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October 15, 2014

To: Patrick Juliana, Chairman
Stormwater Utility Committee

From: Shelly Billingsley, P.E. Shelly Billingsley
Deputy Director of Public Works / City Engineer

CC: Eric Haugaard
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Subject: ***Approval of the Pike River Monitoring Report (Wisconsin Coastal Management Grant)***

BACKGROUND INFORMATION

Staff received a Wisconsin Coastal Management grant to complete water quality sampling in the Pike River. Julie Kinzelman, with the City of Racine Health Department, has taken an active role in developing methods for making our Lake a cleaner water source through a variety of lake and river monitoring projects. Julie Kinzelman and the City of Racine also received a Great Lakes Restoration Initiative Grant to monitor the water quality along the shores of Lake Michigan. Combining the results of these studies will provide the City overall monitoring data for the Lake and the River and the impacts of both on the community.

Staff has uploaded the report to the Alderman Page for your use. This report will also be combined with the Fund for Lake Michigan Grant report which is currently being drafted.

RECOMMENDATION

Approve the Pike River Monitoring Report completed by City of Racine Health Department Laboratory in cooperation with the City of Kenosha Stormwater Utility and the Kenosha Water Utility.

Monitoring of Nonpoint Source Pollutants in the Pike River Watershed & Along Lake Michigan's Coast

A Preliminary Data Report

Stacie Havron

Julie Kinzelman, Ph.D., MT (ASCP)

City of Racine Health Department Laboratory

RACINE ON THE LAKE

City of Racine, Wisconsin

This report was prepared for the City of Kenosha through funding from the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act, Grant # NA11NOS4190097

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Introduction

Background

The Pike River watershed, located in Racine and Kenosha Counties, drains approximately 145 square kilometers of agricultural (40%), residential (20%), open space (11%), transportation (10%) and miscellaneous-related (19%) land. Three branches comprise the river: the north (flows south for 11.1 kilometers), south (flows north for 12.5 kilometers), and main (begins at the confluence of the north and south branches and flows east and south for 15.5 kilometers before emptying into Lake Michigan.) Prior to European settlement in the 1830's, much of the watershed was comprised of old growth maple-basswood forests, oak savannas, prairies, and wetlands (WDNR 2010). Wetlands that were once abundant now account for only two percent of the watershed (AES, 2013). Local development contributes to expanding impermeable surfaces, further compounding altered hydrologic characteristics by increasing storm water runoff and associated pollutants, impairing surface and recreational water quality and degrading riparian habitat. Much of the river, particularly the south branch, has been channelized for agricultural purposes, facilitating flashy flow conditions, increased erosion and sediment loading during rain events. In some areas, river banks are up to seven meters in height due to erosion (Ehlinger and Hoverman, 2005). As a result, the stream reaches on the Pike River have various use designations, impairment statuses, and water quality standards or guidelines as determined by the Wisconsin Department of Natural Resources (WDNR) and the U.S. Environmental Protection Agency (EPA) (Tables 1 and 2).

Stream reaches in the state of Wisconsin have multiple classifications by the WDNR, and the main two that relate to this study are 1.) the quality of fish and other aquatic life uses a stream can support and, 2.) the level of impairment(s) based upon the concentration of key water indicators. Stream reaches are classified based upon fish and other aquatic life as one of three designations: Fish and Aquatic Life (FAL), Limited Forage Fish (LFF), and Limited Aquatic Life (LAL). Each aquatic life designation has specific state standards for five parameters: dissolved oxygen, pH, water temperature, *E. coli* bacteria, and total phosphorus. Other measured study parameters such as specific conductivity and turbidity are not regulated by the WDNR but have recommended guidelines based upon research conducted by or on behalf of the EPA. While all stream reaches are classified according to aquatic life, only the stream branches with documented poor water quality can be classified as impaired. The pollutant(s) causing the impairment is/are identified if possible and a Total Maximum Daily Load (TMDL) plan may be created to achieve eventual remediation in the stream reach depending upon the priority level.

The north, south and main branches on the Pike River have a variety of use designations and impairments within their reaches. The north branch is designated by the WDNR for Fish and Aquatic Life (FAL) use, with the exception of Waxdale Creek, a tributary with stream reaches supporting either Limited Forage Fish (LFF) or Limited Aquatic Life (LAL) uses (see Table 1 for site-specific use designations and corresponding standards). Currently, the north branch and Waxdale Creek are 303 (d)-listed for an unknown pollutant and excess sediment/total suspended solids, resulting in chronic aquatic toxicity and degraded habitat. The south branch is designated for FAL, with two exceptions: 1.) Somers Branch, a tributary which supports a LAL

designation and 2.) the south branch stream reach directly upstream from the confluence of the north and south branches (adjacent to Hwy 31), which supports a LFF designation. This information is outdated and conditions may have improved (or degraded) but the impairment status has not been assessed by the WDNR. The main branch is designated as FAL and is proposed for 303(d) listing due to excessive phosphorus levels, resulting in a degraded biological community. Although 303(d) listings indicate impaired water quality within the Pike River, the sources of impairment are not entirely understood due to a lack of consistent monitoring across the watershed.

Prior to this study, the majority of surface water quality data on the Pike River was outdated and lacking in both temporal and geographic scales. The WDNR had been monitoring water quality at 19 sites on the Pike River; however, the data was limited by parameter diversity, sample frequency and spatial distribution. At some sites only a couple parameters were measured and sampling was limited to once or twice a year. The majority of sites were located on the main branch of the Pike River (n=14), with a few on the north branch (n=4), and only one site on the south branch. Other Pike River historical monitoring efforts were conducted by the University of Wisconsin- Milwaukee by examining fish, aquatic invertebrates, riparian habitat and water quality (Ehlinger *et al* 2008). However this program was spatially limited (north branch and a few reference sites on the south branch only); comprehensive water quality data on the south branch was most notably lacking.

In addition to monitoring riparian locations within the watershed, points of discharge inclusive of stormwater systems needs to be monitored in order to determine potential vectors of impairment. Stormwater discharge monitoring is a key element for developing baseline water quality data and to determine potential impairment sources. Stormwater outfalls discharge excess water and pollutants conveyed from impervious areas (streets, buildings, lawns and parking lots) within a stormwater basin. In the City of Kenosha, over 57 stormwater outfalls in the City of Kenosha drain into the Pike River or Lake Michigan directly; the water quality of the stormwater discharge originating from these outfalls prior to this study was unknown.

Purpose

The purpose of this study was to provide a baseline water quality index and characterize water quality impairment sources within the Pike River watershed and along the Lake Michigan shoreline through comprehensive monitoring of all three branches of the river and associated storm water infrastructure.

Methods

The following section describes monitoring locations chosen for this study, criteria used to select monitoring locations, sample collection techniques, analysis procedures and statistical methods.

Study Area

Three branches and numerous tributaries comprise the river: the north, south, and main. Within the Pike River watershed, 135 square kilometers drain agricultural, suburban, forested,

industrial and urban land directly to the river while the remaining 10 square kilometers drains primarily urban land directly to Lake Michigan (SEWRPC, 1983).

Surface Water Sites

Monitoring sites along the Pike River and its tributaries were selected to yield a representative snapshot of ambient water quality and provide a geographically extensive data set. Surface water samples were collect once weekly from 29 open water sites (9 on the north branch, 8 on the south branch and 12 on the main branch) from May 17th – October 25th 2012 (Figure 1 for site locations). Sites were chosen to provide spatial distribution as to identify areas that are most detrimental to water quality while maintaining feasible access. Satellite imagery and habitat assessments were utilized for determining land use classifications for each site. If a site was located in an area with multiple land uses, the most abundant land use was used for classification.

Stormwater Outfalls

At the onset of this study, the objective was to sample all stormwater outfalls in the City of Kenosha that drain into the Pike River or drain directly into Lake Michigan following dry and wet weather events. Of the 57 stormwater outfalls present, 49 were deemed accessible and sampled with varying frequencies throughout the study (May 17th 2012 – May 21st 2013). Forty-eight stormwater outfalls that either drain into the Pike River (n=25) or Lake Michigan directly (n=23) were sampled six times (three wet and three dry weather). One stormwater outfall draining into Pike River was sampled only three times due to lack of property access. Ten of the 49 outfalls, which were in close proximity to beaches, were monitored once weekly during the summer swimming season (June- August) (see Figures 2-10 for stormwater outfall locations).

Surface water and stormwater outfall samples were collected in sterile Whirl-Pak® bags (Nasco, Ft. Atkinson, WI) using a sampling pole or sampling line. The sample was collected approximately 10 cm below the water's surface, usually in the center of the stream or river, in an up-stream direction to avoid contamination. If the water depth was shallower than 10 cm, the sample was collected at the deepest depth that did not introduce stream bed sediments into the sample. Upon collection, water samples were stored in a cooler on ice packs during transport, held at 4 ° C until returning to the City of Racine Health Department Laboratory (RHD) where sample analysis occurred, usually within required/recommended holding times.

Sample Analysis

Samples were analyzed for a variety of indicators. Surface water samples were analyzed for water temperature, dissolved oxygen, pH, specific conductivity, turbidity and *E. coli*. Total phosphorous and ortho-phosphates were also measured at three representative sites (one on each branch) twice quarterly during dry and wet weather. Stormwater outfalls were analyzed for water temperature, pH, specific conductivity, turbidity, *E. coli* bacteria, total chlorine, detergents, copper and phenol concentrations (Table 3). Time and temperature sensitive indicators were

determined in situ when possible, or measured immediately after sample collection in the field, such as dissolved oxygen (both concentration and saturation percentage) and temperature (air and water). All chemical analyses took place at the City of Racine Health Department Laboratory, with the exception of phosphorus samples (total and ortho-phosphates), which were shipped to and analyzed by the Wisconsin State Laboratory of Hygiene (WSLH).

Temperature

Air temperature in degrees Celsius (°C) was taken at each site using an alcohol linear-scale calibrated thermometer. The thermometer was allowed to equilibrate in the shade at chest-height and stabilize before values on the thermometer were recorded.

Water temperature in degrees Celsius (°C) was measured using the thermistor within the YSI dissolved oxygen probe for all sampling locations except at stormwater outfalls. For outfalls, excess sample water was poured into a separate bag, and an alcohol based thermometer was submersed into the bag until the temperature equilibrated and stabilized.

Dissolved Oxygen (DO)

Dissolved oxygen (concentration measured in mg/l and percent saturation) was measured at sampling points using a Yellow Stream Instruments (YSI) Model 550A meter. Calibration and maintenance procedures were followed in accordance to the manufacturer's operations manual. Following calibration, the probe was submerged approximately 10 cm below the surface of the water following the collection of surface water samples and moved in a circular manner. The gentle movement of the probe through the water prevents the consumption of dissolved oxygen which would cause an artificially low reading. Concentrations were allowed to stabilize and values were recorded.

pH

The pH of each sample was measured at Racine Health Department Laboratory on the same day of sample collection using a calibrated Corning Model 430 pH meter (Corning, New York). A two-point calibration utilizing two known pH buffer standards, 7.00 and 4.01, was performed daily prior to sample analysis. The calibrated values and percent slope were recorded; the acceptable range for the slope was 95 - 100%. If values fell outside of this range standards were discarded and calibration occurred again. A thoroughly mixed 80 ml aliquot of the sample was poured into a clean 100 ml beaker and placed under the electrode. Once the reading had equilibrated (usually within 2-3 minutes), the pH value was recorded in standard units (s.u).

Specific Conductivity

Specific conductivity of each sample was measured at Racine Health Department Laboratory the same day of sample collection using a digital conductivity meter Oakton model Con-510 (Vernon Hills, IL). The meter was calibrated monthly and a quality control check was performed daily, prior to sample analysis. A thoroughly mixed 80 ml aliquot of the sample was poured into a clean 100 ml beaker and placed under the probe. Once the reading had equilibrated (usually within 10 seconds), the value was recorded in micro Siemens per centimeter (µS/cm).

Turbidity

The turbidity of each sample was measured usually the same day as collection (or the following day if time did not allow for same day analysis). All turbidity units were recorded in Nephelometric Turbidity Units (NTU) using a HF Scientific Micro 100 Turbidimeter (HF® scientific, Inc., Fort Myers, FL) and calibrated monthly with primary (0.02, 10, 1000 NTU) standards (GFS Chemicals, Columbus, OH). A check of the turbidimeter's calibration was performed daily before sample analysis with sealed secondary standards of the same units (GFS Chemicals, Columbus, OH). A thoroughly mixed aliquot of the sample was poured into a rinsed cuvette and the outside surface wiped with an alcohol swab and dried. The cuvette was placed in the turbidimeter optical well and indexed, where the cuvette was rotated in 10° increments until a complete rotation occurred. The lowest reading of the sample was recorded in NTU.

E. coli enumeration

E. coli concentrations were enumerated using IDEXX Colilert - 18® or IDEXX Colilert® (IDEXX, Inc., Westbrook, ME), a selective cultural identification method utilizing bacterial enzymatic activity and differential substrates, for the detection of *E. coli* according to previously established laboratory protocols. Generally, surface water samples were processed diluted, 1:10 (10 ml of sample + 90 ml sterile distilled water) during normal flow conditions, or 1:100 (1.0 ml sample + 99 ml of sterile distilled water) when *E. coli* concentrations were expected to be elevated during wet weather events. Stormwater outfall samples were typically processed diluted at 1:100 (1.0 ml sample + 99 ml of sterile distilled water). The sample to be tested was then mixed with reagent and sealed in a Quanti-Tray/2000 according to manufacturer's instructions (Colilert® or Colilert-18® product insert, IDEXX Laboratories, Westbrook, ME). After incubation at 35 ºC ± 0.5 ° C for 18 hours (or 24 hours for Colilert®), Quanti-Tray wells were read for fluorescence, indicating 4-methyl-umbelliferyl ß-D-glucuronide (MUG) cleavage (confirmatory for the presence of *E. coli*), with the aid of a UV light box (366 nm). Wells producing fluorescence in the absence of yellow color were determined to be false readings (*E. coli* would be classified as a total coliform and therefore should be detected by this method, according to the manufacturer). The number of wells producing fluorescence was compared to the MPN table provided by the manufacturer to enumerate *E. coli* as MPN/100 ml (Most Probable Number of *E. coli* per 100ml). *E. coli* concentrations below the detection limit were treated as half the detection limit for statistical calculation purposes, i.e. <10 MPN/100 ml became 5 MPN/100 ml. Quality control organisms (positive = *E. coli* ATCC #25922, negative = P. aeruginosa ATCC # 10145) was run once per box of reagent to validate (qualitative) test performance.

Total Phosphorus and Ortho-phosphates

Samples were analyzed for total phosphorous (mg/l) and ortho-phosphates (mg/l) seasonally in an attempt to capture conditions representative of base flow and high flow (either spring melt or rain events). Total phosphorous samples were collected in sterile 250 ml plastic bottles, preserved with sulfuric acid, added to produce a final pH of approximately 1.0, which was verified using a colorpHast® pH indicator strip (EM Science, Gibbstown, NJ), and held at 0- 4 °C. Ortho-phosphate samples were collected in sterile 60ml plastic bottles and held at 0- 4 °C.

Samples were shipped on ice to the Wisconsin State Laboratory of Hygiene and analyzed within 28 days of sample collection.

Chlorine

Outfall samples were tested for total residual chlorine on the same day of sample collection using a Lovibond® Comparator 2000 test kit. A 10 ml aliquot of each sample was mixed with a crushed DPD No 4 chlorine reagent indicator tablet in a clean glass vial. Chlorine was measured in mg/l using a comparator that matches pink color intensity (indicating diethyl-p-phenylenediamine) to the concentration of total chlorine.

Detergents

Outfall samples were analyzed for detergents on the same day of sample collection using a CHEMets Test kit R-9400 (CHEMetrics, Inc., Calverton, VA). As per manufactures directions, a 5 ml aliquot of sample was mixed with a provided quantity of methylene blue and vigorously shaken for 30 seconds. The sample was then left undisturbed for one minute. A CHEMet assembly ampoule with an immiscible organic solvent was employed to draw up the blue complex. Detergents, which are one of the most prominent methylene blue active substances, were measured in ppm (mg/l) using the provided comparator that matched the blue color intensity to the concentration of methylene blue active substances in the sample.

Copper

Outfall samples were analyzed for copper on the same day of sample collection using a CHEMets Test kit R-3510 (CHEMetrics, Inc., Calverton, VA). A 25 ml aliquot of sample was mixed with a provided quantity of bathocuproine to form an orange-colored chelate. After a two minute reaction time, the sample was measured in ppm (mg/l) using a comparator, which equated the orange color intensity to the copper concentration.

Phenols

Outfall samples were analyzed for phenols on the same day of sample collection using a CHEMets Test kit R-8012 (CHEMetrics, Inc., Calverton, VA). The reaction was initiated by dissolving potassium ferricyanide into a 25 ml aliquot of sample, then adding a provided quantity of 4-aminoantipyrine to form a red colored complex. After a one minute reaction time, the sample was measured in ppm (mg/l) using a comparator, which equated the red color intensity to the phenol concentration.

Statistical Analysis

A number of basic statistical analyses were conducted to determine conditions impacting water quality. All *E. coli* concentration data were log-normalized and expressed as a log- transformed variables unless stated otherwise to partially satisfy statistical conditions of normality and equal variance. Microsoft® Office Excel data analysis ToolPak was used to calculate descriptive statistics. Minimum significant *r* values ($p<0.05$) were identified for every pair of variables based

upon the degree of freedom present in the analysis. P values of <0.05 were considered significant, unless otherwise noted.

Results

A drought was officially declared for southeastern Wisconsin in the summer of 2012, making the original target of eight wet weather sampling events (>0.635 cm of precipitation within 24 hours) impossible to achieve for all surface water sites. As a result, 21 dry and three wet weather sampling events occurred for surface water sites during this study.

Surface Water Sites

Water temperature

None of the surface water sites exceeded state standards for water temperature during the course of this study (water temperature standards vary based on use designation, see Table 4).

Dissolved oxygen concentration

Almost half (13 of 29) of surface water sites did not meet WDNR DO standards on at least one occasion, indicating they may be unsupportive of aquatic life in their present condition (see Table 5 for number of exceedances and site-specific use designations and standards). Of these, seven small tributaries located primarily on agricultural and forested lands failed to meet required DO standards in 20% of assessed samples (north (n=3), south (n=3) and main (n=1) branches). The Somers Branch, a tributary on the south branch designated as LAL, had the most samples which failed to meet standards, not meeting the lowest dissolved standard of 1.0 mg/L 23 % of sampling events (wet and dry conditions combined).

pH

The JR-Parkside site, located on a small tributary flowing into the main branch exceeded the WDNR state standard for pH (6.0-9.0 s.u.) one time under dry weather conditions. All other dates at this location and all other sites met state standard criteria for pH (Table 6).

Specific Conductivity

Specific conductivity exceeded the EPA recommended guideline of 1,500 µS/cm at least once at seven of the 29 sites, primarily on smaller tributaries across various landscapes (agricultural, residential and forested) on the north and main branches. However, exceedances occurred less than 30% of the time, with the exception of a small tributary on the main branch near Petrifying Springs Park (JR-Parkside site), which exceeded the standard 88 percent of the time (Table 7).

Turbidity

All sites exceeded the recommended EPA turbidity guideline of < 14 Nephelometric Turbidity Units (NTU) during the three wet weather sampling events. Nine sites also exceeded the turbidity standard for at least 50% of dry weather sampling events. Sites with higher turbidity were typically located in agricultural areas with narrow vegetated buffer strips (north and south

branches) and/or bluff areas with down cutting banks due to erosion (main branch). Turbidity and 24- hour (hr) precipitation were significantly, positively correlated at 13 sites ($p<0.05$); turbidity and 48- and 72- hr precipitation were significantly positively correlated at 12 of these 13 sites ($p<0.05$). Turbidity and volumetric flow (discharge) were also significantly positively correlated at the same 13 sites ($p<0.05$) (Table 8).

E. coli

E. coli concentrations exceeded the state standard for primary recreational contact (235 MPN/100ml) at all sites during the three wet weather events, with the exception of School Tributary, a smaller stream flowing in an agricultural area on the south branch (Figure 11). *E. coli* concentrations at all sites were significantly positively correlated with 24-, 48- and 72- hr precipitation with the following exceptions ($p<0.05$): *E. coli* concentrations at Lamparek Ditch, Hwy K, and School Tributary were not significantly correlated with any rainfall amounts ($p>0.05$); *E. coli* concentrations were not significantly correlated with 48- or 72 hr precipitations at the Somers Branch site nor were they significantly correlated with 72- hr precipitation for Oakes Rd and Waxdale Creek sites ($p>0.05$) (Table 9). Fifteen sites (located in agricultural areas on all three branches and small tributaries in residential areas) also exceeded the *E. coli* bacteria standard at least 50 percent of the time during dry weather sampling events. Ten sites exceeded the standard at least 75 percent of the time, wet and dry weather events combined.

Total Phosphorous and Ortho-phosphates

Total phosphorus, all samples collected on all three branches of the Pike River, consistently exceeded the state standard (0.075 mg/l) during both dry and wet weather (Table 10). The highest concentrations of phosphorus were noted in agricultural areas with narrow vegetated buffer strips on the north and south branches during wet weather. Ortho-phosphate concentrations ranged between 0.09- 0.18 mg/L, approximately half that of total phosphorus (no state standard exists for this analyte).

Stormwater outfalls

Eight of the 57 stormwater outfalls were deemed inaccessible and not sampled. Eleven of the 49 accessible stormwater outfalls did not flow during the course of this study (Table 11).

Water Temperature

None of the outfalls exceeded the recommended guideline for water temperature (30 °C) during the course of this study (Table 12).

pH

Only one outfall (K1), draining directly into the south branch of the river, exceeded the pH standard range (6.0-9.0 s.u.): one time each under both wet and dry conditions. All other outfall sample results were within the acceptable range (Table 13).

Specific Conductivity

Specific conductivity was above 1,500 µS/cm at least one time during dry and wet weather sampling events at 17 outfalls draining into the river or to Lake Michigan directly. Six of these outfalls exceeded the recommended specific conductivity criteria for determining polluted outfalls (2,000 µS/cm) on at least one occasion, and one of these (PM 5) exceeded the 2,000 µS/cm criteria 11 times (Table 14).

Turbidity

Twenty-four outfalls (Pike River (n=11) and Lake Michigan (n=13)) exceeded the recommended turbidity standard for surface waters (14 NTU). Many of these outfalls were located on the main branch near the river mouth (wet conditions) or draining into the Kenosha Harbor (wet and dry conditions). None of the outfalls exceeded the recommended turbidity guideline for determining polluting outfalls (1,000 NTU) (Table 15).

E. coli

All 38 flowing outfalls exceeded the surface water recreational standard (235 MPN/100 ml) at least once. Eighteen outfalls were identified as major sources for microbial pollution, with *E. coli* levels exceeding 10,000 MPN/100ml during wet weather events; *E. coli* concentrations at six of these outfalls were significantly positively correlated with 24- and 48- hr rainfall amounts ($p<0.05$) (Table 16). Seven of the 18 outfalls with elevated *E. coli* concentrations were in close proximity to beaches. One outfall, PM1 (located near the river mouth), also had consistently high *E. coli* during dry weather.

Total Chlorine

Four outfalls (PPB A, PM 5, Pennoyer and Southport 1) exceeded the recommended total chlorine standard of < 0.1 mg/l (two wet and two dry weather) once. All other outfalls sample results were within acceptable range (Table 17).

Detergents

Thirty-three outfalls exceeded the recommended detergent standard of < 0.25 mg/l at least once. While most (n=36) of the detergent concentrations were less than-or-equal to 0.5 mg/l, one outfall, AP 1, tested as high as 1.0 mg/l (Table 18).

Copper

Two outfalls exceeded the recommended copper standard of <0.2 mg/l one time each. Most outfalls (n=35) tested below the limit of detection for copper (0.1 mg/l) (Table 19).

Phenols

Seven outfalls exceeded the recommended phenols standard of <0.1 mg/l. All seven outfalls tested just above the limit of detection (0.1 mg/l), and each outfall exceedance was a single occurrence (Table 20).

Conclusions and Recommendations

This study established a baseline water quality index and helped identify impairment sources to the Pike River and Lake Michigan shoreline. Problem areas such as small tributaries in agriculturally-intensive areas with narrow riparian buffers frequently had elevated *E. coli* levels and low DO, indicating microbial pollution and aquatic life impairment. Specific conductivity and turbidity also are elevated at some sites, but the full extent of their impact on water quality is outside of the scope of this study due to sampling only occurring during the summer and fall seasons (before snowfall and the de-icing agents are applied to roads) and during mostly dry weather conditions. Total phosphorous results from all three branches indicate high phosphorous-loading in the watershed; however, monitoring additional surface waters may be needed to further refine the location of "hot spots", thereby ensuring future restoration projects are crafted with the best information possible. It is recommended all 29 surface water sites undergo a second year of monitoring, and at least six additional surface water sites are monitored for total phosphorous. Continued and additional monitoring of surface waters is recommended during rain events, including an increase in both the number of events (weather depending) and the number of sites. Specifically, additional surface water sites that are upstream of current sites on smaller residential tributaries (such as Waxdale and Sorenson Creeks) should be monitored during rain events to localize potential pollutant sources.

