing (the WDNR shall be notified in advance of the time and location of any dye water testing), or smoke testing (neighboring property owners will be notified prior to smoke testing). The method selected will depend on various factors such as building and land uses in the area (including proximity to industrial activity), location of water mains, location of sanitary sewers, past history with property owners, ease of access, and potential disruption to property owners.

The City will assess whether or not an identified source facility is appropriately permitted to discharge into the MS4 by requesting permit information from the WDNR as needed.

When an illicit connection/discharge is located, the City will begin procedures to work with the subject property owner or person/entity in responsible charge to eliminate the connection as expediently as possible.

In the case of an illicit discharge that originates within the City and that discharges directly to a neighboring municipality, the City will notify the affected municipality within one working day of confirming the illicit discharge.

In the case of a potential illicit discharge that appears to originate from a neighboring municipality, the City will notify that municipality as soon as practicable, but generally within one working day.
Prior to the actual disconnection, the City will require the owner/operator of the illicit connection/discharge to take all reasonable measures to minimize the discharge of pollutants to the MS4.

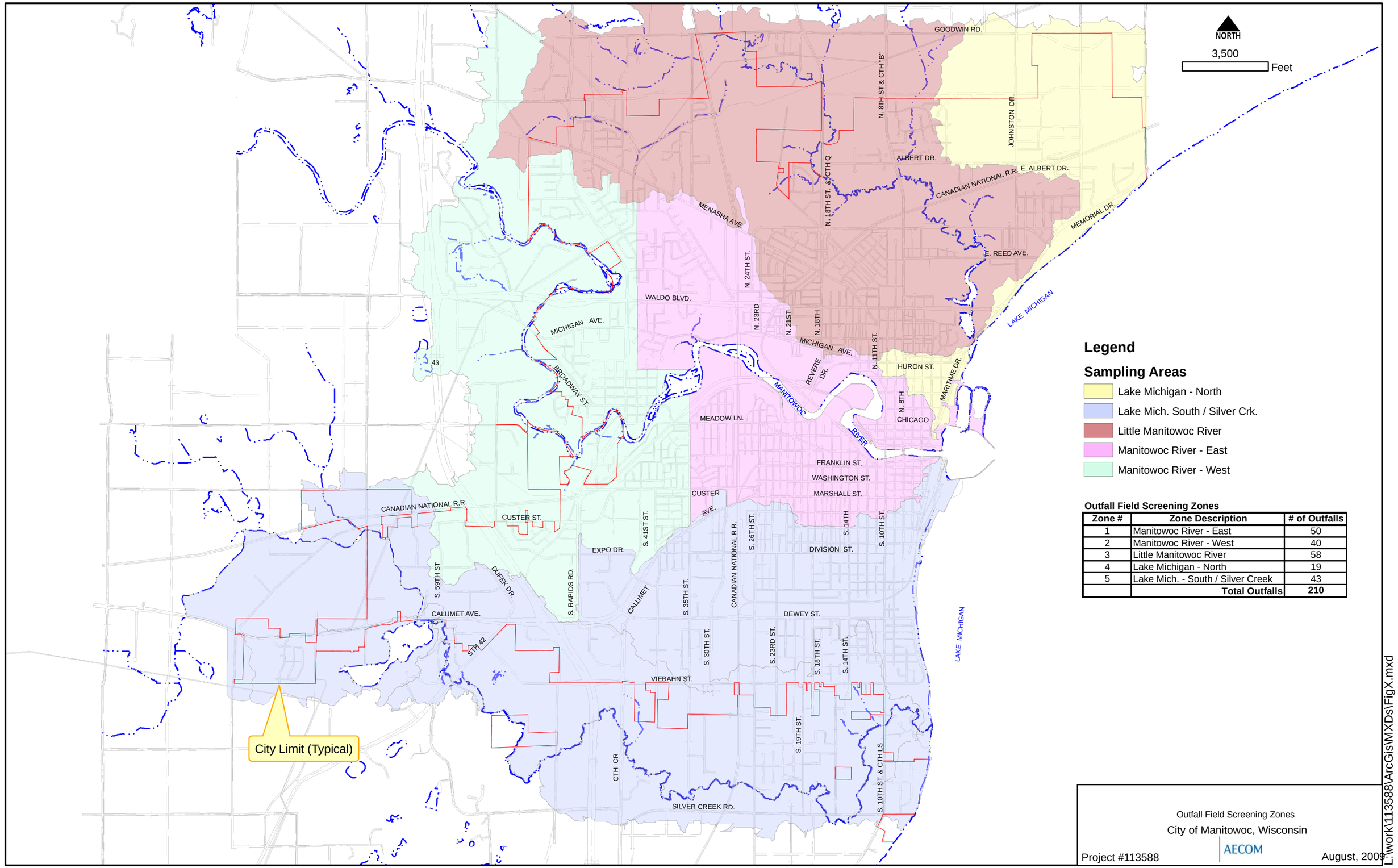
Each illicit connection/discharge discovery will be handled on a case-by-case basis. The City has not prepared an exact remedy or timeframe for illicit discharge correction because of the wide variability of potential discharge situations. More complicated or costly remedies may take a longer period of time to correct. If it appears that more than 30 days are required to remove an illicit connection, the WDNR will be contacted and provided with additional details regarding the problem and discuss an appropriate action including but not limited to interim measures to eliminate or reduce pollutant exposure and an estimated timeline for complete elimination.