Baseline monitoring of stormwater outfalls draining to the Pike River and Lake Michigan revealed pollutant sources and impairments to water quality. Water temperature, pH and turbidity results of the outfalls sampled are of less concern, but elevated specific conductivity, *E. coli* and detergent concentrations at many of the outfalls indicate impairment sources with a high probability of sanitary infiltration. Results from this study indicate monitoring of some stormwater outfalls should continue due to the number of exceedances for *E. coli* bacteria levels and/or further investigation is warranted (Table 21). At the river mouth, municipal infrastructure appears to be contributing to poor water quality and needs further investigation. Monitoring of total and human-specific *Bacteroides*, a strain of bacteria specific to humans, should occur at outfall PM1 due to elevated dry weather *E. coli* levels and the presence of detergents (indicating possible sanitary infiltration). Select outfalls draining into the Pike River will be monitored under a Fund for Lake Michigan grant in 2013. Increasing the sampling frequency of the outfalls with elevated *E. coli*, especially during swimming season, is recommended for 2013, depending on the proximity of the outfalls to the swim area. In addition to the problem outfalls mentioned above, untested stormwater outfalls draining into the Pike River farther upstream in Sturtevant, Mount Pleasant and Elmwood Park municipalities should also be monitored. High *E. coli* concentrations at surface water sites in these municipalities during wet weather indicate that stormwater outfalls in close proximity could be pollutant sources in addition to other non-point, precipitation mobilized sources.

Drought conditions during 2012 led to fewer samples collected on ephemeral tributaries due to lack of flow. Preliminary data analysis indicates differences exist between years one and two for dissolved oxygen and *E. coli* concentrations, likely related to differences in water temperatures and precipitation. Since only three wet weather surface water sampling events occurred in 2012, more rain event monitoring will occur in 2013 for surface water sites and stormwater outfalls, weather depending.

Monitoring has continued outside of this project and further statistical analysis will be forthcoming. It is therefore recommended that the 2012 data be interpreted in conjunction with the 2013 data due to extreme weather conditions in 2012. It is important that 2012 data does not exclusively influence watershed plan decisions or recommended best management practices due to this being a poor representative year. A final report with the results of the Pike River Watershed study will be published in 2014 that includes two years of data collected under both the Wisconsin Coastal Management Program and the Fund for Lake Michigan grants.

Sources

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Table 1. Designated uses, impairment status and water quality standards for surface water sites.

2012 - 2013 Racine Health Department Pike River Sampling Sites and Use Classification, Impairment Status, and Applicable Standards or Guidelines

Pike River Section	North Branch									South Branch								Main Branch											
	Upstream to Downstream →									*Upstream to Downstream →*								*Upstream to Downstream →*											
Racine Health Department Sampling Sites (t) denotes tributaries	Bartlett Branch (t)	Oakes Rd	Waxdale Creek (t)	Willow Rd (t)	Hwy 11	Chicory Creek (t)	Braun Rd	Lamparek Ditch (t)	Hwy KR	Hwy K	Hwy EA- Hwy S	Hwy EA- Hwy L (t)	Hwy L	Hwy E	Somers Branch (t)	School Tributary (t)	Hwy 31	Hwy A-Petrifying Springs	JR-Petrifying Springs	JR-Parkside (t)	Wood Rd-Hwy A	Hwy Y	Sorenson Creek (t)	Hwy A-13th	Hwy E-Hwy 32	Kenosha Branch (t)	Carthage Hwy 32	Alford Park at Pike	Hwy 32-7th Ave
WI DNR Use Classification	FAL		LAL	LFF	FAL					FAL					LAL	FAL	LFF	FAL											
WI DNR Impairment Status	303(d) listed for FAL*									Not Assessed								Proposed to be 303(d) listed for FAL**											

Parameter	Standard or Guideline	Source	Applicable Standard or Guideline to Site, based upon Use Classification or Variance																										
Water Temperature	see other table	NR 102, WisCALM	state standard: specific to month and designation															state standard: specific to month and designation											
Dissolved Oxygen	FAL > 5.0 mg/L	NR 102.04(4)																											
	LFF > 3.0 mg/L	NR 104.02(3)																											
	LAL > 1.0 mg/L	NR 104.02(3)																											
	Variance > 2.0	NR 104.06(2)a																											
pH	6.0 - 9.0 s.u.	NR 102.04	state standard: 6.0 - 9.0 s.u.															state standard: 6.0 - 9.0 s.u.											
Specific Conductivity	< 1,500 µS/cm	USEPA 2012	recommended guideline: < 1,500 µS/cm															recommended guideline: < 1,500 µS/cm											
Turbidity	< 14 NTU	USEPA 2000	recommended guideline: < 14 NTU															recommended guideline: < 14 NTU											
Total Phosphorus	FAL, LFF ≤ 0.075 mg/L	NR 102.06 (3)(b)	≤ 0.075 mg/L			≤ 0.075 mg/L										≤ 0.075 mg/L		≤ 0.075 mg/L											
	LAL: no standard (N.S.)	NR 104.02 (3)(b)(2)			N.S.										N.S.														
E. coli	< 235 MPN/100 ml	102.04 (5)(a)	state standard/ recommended guideline: < 235 MPN/100 ml															state standard/ recommended guideline: < 235 MPN/100 ml											

Use Classification and Color Code	Color Code
Fish and Aquatic Life (FAL)	Not applicable to site
Limited Forage Fish (LFF)	Variance to Use Classification
Limited Aquatic Life (LAL)	Applicable to multiple Use Classifications

* Impairment: Chronic Aquatic Toxicity, Degraded Habitat; pollutant: unknown pollutant, sediment/Total Suspended Solids; **Impairment: degraded biological community, pollutant: phosphorus; *** Despite a FAL or LFF designation, NR 104.06(2)a stipulates these waters only require a 2.0 mg/L DO concentration.

The Pike River impairments, designated uses and associated standards listed are current as of August 2013, however these may change when future WDNR evaluation and updates occur.

Table 2. Ambient water temperature and water quality temperature criteria for Fish and Aquatic Life and Limited Forage Fish uses.

Ambient Water Temperature and Water Quality Temperature Criteria for Warm-Small Waters						
	Fish and Aquatic Life Use					
	Limited Forage Fish					
	Ambient		Sub-Lethal		Acute*	
Month	°C	°C	°C	°C	°C	°C
Jan	0.6	2.8	9.4	12.2	24.4	25.6
Feb	1.1	3.9	10.0	12.2	24.4	26.1
Mar	3.3	6.1	11.1	13.9	25.0	26.7
Apr	8.9	10.0	12.8	17.2	26.1	27.2
May	14.4	15.0	18.3	21.1	27.8	28.9
Jun	18.9	17.8	24.4	25.0	28.9	29.4
Jul	20.6	20.6	27.2	27.2	29.4	30.0
Aug	19.4	20.0	27.2	26.1	28.9	30.0
Sep	15.6	17.2	22.8	22.8	27.8	29.4
Oct	10.0	12.8	16.1	17.2	26.7	28.3
Nov	4.4	7.8	9.4	12.2	25.0	26.7
Dec	1.7	4.4	9.4	12.2	24.4	26.1
Warm-Small Waters have a fish and aquatic life use designation of "warm sport fish community" or "warm water forage fish community" and uni-directional 7Q10 flows < 200 cfs (129 million						
*Acute water quality criteria are applied for daily maximum						
Source: NR 102.25(2)						

Table 3. Water quality parameters collected for surface water sites and stormwater outfalls.

Water Quality Parameter	Surface Water Sites	Stormwater Outfalls	Beach Proximity Outfalls
Air Temperature	x	x	
Water Temperature	x	x	
Dissolved Oxygen	x		
pH	x	x	
Specific Conductivity	x	x	x
Turbidity	x	x	
Phosphorous (total + ortho)*	x		
E. coli	x	x	x
Total Chlorine		x	
Detergents		x	
Copper		x	
Phenols		x	
* Three surface water sites were monitored for Phosphorous			

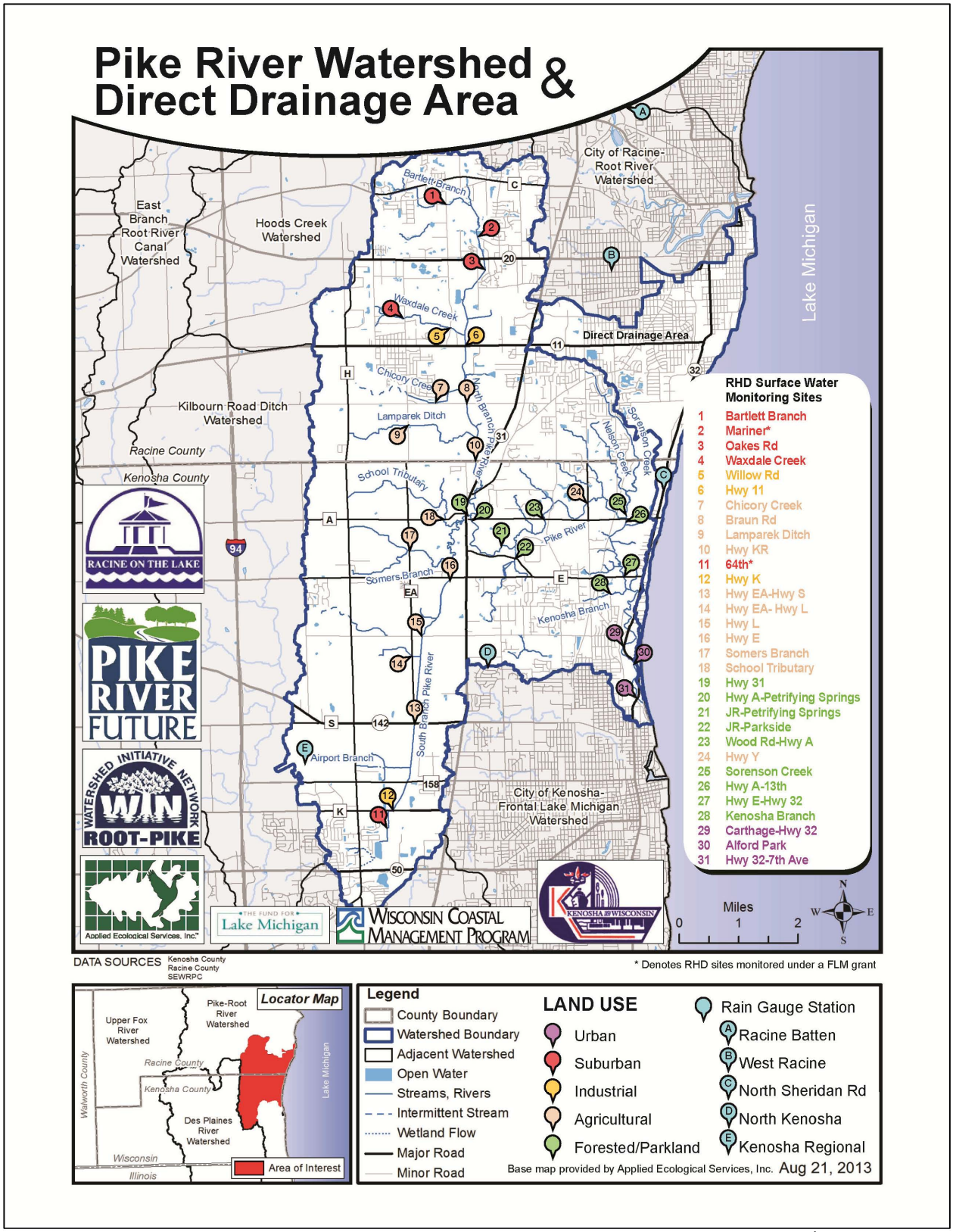


Figure 1. Surface water sites on the Pike River classified by land use type. Two sites shown, Mariner and 64th, are monitored under a Fund for Lake Michigan grant, and were not included in this report.

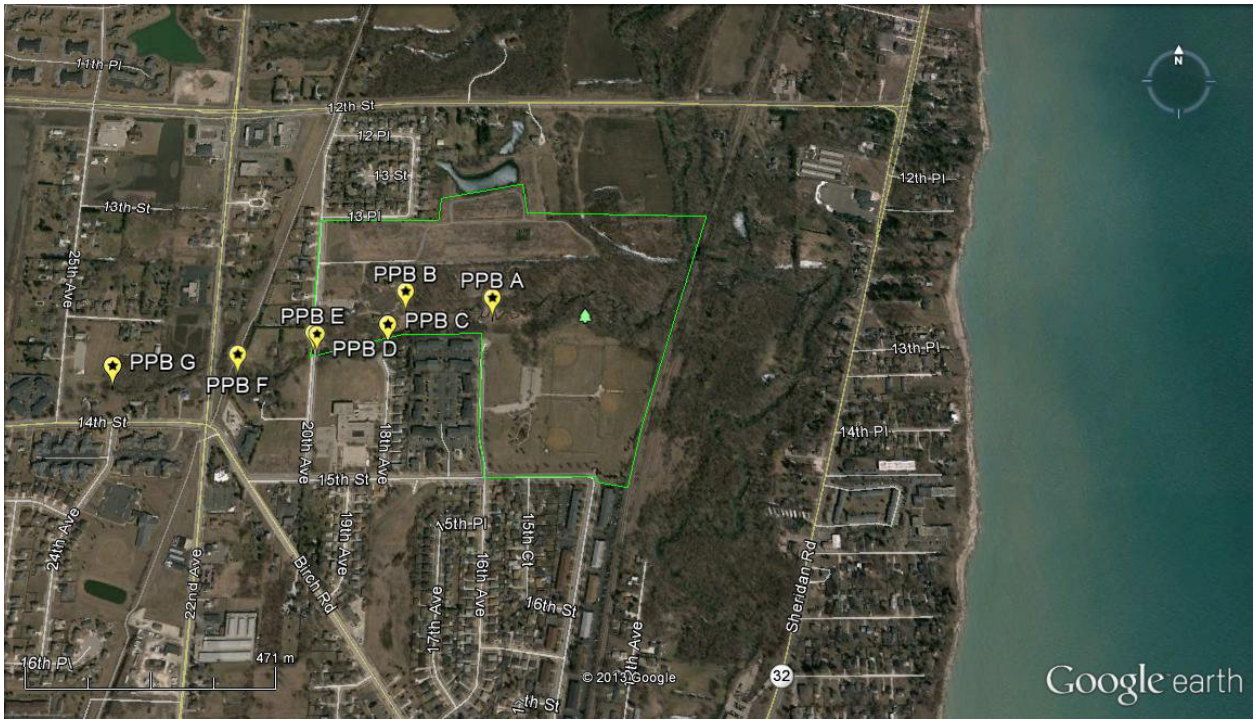


Figure 2. Poerio Park (PPB) stormwater outfalls, all which drain into the tributary Kenosha Branch.

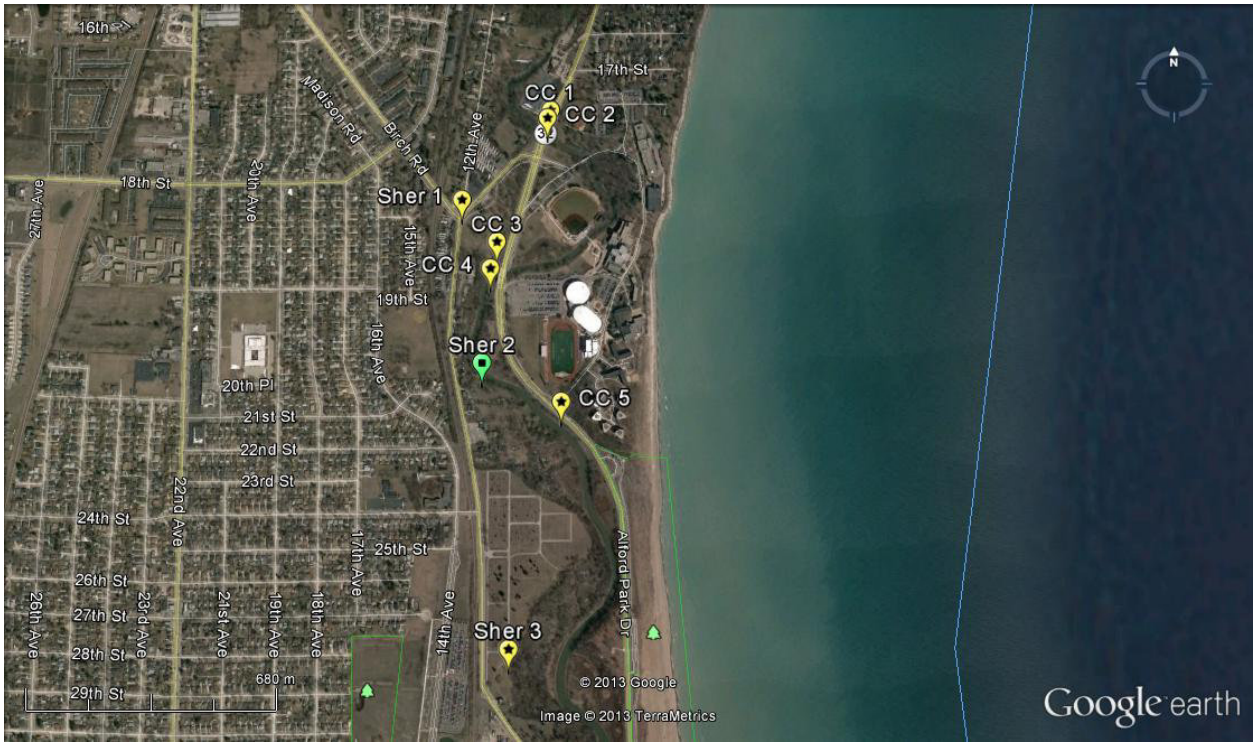


Figure 3. Carthage College (CC) and Sheridan Road (Sher) stormwater outfalls, all drain into the main branch of the Pike River several kilometers upstream from the river mouth. Green icon (Sher 2) indicates this outfall became inaccessible during this study.

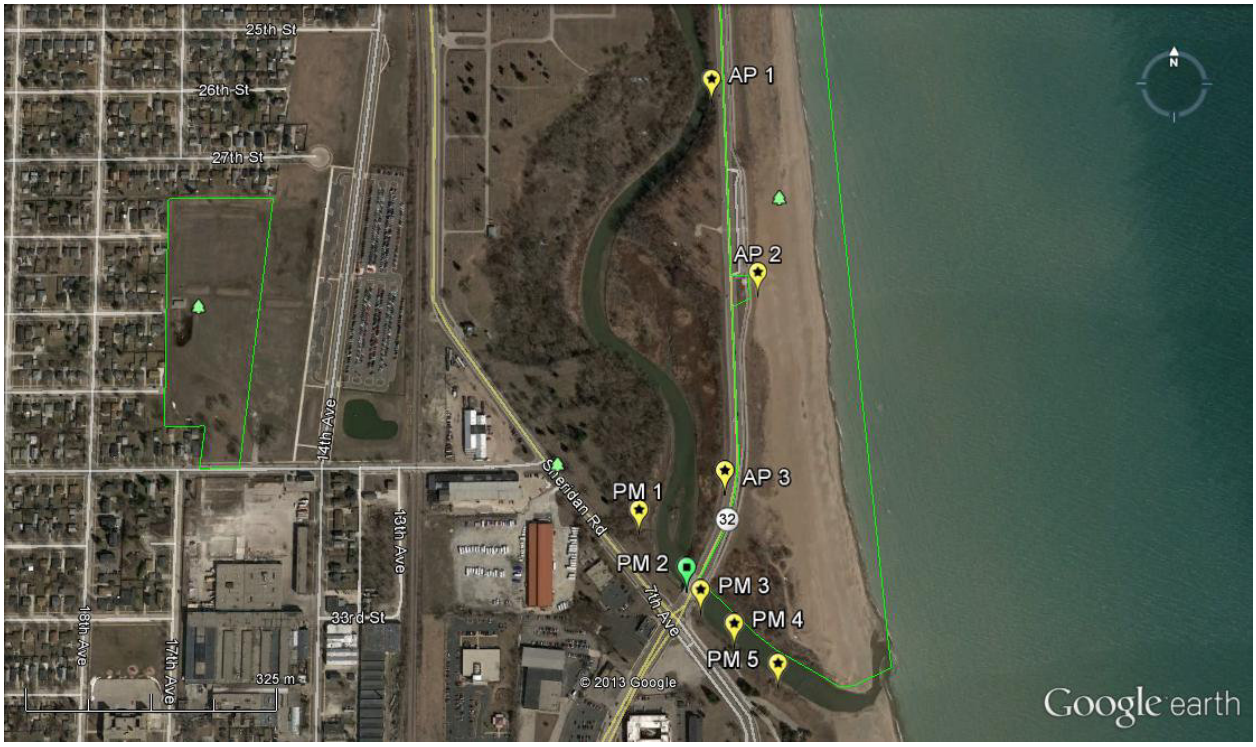


Figure 4. Alford Park (AP) and Pike River mouth (PM) outfalls. Green icon (PM2) represents an inaccessible outfall. Alford Park beach is directly north of Pike River mouth while Pennoyer Park beach is directly south.

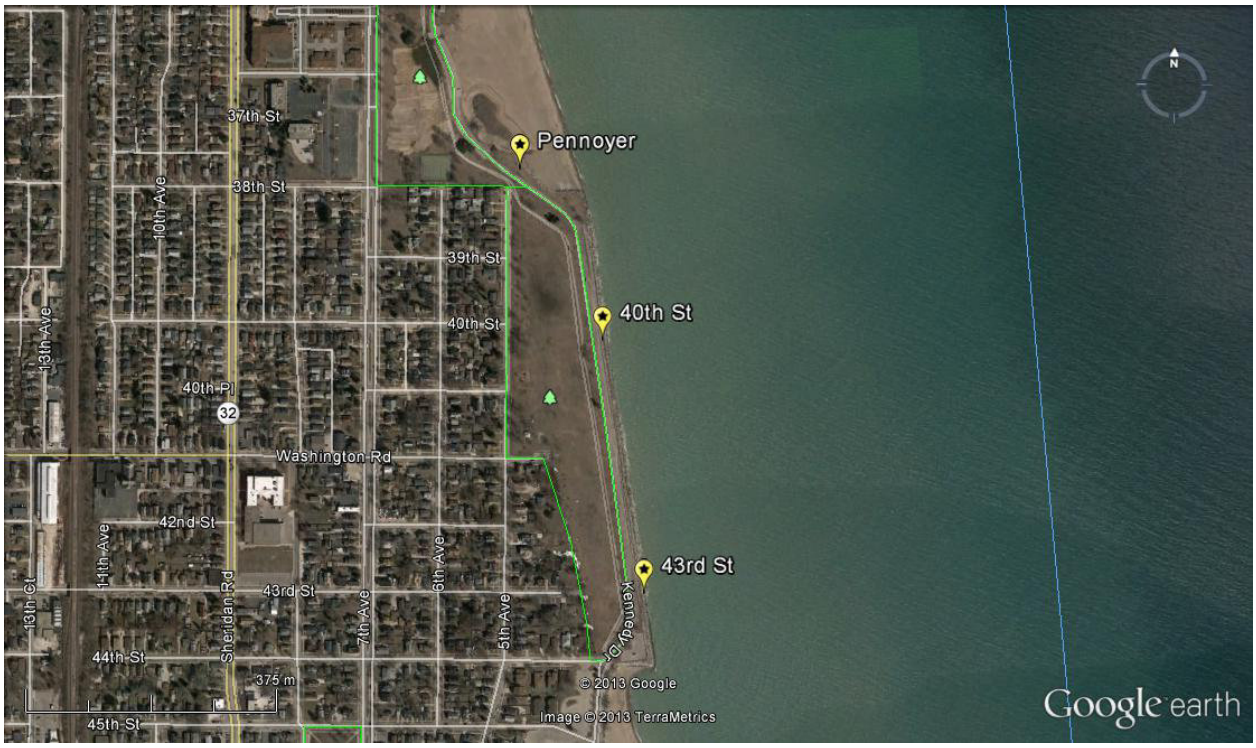


Figure 5. Lake Michigan draining outfalls, which are in close proximity to Kenosha beaches Pennoyer Park (to the north) and Simmons Island (to the south). All three were monitored weekly during summer (June – August) 2012.

Figure 6. Stormwater outfalls draining into the Kenosha Harbor. HP 54th D (green icon) was submerged and therefore inaccessible. The Kenosha Harbor discharges into Lake Michigan directly south of Simmons Island.

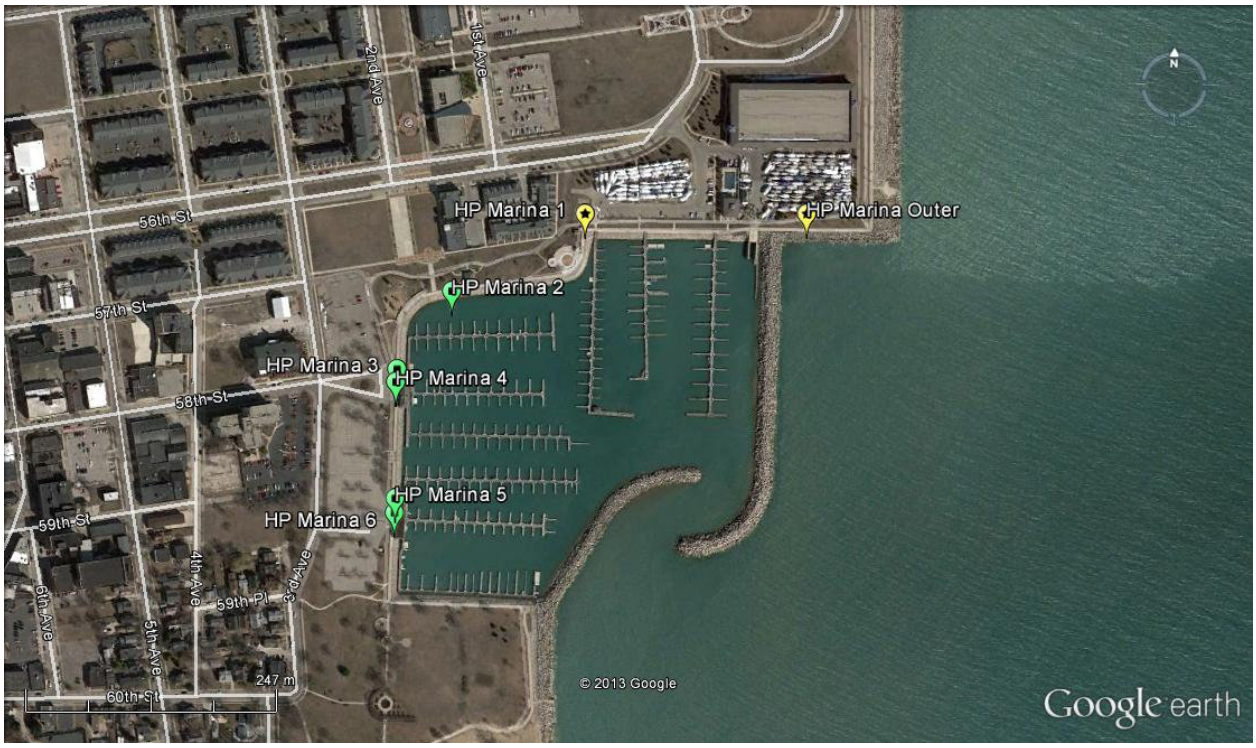


Figure 7. Stormwater outfalls draining into the Kenosha Marina. HP Marina 2 – 6 outfalls (green icons) were all inaccessible.

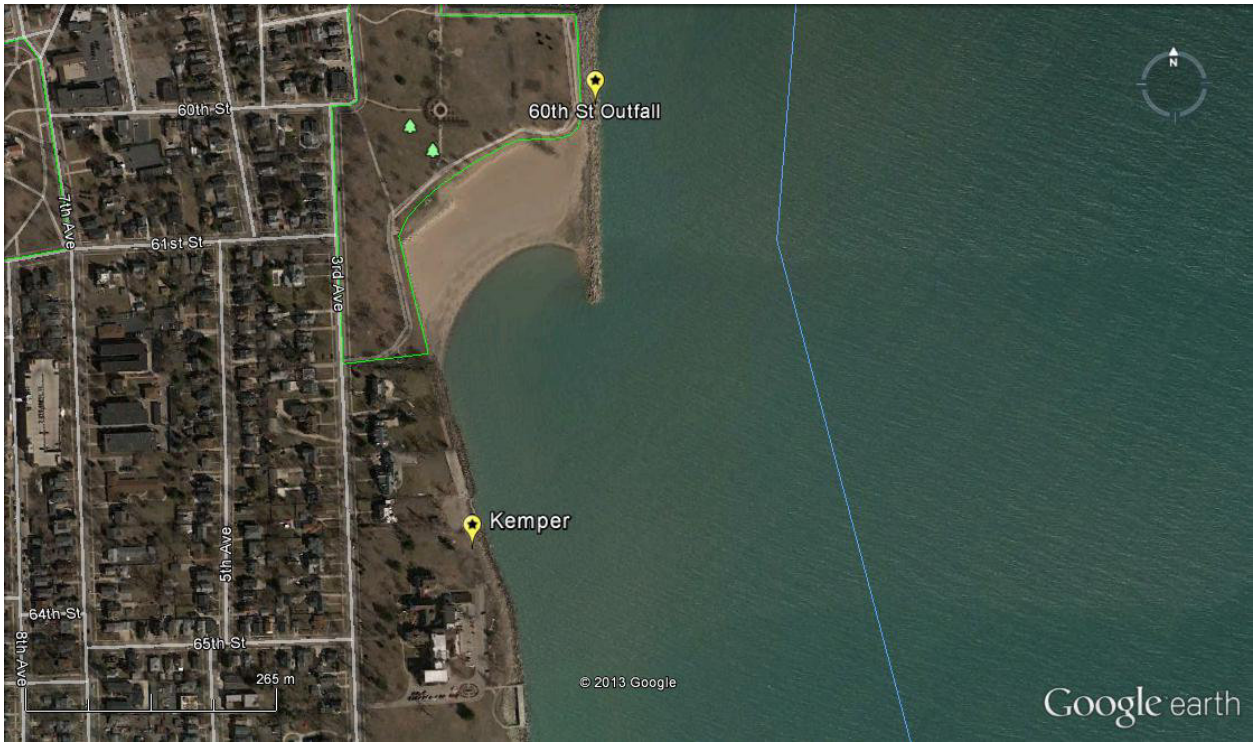


Figure 8. Kemper and 60th St. outfalls, both which were monitored weekly during summer (June – August) 2012 due to their close proximity to Eichelman Park Beach.

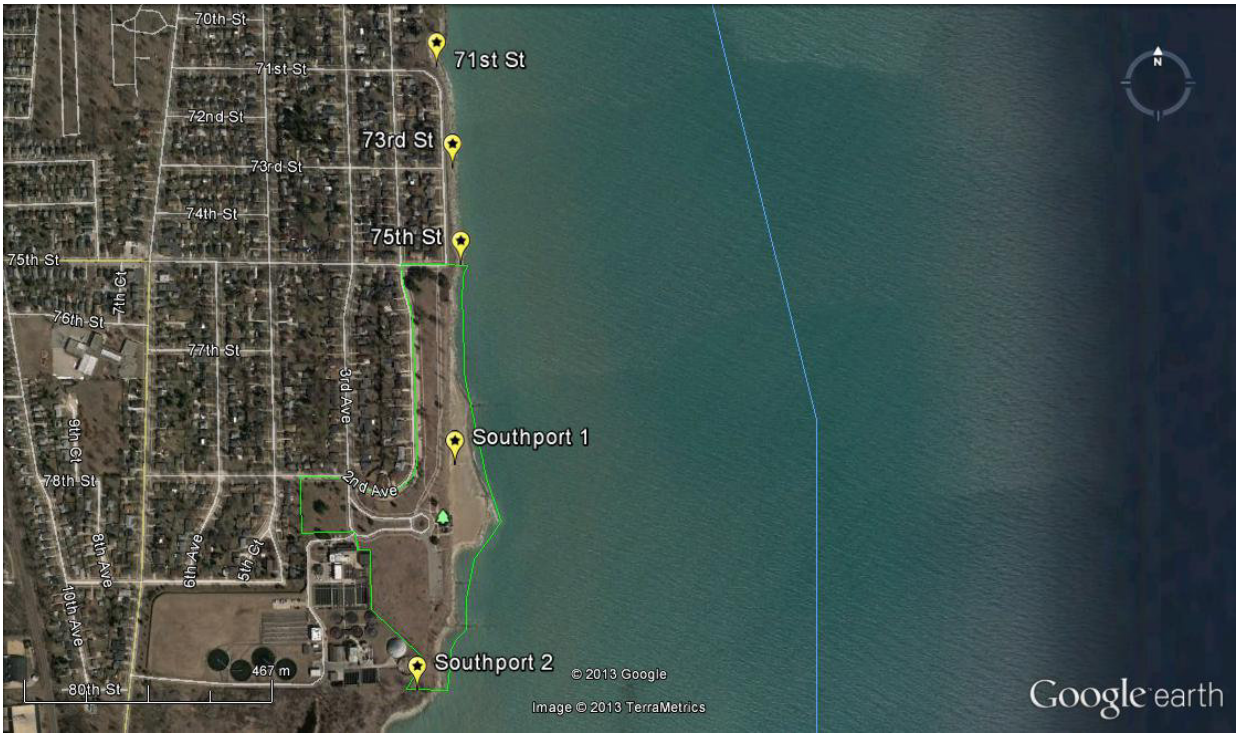


Figure 9. Lake Michigan draining outfalls in southern Kenosha adjacent to Southport Park Beach. Four outfalls, 71st, 73rd, 75th and Southport 1 were all monitored weekly during summer (June – August) 2012.

Figure 10. Stormwater outfalls draining into the south branch of the Pike River. Two outfalls (158 and K-158) did not flow during the course of this study.

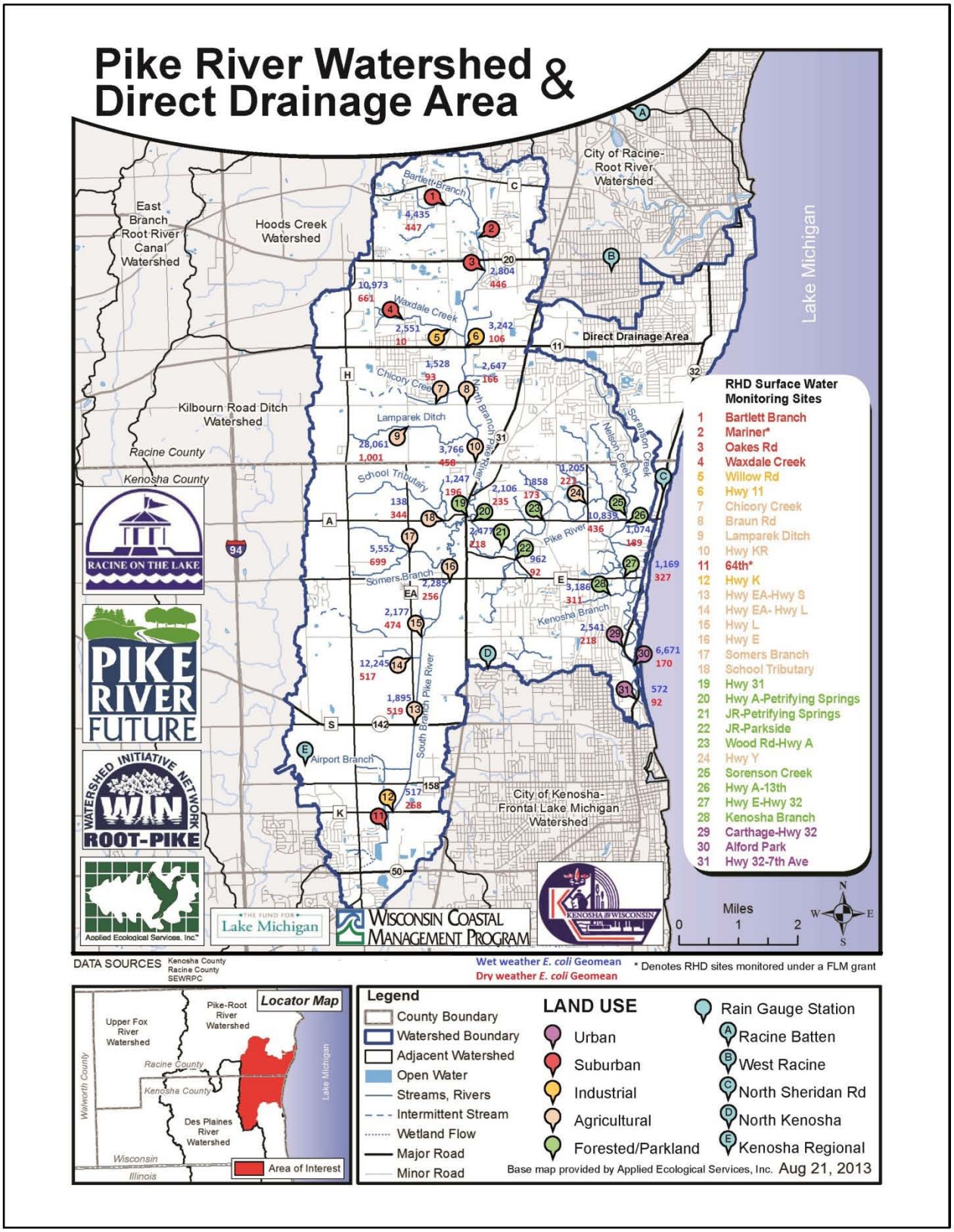


Figure 11. Wet weather (blue text) and dry weather (red text) *E. coli* geomeans displayed for surface water sites.

Table 4. Water temperature summary data, exceedances and correlations for surface water sites.

Water Temperature (°C) Summary Data by Surface Water Site in the Pike River Watershed 5.17.12 - 10.25.12																				
Site Code	Site (Upstream to Downstream)		#	χ	Med.	Min.	Max.	# of Exceedances		Correlations										
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
1	Bartlett Branch	North Branch	12	16.6	16.1	12.2	22.6	0	-	0.46	0.13	0.64	0.03	0.74	0.01	0.54	0.07	0.57	0.05
3	Oakes Rd		24	17.8	18.5	6.4	25.1	0	-	0.21	0.32	0.16	0.45	0.25	0.23	0.85	0.00	0.35	0.09
4	Waxdale Creek		24	17.4	18.0	8.3	24.2	0	-	0.32	0.13	0.37	0.07	0.44	0.03	0.77	0.00	0.45	0.03
5	Willow Rd		23	22.5	22.9	15.7	27.5	0	-	0.08	0.73	0.10	0.65	0.15	0.51	0.71	0.00	0.16	0.46
6	Hwy 11		24	20.6	21.7	12.9	26.2	0	-	0.18	0.40	0.21	0.32	0.27	0.20	0.82	0.00	0.30	0.15
7	Braun Rd		24	19.8	21.3	11.0	25.7	0	-	0.20	0.34	0.24	0.26	0.29	0.16	0.77	0.00	0.33	0.12
8	Chicory Creek		24	17.7	17.8	6.7	25.2	0	-	0.30	0.15	0.31	0.14	0.34	0.11	0.80	0.00	0.40	0.05
9	Lamparek Ditch		13	15.1	14.7	10.4	20.9	0	-	0.41	0.17	0.48	0.10	0.43	0.14	0.73	0.00	0.47	0.11
10	Hwy KR		24	19.3	20.7	9.7	25.4	0	-	0.20	0.36	0.16	0.45	0.27	0.20	0.81	0.00	0.38	0.06
12	Hwy K	South Branch	23	19.7	20.1	12.2	27.7	0	-	0.20	0.36	0.19	0.39	0.35	0.11	0.66	0.00	0.43	0.04
13	Hwy EA- Hwy S		24	17.7	18.6	7.7	25.7	0	-	0.18	0.39	0.17	0.42	0.30	0.15	0.72	0.00	0.40	0.06
14	Hwy EA- Hwy L		17	17.7	18.8	10.7	23.6	0	-	0.10	0.70	0.12	0.64	0.21	0.41	0.71	0.00	0.32	0.22
15	Hwy L		24	17.8	18.4	7.2	26.2	0	-	0.18	0.41	0.18	0.41	0.24	0.26	0.74	0.00	0.37	0.08
16	Hwy E		23	17.5	17.0	7.1	25.4	0	-	0.19	0.37	0.18	0.41	0.25	0.24	0.75	0.00	0.36	0.09
17	Somers Branch		21	16.6	15.8	7.8	23.0	0	-	0.27	0.23	0.26	0.25	0.32	0.15	0.85	0.00	0.45	0.04
18	School Tributary		24	16.4	17.0	6.2	23.1	0	-	0.23	0.29	0.17	0.43	0.21	0.34	0.77	0.00	0.40	0.06
19	Hwy 31		24	17.7	17.7	7.4	25.3	0	-	0.16	0.45	0.12	0.57	0.19	0.38	0.81	0.00	0.32	0.13
20	Hwy A-Petrifying Springs	Main Branch	24	19.2	20.3	9.4	26.7	0	-	0.15	0.48	0.10	0.65	0.15	0.49	0.75	0.00	0.31	0.14
21	JR-Petrifying Springs		24	19.2	20.2	8.5	26.2	0	-	0.17	0.42	0.12	0.57	0.18	0.40	0.77	0.00	0.34	0.11
22	JR-Parkside		24	17.3	18.0	9.1	22.9	0	-	0.22	0.30	0.17	0.44	0.20	0.36	0.76	0.00	0.37	0.08
23	Wood Rd-Hwy A		24	19.0	19.5	7.9	26.2	0	-	0.18	0.41	0.12	0.57	0.21	0.32	0.79	0.00	0.34	0.11
24	Hwy Y		24	18.7	19.1	7.4	26.0	0	-	0.19	0.37	0.14	0.53	0.22	0.30	0.75	0.00	0.36	0.09
25	Sorenson Creek		24	17.5	18.2	6.1	24.8	0	-	0.21	0.34	0.14	0.53	0.21	0.33	0.72	0.00	0.36	0.09
26	Hwy A-13th		24	18.9	19.9	7.4	26.2	0	-	0.19	0.37	0.13	0.55	0.20	0.34	0.83	0.00	0.34	0.10
27	Hwy E-Hwy 32		24	18.8	19.2	7.6	26.7	0	-	0.17	0.42	0.11	0.61	0.18	0.39	0.77	0.00	0.32	0.12
28	Kenosha Branch		24	18.5	19.6	7.1	25.0	0	-	0.19	0.36	0.12	0.58	0.18	0.41	0.78	0.00	0.31	0.14
29	Carthage Hwy 32		24	19.8	20.6	8.0	27.9	0	-	0.14	0.51	0.08	0.73	0.15	0.48	0.81	0.00	0.30	0.15
30	Alford Park at Pike		24	21.0	22.2	8.2	29.1	0	-	0.08	0.71	0.01	0.96	0.08	0.71	0.81	0.00	0.20	0.36
31	Hwy 32-7th Ave		24	20.6	22.1	7.3	26.8	0	-	0.11	0.61	0.02	0.92	0.08	0.70	0.73	0.00	0.25	0.24

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum | r = correlation coefficient | Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	For FAL and LFF state standards, see Ambient Water Temperature and Water Quality Temperature Criteria for Warm-Small Waters Table. Recommended guideline N/A.	
Limited Forage Fish (LFF)		
Limited Aquatic Life (LAL)	LAL waters state standard: temperature at any point may not exceed 30° C (86 °F)	

Source: See Ambient Water Temperature and Water Quality Temperature Criteria for Warm-Small Waters Table

Table 5. Dissolved oxygen summary data, exceedances and correlations for surface water sites.

Dissolved Oxygen (mg/l) Summary Data by Surface Water Site in the Pike River Watershed 5.17.12 - 10.25.12																					
Site Code	Site (Upstream to Downstream)		#	χ	Med.	Min.	Max.	# of Exceedances		Correlations											
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
1	Bartlett Branch	North Branch	12	3.6	3.7	1.7	5.1	11	-	-0.19	0.55	-0.31	0.33	-0.41	0.18	-0.47	0.12	-0.27	0.40
3	Oakes Rd		24	5.9	5.9	3.8	9.5	0	-	0.11	0.61	0.15	0.47	0.06	0.79	-0.69	0.00	-0.06	0.79
4	Waxdale Creek		24	5.2	5.2	1.4	12.3	0	-	0.02	0.93	-0.09	0.69	-0.16	0.45	-0.43	0.04	-0.04	0.86
5	Willow Rd		23	7.8	7.6	6.3	9.4	0	-	-0.33	0.12	-0.47	0.02	-0.60	0.00	0.24	0.27	-0.42	0.05
6	Hwy 11		24	7.5	7.5	5.3	9.0	0	-	-0.57	0.00	-0.61	0.00	-0.60	0.00	-0.11	0.61	-0.67	0.00
7	Chicory Creek		24	2.9	2.2	0.1	9.8	21	-	0.16	0.45	0.15	0.48	0.05	0.83	-0.48	0.02	0.12	0.58
8	Braun Rd		23	8.7	8.0	5.6	14.6	0	-	-0.35	0.10	-0.40	0.06	-0.41	0.05	-0.21	0.32	-0.41	0.05
9	Lamparek Ditch		13	6.6	5.9	7.3	8.2	6	-	-0.07	0.82	-0.16	0.61	-0.32	0.29	0.23	0.44	-0.13	0.68
10	Hwy KR		24	6.7	6.7	5.4	8.9	0	-	-0.25	0.23	-0.20	0.36	-0.22	0.31	-0.46	0.02	-0.27	0.20
12	Hwy K	South Branch	23	7.9	8.1	5.1	12.8	0	-	-0.37	0.09	-0.40	0.06	-0.46	0.03	0.11	0.61	-0.44	0.04
13	Hwy EA- Hwy S		24	6.8	6.9	1.3	12.3	1	-	-0.19	0.38	-0.16	0.46	-0.13	0.55	-0.34	0.10	-0.21	0.33
14	Hwy EA- Hwy L		17	5.5	4.4	6.2	17.5	9	-	-0.20	0.43	-0.34	0.19	-0.46	0.06	0.01	0.98	-0.26	0.31
15	Hwy L		24	5.5	4.5	1.2	11.0	2	-	-0.02	0.94	0.08	0.73	0.08	0.72	0.02	0.94	0.00	0.98
16	Hwy E		23	7.2	7.0	3.1	12.0	0	-	-0.23	0.28	-0.30	0.17	-0.32	0.14	0.30	0.16	-0.25	0.25
17	Somers Branch		21	4.8	2.7	0.1	15.6	5	-	-0.18	0.44	-0.33	0.15	-0.41	0.06	0.00	0.99	-0.27	0.24
18	School Tributary		24	4.0	2.4	0.5	11.5	18	-	-0.19	0.37	-0.34	0.10	-0.39	0.06	-0.06	0.77	-0.25	0.24
19	Hwy 31		24	8.3	8.5	6.4	10.4	0	-	-0.45	0.03	-0.52	0.01	-0.54	0.01	0.22	0.31	-0.49	0.02
20	Hwy A-Petrifying Springs	Main Branch	24	7.9	7.7	6.2	9.7	0	-	-0.47	0.02	-0.53	0.01	-0.55	0.01	-0.20	0.36	-0.54	0.01
21	JR-Petrifying Springs		24	7.7	7.4	6.0	10.9	0	-	-0.34	0.11	-0.35	0.10	-0.35	0.09	-0.29	0.17	-0.40	0.06
22	JR-Parkside		24	2.2	1.8	0.6	9.9	22	-	-0.02	0.91	-0.13	0.56	-0.15	0.49	-0.04	0.86	-0.01	0.98
23	Wood Rd-Hwy A		24	8.1	7.7	6.1	12.4	0	-	-0.25	0.24	-0.29	0.17	-0.35	0.10	-0.04	0.85	-0.32	0.13
24	Hwy Y		24	8.1	8.0	5.8	12.2	0	-	-0.28	0.19	-0.30	0.16	-0.35	0.09	-0.34	0.11	-0.37	0.08
25	Sorenson Creek		24	6.8	6.9	2.7	11.8	3	-	-0.04	0.85	-0.07	0.74	-0.09	0.67	-0.03	0.89	-0.04	0.84
26	Hwy A-13th		24	8.4	8.1	4.6	13.2	1	-	-0.16	0.46	-0.18	0.41	-0.24	0.26	-0.23	0.29	-0.24	0.26
27	Hwy E-Hwy 32		24	7.4	7.3	4.6	11.2	1	-	-0.12	0.59	-0.08	0.71	-0.09	0.69	-0.59	0.00	-0.16	0.44
28	Kenosha Branch		24	9.6	8.6	6.3	22.5	0	-	-0.27	0.20	-0.32	0.13	-0.36	0.08	0.34	0.10	-0.28	0.18
29	Carthage Hwy 32		24	7.7	8.1	5.0	10.7	0	-	-0.30	0.15	-0.29	0.17	-0.31	0.14	-0.17	0.42	-0.36	0.08
30	Alford Park at Pike		24	9.7	9.5	5.4	14.8	0	-	-0.34	0.11	-0.22	0.30	-0.17	0.42	-0.11	0.61	-0.35	0.10
31	Hwy 32-7th Ave		24	8.3	8.3	4.7	13.0	1	-	-0.41	0.04	-0.47	0.02	-0.50	0.01	0.12	0.58	-0.44	0.03

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	Not less than 5.0 mg/l	Not applicable
Limited Forage Fish (LFF)	Not less than 3.0 mg/l	
Limited Aquatic Life (LAL)	Not less than 1.0 mg/L	
Variance (despite use designation)	Not less than 2.0 mg/L	

Source: NR 102.04(4), NR 104.02(3), NR 104.02(3), NR 104.06(2)a

Table 6. Summary data, exceedances and correlations for pH of surface water sites.