The City has implemented Chapter 30 Illicit Discharge and Connection Ordinance of the Municipal Code. This ordinance develops the local regulatory authority to prohibit discharges, conduct monitoring, and identifies notification, violation, and enforcement procedures.

Notifications regarding spills and illicit discharges should follow the procedures and information located in Chapter 30 and the “City of Manitowoc Illicit Discharge Procedures Guide”.

Appendix A

Outfall Field Screening Zones



Outfall Field Screening Zones

Zone #	Zone Description	# of Outfalls
1	Manitowoc River - East	50
2	Manitowoc River - West	40
3	Little Manitowoc River	58
4	Lake Michigan - North	19
5	Lake Mich. - South / Silver Creek	43
	Total Outfalls	**210**

Outfall Field Screening Zones
City of Manitowoc, Wisconsin
AECOM
Project #113588
August, 2009

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Appendix B

Example Outfall Field Screening Form

ILLICIT DISCHARGE INSPECTION FORM
City of Manitowoc, WI

Pipe / Outfall Location & Description: In Concrete Wall between Marina and YMCA Beach

Waterway: Lake Michigan Outfall ID: **L1-OUT1** Size: 36" Shape: round Material: RCP .

NOTES: Outfall submerged, upstream manhole L1-19

Inspector's Names: _____

_____

Date of Inspection: _____

Time of Inspection: _____

Date of Last Rainfall: _____

Amount of last rainfall: _____ in.

Is pipe/outfall active? Y / N

If active, is flow sufficient to sample? Y / N

FLOW/DISCHARGE ESTIMATE (for active outfalls)

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

Water Level in Pipe/Channel: _____ inches.

OUTFALL SCREENING RESULTS

VISUAL OBSERVATIONS (evaluate and add notes as applicable at item or in comments section)

Is outfall submerged? Y / N

(If outfall is submerged conduct visual screening at outfall if practicable and representative, else conduct at upstream location. Do not conduct chemical screening at outfall except to supplement upstream sample if suspicious conditions are present in pooled water.) Note in comments where screening was conducted if not at outfall.

Outfall Damaged?: Y / N

Erosion at Outfall?: Y / N

Stains/Deposits/Sediment at Outfall?: Y / N

Benthic Growth at Outfall?: Y / N

Abnormal Vegetation at Outfall?: Y / N

Unusual Water Color?: Y / N

Unusual Odor?: Y / N

Turbidity?: Y / N

Floatables?: Y / N

Surface Sheen?: Y / N

SAMPLE RESULTS (expected range)

pH: _____ SU (6.0<sample>9.0)

Chlorine: _____ mg/L (sample<1.0)

Detergent: _____ mg/L (sample<0.5)

Copper: _____ mg/L (sample<0.2)

Phenols: _____ mg/L (sample<0.1)

Additional Comments/Observations: _____

Appendix C

Testing Procedures

STORM WATER DISCHARGES

Read MSDS Before Using

Total Chlorine

1. Rinse the sample cup with your sample and fill to the **25 mL mark.**
2. Add **5 drops** of the A-2500 Activator Solution.
3. Stir with the tip of a chlorine CHEMet™ ampoule and wait **1 minute.**
4. Immerse the CHEMet™ ampoule in the contents of the sample cup and snap the tip (fig. 1).
5. After 1 minute, wipe all liquid from the exterior of the ampoule and then use the appropriate chlorine comparator to determine the level of chlorine in the sample (figs. 2 & 3).

Total Copper

1. Rinse the sample cup with your sample and fill to the **25 mL mark.**
2. Immerse a copper CHEMet™ ampoule in the contents of the sample cup and snap the tip (fig. 1).
3. After 1 minute, wipe all liquid from the exterior of the ampoule and then use the appropriate copper comparator to determine the level of copper in the sample (figs. 2 & 3).

Total Phenols

1. Rinse the plastic beaker with your sample and fill to the **50 mL mark.**
2. Stir briefly (5-10 seconds) with the tip of the CHEMet™ ampoule to dissolve the crystals and snap the tip of the ampoule (fig. 1).
3. Immediately wipe all liquid from the exterior of the ampoule and use the appropriate phenols comparator to determine the level of phenols in the sample (figs. 2 & 3).