pH (s.u.) Summary Data by Surface Water Site in the Pike River Watershed 5.17.12 - 10.25.12																					
Site Code	Site (Upstream to Downstream)		#	χ	Med.	Min.	Max.	# of Exceedances		Correlations											
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
1	Bartlett Branch	North Branch	12	7.7	7.7	7.3	7.9	0	-	-0.71	0.01	-0.68	0.01	-0.52	0.08	-0.26	0.41	-0.75	0.00
3	Oakes Rd		24	7.7	7.8	7.4	8.0	0	-	-0.58	0.00	-0.54	0.01	-0.45	0.03	-0.37	0.07	-0.59	0.00
4	Waxdale Creek		24	7.8	7.8	7.4	8.5	0	-	-0.50	0.01	-0.53	0.01	-0.53	0.01	0.07	0.73	-0.53	0.01
5	Willow Rd		23	8.0	8.0	7.5	8.3	0	-	-0.56	0.01	-0.53	0.01	-0.44	0.03	-0.06	0.79	-0.56	0.01
6	Hwy 11		24	8.0	8.0	7.4	8.2	0	-	-0.71	0.00	-0.69	0.00	-0.53	0.01	-0.08	0.70	-0.71	0.00
7	Chicory Creek		24	7.6	7.6	7.2	7.9	0	-	-0.48	0.02	-0.46	0.02	-0.38	0.06	-0.34	0.11	-0.51	0.01
8	Braun Rd		24	8.0	8.0	7.4	8.2	0	-	-0.55	0.01	-0.51	0.01	-0.38	0.07	-0.10	0.64	-0.51	0.01
9	Lamparek Ditch		13	7.8	8.0	7.3	8.2	0	-	-0.42	0.16	-0.51	0.08	-0.61	0.03	0.18	0.56	-0.48	0.09
10	Hwy KR		24	7.9	7.9	7.5	8.3	0	-	-0.46	0.02	-0.44	0.03	-0.36	0.09	-0.13	0.55	-0.39	0.06
12	Hwy K	South Branch	23	8.1	8.1	7.4	8.5	0	-	-0.02	0.94	0.01	0.95	0.13	0.56	-0.03	0.88	0.04	0.85
13	Hwy EA- Hwy S		24	7.9	7.8	7.4	8.3	0	-	-0.55	0.01	-0.55	0.01	-0.38	0.06	0.03	0.88	-0.47	0.02
14	Hwy EA- Hwy L		17	7.8	7.8	7.3	8.4	0	-	-0.51	0.04	-0.58	0.02	-0.54	0.02	-0.01	0.97	-0.47	0.06
15	Hwy L		24	7.8	7.7	7.3	8.0	0	-	-0.46	0.02	-0.39	0.06	-0.32	0.13	0.24	0.25	-0.44	0.03
16	Hwy E		23	7.9	7.9	7.4	8.2	0	-	-0.51	0.01	-0.54	0.01	-0.45	0.03	0.34	0.12	-0.54	0.01
17	Somers Branch		21	7.8	7.7	7.1	8.7	0	-	-0.38	0.09	-0.44	0.04	-0.47	0.03	-0.02	0.93	-0.46	0.04
18	School Tributary		24	8.0	8.0	7.6	8.4	0	-	-0.32	0.13	-0.41	0.04	-0.45	0.03	-0.12	0.59	-0.37	0.08
19	Hwy 31		24	8.1	8.1	7.7	8.3	0	-	-0.46	0.02	-0.62	0.00	-0.57	0.00	0.39	0.06	-0.57	0.00
20	Hwy A-Petrifying Springs	Main Branch	24	8.1	8.1	7.6	8.5	0	-	-0.57	0.00	-0.67	0.00	-0.61	0.00	0.03	0.87	-0.58	0.00
21	JR-Petrifying Springs		24	8.0	8.0	7.4	8.3	0	-	-0.34	0.10	-0.41	0.05	-0.36	0.09	-0.18	0.39	-0.37	0.08
22	JR-Parkside		24	7.3	7.2	7.0	7.9	1	-	-0.15	0.49	-0.30	0.15	-0.37	0.07	0.07	0.74	-0.15	0.48
23	Wood Rd-Hwy A		24	8.0	8.1	7.6	8.5	0	-	-0.47	0.02	-0.58	0.00	-0.58	0.00	0.37	0.08	-0.47	0.02
24	Hwy Y		24	8.0	8.1	7.5	8.5	0	-	-0.54	0.01	-0.62	0.00	-0.60	0.00	0.17	0.44	-0.56	0.00
25	Sorenson Creek		24	8.0	8.0	7.6	8.7	0	-	-0.40	0.05	-0.46	0.03	-0.43	0.04	0.38	0.07	-0.36	0.09
26	Hwy A-13th		24	8.1	8.1	7.7	8.5	0	-	-0.31	0.14	-0.39	0.06	-0.42	0.04	0.29	0.17	-0.32	0.12
27	Hwy E-Hwy 32		24	8.0	8.0	7.7	8.6	0	-	-0.35	0.09	-0.43	0.03	-0.44	0.03	0.29	0.17	-0.36	0.09
28	Kenosha Branch		24	8.1	8.1	7.7	8.8	0	-	-0.50	0.01	-0.56	0.00	-0.54	0.01	0.58	0.00	-0.42	0.04
29	Carthage Hwy 32		24	8.1	8.1	7.7	8.7	0	-	-0.38	0.07	-0.48	0.02	-0.48	0.02	0.45	0.03	-0.34	0.11
30	Alford Park at Pike		24	8.3	8.2	7.6	8.9	0	-	-0.46	0.02	-0.36	0.08	-0.27	0.20	0.39	0.06	-0.41	0.05
31	Hwy 32-7th Ave		24	8.2	8.2	7.6	8.6	0	-	-0.49	0.02	-0.61	0.00	-0.64	0.00	0.26	0.22	-0.47	0.02

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	Not less than 6.0 or greater than 9.0 s.u.	Not applicable
Limited Forage Fish (LFF)		
Limited Aquatic Life (LAL)		

Source: WI DNR NR 102.04 (4)

Table 7. Specific conductivity summary data, exceedances and correlations for surface water sites.

Specific Conductivity (µS/cm) Summary Data by Surface Water Site in the Pike River Watershed 5.17.12 - 10.25.12																				
Site Code	Site (Upstream to Downstream)		#	χ	Med.	Min.	Max.	# of Exceedances		Correlations										
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
1	Bartlett Branch	North Branch	12	1,167	1,154	833	1,511	-	1	-0.18	0.58	-0.38	0.22	-0.60	0.04	-0.18	0.57	-0.35	0.26
3	Oakes Rd		24	1,164	1,198	406	1,968	-	5	-0.53	0.01	-0.61	0.00	-0.72	0.00	0.36	0.08	-0.49	0.01
4	Waxdale Creek		24	1,395	1,265	452	2,190	-	8	-0.18	0.41	-0.26	0.22	-0.33	0.11	0.29	0.17	-0.23	0.29
5	Willow Rd		23	416	370	292	709	-	0	0.61	0.00	0.62	0.00	0.54	0.01	-0.22	0.31	0.63	0.00
6	Hwy 11		24	539	507	384	947	-	0	-0.08	0.71	-0.06	0.76	-0.01	0.96	-0.18	0.40	-0.10	0.65
7	Chicory Creek		24	634	650	263	890	-	0	-0.63	0.00	-0.71	0.00	-0.71	0.00	0.20	0.34	-0.65	0.00
8	Braun Rd		24	552	512	390	912	-	0	0.00	0.99	0.03	0.90	0.07	0.73	-0.09	0.66	0.00	0.99
9	Lamparek Ditch		13	1,230	889	503	2,970	-	3	-0.28	0.35	-0.31	0.30	-0.28	0.35	-0.50	0.08	-0.29	0.34
10	Hwy KR		24	553	508	374	881	-	0	-0.03	0.87	-0.01	0.95	-0.03	0.90	-0.18	0.40	-0.06	0.77
12	Hwy K	South Branch	23	816	826	605	934	-	0	-0.16	0.47	-0.27	0.21	-0.35	0.10	0.02	0.92	-0.19	0.39
13	Hwy EA- Hwy S		24	943	1,002	457	1,217	-	0	-0.57	0.00	-0.71	0.00	-0.80	0.00	0.26	0.23	-0.61	0.00
14	Hwy EA- Hwy L		17	888	885	681	1,206	-	0	-0.24	0.34	-0.31	0.22	-0.12	0.64	-0.09	0.73	-0.28	0.27
15	Hwy L		24	975	1,025	565	1,175	-	0	-0.48	0.02	-0.68	0.00	-0.68	0.00	0.14	0.52	-0.51	0.01
16	Hwy E		23	955	1,009	501	1,120	-	0	-0.67	0.00	-0.80	0.00	-0.82	0.00	0.07	0.76	-0.73	0.00
17	Somers Branch		21	705	749	298	1,339	-	0	-0.43	0.05	-0.32	0.15	-0.13	0.58	0.05	0.83	-0.26	0.25
18	School Tributary		24	926	953	732	1,106	-	0	-0.24	0.25	-0.04	0.86	0.14	0.51	-0.48	0.02	-0.32	0.13
19	Hwy 31		24	872	936	543	1,057	-	0	-0.17	0.42	-0.39	0.06	-0.50	0.01	0.18	0.40	-0.25	0.24
20	Hwy A-Petrifying Springs	Main Branch	24	633	608	423	910	-	0	-0.17	0.44	-0.15	0.47	-0.15	0.49	-0.06	0.78	-0.19	0.38
21	JR-Petrifying Springs		24	611	596	423	910	-	0	-0.23	0.28	-0.17	0.42	-0.16	0.46	-0.06	0.78	-0.24	0.26
22	JR-Parkside		24	2,515	2,755	818	3,370	-	21	-0.47	0.02	-0.46	0.02	-0.35	0.09	0.41	0.05	-0.39	0.06
23	Wood Rd-Hwy A		24	608	596	374	918	-	0	-0.35	0.09	-0.37	0.07	-0.34	0.11	-0.06	0.77	-0.35	0.09
24	Hwy Y		24	618	594	369	907	-	0	-0.36	0.08	-0.39	0.06	-0.37	0.08	-0.07	0.73	-0.39	0.06
25	Sorenson Creek		24	676	622	8	1,170	-	1	-0.39	0.06	-0.42	0.04	-0.39	0.06	0.57	0.00	-0.33	0.11
26	Hwy A-13th		24	611	600	401	896	-	0	-0.39	0.06	-0.43	0.04	-0.41	0.05	0.22	0.30	-0.40	0.05
27	Hwy E-Hwy 32		24	618	598	426	904	-	0	-0.35	0.09	-0.40	0.05	-0.40	0.05	0.08	0.70	-0.36	0.08
28	Kenosha Branch		24	1,139	1,230	247	1,727	-	3	-0.47	0.02	-0.57	0.00	-0.65	0.00	0.45	0.03	-0.39	0.06
29	Carthage Hwy 32		24	662	641	415	977	-	0	-0.35	0.09	-0.43	0.04	-0.47	0.02	-0.20	0.35	-0.40	0.05
30	Alford Park at Pike		24	666	630	388	984	-	0	-0.45	0.03	-0.52	0.01	-0.55	0.01	-0.13	0.53	-0.50	0.01
31	Hwy 32-7th Ave		24	647	616	355	1,010	-	0	-0.40	0.05	-0.46	0.02	-0.50	0.01	-0.14	0.53	-0.44	0.03

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	Not applicable	<1,500 µS/cm
Limited Forage Fish (LFF)		
Limited Aquatic Life (LAL)		

Source: U.S. EPA, 2012

Table 8. Turbidity summary data, exceedances and correlations for surface water sites.

Turbidity (NTU) Summary Data by Surface Water Site in the Pike River Watershed 5.17.12 - 10.25.12																					
Site Code	Site (Upstream to Downstream)		#	χ	Med.	Min.	Max.	# of Exceedances		Correlations											
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
1	Bartlett Branch	North Branch	12	13.1	11.2	4.0	26.5	-	3	-0.18	0.57	-0.29	0.36	-0.38	0.22	-0.06	0.86	-0.27	0.39
3	Oakes Rd	North Branch	24	15.6	11.2	2.9	53.2	-	7	0.02	0.93	-0.02	0.93	-0.10	0.65	-0.51	0.01	-0.13	0.55
4	Waxdale Creek	North Branch	24	10.9	5.0	1.3	63.2	-	4	-0.12	0.59	0.04	0.86	0.20	0.34	0.36	0.09	-0.02	0.92
5	Willow Rd	North Branch	23	3.7	2.1	0.4	26.1	-	1	0.27	0.22	0.22	0.31	0.13	0.56	-0.15	0.49	0.20	0.37
6	Hwy 11	North Branch	24	29.2	16.2	5.9	130.0	-	14	0.15	0.47	0.09	0.67	0.09	0.68	0.43	0.04	0.21	0.33
7	Chicory Creek	North Branch	24	35.4	12.7	4.3	296.0	-	10	-0.08	0.72	-0.11	0.60	-0.17	0.43	0.37	0.08	-0.08	0.70
8	Braun Rd	North Branch	24	18.8	9.3	4.2	82.5	-	9	0.74	0.00	0.70	0.00	0.51	0.01	0.36	0.09	0.70	0.00
9	Lamparek Ditch	North Branch	13	37.4	16.3	4.7	103.0	-	8	-0.11	0.73	-0.15	0.63	-0.16	0.60	-0.23	0.45	-0.10	0.74
10	Hwy KR	North Branch	24	19.3	14.3	5.3	82.7	-	12	0.92	0.00	0.88	0.00	0.78	0.00	0.05	0.82	0.90	0.00
12	Hwy K	South Branch	23	45.9	39.7	5.0	208.0	-	19	0.89	0.00	0.87	0.00	0.81	0.00	-0.11	0.61	0.92	0.00
13	Hwy EA- Hwy S	South Branch	24	18.5	13.9	5.7	55.7	-	12	0.06	0.79	0.01	0.95	0.08	0.72	-0.36	0.09	0.11	0.59
14	Hwy EA- Hwy L	South Branch	17	37.8	20.0	4.2	135.0	-	13	0.48	0.05	0.36	0.16	0.22	0.39	0.28	0.27	0.62	0.01
15	Hwy L	South Branch	24	18.5	12.6	2.7	114.0	-	11	0.16	0.46	0.08	0.70	0.07	0.73	0.10	0.66	0.25	0.24
16	Hwy E	South Branch	23	20.4	4.5	1.3	250.0	-	7	0.04	0.87	-0.02	0.93	-0.02	0.93	0.18	0.42	0.09	0.70
17	Somers Branch	South Branch	21	134.6	64.6	2.4	517.0	-	19	-0.22	0.34	-0.23	0.32	-0.15	0.51	0.27	0.24	-0.17	0.45
18	School Tributary	South Branch	24	17.4	15.0	7.3	49.2	-	15	0.09	0.68	0.07	0.74	0.01	0.97	-0.06	0.79	0.15	0.50
19	Hwy 31	South Branch	24	12.4	7.7	2.3	120.0	-	3	0.91	0.00	0.76	0.00	0.64	0.00	0.13	0.55	0.97	0.00
20	Hwy A-Petrifying Springs	Main Branch	24	17.9	13.5	4.7	93.3	-	12	0.90	0.00	0.77	0.00	0.65	0.00	0.19	0.37	0.94	0.00
21	JR-Petrifying Springs	Main Branch	24	17.7	14.5	5.5	60.4	-	12	0.76	0.00	0.66	0.00	0.53	0.01	0.21	0.33	0.85	0.00
22	JR-Parkside	Main Branch	24	53.0	29.6	3.6	304.0	-	17	-0.26	0.21	-0.31	0.14	-0.32	0.13	-0.03	0.89	-0.17	0.42
23	Wood Rd-Hwy A	Main Branch	24	19.5	14.3	5.2	95.3	-	13	0.87	0.00	0.84	0.00	0.75	0.00	0.17	0.44	0.87	0.00
24	Hwy Y	Main Branch	24	28.0	8.3	2.5	461.0	-	4	0.95	0.00	0.93	0.00	0.80	0.00	0.06	0.78	0.97	0.00
25	Sorenson Creek	Main Branch	24	21.7	12.9	4.8	76.4	-	11	0.18	0.40	0.10	0.65	0.00	0.99	0.47	0.02	0.15	0.49
26	Hwy A-13th	Main Branch	24	9.7	6.2	3.0	43.5	-	4	0.82	0.00	0.88	0.00	0.92	0.00	0.13	0.54	0.92	0.00
27	Hwy E-Hwy 32	Main Branch	24	15.6	10.6	3.2	106.0	-	8	0.95	0.00	0.92	0.00	0.83	0.00	0.09	0.67	0.96	0.00
28	Kenosha Branch	Main Branch	24	9.3	7.6	4.4	29.1	-	4	0.15	0.47	0.17	0.43	0.19	0.39	-0.03	0.90	-0.03	0.90
29	Carthage Hwy 32	Main Branch	24	14.6	13.7	5.4	29.1	-	12	0.54	0.01	0.67	0.00	0.75	0.00	0.23	0.28	0.65	0.00
30	Alford Park at Pike	Main Branch	24	23.9	18.8	7.6	77.6	-	18	0.01	0.96	-0.04	0.87	-0.09	0.69	-0.01	0.98	-0.05	0.83
31	Hwy 32-7th Ave	Main Branch	24	23.9	17.3	5.8	47.6	-	18	0.62	0.00	0.62	0.00	0.59	0.00	0.20	0.35	0.60	0.00

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	Not applicable	<14 NTU
Limited Forage Fish (LFF)		
Limited Aquatic Life (LAL)		

Source: U.S. EPA, 2000

Table 9. *E. coli* summary data, exceedances and correlations for surface water sites.

***E. coli* (MPN/ 100 ml) Summary Data by Surface Water Site in the Pike River Watershed**
5.17.12 - 10.25.12

Site Code	Site (Upstream to Downstream)		#	χ	Med.	Min.	Max.	# of Exceedances		Correlations									
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
1	Bartlett Branch	North Branch	12	2,952	545	86	24,192	10	-	0.74	0.01	0.81	0.00	0.74	0.01	0.04	0.90	0.77	0.00
3	Oakes Rd		24	1,434	503	41	12,033	18	-	0.57	0.00	0.51	0.01	0.36	0.08	0.17	0.43	0.45	0.03
4	Waxdale Creek		24	5,654	746	63	77,010	20	-	0.41	0.04	0.41	0.04	0.27	0.20	0.31	0.14	0.36	0.09
5	Willow Rd		23	631	5	5	10,462	3	-	0.72	0.00	0.69	0.00	0.58	0.00	-0.20	0.36	0.69	0.00
6	Hwy 11		24	669	129	30	7,270	6	-	0.70	0.00	0.71	0.00	0.58	0.00	-0.16	0.45	0.67	0.00
7	Chicory Creek		24	614	135	10	10,462	6	-	0.74	0.00	0.74	0.00	0.60	0.00	-0.19	0.37	0.73	0.00
8	Braun Rd		24	623	221	20	5,172	11	-	0.66	0.00	0.65	0.00	0.52	0.01	0.00	1.00	0.61	0.00
9	Lamparek Ditch		13	6,797	738	209	32,550	12	-	0.52	0.07	0.55	0.05	0.52	0.07	-0.10	0.75	0.51	0.07
10	Hwy KR		24	991	484	175	6,500	23	-	0.78	0.00	0.73	0.00	0.66	0.00	0.07	0.76	0.69	0.00
12	Hwy K	South Branch	23	706	336	5	3,873	15	-	0.24	0.26	0.24	0.28	0.11	0.62	0.09	0.67	0.20	0.35
13	Hwy EA- Hwy S		24	967	534	1,276	6,240	21	-	0.47	0.02	0.43	0.04	0.31	0.14	-0.12	0.57	0.35	0.09
14	Hwy EA- Hwy L		17	3,233	1,421	5	13,540	12	-	0.51	0.04	0.61	0.01	0.48	0.05	-0.40	0.11	0.40	0.11
15	Hwy L		24	986	609	86	6,488	19	-	0.55	0.00	0.53	0.01	0.34	0.11	-0.24	0.26	0.49	0.02
16	Hwy E		23	830	282	52	6,488	12	-	0.59	0.00	0.59	0.00	0.44	0.03	0.00	0.99	0.57	0.00
17	Somers Branch		21	3,835	1,046	5	24,192	17	-	0.44	0.04	0.42	0.06	0.36	0.11	-0.04	0.85	0.38	0.09
18	School Tributary		24	1,308	284	20	19,863	14	-	-0.22	0.30	-0.06	0.77	-0.12	0.59	-0.63	0.00	-0.28	0.19
19	Hwy 31		24	482	212	52	5,172	9	-	0.72	0.00	0.70	0.00	0.60	0.00	0.28	0.18	0.75	0.00
20	Hwy A-Petrifying Springs	Main Branch	24	632	245	41	4,352	13	-	0.73	0.00	0.76	0.00	0.66	0.00	-0.04	0.86	0.68	0.00
21	JR-Petrifying Springs		24	550	216	63	4,280	11	-	0.75	0.00	0.72	0.00	0.61	0.00	-0.03	0.88	0.60	0.00
22	JR-Parkside		24	782	93	5	12,033	6	-	0.55	0.01	0.65	0.00	0.55	0.01	0.18	0.41	0.65	0.00
23	Wood Rd-Hwy A		24	553	161	41	5,380	11	-	0.64	0.00	0.67	0.00	0.70	0.00	0.03	0.91	0.62	0.00
24	Hwy Y		24	519	272	41	4,352	14	-	0.63	0.00	0.64	0.00	0.60	0.00	0.16	0.46	0.63	0.00
25	Sorenson Creek		24	5,031	609	86	86,640	18	-	0.64	0.00	0.63	0.00	0.64	0.00	0.26	0.22	0.69	0.00
26	Hwy A-13th		24	645	224	41	6,131	12	-	0.63	0.00	0.62	0.00	0.62	0.00	0.34	0.10	0.71	0.00
27	Hwy E-Hwy 32		24	930	341	50	11,199	18	-	0.65	0.00	0.61	0.00	0.54	0.01	0.33	0.12	0.68	0.00
28	Kenosha Branch		24	1,030	403	30	7,980	17	-	0.58	0.00	0.61	0.00	0.56	0.00	-0.51	0.01	0.47	0.02
29	Carthage Hwy 32		24	656	264	41	5,794	13	-	0.70	0.00	0.67	0.00	0.62	0.00	-0.06	0.80	0.72	0.00
30	Alford Park at Pike		24	1,202	197	31	12,997	11	-	0.74	0.00	0.73	0.00	0.68	0.00	-0.34	0.11	0.73	0.00
31	Hwy 32-7th Ave		24	379	110	5	4,352	5	-	0.57	0.00	0.67	0.00	0.70	0.00	-0.03	0.89	0.61	0.00

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	Not greater than 235 MPN/100 ml	Not applicable
Limited Forage Fish (LFF)	Not applicable	Not greater than 235 MPN/100 ml
Limited Aquatic Life (LAL)		

Source: WI DNR NR 102.12 (1), (Clayton et al, 2012)

Table 10. Total phosphorous and ortho-phosphate summary data, exceedances and correlations for surface water sites.

Total Phosphorous and Ortho-phosphate (mg/l) Summary Data by Surface Water Site in the Pike River Watershed 5.17.12 - 03.12.13*																				
Site Code	Site (Upstream to Downstream)	Branch	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations										
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
Total Phosphorous (mg/L)																				
10	Hwy KR	N	6	0.294	0.226	0.124	0.644	6	-	0.54	0.27	0.73	0.10	0.73	0.10	0.47	0.35	0.13	0.80
19	Hwy 31	S	6	0.281	0.150	0.087	0.829	6	-	0.69	0.13	0.80	0.05	0.80	0.05	-0.06	0.91	0.31	0.55
29	Carthage Hwy 32	M	1	0.260	0.260	0.260	0.260	1	-	Not Applicable									
31	Hwy 32-7th Ave	M	5	0.224	0.210	0.082	0.478	5	-	0.51	0.38	0.73	0.16	0.73	0.16	-0.15	0.81	0.49	0.40
Ortho-phosphates (mg/L): no standard exisits (n.s)																				
10	Hwy KR	N	6	0.160	0.148	0.070	0.288	n.s.	-	-0.11	0.84	-0.02	0.96	-0.03	0.95	0.76	0.08	-0.20	0.71
19	Hwy 31	S	6	0.126	0.134	0.055	0.183	n.s.	-	0.62	0.19	0.77	0.08	0.77	0.08	-0.10	0.85	0.54	0.27
29	Carthage Hwy 32	M	1	0.181	0.181	0.181	0.181	n.s.	-	Not Applicable									
31	Hwy 32-7th Ave	M	5	0.089	0.091	0.046	0.160	n.s.	-	0.15	0.80	0.51	0.38	0.53	0.36	-0.65	0.24	0.89	0.04
# = number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum										r = correlation coefficient					Significant p values < 0.05				

Use Classification Color Code and Relevant State and/or Recommended Standard(s)		
Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	Not greater than 0.075 mg/l	Not applicable
Limited Forage Fish (LFF)		
Limited Aquatic Life (LAL)	Not applicable	Not greater than 0.075 mg/l

Two dates for phosphorus sampling occurred outside of the May 17- Oct. 25, 2012 study period to meet wet weather sampling targets.
Carthage Hwy 32 was collected one time instead of 32-7th Ave due to tidal intrusion, so no correlations are available for this site.

Source: WI DNR NR 102.06 (3)(b), NR 102.06 (6)(d), and NR 104.06 (1), Table 4.

Table 11. Stormwater outfalls draining into Pike River and Lake Michigan that were inaccessible or did not flow during this study.

Pike River and Lake Michigan Stormwater Outfalls	
Inaccessible Outfalls	Non-discharging Outfalls
PM 2	CC 2
HP 54th D	CC 3
HP Marina 2	CC 4
HP Marina 3	CC 5
HP Marina 4	Sher 1
HP Marina 5	AP 2
HP Marina 6	50th 2
85th St	HP 54th A
blue text = Lake Michigan draining outfalls; black text = Pike River	HP Marina 1
	K-158
	158

Table 12. Water temperature summary data, exceedances and correlations for stormwater outfalls.

Water Temperature (°C) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas 5.17.12 - 5.21.13																	
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations								
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature		
									24hr		48hr		72hr				
									r	p	r	p	r	p	r	p	
1	PPB A	0	nd	nd	nd	nd	-	nd	nc	nc	nc	nc	nc	nc	nc	nc	
2	PPB B	2	21.2	21.2	19.9	22.5	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
3	PPB C	6	16.9	14.8	13.3	22.5	-	0	0.01	0.99	0.72	0.07	0.76	0.05	0.53	0.23	
4	PPB D	1	8.0	8.0	8.0	8.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
5	PPB E	4	7.6	5.4	2.0	17.4	-	0	0.94	0.06	0.81	0.19	1.00	0.00	0.98	0.02	
6	PPB F	2	20.1	22.5	22.5	22.8	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
7	PPB G	6	18.2	19.1	10.6	22.9	-	0	0.44	0.38	0.45	0.38	0.48	0.34	0.83	0.04	
8	CC 1	2	18.3	20.0	10.4	24.6	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
14	Sher 2	3	18.6	19.8	14.6	21.4	-	0	0.67	0.53	0.68	0.52	0.69	0.51	0.85	0.35	
15	Sher 3	4	15.8	16.0	13.0	18.1	-	0	-0.86	0.14	-0.86	0.14	-0.86	0.14	0.98	0.02	
16	AP 1	3	23.5	23.7	23.1	23.8	-	0	-0.45	0.70	-0.47	0.69	-0.70	0.51	0.13	0.92	
18	AP 3	2	23.9	23.9	23.8	24.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
19	PM 1	6	19.0	19.0	14.4	22.1	-	0	0.33	0.47	0.34	0.46	0.37	0.41	0.92	0.00	
21	PM 3	3	18.5	17.2	14.9	23.4	-	0	0.90	0.29	0.90	0.29	0.90	0.29	0.79	0.42	
22	PM 4	4	16.6	15.5	13.0	22.4	-	0	-0.83	0.17	-0.83	0.17	-0.83	0.17	1.00	0.00	
23	PM 5	7	17.4	18.2	14.1	21.1	-	0	0.28	0.55	0.31	0.49	0.35	0.44	0.81	0.03	
24	Pennoyer	3	18.8	20.2	12.0	24.2	-	0	0.75	0.46	0.75	0.46	0.75	0.46	nc	nc	
25	40th St	1	22.9	22.9	22.9	22.9	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
26	43rd St	0	nd	nd	nd	nd	-	nd	nc	nc	nc	nc	nc	nc	nc	nc	
27	50th 1	5	8.2	8.1	1.0	18.0	-	0	-0.11	0.86	0.05	0.94	0.41	0.49	0.99	0.00	
29	50th 3	6	18.3	18.7	11.7	25.7	-	0	0.59	0.22	0.48	0.34	0.56	0.24	0.91	0.01	
30	Simmons A	5	19.7	21.8	11.6	24.6	-	0	0.39	0.52	0.39	0.52	0.47	0.42	0.95	0.01	
31	Simmons B	6	6.5	6.0	1.0	13.4	-	0	0.13	0.81	0.29	0.57	0.58	0.22	0.96	0.00	
32	HP52	7	19.0	17.6	12.0	25.0	-	0	0.44	0.32	0.44	0.32	0.50	0.25	0.97	0.00	
34	HP 54th B	5	17.0	15.1	13.9	24.8	-	0	-0.38	0.52	-0.38	0.52	-0.38	0.52	0.64	0.25	
35	HP 54th C	1	16.1	16.1	16.1	16.1	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
37	HP 54th E	7	18.3	16.2	10.2	24.9	-	0	0.37	0.42	0.37	0.42	0.43	0.34	0.98	0.00	
38	HP Marina Out	2	13.3	13.3	3.8	22.8	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
45	60th St	4	15.8	15.0	13.0	20.1	-	0	-0.62	0.38	-1.00	0.00	-1.00	0.00	0.89	0.11	
46	Kemper	3	18.0	17.4	13.8	22.8	-	0	-0.80	0.41	-0.80	0.41	-0.03	0.98	0.93	0.24	
47	71st St	3	17.0	17.0	17.0	22.2	-	0	0.37	0.76	-0.14	0.91	-0.54	0.63	nc	nc	
48	73rd St	2	19.3	19.3	18.0	20.5	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
49	75th St	1	4.8	4.8	4.8	4.8	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
50	Southport 1	4	16.8	7.3	13.3	21.5	-	0	0.50	0.50	0.50	0.50	0.50	0.50	1.00	0.00	
51	Southport 2	6	19.4	19.5	13.9	24.8	-	0	0.55	0.26	0.55	0.26	0.63	0.18	0.85	0.03	
52	K1	6	20.8	23.3	11.0	24.8	-	0	0.26	0.63	0.26	0.63	0.26	0.62	0.83	0.04	
53	K2	5	19.8	23.0	11.6	25.7	-	0	0.52	0.37	0.52	0.37	0.64	0.24	0.97	0.01	
56	KIP	5	19.7	21.0	11.0	23.8	-	0	0.05	0.93	0.05	0.93	0.24	0.70	0.89	0.04	

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum | r correlation coefficient | Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = State Standard for Surface Water: by month, not applicable to stormwater outfalls

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: LAL state standard of not greater than 30 °C

Source: NR 102.04 4(e)

Table 13. Summary data, exceedances and correlations for pH at stormwater outfalls.

pH (s.u) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas 5.17.12 - 5.21.13																	
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations								
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature		
									24hr		48hr		72hr				
									r	p	r	p	r	p	r	p	
1	PPB A	1	7.1	7.1	7.1	7.1	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
2	PPB B	2	8.0	8.0	7.9	8.1	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
3	PPB C	5	8.1	8.2	7.7	8.4	0	-	-0.99	0.00	-0.99	0.00	-1.00	0.00	-0.56	0.32	
4	PPB D	1	8.9	8.9	8.9	8.9	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
5	PPB E	4	8.2	8.3	8.0	8.4	0	-	-0.02	0.98	-0.80	0.20	-0.33	0.67	-0.40	0.60	
6	PPB F	2	7.8	7.8	7.6	7.9	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
7	PPB G	4	7.6	7.6	7.5	7.7	0	-	0.19	0.81	0.19	0.81	0.30	0.70	0.53	0.47	
8	CC 1	2	7.7	7.7	7.5	7.8	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
14	Sher 2	3	8.2	8.3	8.0	8.3	0	-	-1.00	0.01	-1.00	0.02	-1.00	0.02	-0.96	0.19	
15	Sher 3	2	7.5	7.5	7.5	7.6	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
16	AP 1	3	7.5	7.5	7.4	7.8	0	-	-0.03	0.98	-0.01	1.00	0.27	0.82	0.35	0.77	
18	AP 3	2	7.8	7.8	7.7	7.8	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
19	PM 1	4	7.9	7.9	7.9	8.1	0	-	-0.73	0.16	-0.74	0.16	-0.80	0.10	-0.58	0.30	
21	PM 3	2	8.1	8.1	8.0	8.2	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
22	PM 4	3	7.9	7.9	7.8	8.0	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
23	PM 5	4	8.1	8.0	7.9	8.3	0	-	-0.84	0.16	-0.91	0.09	-0.96	0.04	-0.46	0.54	
24	Pennoyer	2	7.5	7.5	7.4	7.5	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
25	40th St	4	8.1	8.0	7.8	8.4	0	-	-0.88	0.12	-0.94	0.06	-0.98	0.02	nc	nc	
26	43rd St	3	8.2	8.2	7.9	8.4	0	-	-1.00	0.04	-1.00	0.05	-0.97	0.15	nc	nc	
27	50th 1	5	7.8	7.8	7.7	8.0	0	-	-0.65	0.24	-0.79	0.11	-0.88	0.05	-0.48	0.41	
29	50th 3	5	8.3	8.3	8.1	8.4	0	-	-0.97	0.01	-0.94	0.02	-0.98	0.00	-0.65	0.24	
30	Simmons A	4	7.6	7.6	7.2	8.0	0	-	0.95	0.05	0.95	0.05	0.87	0.13	0.12	0.88	
31	Simmons B	6	7.9	8.0	7.8	8.0	0	-	-0.85	0.03	-0.94	0.00	-0.91	0.01	-0.34	0.51	
32	HP52	4	7.8	7.7	7.6	8.1	0	-	-0.23	0.77	-0.23	0.77	-0.37	0.63	0.03	0.97	
34	HP 54th B	2	8.0	8.0	7.9	8.1	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
35	HP 54th C	0	nd	nd	nd	nd	nd	-	nc	nc	nc	nc	nc	nc	nc	nc	
37	HP 54th E	4	8.0	7.9	7.9	8.1	0	-	-0.76	0.24	-0.76	0.24	-0.68	0.32	0.11	0.89	
38	HP Marina Out	2	7.8	7.8	7.5	8.0	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
45	60th St	4	7.8	7.8	7.8	7.8	0	-	-0.29	0.71	-0.08	0.92	-0.08	0.92	nc	nc	
46	Kemper	5	8.1	8.1	7.7	8.3	0	-	-0.90	0.04	-0.90	0.04	-0.81	0.10	0.98	0.00	
47	71st St	4	7.6	7.6	7.3	8.0	0	-	-0.52	0.48	-0.32	0.68	0.01	0.99	nc	nc	
48	73rd St	6	8.0	8.1	7.5	8.5	0	-	-0.73	0.10	-0.81	0.05	-0.88	0.02	nc	nc	
49	75th St	4	8.0	8.0	7.5	8.5	0	-	-0.89	0.11	-0.99	0.01	-1.00	0.00	nc	nc	
50	Southport 1	3	7.3	7.3	7.3	7.3	0	-	-0.74	0.47	-0.74	0.47	-0.74	0.47	nc	nc	
51	Southport 2	4	8.6	8.6	8.2	8.9	0	-	0.59	0.41	0.59	0.41	0.77	0.23	0.94	0.06	
52	K1	5	8.9	8.9	8.4	9.3	2	-	0.51	0.38	0.51	0.38	0.47	0.43	0.76	0.14	
53	K2	5	8.6	8.6	8.3	8.9	0	-	0.23	0.71	0.23	0.71	0.32	0.60	0.79	0.11	
56	KIP	5	7.8	7.7	7.7	8.0	0	-	-0.94	0.02	-0.93	0.02	-0.95	0.01	0.44	0.46	

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum | r correlation coefficient | Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = State Standard for Fish and Aquatic Life (FAL) Surface Water: ≥ 6.0 s.u. and ≤ 9.0 s.u.

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: outside of surface standard range of 6.0 - 9.0 s.u.

Source: WI DNR NR 102.04 (4)(c), NR 104.02 (3)(a)2.c.), and NR 104.02 (3)(b)

Table 14. Specific conductivity summary data, exceedances and correlations for stormwater outfalls.

Specific Conductivity (µS/cm) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas 5.17.12 - 5.21.13																
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations							
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature	
									24hr		48hr		72hr			
									r	p	r	p	r	p	r	p
1	PPB A	1	234	234	234	234	0	0	nc	nc	nc	nc	nc	nc	nc	nc
2	PPB B	2	283	283	192	374	0	0	nc	nc	nc	nc	nc	nc	nc	nc
3	PPB C	6	1,146	1,000	357	2,350	2	1	-0.70	0.08	-0.70	0.08	-0.74	0.06	0.56	0.20
4	PPB D	1	2,300	2,300	2,300	2,300	1	1	nc	nc	nc	nc	nc	nc	nc	nc
5	PPB E	4	1,334	1,251	1,075	1,760	1	0	0.87	0.13	0.41	0.59	0.80	0.20	0.79	0.21
6	PPB F	2	693	693	543	843	0	0	nc	nc	nc	nc	nc	nc	nc	nc
7	PPB G	6	1,065	1,043	359	1,747	2	0	-0.43	0.39	-0.43	0.39	-0.49	0.32	0.48	0.34
8	CC 1	2	81	81	76	86	0	0	nc	nc	nc	nc	nc	nc	nc	nc
14	Sher 2	3	1,581	1,681	631	2,430	2	1	-0.90	0.28	-0.91	0.27	-0.91	0.26	-0.99	0.10
15	Sher 3	4	1,411	1,621	735	1,668	3	0	-1.00	0.00	-1.00	0.00	-1.00	0.00	0.93	0.07
16	AP 1	3	377	65	52	1,014	0	0	-0.98	0.13	-0.98	0.11	-0.99	0.07	0.86	0.34
18	AP 3	2	1,499	1,499	1,486	1,512	1	0	nc	nc	nc	nc	nc	nc	nc	nc
19	PM 1	6	1,145	1,251	674	1,520	1	0	0.25	0.59	0.24	0.60	0.17	0.71	0.50	0.26
21	PM 3	3	1,414	1,303	1,048	1,892	1	0	-0.40	0.74	-0.40	0.74	-0.40	0.74	0.65	0.55
22	PM 4	4	2,042	1,740	1,597	2,790	3	1	-0.61	0.39	-0.61	0.39	-0.61	0.39	0.93	0.07
23	PM 5	16	2,180	2,435	601	3,200	13	11	-0.73	0.00	-0.77	0.00	-0.77	0.00	-0.46	0.07
24	Pennoyer	15	1,691	2,040	158	2,770	12	8	-0.86	0.00	-0.88	0.00	-0.88	0.00	nc	nc
25	40th St	14	434	382	311	925	0	0	-0.24	0.41	-0.16	0.58	-0.16	0.58	nc	nc
26	43rd St	13	339	316	297	439	0	0	-0.28	0.35	-0.28	0.35	-0.31	0.30	nc	nc
27	50th 1	5	610	558	355	857	0	0	-0.41	0.49	-0.57	0.32	-0.70	0.19	-0.33	0.59
29	50th 3	6	816	837	668	886	0	0	0.17	0.75	0.14	0.79	-0.10	0.85	-0.25	0.64
30	Simmons A	5	606	319	201	1,511	1	0	-0.46	0.44	-0.46	0.44	-0.42	0.48	-0.04	0.95
31	Simmons B	6	405	335	311	568	0	0	0.50	0.31	0.59	0.22	0.80	0.06	0.83	0.04
32	HP52	7	342	337	282	433	0	0	-0.26	0.58	-0.26	0.58	-0.37	0.41	-0.92	0.00
34	HP 54th B	5	321	319	308	334	0	0	-0.76	0.13	-0.76	0.13	-0.76	0.13	-0.34	0.58
35	HP 54th C	1	330	330	330	330	0	0	nc	nc	nc	nc	nc	nc	nc	nc
37	HP 54th E	7	239	309	8	359	0	0	0.03	0.94	0.03	0.94	0.07	0.88	0.71	0.07
38	HP Marina Out	2	442	442	302	582	0	0	nc	nc	nc	nc	nc	nc	nc	nc
45	60th St	18	1,041	1,220	244	1,520	1	0	-0.82	0.00	-0.81	0.00	-0.83	0.00	0.99	0.00
46	Kemper	17	891	943	387	1,366	0	0	-0.58	0.02	-0.61	0.01	-0.61	0.01	-0.33	0.19
47	71st St	6	308	238	387	683	0	0	-0.07	0.89	0.09	0.87	0.32	0.53	nc	nc
48	73rd St	6	858	823	337	1,447	0	0	-0.51	0.30	-0.52	0.29	-0.47	0.34	nc	nc
49	75th St	14	333	325	295	431	0	0	0.32	0.26	0.46	0.10	0.46	0.10	nc	nc
50	Southport 1	12	779	1,034	79	1,285	0	0	-0.86	0.00	-0.87	0.00	-0.84	0.00	0.77	0.00
51	Southport 2	5	1,128	975	782	1,661	1	0	-0.78	0.12	-0.78	0.12	-0.88	0.05	-0.32	0.60
52	K1	6	760	561	489	1,846	1	0	-0.28	0.59	-0.28	0.59	-0.30	0.56	0.52	0.29
53	K2	5	872	881	736	953	0	0	0.41	0.50	0.41	0.50	0.50	0.39	0.97	0.01
56	KIP	5	947	662	463	1,661	1	0	-0.95	0.01	-0.95	0.01	-0.92	0.03	0.51	0.38

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum | r = correlation coefficient | Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = Recommended Standard for Fish and Aquatic Life (FAL) Surface Water: ≤ 1,500 µS/cm

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: > 2,000 µS/cm

Source: (U.S. EPA, 2012); (Brown et al, 2004)

Table 15. Turbidity summary data, exceedances and correlations for stormwater outfalls.

Turbidity (NTU) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas 5.17.12 - 5.21.13																
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations							
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature	
									24hr		48hr		72hr			
									r	p	r	p	r	p	r	p
1	PPB A	0	nd	nd	nd	nd	nd	nd	nc	nc	nc	nc	nc	nc	nc	nc
2	PPB B	2	12.1	12.1	4.4	19.8	1	0	nc	nc	nc	nc	nc	nc	nc	nc
3	PPB C	6	5.7	4.7	1.1	12.2	0	0	0.77	0.04	0.77	0.04	0.73	0.06	0.21	0.66
4	PPB D	1	2.4	2.4	2.4	2.4	0	0	nc	nc	nc	nc	nc	nc	nc	nc
5	PPB E	4	1.8	1.6	1.0	2.9	0	0	-0.24	0.76	0.59	0.41	0.05	0.95	0.12	0.88
6	PPB F	2	95.7	95.7	73.4	118.0	2	0	nc	nc	nc	nc	nc	nc	nc	nc
7	PPB G	6	17.5	12.5	3.1	56.3	3	0	0.20	0.71	0.20	0.70	0.30	0.57	-0.03	0.96
8	CC 1	2	64.1	64.1	76.4	114.0	2	0	nc	nc	nc	nc	nc	nc	nc	nc
9	Sher 2	3	114.6	22.4	14.5	307.0	3	0	1.00	0.00	1.00	0.02	1.00	0.02	0.96	0.18
10	Sher 3	4	2.0	2.1	0.7	3.2	0	0	0.03	0.97	0.03	0.97	0.03	0.97	0.03	0.97
11	AP 1	2	13.0	13.0	10.5	15.4	1	0	nc	nc	nc	nc	nc	nc	nc	nc
12	AP 3	2	135.0	135.0	121.0	149.0	2	0	nc	nc	nc	nc	nc	nc	nc	nc
13	PM 1	6	7.6	5.3	2.8	17.1	1	0	0.07	0.88	0.07	0.88	0.16	0.74	0.56	0.20
14	PM 3	3	2.1	2.5	1.0	2.9	0	0	0.52	0.65	0.52	0.65	0.52	0.65	-0.54	0.63
15	PM 4	4	17.0	16.5	12.0	22.4	2	0	-0.10	0.90	-0.10	0.90	-0.10	0.90	0.60	0.40
16	PM 5	7	25.9	8.4	2.6	96.6	2	0	-0.35	0.44	-0.33	0.48	-0.29	0.52	-0.11	0.81
17	Pennoyer	4	17.9	20.9	1.4	28.5	3	0	0.85	0.15	0.85	0.15	0.85	0.15	nc	nc
18	40th St	5	23.4	12.9	6.7	71.6	2	0	0.07	0.91	0.03	0.96	-0.01	0.98	nc	nc
19	43rd St	3	5.5	5.4	4.7	6.3	0	0	-0.53	0.64	-0.40	0.74	-0.25	0.84	nc	nc
20	50th 1	5	28.9	8.7	4.5	72.6	2	0	0.94	0.02	0.95	0.01	0.79	0.11	-0.09	0.88
21	50th 3	6	2.2	1.9	1.0	5.4	0	0	0.18	0.74	0.19	0.72	0.43	0.40	0.58	0.23
22	Simmons A	5	42.7	5.2	2.3	192.0	1	0	-0.45	0.45	-0.45	0.45	-0.49	0.40	-0.24	0.69
23	Simmons B	6	6.1	2.1	0.7	26.8	1	0	0.24	0.64	0.36	0.49	0.27	0.61	-0.15	0.78
24	HP52	7	7.7	7.2	0.9	25.6	1	0	0.30	0.51	0.30	0.51	0.50	0.25	0.20	0.67
25	HP 54th B	5	3.2	2.3	1.1	8.5	0	0	-0.12	0.85	-0.12	0.85	-0.12	0.85	-0.60	0.28
26	HP 54th C	1	0.7	0.7	0.7	0.7	0	0	nc	nc	nc	nc	nc	nc	nc	nc
28	HP 54th E	7	101.2	5.1	1.1	348.0	2	0	-0.12	0.80	-0.12	0.80	-0.17	0.72	-0.77	0.04
29	HP Marina Out	2	8.5	8.5	2.3	14.6	1	0	nc	nc	nc	nc	nc	nc	nc	nc
30	60th St	6	12.9	12.4	4.9	24.8	3	0	-0.40	0.43	-0.25	0.63	-0.25	0.63	0.27	0.61
31	Kemper	6	6.7	3.7	1.2	16.3	1	0	0.30	0.57	0.30	0.57	0.18	0.73	-0.99	0.00
32	71st St	4	4.1	3.4	2.6	6.9	0	0	-0.55	0.45	-0.34	0.66	0.02	0.98	nc	nc
33	73rd St	6	5.0	3.1	0.8	16.0	1	0	0.90	0.01	0.83	0.04	0.67	0.14	nc	nc
34	75th St	4	6.2	6.0	2.9	9.7	0	0	0.40	0.60	0.36	0.64	0.35	0.65	nc	nc
35	Southport 1	5	9.6	4.7	3.1	22.5	1	0	-0.57	0.31	-0.57	0.31	-0.57	0.31	-0.60	0.29
36	Southport 2	6	3.8	3.1	1.4	7.1	0	0	0.41	0.42	0.41	0.42	0.39	0.44	0.03	0.96
37	K1	6	18.8	10.0	1.4	70.4	3	0	-0.35	0.49	-0.35	0.49	-0.35	0.49	0.36	0.48
38	K2	5	145.3	203.0	31.6	213.0	5	0	0.36	0.55	0.36	0.55	0.51	0.38	0.93	0.02
39	KIP	5	3.8	3.9	2.4	5.5	0	0	0.67	0.21	0.61	0.27	0.59	0.29	0.31	0.61

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum | r = correlation coefficient | Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = Recommended Standard for Surface Water: ≤ 14 NTU | **Rec. Guideline** = Recommended Guideline for Determining Polluting Outfalls: > 1,000 NTU

Source: EPA, 2012; Brown et al, 2004

Table 16. *E. coli* summary data, exceedances and correlations for stormwater outfalls.

E. coli (MPN/100 ml) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas 5.17.12 - 5.21.13																
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations							
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature	
									24hr		48hr		72hr			
									r	p	r	p	r	p	r	p
1	PPB A	1	24,192	24,192	24,192	24,192	1	1	nc	nc	nc	nc	nc	nc	nc	nc
2	PPB B	2	9,987	9,987	7,940	12,033	2	1	nc	nc	nc	nc	nc	nc	nc	nc
3	PPB C	6	9,086	1,954	616	24,192	6	2	0.53	0.22	0.53	0.22	0.50	0.26	0.60	0.15
4	PPB D	1	50	50	50	50	0	0	nc	nc	nc	nc	nc	nc	nc	nc
5	PPB E	4	1,229	895	50	3,076	2	0	-0.14	0.86	-0.86	0.14	-0.47	0.53	-0.59	0.41
6	PPB F	2	5,710	5,710	2,755	8,664	2	0	nc	nc	nc	nc	nc	nc	nc	nc
7	PPB G	6	4,208	716	31	17,329	4	1	0.83	0.04	0.83	0.04	0.87	0.03	0.02	0.96
8	CC 1	2	14,335	14,335	6,200	22,470	2	1	nc	nc	nc	nc	nc	nc	nc	nc
14	Sher 2	3	14,221	12,996	5,475	24,192	3	2	0.11	0.93	0.09	0.94	0.08	0.95	-0.17	0.89
15	Sher 3	4	626	347	31	1,779	2	0	-0.46	0.54	-0.46	0.54	-0.46	0.54	0.11	0.89
16	AP 1	3	187	200	52	310	1	0	0.91	0.27	0.92	0.26	0.99	0.08	-0.72	0.48
18	AP 3	2	39,520	39,520	2,030	77,010	2	1	nc	nc	nc	nc	nc	nc	nc	nc
19	PM 1	6	11,409	9,156	510	24,192	6	3	0.42	0.35	0.42	0.35	0.44	0.32	0.90	0.01
21	PM 3	3	8,111	100	40	24,192	1	1	1.00	0.04	1.00	0.04	1.00	0.04	0.49	0.67
22	PM 4	4	302	345	51	510	2	0	0.61	0.39	0.61	0.39	0.61	0.39	-0.12	0.88
23	PM 5	16	2,592	1,383	203	8,664	14	0	0.38	0.14	0.40	0.13	0.38	0.15	-0.71	0.00
24	Pennoyer	15	3,432	393	5	24,192	10	2	0.52	0.05	0.53	0.04	0.51	0.05	nc	nc
25	40th St	14	328	47	5	1,515	6	0	0.67	0.01	0.69	0.01	0.64	0.01	nc	nc
26	43rd St	13	7,076	1,396	132	24,192	10	4	-0.22	0.48	-0.19	0.54	-0.15	0.63	nc	nc
27	50th 1	5	447	86	20	1,785	2	0	0.56	0.32	0.67	0.21	0.61	0.27	0.00	1.00
29	50th 3	6	1,183	35	10	6,488	2	0	0.61	0.20	0.54	0.27	0.73	0.10	0.61	0.20
30	Simmons A	5	481	311	5	1,340	3	0	0.38	0.52	0.38	0.52	0.35	0.57	-0.51	0.38
31	Simmons B	6	6,775	2,488	259	24,192	6	2	-0.18	0.73	-0.07	0.90	0.09	0.87	0.14	0.79
32	HP52	7	2,974	31	5	12,033	3	1	0.76	0.05	0.76	0.05	0.85	0.02	0.03	0.95
34	HP 54th B	5	305	5	5	1,480	1	0	0.95	0.01	0.95	0.01	0.95	0.01	0.26	0.67
35	HP 54th C	1	10	10	10	10	0	0	nc	nc	nc	nc	nc	nc	nc	nc
37	HP 54th E	7	923	97	5	4,106	2	0	0.75	0.05	0.75	0.05	0.86	0.01	0.33	0.47
38	HP Marina Out	2	358	358	52	663	1	0	nc	nc	nc	nc	nc	nc	nc	nc
45	60th St	18	5,164	1,528	161	24,192	16	3	-0.05	0.85	0.06	0.82	0.08	0.74	0.64	0.00
46	Kemper	17	2,958	860	52	15,531	15	1	0.53	0.03	0.55	0.02	0.46	0.07	-0.85	0.00
47	71st St	6	10,678	8,577	464	24,192	6	3	0.33	0.52	0.21	0.70	0.05	0.92	nc	nc
48	73rd St	16	2,992	551	31	24,192	9	1	0.50	0.05	0.55	0.03	0.62	0.01	nc	nc
49	75th St	14	416	87	5	2,909	5	0	0.76	0.00	0.74	0.00	0.77	0.00	nc	nc
50	Southport 1	14	7,626	4,791	240	24,192	14	4	0.16	0.59	0.13	0.66	0.11	0.70	0.46	0.10
51	Southport 2	6	1,406	957	601	3,010	6	0	0.66	0.16	0.66	0.16	0.58	0.23	0.62	0.19
52	K1	6	307	305	10	740	3	0	0.58	0.23	0.58	0.23	0.61	0.20	-0.15	0.77
53	K2	5	891	620	20	3,110	3	0	0.85	0.07	0.85	0.07	0.86	0.06	0.24	0.69
56	KIP	5	1739.0	345.0	100.0	6200.0	3	0	0.67	0.22	0.67	0.22	0.70	0.19	0.42	0.48

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = State Standard for Fish and Aquatic Life (FAL) Surface Water: ≤ 235 MPN/100 ml

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: ≥ 10,000 MPN/100 ml

Source: NR 102.12 (1). (communication with Larson, 2013).