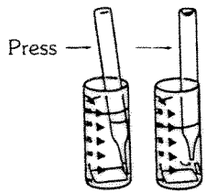


Figure 1

Place the CHEMet™ ampoule's tapered tip into one of the depressions in the bottom of the sample cup. Snap the tip by pressing the ampoule toward the side of the cup. The sample will fill the ampoule, leaving a small bubble to facilitate mixing. Mix the contents of the ampoule by inverting it several times, allowing the bubble to travel from end to end each time.

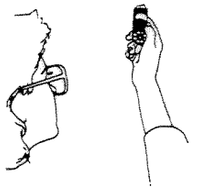


Figure 2

When using the **low range comparator,** the CHEMet™ ampoule is placed in the center tube, flat end downward. The top of the cylinder is then directed toward a source of light while viewing from the bottom. Hold the comparator in a nearly horizontal position and rotate it until the color standard below the CHEMet™ ampoule shows the closest match.

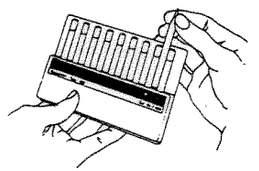
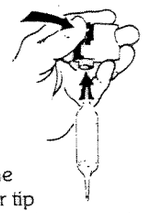


Figure 3

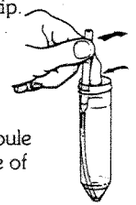
The **high range comparator** should be illuminated by a source of light from above. The filled CHEMet™ ampoule should be placed between the color standards for viewing until the color standard to the right of the CHEMet™ ampoule shows the closest match.

Detergents

1. Rinse the reaction tube (red cap) with sample and fill to the **5 mL mark.**
2. While holding the double-tipped ampoule in a vertical position, snap the upper tip using the tip breaking tool.



3. Invert the ampoule and position the open end over the reaction tube. Snap the upper tip and allow the ampoule to empty into the tube.
4. Cap the reaction tube and shake it vigorously for **30 seconds**. Allow the tube to stand undisturbed for approximately 1 minute.
5. Make sure that the flexible tubing is firmly attached to the CHEMet™ ampoule tip.
6. Place the CHEMet™ assembly (tubing first) into the reaction tube, making sure that the end of the flexible tubing rests on the bottom. Break the tip of the CHEMet™ ampoule by gently pressing it against the side of the reaction tube.



7. When filling is complete, remove the CHEMet™ assembly from the reaction tube.

   NOTE: The CHEMet™ ampoule should draw in fluid only from the organic phase (bottom layer).

8. Invert the ampoule several times, allowing the bubble to travel from end to end. Using a tissue, remove the flexible tubing from the CHEMet™ ampoule and wipe all liquid from the exterior of the ampoule.
9. Place a small white cap firmly onto the tip of the ampoule.
10. Use the detergents comparator to determine the level of detergent in the sample (fig. 2).

NOTE: Empty the reaction tube into the organic waste collection bottle.

pH

1. Rinse the plastic beaker with sample and fill to the 100 mL mark.
2. Remove the black protective cap from the meter.
3. Turn the meter on using ON/OFF switch.
4. Dip in the sample up to the shoulder on the meter.
5. Stir gently and wait a few seconds for the digital reading to stabilize.
6. When the meter is not in use, switch off and replace the protective cap.

Operating Notes

A. To condition the meter, soak the probe in tap water or pH 7 buffer solution for at least 30 minutes prior to using it the first time. You should also condition the meter if it is not used for more than 1 week.

B. A dry electrode may result in widely fluctuating pH readings (±0.5 pH units). To improve performance, leave the probe immersed in water (up to the shoulder) for a few minutes at least once a week.

C. Replace run-down batteries by removing the four screws on the rear housing. Insert 4 new 1.4 V batteries. (Duracell MP 675 H or equivalent)

D. To calibrate the instrument, dip the probe in pH 7 buffer solution. Allow the display to stabilize. Use the small key-shaped tool to turn the right trimmer and adjust the display to read 7.0. Rinse the probe in distilled water. Immerse the probe into either pH 4 or 10 buffer, and allow the display to stabilize. Then adjust the left trimmer to read either pH 4 or 10.

Sample Filtration

Turbidity in the sample could lead to difficulty in reading colorimetric test results. A 30 cc syringe and 0.45 µm disposable filters are included in the kit for use in reducing turbidity.

Reorder Information

Storm Water Discharges Test Kit, Chlorine, Copper, Phenols, Detergents, & pH M-1000
Storm Water Discharges CHEMets™ Refill Chlorine, Copper, Phenols MR-1000
Detergents Refill R-9400
pH Meter A-0085

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