Table 17. Total chlorine summary data, exceedances and correlations for stormwater outfalls.

Total Chlorine (mg/l) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas 5.17.12 - 5.21.13																
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations							
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature	
									24hr		48hr		72hr			
									r	p	r	p	r	p	r	p
2	PPB A	1	0.50	0.50	0.50	0.50	-	1	nc	nc	nc	nc	nc	nc	nc	nc
2	PPB B	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
3	PPB C	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
4	PPB D	1	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
5	PPB E	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
6	PPB F	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
7	PPB G	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
8	CC 1	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
14	Sher 2	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
15	Sher 3	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
16	AP 1	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
18	AP 3	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
19	PM 1	7	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
21	PM 3	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
22	PM 4	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
23	PM 5	6	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc
24	Pennoyer	4	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc
25	40th St	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
26	43rd St	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
27	50th 1	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
29	50th 3	6	0.0	0.0	0.0	0.1	-	0	nc	nc	nc	nc	nc	nc	nc	nc
30	Simmons A	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
31	Simmons B	6	0.0	0.1	0.0	0.1	-	0	-0.15	0.77	-0.27	0.61	-0.19	0.72	0.17	0.74
32	HP52	7	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
34	HP 54th B	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
35	HP 54th C	1	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
37	HP 54th E	7	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
38	HP Marina Out	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
45	60th St	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
46	Kemper	6	0.0	0.0	0.0	0.1	-	0	nc	nc	nc	nc	nc	nc	nc	nc
47	71st St	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
48	73rd St	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
49	75th St	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
50	Southport 1	5	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc
51	Southport 2	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
52	K1	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
53	K2	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
56	KIP	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum | r correlation coefficient | Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = Recommended Standard for all flowing surface waters: 0.019 mg/L (acute toxicity)

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: ≥ 0.1 mg/l

Source: NR 105.06; Brown et al, 2004

Table 18. Detergent summary data, exceedances and correlations for stormwater outfalls.

Detergent (mg/l) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas 5.17.12 - 5.21.13																	
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations								
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature	
									24hr		48hr		72hr			
									r	p	r	p	r	p	r	p
1	PPB A	1	0.00	0.00	0.00	0.00	-	0	nc	nc	nc	nc	nc	nc	nc	nc
2	PPB B	2	0.38	0.38	0.25	0.50	-	2	nc	nc	nc	nc	nc	nc	nc	nc
3	PPB C	6	0.33	0.25	0.20	0.50	-	5	-0.18	0.73	-0.18	0.73	-0.10	0.85	0.08	0.88
4	PPB D	1	0.63	0.63	0.63	0.63	-	1	nc	nc	nc	nc	nc	nc	nc	nc
5	PPB E	4	0.25	0.25	0.13	0.38	-	3	0.74	0.26	-0.13	0.87	0.47	0.53	0.36	0.64
6	PPB F	2	0.25	0.25	0.25	0.25	-	2	nc	nc	nc	nc	nc	nc	nc	nc
7	PPB G	6	0.25	0.25	0.25	0.25	-	6	nc	nc	nc	nc	nc	nc	nc	nc
8	CC 1	2	0.23	0.23	0.20	0.25	-	1	nc	nc	nc	nc	nc	nc	nc	nc
14	Sher 2	3	0.42	0.50	0.25	0.50	-	3	-1.00	0.01	-1.00	0.01	-1.00	0.01	-0.97	0.17
15	Sher 3	4	0.25	0.25	0.25	0.25	-	4	nc	nc	nc	nc	nc	nc	nc	nc
16	AP 1	3	0.50	0.25	0.25	1.00	-	3	-0.98	0.12	-0.99	0.11	-0.99	0.07	0.87	0.33
18	AP 3	2	0.38	0.38	0.25	0.50	-	2	nc	nc	nc	nc	nc	nc	nc	nc
19	PM 1	6	0.22	0.25	0.05	0.25	-	5	0.06	0.91	0.06	0.91	0.08	0.88	0.82	0.05
21	PM 3	3	0.25	0.25	0.25	0.25	-	3	nc	nc	nc	nc	nc	nc	nc	nc
22	PM 4	3	0.00	0.00	0.00	0.00	-	0	nc	nc	nc	nc	nc	nc	nc	nc
23	PM 5	6	0.31	0.25	0.15	0.50	-	5	-0.12	0.82	-0.04	0.94	0.05	0.93	0.38	0.46
24	Pennoyer	4	0.25	0.25	0.25	0.25	-	4	nc	nc	nc	nc	nc	nc	nc	nc
25	40th St	5	0.09	0.10	0.00	0.25	-	1	nc	nc	nc	nc	nc	nc	nc	nc
26	43rd St	3	0.12	0.10	0.00	0.25	-	1	nc	nc	nc	nc	nc	nc	nc	nc
27	50th 1	5	0.13	0.13	0.10	0.15	-	0	0.56	0.32	-0.05	0.93	-0.41	0.49	-0.98	0.00
29	50th 3	6	0.18	0.23	0.05	0.25	-	3	0.17	0.74	0.09	0.87	-0.13	0.80	-0.33	0.52
30	Simmons A	5	0.20	0.20	0.00	0.35	-	2	0.25	0.69	0.25	0.69	0.11	0.87	-0.75	0.15
31	Simmons B	5	0.15	0.15	0.00	0.38	-	2	0.71	0.18	0.72	0.17	0.86	0.06	0.60	0.29
32	HP52	7	0.15	0.25	0.00	0.25	-	4	0.45	0.31	0.45	0.31	0.50	0.25	0.18	0.69
34	HP 54th B	5	0.06	0.00	0.00	0.25	-	1	nc	nc	nc	nc	nc	nc	nc	nc
35	HP 54th C	1	0.00	0.00	0.00	0.00	-	0	nc	nc	nc	nc	nc	nc	nc	nc
37	HP 54th E	7	0.16	0.20	0.00	0.40	-	3	0.41	0.36	0.41	0.36	0.41	0.36	-0.11	0.81
38	HP Marina Out	2	0.13	0.13	0.00	0.25	-	1	nc	nc	nc	nc	nc	nc	nc	nc
45	60th St	6	0.22	0.25	0.10	0.25	-	4	-0.85	0.03	-0.85	0.03	-0.85	0.03	0.90	0.01
46	Kemper	6	0.21	0.23	0.15	0.25	-	3	-0.38	0.46	-0.38	0.46	-0.59	0.22	-0.32	0.53
47	71st St	4	0.30	0.28	0.15	0.50	-	3	0.08	0.92	-0.15	0.85	-0.48	0.52	nc	nc
48	73rd St	6	0.19	0.24	0.00	0.25	-	4	0.67	0.14	0.80	0.06	0.76	0.08	nc	nc
49	75th St	4	0.10	0.13	0.00	0.15	-	0	1.00	0.00	0.97	0.03	0.95	0.05	nc	nc
50	Southport 1	5	0.19	0.25	0.05	0.25	-	3	-0.21	0.73	-0.21	0.73	-0.21	0.73	0.82	0.09
51	Southport 2	6	0.22	0.25	0.05	0.25	-	5	-0.07	0.90	-0.07	0.90	-0.02	0.98	0.76	0.08
52	K1	6	0.23	0.23	0.10	0.50	-	3	0.00	0.99	0.00	0.99	-0.05	0.92	0.10	0.86
53	K2	5	0.21	0.25	0.15	0.25	-	3	0.43	0.47	0.43	0.47	0.58	0.31	0.88	0.05
56	KIP	5	0.22	0.25	0.15	0.25	-	3	0.46	0.43	0.46	0.43	0.42	0.48	0.29	0.63

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum | r correlation coefficient | Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = Recommended Standard for Surface Water: Not applicable | **Rec. Guideline** = Recommended Guideline for Determining Polluting Outfalls: ≥ 0.25 ppm

Source: Brown et al, 2004

Table 19. Copper summary data, exceedances and correlations for stormwater outfalls.

Copper (mg/l) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas 5.17.12 - 5.21.13																
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations							
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature	
									24hr		48hr		72hr			
									r	p	r	p	r	p	r	p
1	PPB A	1	0.00	0.00	0.00	0.00	-	0	nc	nc	nc	nc	nc	nc	nc	nc
2	PPB B	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
3	PPB C	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
4	PPB D	1	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
5	PPB E	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
6	PPB F	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
7	PPB G	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
8	CC 1	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
14	Sher 2	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
15	Sher 3	4	0.0	0.0	0.0	0.1	-	0	nc	nc	nc	nc	nc	nc	nc	nc
16	AP 1	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
18	AP 3	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
19	PM 1	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
21	PM 3	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
22	PM 4	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
23	PM 5	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
24	Pennoyer	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
25	40th St	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
26	43rd St	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
27	50th 1	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
29	50th 3	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
30	Simmons A	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
31	Simmons B	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
32	HP52	7	0.0	0.0	0.0	0.3	-	1	nc	nc	nc	nc	nc	nc	nc	nc
34	HP 54th B	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
35	HP 54th C	1	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
37	HP 54th E	7	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
38	HP Marina Out	2	0.1	0.1	0.0	0.1	-	0	nc	nc	nc	nc	nc	nc	nc	nc
45	60th St	6	0.0	0.0	0.0	0.1	-	0	nc	nc	nc	nc	nc	nc	nc	nc
46	Kemper	6	0.0	0.0	0.0	0.1	-	0	nc	nc	nc	nc	nc	nc	nc	nc
47	71st St	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
48	73rd St	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
49	75th St	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
50	Southport 1	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
51	Southport 2	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
52	K1	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
53	K2	5	0.1	0.0	0.0	0.5	-	1	nc	nc	nc	nc	nc	nc	nc	nc
56	KIP	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum | r correlation coefficient | Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = State Standard for all flowing surface waters: 0.0298 mg/l (acute toxicity)

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: >0.2mg/l

Source: NR 105.06; AECOM, 2009

Table 20. Phenol summary data, exceedances and correlations for stormwater outfalls.

Phenol (mg/l) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas 5.17.12 - 5.21.13																	
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations								
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature		
									24hr		48hr		72hr				
									r	p	r	p	r	p	r	p	
1	PPB A	1	0.10	0.10	0.10	0.10	-	1	nc	nc	nc	nc	nc	nc	nc	nc	
2	PPB B	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
3	PPB C	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
4	PPB D	1	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
5	PPB E	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
6	PPB F	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
7	PPB G	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
8	CC 1	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
14	Sher 2	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
15	Sher 3	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
16	AP 1	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
18	AP 3	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
19	PM 1	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
21	PM 3	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
22	PM 4	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
23	PM 5	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
24	Pennoyer	4	0.0	0.0	0.0	0.1	-	1	0.67	0.33	0.67	0.33	0.67	0.33	nc	nc	
25	40th St	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
26	43rd St	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
27	50th 1	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
29	50th 3	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
30	Simmons A	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
31	Simmons B	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
32	HP52	7	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
34	HP 54th B	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
35	HP 54th C	1	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
37	HP 54th E	7	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc	
38	HP Marina Out	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
45	60th St	6	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc	
46	Kemper	6	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc	
47	71st St	4	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc	
48	73rd St	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
49	75th St	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
50	Southport 1	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
51	Southport 2	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
52	K1	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
53	K2	5	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc	
56	KIP	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc	
# = number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum									r correlation coefficient				Significant p values < 0.05				
* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period																	
Surface Standard = Recommended Standard for Surface Water: Not applicable								**Rec. Guideline** = Recommended Guideline for Determining Polluting Outfalls: ≥ 0.1 mg/l									
Source: AECOM, 2009																	

Table 21. Recommended continued monitoring for stormwater outfalls draining in to the Pike River and Lake Michigan directly.

Stormwater Outfalls Recommended for Continued Monitoring	
Pike River	**Lake Michigan**
PPB C	Pennoyer
PPB F	50th 3
CC1	Simmons B
PM 1	HP 54
PM 4	60th St
PM 5	Kemper
K1	71st St
K2	73rd St
KIP	Southport 1
	Southport 2

2012 - 2013 Racine Health Department Pike River Sampling Sites and Use Classification, Impairment Status, and Applicable Standards or Guidelines

Pike River Section	North Branch									South Branch								Main Branch											
	Upstream to Downstream →									*Upstream to Downstream →*								*Upstream to Downstream →*											
Racine Health Department Sampling Sites (t) denotes tributaries	Bartlett Branch (t)	Oakes Rd	Waxdale Creek (t)	Willow Rd (t)	Hwy 11	Chicory Creek (t)	Braun Rd	Lamparek Ditch (t)	Hwy KR	Hwy K	Hwy EA- Hwy S	Hwy EA- Hwy L (t)	Hwy L	Hwy E	Somers Branch (t)	School Tributary (t)	Hwy 31	Hwy A-Petrifying Springs	JR-Petrifying Springs	JR-Parkside (t)	Wood Rd-Hwy A	Hwy Y	Sorenson Creek (t)	Hwy A-13th	Hwy E-Hwy 32	Kenosha Branch (t)	Carthage Hwy 32	Alford Park at Pike	Hwy 32-7th Ave
WI DNR Use Classification	FAL		LAL	LFF	FAL					FAL					LAL	FAL	LFF	FAL											
WI DNR Impairment Status	303(d) listed for FAL*									Not Assessed								Proposed to be 303(d) listed for FAL**											

Parameter	Standard or Guideline	Source	Applicable Standard or Guideline to Site, based upon Use Classification or Variance																										
Water Temperature	see other table	NR 102, WisCALM	state standard: specific to month and designation															state standard: specific to month and designation											
Dissolved Oxygen	FAL > 5.0 mg/L	NR 102.04(4)																											
	LFF > 3.0 mg/L	NR 104.02(3)																											
	LAL > 1.0 mg/L	NR 104.02(3)																											
	Variance > 2.0 mg/L ***	NR 104.06(2)a																											
pH	6.0 - 9.0 s.u.	NR 102.04	state standard: 6.0 - 9.0 s.u.															state standard: 6.0 - 9.0 s.u.											
Specific Conductivity	< 1,500 µS/cm	USEPA 2012	recommended guideline: < 1,500 µS/cm															recommended guideline: < 1,500 µS/cm											
Turbidity	< 14 NTU	USEPA 2000	recommended guideline: < 14 NTU															recommended guideline: < 14 NTU											
Total Phosphorus	FAL, LFF ≤ 0.075 mg/L	NR 102.06 (3)(b)	≤ 0.075 mg/L			≤ 0.075 mg/L										≤ 0.075 mg/L		≤ 0.075 mg/L											
	LAL: no standard (N.S.)	NR 104.02 (3)(b)(2)			N.S.										N.S.														
E. coli	< 235 MPN/100 ml	102.04 (5)(a)	state standard/ recommended guideline: < 235 MPN/100 ml															state standard/ recommended guideline: < 235 MPN/100 ml											

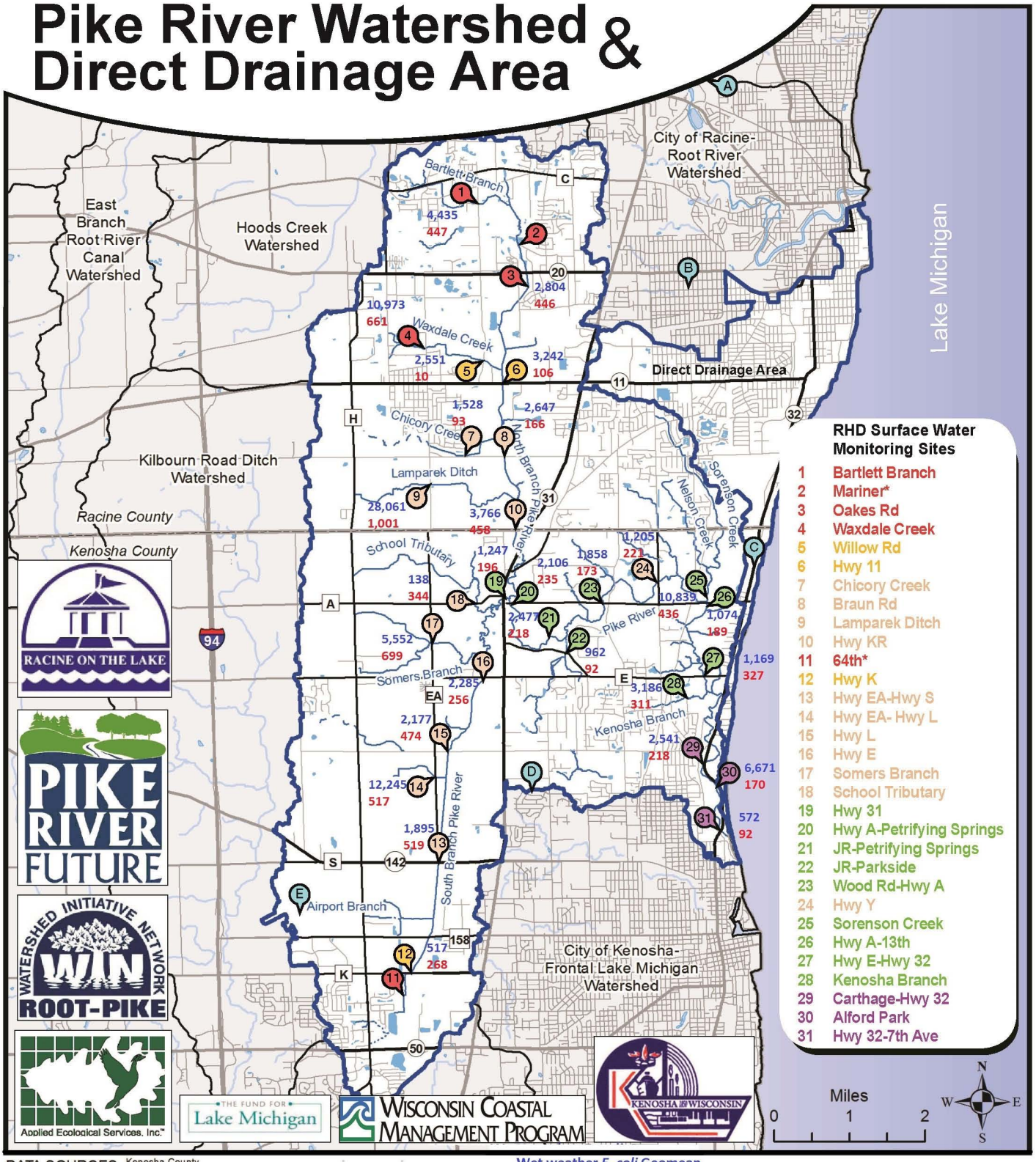
Use Classification and Color Code	Color Code
Fish and Aquatic Life (FAL)	Not applicable to site
Limited Forage Fish (LFF)	Variance to Use Classification
Limited Aquatic Life (LAL)	Applicable to multiple Use Classifications

* Impairment: Chronic Aquatic Toxicity, Degraded Habitat; pollutant: unknown pollutant, sediment/Total Suspended Solids; **Impairment: degraded biological community, pollutant: phosphorus; *** Despite a FAL or LFF designation, NR 104.06(2)a stipulates these waters only require a 2.0 mg/L DO concentration.

The Pike River impairments, designated uses and associated standards listed are current as of August 2013, however these may change when future WDNR evaluation and updates occur.

Ambient Water Temperature and Water Quality Temperature Criteria for Warm-Small Waters						
	Fish and Aquatic Life Use					
	Limited Forage Fish					
	Ambient		Sub-Lethal		Acute*	
Month	°C	°C	°C	°C	°C	°C
Jan	0.6	2.8	9.4	12.2	24.4	25.6
Feb	1.1	3.9	10.0	12.2	24.4	26.1
Mar	3.3	6.1	11.1	13.9	25.0	26.7
Apr	8.9	10.0	12.8	17.2	26.1	27.2
May	14.4	15.0	18.3	21.1	27.8	28.9
Jun	18.9	17.8	24.4	25.0	28.9	29.4
Jul	20.6	20.6	27.2	27.2	29.4	30.0
Aug	19.4	20.0	27.2	26.1	28.9	30.0
Sep	15.6	17.2	22.8	22.8	27.8	29.4
Oct	10.0	12.8	16.1	17.2	26.7	28.3
Nov	4.4	7.8	9.4	12.2	25.0	26.7
Dec	1.7	4.4	9.4	12.2	24.4	26.1
Warm-Small Waters have a fish and aquatic life use designation of "warm sport fish community" or "warm water forage fish community" and uni-directional 7Q10 flows < 200 cfs (129 million gallons/day).						
*Acute water quality criteria are applied for daily maximum temperatures.						
Source: NR 102.25(2)						

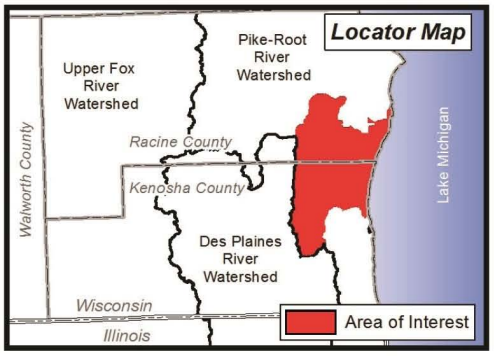
Pike River Watershed & Direct Drainage Area



DATA SOURCES Kenosha County, Racine County, SEWRPC

Wet weather *E. coli* Geomean
Dry weather *E. coli* Geomean

* Denotes RHD sites monitored under a FLM grant



Legend

- County Boundary
- Watershed Boundary
- Adjacent Watershed
- Open Water
- Streams, Rivers
- Intermittent Stream
- Wetland Flow
- Major Road
- Minor Road

LAND USE

- Urban
- Suburban
- Industrial
- Agricultural
- Forested/Parkland

- Rain Gauge Station
- A Racine Batten
- B West Racine
- C North Sheridan Rd
- D North Kenosha
- E Kenosha Regional

Base map provided by Applied Ecological Services, Inc. Aug 21, 2013

Water Temperature (°C) Summary Data by Surface Water Site in the Pike River Watershed
5.17.12 - 10.25.12

Site Code	Site (Upstream to Downstream)		#	χ	Med.	Min.	Max.	# of Exceedances		Correlations									
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
1	Bartlett Branch	North Branch	12	16.6	16.1	12.2	22.6	0	-	0.46	0.13	0.64	0.03	0.74	0.01	0.54	0.07	0.57	0.05
3	Oakes Rd		24	17.8	18.5	6.4	25.1	0	-	0.21	0.32	0.16	0.45	0.25	0.23	0.85	0.00	0.35	0.09
4	Waxdale Creek		24	17.4	18.0	8.3	24.2	0	-	0.32	0.13	0.37	0.07	0.44	0.03	0.77	0.00	0.45	0.03
5	Willow Rd		23	22.5	22.9	15.7	27.5	0	-	0.08	0.73	0.10	0.65	0.15	0.51	0.71	0.00	0.16	0.46
6	Hwy 11		24	20.6	21.7	12.9	26.2	0	-	0.18	0.40	0.21	0.32	0.27	0.20	0.82	0.00	0.30	0.15
7	Braun Rd		24	19.8	21.3	11.0	25.7	0	-	0.20	0.34	0.24	0.26	0.29	0.16	0.77	0.00	0.33	0.12
8	Chicory Creek		24	17.7	17.8	6.7	25.2	0	-	0.30	0.15	0.31	0.14	0.34	0.11	0.80	0.00	0.40	0.05
9	Lamparek Ditch		13	15.1	14.7	10.4	20.9	0	-	0.41	0.17	0.48	0.10	0.43	0.14	0.73	0.00	0.47	0.11
10	Hwy KR		24	19.3	20.7	9.7	25.4	0	-	0.20	0.36	0.16	0.45	0.27	0.20	0.81	0.00	0.38	0.06
12	Hwy K	South Branch	23	19.7	20.1	12.2	27.7	0	-	0.20	0.36	0.19	0.39	0.35	0.11	0.66	0.00	0.43	0.04
13	Hwy EA- Hwy S		24	17.7	18.6	7.7	25.7	0	-	0.18	0.39	0.17	0.42	0.30	0.15	0.72	0.00	0.40	0.06
14	Hwy EA- Hwy L		17	17.7	18.8	10.7	23.6	0	-	0.10	0.70	0.12	0.64	0.21	0.41	0.71	0.00	0.32	0.22
15	Hwy L		24	17.8	18.4	7.2	26.2	0	-	0.18	0.41	0.18	0.41	0.24	0.26	0.74	0.00	0.37	0.08
16	Hwy E		23	17.5	17.0	7.1	25.4	0	-	0.19	0.37	0.18	0.41	0.25	0.24	0.75	0.00	0.36	0.09
17	Somers Branch		21	16.6	15.8	7.8	23.0	0	-	0.27	0.23	0.26	0.25	0.32	0.15	0.85	0.00	0.45	0.04
18	School Tributary		24	16.4	17.0	6.2	23.1	0	-	0.23	0.29	0.17	0.43	0.21	0.34	0.77	0.00	0.40	0.06
19	Hwy 31		24	17.7	17.7	7.4	25.3	0	-	0.16	0.45	0.12	0.57	0.19	0.38	0.81	0.00	0.32	0.13
20	Hwy A-Petrifying Springs	Main Branch	24	19.2	20.3	9.4	26.7	0	-	0.15	0.48	0.10	0.65	0.15	0.49	0.75	0.00	0.31	0.14
21	JR-Petrifying Springs		24	19.2	20.2	8.5	26.2	0	-	0.17	0.42	0.12	0.57	0.18	0.40	0.77	0.00	0.34	0.11
22	JR-Parkside		24	17.3	18.0	9.1	22.9	0	-	0.22	0.30	0.17	0.44	0.20	0.36	0.76	0.00	0.37	0.08
23	Wood Rd-Hwy A		24	19.0	19.5	7.9	26.2	0	-	0.18	0.41	0.12	0.57	0.21	0.32	0.79	0.00	0.34	0.11
24	Hwy Y		24	18.7	19.1	7.4	26.0	0	-	0.19	0.37	0.14	0.53	0.22	0.30	0.75	0.00	0.36	0.09
25	Sorenson Creek		24	17.5	18.2	6.1	24.8	0	-	0.21	0.34	0.14	0.53	0.21	0.33	0.72	0.00	0.36	0.09
26	Hwy A-13th		24	18.9	19.9	7.4	26.2	0	-	0.19	0.37	0.13	0.55	0.20	0.34	0.83	0.00	0.34	0.10
27	Hwy E-Hwy 32		24	18.8	19.2	7.6	26.7	0	-	0.17	0.42	0.11	0.61	0.18	0.39	0.77	0.00	0.32	0.12
28	Kenosha Branch		24	18.5	19.6	7.1	25.0	0	-	0.19	0.36	0.12	0.58	0.18	0.41	0.78	0.00	0.31	0.14
29	Carthage Hwy 32		24	19.8	20.6	8.0	27.9	0	-	0.14	0.51	0.08	0.73	0.15	0.48	0.81	0.00	0.30	0.15
30	Alford Park at Pike		24	21.0	22.2	8.2	29.1	0	-	0.08	0.71	0.01	0.96	0.08	0.71	0.81	0.00	0.20	0.36
31	Hwy 32-7th Ave		24	20.6	22.1	7.3	26.8	0	-	0.11	0.61	0.02	0.92	0.08	0.70	0.73	0.00	0.25	0.24

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	For FAL and LFF state standards, see Ambient Water Temperature and Water Quality Temperature Criteria for Warm-Small Waters Table.	Recommended guideline N/A.
Limited Forage Fish (LFF)		
Limited Aquatic Life (LAL)	LAL waters state standard: temperature at any point may not exceed 30° C (86 °F)	

Source: See Ambient Water Temperature and Water Quality Temperature Criteria for Warm-Small Waters Table

Dissolved Oxygen (mg/l) Summary Data by Surface Water Site in the Pike River Watershed
5.17.12 - 10.25.12

Site Code	Site (Upstream to Downstream)		#	χ	Med.	Min.	Max.	# of Exceedances		Correlations									
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
1	Bartlett Branch	North Branch	12	3.6	3.7	1.7	5.1	11	-	-0.19	0.55	-0.31	0.33	-0.41	0.18	-0.47	0.12	-0.27	0.40
3	Oakes Rd		24	5.9	5.9	3.8	9.5	0	-	0.11	0.61	0.15	0.47	0.06	0.79	-0.69	0.00	-0.06	0.79
4	Waxdale Creek		24	5.2	5.2	1.4	12.3	0	-	0.02	0.93	-0.09	0.69	-0.16	0.45	-0.43	0.04	-0.04	0.86
5	Willow Rd		23	7.8	7.6	6.3	9.4	0	-	-0.33	0.12	-0.47	0.02	-0.60	0.00	0.24	0.27	-0.42	0.05
6	Hwy 11		24	7.5	7.5	5.3	9.0	0	-	-0.57	0.00	-0.61	0.00	-0.60	0.00	-0.11	0.61	-0.67	0.00
7	Chicory Creek		24	2.9	2.2	0.1	9.8	21	-	0.16	0.45	0.15	0.48	0.05	0.83	-0.48	0.02	0.12	0.58
8	Braun Rd		23	8.7	8.0	5.6	14.6	0	-	-0.35	0.10	-0.40	0.06	-0.41	0.05	-0.21	0.32	-0.41	0.05
9	Lamparek Ditch		13	6.6	5.9	7.3	8.2	6	-	-0.07	0.82	-0.16	0.61	-0.32	0.29	0.23	0.44	-0.13	0.68
10	Hwy KR		24	6.7	6.7	5.4	8.9	0	-	-0.25	0.23	-0.20	0.36	-0.22	0.31	-0.46	0.02	-0.27	0.20
12	Hwy K	South Branch	23	7.9	8.1	5.1	12.8	0	-	-0.37	0.09	-0.40	0.06	-0.46	0.03	0.11	0.61	-0.44	0.04
13	Hwy EA- Hwy S		24	6.8	6.9	1.3	12.3	1	-	-0.19	0.38	-0.16	0.46	-0.13	0.55	-0.34	0.10	-0.21	0.33
14	Hwy EA- Hwy L		17	5.5	4.4	6.2	17.5	9	-	-0.20	0.43	-0.34	0.19	-0.46	0.06	0.01	0.98	-0.26	0.31
15	Hwy L		24	5.5	4.5	1.2	11.0	2	-	-0.02	0.94	0.08	0.73	0.08	0.72	0.02	0.94	0.00	0.98
16	Hwy E		23	7.2	7.0	3.1	12.0	0	-	-0.23	0.28	-0.30	0.17	-0.32	0.14	0.30	0.16	-0.25	0.25
17	Somers Branch		21	4.8	2.7	0.1	15.6	5	-	-0.18	0.44	-0.33	0.15	-0.41	0.06	0.00	0.99	-0.27	0.24
18	School Tributary		24	4.0	2.4	0.5	11.5	18	-	-0.19	0.37	-0.34	0.10	-0.39	0.06	-0.06	0.77	-0.25	0.24
19	Hwy 31		24	8.3	8.5	6.4	10.4	0	-	-0.45	0.03	-0.52	0.01	-0.54	0.01	0.22	0.31	-0.49	0.02
20	Hwy A-Petrifying Springs	Main Branch	24	7.9	7.7	6.2	9.7	0	-	-0.47	0.02	-0.53	0.01	-0.55	0.01	-0.20	0.36	-0.54	0.01
21	JR-Petrifying Springs		24	7.7	7.4	6.0	10.9	0	-	-0.34	0.11	-0.35	0.10	-0.35	0.09	-0.29	0.17	-0.40	0.06
22	JR-Parkside		24	2.2	1.8	0.6	9.9	22	-	-0.02	0.91	-0.13	0.56	-0.15	0.49	-0.04	0.86	-0.01	0.98
23	Wood Rd-Hwy A		24	8.1	7.7	6.1	12.4	0	-	-0.25	0.24	-0.29	0.17	-0.35	0.10	-0.04	0.85	-0.32	0.13
24	Hwy Y		24	8.1	8.0	5.8	12.2	0	-	-0.28	0.19	-0.30	0.16	-0.35	0.09	-0.34	0.11	-0.37	0.08
25	Sorenson Creek		24	6.8	6.9	2.7	11.8	3	-	-0.04	0.85	-0.07	0.74	-0.09	0.67	-0.03	0.89	-0.04	0.84
26	Hwy A-13th		24	8.4	8.1	4.6	13.2	1	-	-0.16	0.46	-0.18	0.41	-0.24	0.26	-0.23	0.29	-0.24	0.26
27	Hwy E-Hwy 32		24	7.4	7.3	4.6	11.2	1	-	-0.12	0.59	-0.08	0.71	-0.09	0.69	-0.59	0.00	-0.16	0.44
28	Kenosha Branch		24	9.6	8.6	6.3	22.5	0	-	-0.27	0.20	-0.32	0.13	-0.36	0.08	0.34	0.10	-0.28	0.18
29	Carthage Hwy 32		24	7.7	8.1	5.0	10.7	0	-	-0.30	0.15	-0.29	0.17	-0.31	0.14	-0.17	0.42	-0.36	0.08
30	Alford Park at Pike		24	9.7	9.5	5.4	14.8	0	-	-0.34	0.11	-0.22	0.30	-0.17	0.42	-0.11	0.61	-0.35	0.10
31	Hwy 32-7th Ave		24	8.3	8.3	4.7	13.0	1	-	-0.41	0.04	-0.47	0.02	-0.50	0.01	0.12	0.58	-0.44	0.03

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	Not less than 5.0 mg/l	Not applicable
Limited Forage Fish (LFF)	Not less than 3.0 mg/l	
Limited Aquatic Life (LAL)	Not less than 1.0 mg/L	
Variance (despite use designation)	Not less than 2.0 mg/L	

Source: NR 102.04(4), NR 104.02(3), NR 104.02(3), NR 104.06(2)a

pH (s.u.) Summary Data by Surface Water Site in the Pike River Watershed

5.17.12 - 10.25.12

Site Code	Site (Upstream to Downstream)		#	χ	Med.	Min.	Max.	# of Exceedances		Correlations									
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
1	Bartlett Branch	North Branch	12	7.7	7.7	7.3	7.9	0	-	-0.71	0.01	-0.68	0.01	-0.52	0.08	-0.26	0.41	-0.75	0.00
3	Oakes Rd		24	7.7	7.8	7.4	8.0	0	-	-0.58	0.00	-0.54	0.01	-0.45	0.03	-0.37	0.07	-0.59	0.00
4	Waxdale Creek		24	7.8	7.8	7.4	8.5	0	-	-0.50	0.01	-0.53	0.01	-0.53	0.01	0.07	0.73	-0.53	0.01
5	Willow Rd		23	8.0	8.0	7.5	8.3	0	-	-0.56	0.01	-0.53	0.01	-0.44	0.03	-0.06	0.79	-0.56	0.01
6	Hwy 11		24	8.0	8.0	7.4	8.2	0	-	-0.71	0.00	-0.69	0.00	-0.53	0.01	-0.08	0.70	-0.71	0.00
7	Chicory Creek		24	7.6	7.6	7.2	7.9	0	-	-0.48	0.02	-0.46	0.02	-0.38	0.06	-0.34	0.11	-0.51	0.01
8	Braun Rd		24	8.0	8.0	7.4	8.2	0	-	-0.55	0.01	-0.51	0.01	-0.38	0.07	-0.10	0.64	-0.51	0.01
9	Lamparek Ditch		13	7.8	8.0	7.3	8.2	0	-	-0.42	0.16	-0.51	0.08	-0.61	0.03	0.18	0.56	-0.48	0.09
10	Hwy KR		24	7.9	7.9	7.5	8.3	0	-	-0.46	0.02	-0.44	0.03	-0.36	0.09	-0.13	0.55	-0.39	0.06
12	Hwy K	South Branch	23	8.1	8.1	7.4	8.5	0	-	-0.02	0.94	0.01	0.95	0.13	0.56	-0.03	0.88	0.04	0.85
13	Hwy EA- Hwy S		24	7.9	7.8	7.4	8.3	0	-	-0.55	0.01	-0.55	0.01	-0.38	0.06	0.03	0.88	-0.47	0.02
14	Hwy EA- Hwy L		17	7.8	7.8	7.3	8.4	0	-	-0.51	0.04	-0.58	0.02	-0.54	0.02	-0.01	0.97	-0.47	0.06
15	Hwy L		24	7.8	7.7	7.3	8.0	0	-	-0.46	0.02	-0.39	0.06	-0.32	0.13	0.24	0.25	-0.44	0.03
16	Hwy E		23	7.9	7.9	7.4	8.2	0	-	-0.51	0.01	-0.54	0.01	-0.45	0.03	0.34	0.12	-0.54	0.01
17	Somers Branch		21	7.8	7.7	7.1	8.7	0	-	-0.38	0.09	-0.44	0.04	-0.47	0.03	-0.02	0.93	-0.46	0.04
18	School Tributary		24	8.0	8.0	7.6	8.4	0	-	-0.32	0.13	-0.41	0.04	-0.45	0.03	-0.12	0.59	-0.37	0.08
19	Hwy 31		24	8.1	8.1	7.7	8.3	0	-	-0.46	0.02	-0.62	0.00	-0.57	0.00	0.39	0.06	-0.57	0.00
20	Hwy A-Petrifying Springs	Main Branch	24	8.1	8.1	7.6	8.5	0	-	-0.57	0.00	-0.67	0.00	-0.61	0.00	0.03	0.87	-0.58	0.00
21	JR-Petrifying Springs		24	8.0	8.0	7.4	8.3	0	-	-0.34	0.10	-0.41	0.05	-0.36	0.09	-0.18	0.39	-0.37	0.08
22	JR-Parkside		24	7.3	7.2	7.0	7.9	1	-	-0.15	0.49	-0.30	0.15	-0.37	0.07	0.07	0.74	-0.15	0.48
23	Wood Rd-Hwy A		24	8.0	8.1	7.6	8.5	0	-	-0.47	0.02	-0.58	0.00	-0.58	0.00	0.37	0.08	-0.47	0.02
24	Hwy Y		24	8.0	8.1	7.5	8.5	0	-	-0.54	0.01	-0.62	0.00	-0.60	0.00	0.17	0.44	-0.56	0.00
25	Sorenson Creek		24	8.0	8.0	7.6	8.7	0	-	-0.40	0.05	-0.46	0.03	-0.43	0.04	0.38	0.07	-0.36	0.09
26	Hwy A-13th		24	8.1	8.1	7.7	8.5	0	-	-0.31	0.14	-0.39	0.06	-0.42	0.04	0.29	0.17	-0.32	0.12
27	Hwy E-Hwy 32		24	8.0	8.0	7.7	8.6	0	-	-0.35	0.09	-0.43	0.03	-0.44	0.03	0.29	0.17	-0.36	0.09
28	Kenosha Branch		24	8.1	8.1	7.7	8.8	0	-	-0.50	0.01	-0.56	0.00	-0.54	0.01	0.58	0.00	-0.42	0.04
29	Carthage Hwy 32		24	8.1	8.1	7.7	8.7	0	-	-0.38	0.07	-0.48	0.02	-0.48	0.02	0.45	0.03	-0.34	0.11
30	Alford Park at Pike		24	8.3	8.2	7.6	8.9	0	-	-0.46	0.02	-0.36	0.08	-0.27	0.20	0.39	0.06	-0.41	0.05
31	Hwy 32-7th Ave		24	8.2	8.2	7.6	8.6	0	-	-0.49	0.02	-0.61	0.00	-0.64	0.00	0.26	0.22	-0.47	0.02

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	Not less than 6.0 or greater than 9.0 s.u.	Not applicable
Limited Forage Fish (LFF)		
Limited Aquatic Life (LAL)		

Source: WI DNR NR 102.04 (4)

Specific Conductivity (µS/cm) Summary Data by Surface Water Site in the Pike River Watershed
5.17.12 - 10.25.12

Site Code	Site (Upstream to Downstream)		#	χ	Med.	Min.	Max.	# of Exceedances		Correlations									
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
1	Bartlett Branch	North Branch	12	1,167	1,154	833	1,511	-	1	-0.18	0.58	-0.38	0.22	-0.60	0.04	-0.18	0.57	-0.35	0.26
3	Oakes Rd		24	1,164	1,198	406	1,968	-	5	-0.53	0.01	-0.61	0.00	-0.72	0.00	0.36	0.08	-0.49	0.01
4	Waxdale Creek		24	1,395	1,265	452	2,190	-	8	-0.18	0.41	-0.26	0.22	-0.33	0.11	0.29	0.17	-0.23	0.29
5	Willow Rd		23	416	370	292	709	-	0	0.61	0.00	0.62	0.00	0.54	0.01	-0.22	0.31	0.63	0.00
6	Hwy 11		24	539	507	384	947	-	0	-0.08	0.71	-0.06	0.76	-0.01	0.96	-0.18	0.40	-0.10	0.65
7	Chicory Creek		24	634	650	263	890	-	0	-0.63	0.00	-0.71	0.00	-0.71	0.00	0.20	0.34	-0.65	0.00
8	Braun Rd		24	552	512	390	912	-	0	0.00	0.99	0.03	0.90	0.07	0.73	-0.09	0.66	0.00	0.99
9	Lamparek Ditch		13	1,230	889	503	2,970	-	3	-0.28	0.35	-0.31	0.30	-0.28	0.35	-0.50	0.08	-0.29	0.34
10	Hwy KR		24	553	508	374	881	-	0	-0.03	0.87	-0.01	0.95	-0.03	0.90	-0.18	0.40	-0.06	0.77
12	Hwy K	South Branch	23	816	826	605	934	-	0	-0.16	0.47	-0.27	0.21	-0.35	0.10	0.02	0.92	-0.19	0.39
13	Hwy EA- Hwy S		24	943	1,002	457	1,217	-	0	-0.57	0.00	-0.71	0.00	-0.80	0.00	0.26	0.23	-0.61	0.00
14	Hwy EA- Hwy L		17	888	885	681	1,206	-	0	-0.24	0.34	-0.31	0.22	-0.12	0.64	-0.09	0.73	-0.28	0.27
15	Hwy L		24	975	1,025	565	1,175	-	0	-0.48	0.02	-0.68	0.00	-0.68	0.00	0.14	0.52	-0.51	0.01
16	Hwy E		23	955	1,009	501	1,120	-	0	-0.67	0.00	-0.80	0.00	-0.82	0.00	0.07	0.76	-0.73	0.00
17	Somers Branch		21	705	749	298	1,339	-	0	-0.43	0.05	-0.32	0.15	-0.13	0.58	0.05	0.83	-0.26	0.25
18	School Tributary		24	926	953	732	1,106	-	0	-0.24	0.25	-0.04	0.86	0.14	0.51	-0.48	0.02	-0.32	0.13
19	Hwy 31		24	872	936	543	1,057	-	0	-0.17	0.42	-0.39	0.06	-0.50	0.01	0.18	0.40	-0.25	0.24
20	Hwy A-Petrifying Springs	Main Branch	24	633	608	423	910	-	0	-0.17	0.44	-0.15	0.47	-0.15	0.49	-0.06	0.78	-0.19	0.38
21	JR-Petrifying Springs		24	611	596	423	910	-	0	-0.23	0.28	-0.17	0.42	-0.16	0.46	-0.06	0.78	-0.24	0.26
22	JR-Parkside		24	2,515	2,755	818	3,370	-	21	-0.47	0.02	-0.46	0.02	-0.35	0.09	0.41	0.05	-0.39	0.06
23	Wood Rd-Hwy A		24	608	596	374	918	-	0	-0.35	0.09	-0.37	0.07	-0.34	0.11	-0.06	0.77	-0.35	0.09
24	Hwy Y		24	618	594	369	907	-	0	-0.36	0.08	-0.39	0.06	-0.37	0.08	-0.07	0.73	-0.39	0.06
25	Sorenson Creek		24	676	622	8	1,170	-	1	-0.39	0.06	-0.42	0.04	-0.39	0.06	0.57	0.00	-0.33	0.11
26	Hwy A-13th		24	611	600	401	896	-	0	-0.39	0.06	-0.43	0.04	-0.41	0.05	0.22	0.30	-0.40	0.05
27	Hwy E-Hwy 32		24	618	598	426	904	-	0	-0.35	0.09	-0.40	0.05	-0.40	0.05	0.08	0.70	-0.36	0.08
28	Kenosha Branch		24	1,139	1,230	247	1,727	-	3	-0.47	0.02	-0.57	0.00	-0.65	0.00	0.45	0.03	-0.39	0.06
29	Carthage Hwy 32		24	662	641	415	977	-	0	-0.35	0.09	-0.43	0.04	-0.47	0.02	-0.20	0.35	-0.40	0.05
30	Alford Park at Pike		24	666	630	388	984	-	0	-0.45	0.03	-0.52	0.01	-0.55	0.01	-0.13	0.53	-0.50	0.01
31	Hwy 32-7th Ave		24	647	616	355	1,010	-	0	-0.40	0.05	-0.46	0.02	-0.50	0.01	-0.14	0.53	-0.44	0.03

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	Not applicable	<1,500 µS/cm
Limited Forage Fish (LFF)		
Limited Aquatic Life (LAL)		

Source: U.S. EPA, 2012

Turbidity (NTU) Summary Data by Surface Water Site in the Pike River Watershed
5.17.12 - 10.25.12

Site Code	Site (Upstream to Downstream)		#	χ	Med.	Min.	Max.	# of Exceedances		Correlations									
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
1	Bartlett Branch	North Branch	12	13.1	11.2	4.0	26.5	-	3	-0.18	0.57	-0.29	0.36	-0.38	0.22	-0.06	0.86	-0.27	0.39
3	Oakes Rd		24	15.6	11.2	2.9	53.2	-	7	0.02	0.93	-0.02	0.93	-0.10	0.65	-0.51	0.01	-0.13	0.55
4	Waxdale Creek		24	10.9	5.0	1.3	63.2	-	4	-0.12	0.59	0.04	0.86	0.20	0.34	0.36	0.09	-0.02	0.92
5	Willow Rd		23	3.7	2.1	0.4	26.1	-	1	0.27	0.22	0.22	0.31	0.13	0.56	-0.15	0.49	0.20	0.37
6	Hwy 11		24	29.2	16.2	5.9	130.0	-	14	0.15	0.47	0.09	0.67	0.09	0.68	0.43	0.04	0.21	0.33
7	Chicory Creek		24	35.4	12.7	4.3	296.0	-	10	-0.08	0.72	-0.11	0.60	-0.17	0.43	0.37	0.08	-0.08	0.70
8	Braun Rd		24	18.8	9.3	4.2	82.5	-	9	0.74	0.00	0.70	0.00	0.51	0.01	0.36	0.09	0.70	0.00
9	Lamparek Ditch		13	37.4	16.3	4.7	103.0	-	8	-0.11	0.73	-0.15	0.63	-0.16	0.60	-0.23	0.45	-0.10	0.74
10	Hwy KR		24	19.3	14.3	5.3	82.7	-	12	0.92	0.00	0.88	0.00	0.78	0.00	0.05	0.82	0.90	0.00
12	Hwy K	South Branch	23	45.9	39.7	5.0	208.0	-	19	0.89	0.00	0.87	0.00	0.81	0.00	-0.11	0.61	0.92	0.00
13	Hwy EA- Hwy S		24	18.5	13.9	5.7	55.7	-	12	0.06	0.79	0.01	0.95	0.08	0.72	-0.36	0.09	0.11	0.59
14	Hwy EA- Hwy L		17	37.8	20.0	4.2	135.0	-	13	0.48	0.05	0.36	0.16	0.22	0.39	0.28	0.27	0.62	0.01
15	Hwy L		24	18.5	12.6	2.7	114.0	-	11	0.16	0.46	0.08	0.70	0.07	0.73	0.10	0.66	0.25	0.24
16	Hwy E		23	20.4	4.5	1.3	250.0	-	7	0.04	0.87	-0.02	0.93	-0.02	0.93	0.18	0.42	0.09	0.70
17	Somers Branch		21	134.6	64.6	2.4	517.0	-	19	-0.22	0.34	-0.23	0.32	-0.15	0.51	0.27	0.24	-0.17	0.45
18	School Tributary		24	17.4	15.0	7.3	49.2	-	15	0.09	0.68	0.07	0.74	0.01	0.97	-0.06	0.79	0.15	0.50
19	Hwy 31		24	12.4	7.7	2.3	120.0	-	3	0.91	0.00	0.76	0.00	0.64	0.00	0.13	0.55	0.97	0.00
20	Hwy A-Petrifying Springs	Main Branch	24	17.9	13.5	4.7	93.3	-	12	0.90	0.00	0.77	0.00	0.65	0.00	0.19	0.37	0.94	0.00
21	JR-Petrifying Springs		24	17.7	14.5	5.5	60.4	-	12	0.76	0.00	0.66	0.00	0.53	0.01	0.21	0.33	0.85	0.00
22	JR-Parkside		24	53.0	29.6	3.6	304.0	-	17	-0.26	0.21	-0.31	0.14	-0.32	0.13	-0.03	0.89	-0.17	0.42
23	Wood Rd-Hwy A		24	19.5	14.3	5.2	95.3	-	13	0.87	0.00	0.84	0.00	0.75	0.00	0.17	0.44	0.87	0.00
24	Hwy Y		24	28.0	8.3	2.5	461.0	-	4	0.95	0.00	0.93	0.00	0.80	0.00	0.06	0.78	0.97	0.00
25	Sorenson Creek		24	21.7	12.9	4.8	76.4	-	11	0.18	0.40	0.10	0.65	0.00	0.99	0.47	0.02	0.15	0.49
26	Hwy A-13th		24	9.7	6.2	3.0	43.5	-	4	0.82	0.00	0.88	0.00	0.92	0.00	0.13	0.54	0.92	0.00
27	Hwy E-Hwy 32		24	15.6	10.6	3.2	106.0	-	8	0.95	0.00	0.92	0.00	0.83	0.00	0.09	0.67	0.96	0.00
28	Kenosha Branch		24	9.3	7.6	4.4	29.1	-	4	0.15	0.47	0.17	0.43	0.19	0.39	-0.03	0.90	-0.03	0.90
29	Carthage Hwy 32		24	14.6	13.7	5.4	29.1	-	12	0.54	0.01	0.67	0.00	0.75	0.00	0.23	0.28	0.65	0.00
30	Alford Park at Pike		24	23.9	18.8	7.6	77.6	-	18	0.01	0.96	-0.04	0.87	-0.09	0.69	-0.01	0.98	-0.05	0.83
31	Hwy 32-7th Ave		24	23.9	17.3	5.8	47.6	-	18	0.62	0.00	0.62	0.00	0.59	0.00	0.20	0.35	0.60	0.00

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	Not applicable	<14 NTU
Limited Forage Fish (LFF)		
Limited Aquatic Life (LAL)		

Source: U.S. EPA, 2000

E. coli (MPN/ 100 ml) Summary Data by Surface Water Site in the Pike River Watershed
5.17.12 - 10.25.12

Site Code	Site (Upstream to Downstream)		#	χ	Med.	Min.	Max.	# of Exceedances		Correlations									
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
1	Bartlett Branch	North Branch	12	2,952	545	86	24,192	10	-	0.74	0.01	0.81	0.00	0.74	0.01	0.04	0.90	0.77	0.00
3	Oakes Rd		24	1,434	503	41	12,033	18	-	0.57	0.00	0.51	0.01	0.36	0.08	0.17	0.43	0.45	0.03
4	Waxdale Creek		24	5,654	746	63	77,010	20	-	0.41	0.04	0.41	0.04	0.27	0.20	0.31	0.14	0.36	0.09
5	Willow Rd		23	631	5	5	10,462	3	-	0.72	0.00	0.69	0.00	0.58	0.00	-0.20	0.36	0.69	0.00
6	Hwy 11		24	669	129	30	7,270	6	-	0.70	0.00	0.71	0.00	0.58	0.00	-0.16	0.45	0.67	0.00
7	Chicory Creek		24	614	135	10	10,462	6	-	0.74	0.00	0.74	0.00	0.60	0.00	-0.19	0.37	0.73	0.00
8	Braun Rd		24	623	221	20	5,172	11	-	0.66	0.00	0.65	0.00	0.52	0.01	0.00	1.00	0.61	0.00
9	Lamparek Ditch		13	6,797	738	209	32,550	12	-	0.52	0.07	0.55	0.05	0.52	0.07	-0.10	0.75	0.51	0.07
10	Hwy KR		24	991	484	175	6,500	23	-	0.78	0.00	0.73	0.00	0.66	0.00	0.07	0.76	0.69	0.00
12	Hwy K	South Branch	23	706	336	5	3,873	15	-	0.24	0.26	0.24	0.28	0.11	0.62	0.09	0.67	0.20	0.35
13	Hwy EA- Hwy S		24	967	534	1,276	6,240	21	-	0.47	0.02	0.43	0.04	0.31	0.14	-0.12	0.57	0.35	0.09
14	Hwy EA- Hwy L		17	3,233	1,421	5	13,540	12	-	0.51	0.04	0.61	0.01	0.48	0.05	-0.40	0.11	0.40	0.11
15	Hwy L		24	986	609	86	6,488	19	-	0.55	0.00	0.53	0.01	0.34	0.11	-0.24	0.26	0.49	0.02
16	Hwy E		23	830	282	52	6,488	12	-	0.59	0.00	0.59	0.00	0.44	0.03	0.00	0.99	0.57	0.00
17	Somers Branch		21	3,835	1,046	5	24,192	17	-	0.44	0.04	0.42	0.06	0.36	0.11	-0.04	0.85	0.38	0.09
18	School Tributary		24	1,308	284	20	19,863	14	-	-0.22	0.30	-0.06	0.77	-0.12	0.59	-0.63	0.00	-0.28	0.19
19	Hwy 31		24	482	212	52	5,172	9	-	0.72	0.00	0.70	0.00	0.60	0.00	0.28	0.18	0.75	0.00
20	Hwy A-Petrifying Springs	Main Branch	24	632	245	41	4,352	13	-	0.73	0.00	0.76	0.00	0.66	0.00	-0.04	0.86	0.68	0.00
21	JR-Petrifying Springs		24	550	216	63	4,280	11	-	0.75	0.00	0.72	0.00	0.61	0.00	-0.03	0.88	0.60	0.00
22	JR-Parkside		24	782	93	5	12,033	6	-	0.55	0.01	0.65	0.00	0.55	0.01	0.18	0.41	0.65	0.00
23	Wood Rd-Hwy A		24	553	161	41	5,380	11	-	0.64	0.00	0.67	0.00	0.70	0.00	0.03	0.91	0.62	0.00
24	Hwy Y		24	519	272	41	4,352	14	-	0.63	0.00	0.64	0.00	0.60	0.00	0.16	0.46	0.63	0.00
25	Sorenson Creek		24	5,031	609	86	86,640	18	-	0.64	0.00	0.63	0.00	0.64	0.00	0.26	0.22	0.69	0.00
26	Hwy A-13th		24	645	224	41	6,131	12	-	0.63	0.00	0.62	0.00	0.62	0.00	0.34	0.10	0.71	0.00
27	Hwy E-Hwy 32		24	930	341	50	11,199	18	-	0.65	0.00	0.61	0.00	0.54	0.01	0.33	0.12	0.68	0.00
28	Kenosha Branch		24	1,030	403	30	7,980	17	-	0.58	0.00	0.61	0.00	0.56	0.00	-0.51	0.01	0.47	0.02
29	Carthage Hwy 32		24	656	264	41	5,794	13	-	0.70	0.00	0.67	0.00	0.62	0.00	-0.06	0.80	0.72	0.00
30	Alford Park at Pike		24	1,202	197	31	12,997	11	-	0.74	0.00	0.73	0.00	0.68	0.00	-0.34	0.11	0.73	0.00
31	Hwy 32-7th Ave		24	379	110	5	4,352	5	-	0.57	0.00	0.67	0.00	0.70	0.00	-0.03	0.89	0.61	0.00

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	Not greater than 235 MPN/100 ml	Not applicable
Limited Forage Fish (LFF)	Not applicable	Not greater than 235 MPN/100 ml
Limited Aquatic Life (LAL)		

Source: WI DNR NR 102.12 (1), (Clayton et al, 2012)

Total Phosphorous and Ortho-phosphate (mg/l) Summary Data by Surface Water Site in the Pike River Watershed
5.17.12 - 03.12.13*

Site Code	Site (Upstream to Downstream)	Branch	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations									
										Precipitation						Air Temperature		Volumetric Flow Rate	
								State Standard	Rec. Guideline	24 hr		48 hr		72hr					
										r	p	r	p	r	p	r	p	r	p
Total Phosphorous (mg/L)																			
10	Hwy KR	N	6	0.294	0.226	0.124	0.644	6	-	0.54	0.27	0.73	0.10	0.73	0.10	0.47	0.35	0.13	0.80
19	Hwy 31	S	6	0.281	0.150	0.087	0.829	6	-	0.69	0.13	0.80	0.05	0.80	0.05	-0.06	0.91	0.31	0.55
29	Carthage Hwy 32	M	1	0.260	0.260	0.260	0.260	1	-	Not Applicable									
31	Hwy 32-7th Ave	M	5	0.224	0.210	0.082	0.478	5	-	0.51	0.38	0.73	0.16	0.73	0.16	-0.15	0.81	0.49	0.40
Ortho-phosphates (mg/L): no standard exisits (n.s)																			
10	Hwy KR	N	6	0.160	0.148	0.070	0.288	n.s.	-	-0.11	0.84	-0.02	0.96	-0.03	0.95	0.76	0.08	-0.20	0.71
19	Hwy 31	S	6	0.126	0.134	0.055	0.183	n.s.	-	0.62	0.19	0.77	0.08	0.77	0.08	-0.10	0.85	0.54	0.27
29	Carthage Hwy 32	M	1	0.181	0.181	0.181	0.181	n.s.	-	Not Applicable									
31	Hwy 32-7th Ave	M	5	0.089	0.091	0.046	0.160	n.s.	-	0.15	0.80	0.51	0.38	0.53	0.36	-0.65	0.24	0.89	0.04

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

Significant p values < 0.05

Use Classification Color Code and Relevant State and/or Recommended Standard(s)

Use Classification and Color Code:	State Standard	Recommended Guideline
Fish and Aquatic Life (FAL)	Not greater than 0.075 mg/l	Not applicable
Limited Forage Fish (LFF)		
Limited Aquatic Life (LAL)	Not applicable	Not greater than 0.075 mg/l

Two dates for phosphorus sampling occurred outside of the May 17- Oct. 25, 2012 study period to meet wet weather sampling targets.

Carthage Hwy 32 was collected one time instead of 32-7th Ave due to tidal intrusion, so no correlations are available for this site.

Source: WI DNR NR 102.06 (3)(b), NR 102.06 (6)(d), and NR 104.06 (1), Table 4.

Water Temperature (°C) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas
5.17.12 - 5.21.13

Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations							
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature	
									24hr		48hr		72hr			
									r	p	r	p	r	p	r	p
1	PPB A	0	nd	nd	nd	nd	-	nd	nc	nc	nc	nc	nc	nc	nc	nc
2	PPB B	2	21.2	21.2	19.9	22.5	-	0	nc	nc	nc	nc	nc	nc	nc	nc
3	PPB C	6	16.9	14.8	13.3	22.5	-	0	0.01	0.99	0.72	0.07	0.76	0.05	0.53	0.23
4	PPB D	1	8.0	8.0	8.0	8.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
5	PPB E	4	7.6	5.4	2.0	17.4	-	0	0.94	0.06	0.81	0.19	1.00	0.00	0.98	0.02
6	PPB F	2	20.1	22.5	22.5	22.8	-	0	nc	nc	nc	nc	nc	nc	nc	nc
7	PPB G	6	18.2	19.1	10.6	22.9	-	0	0.44	0.38	0.45	0.38	0.48	0.34	0.83	0.04
8	CC 1	2	18.3	20.0	10.4	24.6	-	0	nc	nc	nc	nc	nc	nc	nc	nc
14	Sher 2	3	18.6	19.8	14.6	21.4	-	0	0.67	0.53	0.68	0.52	0.69	0.51	0.85	0.35
15	Sher 3	4	15.8	16.0	13.0	18.1	-	0	-0.86	0.14	-0.86	0.14	-0.86	0.14	0.98	0.02
16	AP 1	3	23.5	23.7	23.1	23.8	-	0	-0.45	0.70	-0.47	0.69	-0.70	0.51	0.13	0.92
18	AP 3	2	23.9	23.9	23.8	24.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
19	PM 1	6	19.0	19.0	14.4	22.1	-	0	0.33	0.47	0.34	0.46	0.37	0.41	0.92	0.00
21	PM 3	3	18.5	17.2	14.9	23.4	-	0	0.90	0.29	0.90	0.29	0.90	0.29	0.79	0.42
22	PM 4	4	16.6	15.5	13.0	22.4	-	0	-0.83	0.17	-0.83	0.17	-0.83	0.17	1.00	0.00
23	PM 5	7	17.4	18.2	14.1	21.1	-	0	0.28	0.55	0.31	0.49	0.35	0.44	0.81	0.03
24	Pennoyer	3	18.8	20.2	12.0	24.2	-	0	0.75	0.46	0.75	0.46	0.75	0.46	nc	nc
25	40th St	1	22.9	22.9	22.9	22.9	-	0	nc	nc	nc	nc	nc	nc	nc	nc
26	43rd St	0	nd	nd	nd	nd	-	nd	nc	nc	nc	nc	nc	nc	nc	nc
27	50th 1	5	8.2	8.1	1.0	18.0	-	0	-0.11	0.86	0.05	0.94	0.41	0.49	0.99	0.00
29	50th 3	6	18.3	18.7	11.7	25.7	-	0	0.59	0.22	0.48	0.34	0.56	0.24	0.91	0.01
30	Simmons A	5	19.7	21.8	11.6	24.6	-	0	0.39	0.52	0.39	0.52	0.47	0.42	0.95	0.01
31	Simmons B	6	6.5	6.0	1.0	13.4	-	0	0.13	0.81	0.29	0.57	0.58	0.22	0.96	0.00
32	HP52	7	19.0	17.6	12.0	25.0	-	0	0.44	0.32	0.44	0.32	0.50	0.25	0.97	0.00
34	HP 54th B	5	17.0	15.1	13.9	24.8	-	0	-0.38	0.52	-0.38	0.52	-0.38	0.52	0.64	0.25
35	HP 54th C	1	16.1	16.1	16.1	16.1	-	0	nc	nc	nc	nc	nc	nc	nc	nc
37	HP 54th E	7	18.3	16.2	10.2	24.9	-	0	0.37	0.42	0.37	0.42	0.43	0.34	0.98	0.00
38	HP Marina Out	2	13.3	13.3	3.8	22.8	-	0	nc	nc	nc	nc	nc	nc	nc	nc
45	60th St	4	15.8	15.0	13.0	20.1	-	0	-0.62	0.38	-1.00	0.00	-1.00	0.00	0.89	0.11
46	Kemper	3	18.0	17.4	13.8	22.8	-	0	-0.80	0.41	-0.80	0.41	-0.03	0.98	0.93	0.24
47	71st St	3	17.0	17.0	17.0	22.2	-	0	0.37	0.76	-0.14	0.91	-0.54	0.63	nc	nc
48	73rd St	2	19.3	19.3	18.0	20.5	-	0	nc	nc	nc	nc	nc	nc	nc	nc
49	75th St	1	4.8	4.8	4.8	4.8	-	0	nc	nc	nc	nc	nc	nc	nc	nc
50	Southport 1	4	16.8	7.3	13.3	21.5	-	0	0.50	0.50	0.50	0.50	0.50	0.50	1.00	0.00
51	Southport 2	6	19.4	19.5	13.9	24.8	-	0	0.55	0.26	0.55	0.26	0.63	0.18	0.85	0.03
52	K1	6	20.8	23.3	11.0	24.8	-	0	0.26	0.63	0.26	0.63	0.26	0.62	0.83	0.04
53	K2	5	19.8	23.0	11.6	25.7	-	0	0.52	0.37	0.52	0.37	0.64	0.24	0.97	0.01
56	KIP	5	19.7	21.0	11.0	23.8	-	0	0.05	0.93	0.05	0.93	0.24	0.70	0.89	0.04

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum | r correlation coefficient | Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = State Standard for Surface Water: by month, not applicable to stormwater outfalls

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: LAL state standard of not greater than 30 °C

Source: NR 102.04 4(e)

pH (s.u) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas 5.17.12 - 5.21.13																	
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations								
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature		
									24hr		48hr		72hr				
									r	p	r	p	r	p	r	p	
1	PPB A	1	7.1	7.1	7.1	7.1	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
2	PPB B	2	8.0	8.0	7.9	8.1	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
3	PPB C	5	8.1	8.2	7.7	8.4	0	-	-0.99	0.00	-0.99	0.00	-1.00	0.00	-0.56	0.32	
4	PPB D	1	8.9	8.9	8.9	8.9	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
5	PPB E	4	8.2	8.3	8.0	8.4	0	-	-0.02	0.98	-0.80	0.20	-0.33	0.67	-0.40	0.60	
6	PPB F	2	7.8	7.8	7.6	7.9	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
7	PPB G	4	7.6	7.6	7.5	7.7	0	-	0.19	0.81	0.19	0.81	0.30	0.70	0.53	0.47	
8	CC 1	2	7.7	7.7	7.5	7.8	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
14	Sher 2	3	8.2	8.3	8.0	8.3	0	-	-1.00	0.01	-1.00	0.02	-1.00	0.02	-0.96	0.19	
15	Sher 3	2	7.5	7.5	7.5	7.6	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
16	AP 1	3	7.5	7.5	7.4	7.8	0	-	-0.03	0.98	-0.01	1.00	0.27	0.82	0.35	0.77	
18	AP 3	2	7.8	7.8	7.7	7.8	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
19	PM 1	4	7.9	7.9	7.9	8.1	0	-	-0.73	0.16	-0.74	0.16	-0.80	0.10	-0.58	0.30	
21	PM 3	2	8.1	8.1	8.0	8.2	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
22	PM 4	3	7.9	7.9	7.8	8.0	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
23	PM 5	4	8.1	8.0	7.9	8.3	0	-	-0.84	0.16	-0.91	0.09	-0.96	0.04	-0.46	0.54	
24	Pennoyer	2	7.5	7.5	7.4	7.5	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
25	40th St	4	8.1	8.0	7.8	8.4	0	-	-0.88	0.12	-0.94	0.06	-0.98	0.02	nc	nc	
26	43rd St	3	8.2	8.2	7.9	8.4	0	-	-1.00	0.04	-1.00	0.05	-0.97	0.15	nc	nc	
27	50th 1	5	7.8	7.8	7.7	8.0	0	-	-0.65	0.24	-0.79	0.11	-0.88	0.05	-0.48	0.41	
29	50th 3	5	8.3	8.3	8.1	8.4	0	-	-0.97	0.01	-0.94	0.02	-0.98	0.00	-0.65	0.24	
30	Simmons A	4	7.6	7.6	7.2	8.0	0	-	0.95	0.05	0.95	0.05	0.87	0.13	0.12	0.88	
31	Simmons B	6	7.9	8.0	7.8	8.0	0	-	-0.85	0.03	-0.94	0.00	-0.91	0.01	-0.34	0.51	
32	HP52	4	7.8	7.7	7.6	8.1	0	-	-0.23	0.77	-0.23	0.77	-0.37	0.63	0.03	0.97	
34	HP 54th B	2	8.0	8.0	7.9	8.1	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
35	HP 54th C	0	nd	nd	nd	nd	nd	-	nc	nc	nc	nc	nc	nc	nc	nc	
37	HP 54th E	4	8.0	7.9	7.9	8.1	0	-	-0.76	0.24	-0.76	0.24	-0.68	0.32	0.11	0.89	
38	HP Marina Out	2	7.8	7.8	7.5	8.0	0	-	nc	nc	nc	nc	nc	nc	nc	nc	
45	60th St	4	7.8	7.8	7.8	7.8	0	-	-0.29	0.71	-0.08	0.92	-0.08	0.92	nc	nc	
46	Kemper	5	8.1	8.1	7.7	8.3	0	-	-0.90	0.04	-0.90	0.04	-0.81	0.10	0.98	0.00	
47	71st St	4	7.6	7.6	7.3	8.0	0	-	-0.52	0.48	-0.32	0.68	0.01	0.99	nc	nc	
48	73rd St	6	8.0	8.1	7.5	8.5	0	-	-0.73	0.10	-0.81	0.05	-0.88	0.02	nc	nc	
49	75th St	4	8.0	8.0	7.5	8.5	0	-	-0.89	0.11	-0.99	0.01	-1.00	0.00	nc	nc	
50	Southport 1	3	7.3	7.3	7.3	7.3	0	-	-0.74	0.47	-0.74	0.47	-0.74	0.47	nc	nc	
51	Southport 2	4	8.6	8.6	8.2	8.9	0	-	0.59	0.41	0.59	0.41	0.77	0.23	0.94	0.06	
52	K1	5	8.9	8.9	8.4	9.3	2	-	0.51	0.38	0.51	0.38	0.47	0.43	0.76	0.14	
53	K2	5	8.6	8.6	8.3	8.9	0	-	0.23	0.71	0.23	0.71	0.32	0.60	0.79	0.11	
56	KIP	5	7.8	7.7	7.7	8.0	0	-	-0.94	0.02	-0.93	0.02	-0.95	0.01	0.44	0.46	

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r correlation coefficient

Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = State Standard for Fish and Aquatic Life (FAL) Surface Water: ≥ 6.0 s.u. and ≤ 9.0 s.u.

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: outside of surface standard range of 6.0 - 9.0 s.u.

Source: WI DNR NR 102.04 (4)(c), NR 104.02 (3)(a)2.c.), and NR 104.02 (3)(b)

Specific Conductivity (µS/cm) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas
5.17.12 - 5.21.13

Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations							
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature	
									24hr		48hr		72hr			
									r	p	r	p	r	p	r	p
1	PPB A	1	234	234	234	234	0	0	nc	nc	nc	nc	nc	nc	nc	nc
2	PPB B	2	283	283	192	374	0	0	nc	nc	nc	nc	nc	nc	nc	nc
3	PPB C	6	1,146	1,000	357	2,350	2	1	-0.70	0.08	-0.70	0.08	-0.74	0.06	0.56	0.20
4	PPB D	1	2,300	2,300	2,300	2,300	1	1	nc	nc	nc	nc	nc	nc	nc	nc
5	PPB E	4	1,334	1,251	1,075	1,760	1	0	0.87	0.13	0.41	0.59	0.80	0.20	0.79	0.21
6	PPB F	2	693	693	543	843	0	0	nc	nc	nc	nc	nc	nc	nc	nc
7	PPB G	6	1,065	1,043	359	1,747	2	0	-0.43	0.39	-0.43	0.39	-0.49	0.32	0.48	0.34
8	CC 1	2	81	81	76	86	0	0	nc	nc	nc	nc	nc	nc	nc	nc
14	Sher 2	3	1,581	1,681	631	2,430	2	1	-0.90	0.28	-0.91	0.27	-0.91	0.26	-0.99	0.10
15	Sher 3	4	1,411	1,621	735	1,668	3	0	-1.00	0.00	-1.00	0.00	-1.00	0.00	0.93	0.07
16	AP 1	3	377	65	52	1,014	0	0	-0.98	0.13	-0.98	0.11	-0.99	0.07	0.86	0.34
18	AP 3	2	1,499	1,499	1,486	1,512	1	0	nc	nc	nc	nc	nc	nc	nc	nc
19	PM 1	6	1,145	1,251	674	1,520	1	0	0.25	0.59	0.24	0.60	0.17	0.71	0.50	0.26
21	PM 3	3	1,414	1,303	1,048	1,892	1	0	-0.40	0.74	-0.40	0.74	-0.40	0.74	0.65	0.55
22	PM 4	4	2,042	1,740	1,597	2,790	3	1	-0.61	0.39	-0.61	0.39	-0.61	0.39	0.93	0.07
23	PM 5	16	2,180	2,435	601	3,200	13	11	-0.73	0.00	-0.77	0.00	-0.77	0.00	-0.46	0.07
24	Pennoyer	15	1,691	2,040	158	2,770	12	8	-0.86	0.00	-0.88	0.00	-0.88	0.00	nc	nc
25	40th St	14	434	382	311	925	0	0	-0.24	0.41	-0.16	0.58	-0.16	0.58	nc	nc
26	43rd St	13	339	316	297	439	0	0	-0.28	0.35	-0.28	0.35	-0.31	0.30	nc	nc
27	50th 1	5	610	558	355	857	0	0	-0.41	0.49	-0.57	0.32	-0.70	0.19	-0.33	0.59
29	50th 3	6	816	837	668	886	0	0	0.17	0.75	0.14	0.79	-0.10	0.85	-0.25	0.64
30	Simmons A	5	606	319	201	1,511	1	0	-0.46	0.44	-0.46	0.44	-0.42	0.48	-0.04	0.95
31	Simmons B	6	405	335	311	568	0	0	0.50	0.31	0.59	0.22	0.80	0.06	0.83	0.04
32	HP52	7	342	337	282	433	0	0	-0.26	0.58	-0.26	0.58	-0.37	0.41	-0.92	0.00
34	HP 54th B	5	321	319	308	334	0	0	-0.76	0.13	-0.76	0.13	-0.76	0.13	-0.34	0.58
35	HP 54th C	1	330	330	330	330	0	0	nc	nc	nc	nc	nc	nc	nc	nc
37	HP 54th E	7	239	309	8	359	0	0	0.03	0.94	0.03	0.94	0.07	0.88	0.71	0.07
38	HP Marina Out	2	442	442	302	582	0	0	nc	nc	nc	nc	nc	nc	nc	nc
45	60th St	18	1,041	1,220	244	1,520	1	0	-0.82	0.00	-0.81	0.00	-0.83	0.00	0.99	0.00
46	Kemper	17	891	943	387	1,366	0	0	-0.58	0.02	-0.61	0.01	-0.61	0.01	-0.33	0.19
47	71st St	6	308	238	387	683	0	0	-0.07	0.89	0.09	0.87	0.32	0.53	nc	nc
48	73rd St	6	858	823	337	1,447	0	0	-0.51	0.30	-0.52	0.29	-0.47	0.34	nc	nc
49	75th St	14	333	325	295	431	0	0	0.32	0.26	0.46	0.10	0.46	0.10	nc	nc
50	Southport 1	12	779	1,034	79	1,285	0	0	-0.86	0.00	-0.87	0.00	-0.84	0.00	0.77	0.00
51	Southport 2	5	1,128	975	782	1,661	1	0	-0.78	0.12	-0.78	0.12	-0.88	0.05	-0.32	0.60
52	K1	6	760	561	489	1,846	1	0	-0.28	0.59	-0.28	0.59	-0.30	0.56	0.52	0.29
53	K2	5	872	881	736	953	0	0	0.41	0.50	0.41	0.50	0.50	0.39	0.97	0.01
56	KIP	5	947	662	463	1,661	1	0	-0.95	0.01	-0.95	0.01	-0.92	0.03	0.51	0.38

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum | r = correlation coefficient | Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = Recommended Standard for Fish and Aquatic Life (FAL) Surface Water: ≤ 1,500 µS/cm

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: > 2,000 µS/cm

Source: (U.S. EPA, 2012); (Brown et al, 2004)

Turbidity (NTU) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas
5.17.12 - 5.21.13

Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations							
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature	
									24hr		48hr		72hr			
									r	p	r	p	r	p	r	p
1	PPB A	0	nd	nd	nd	nd	nd	nd	nc	nc	nc	nc	nc	nc	nc	nc
2	PPB B	2	12.1	12.1	4.4	19.8	1	0	nc	nc	nc	nc	nc	nc	nc	nc
3	PPB C	6	5.7	4.7	1.1	12.2	0	0	0.77	0.04	0.77	0.04	0.73	0.06	0.21	0.66
4	PPB D	1	2.4	2.4	2.4	2.4	0	0	nc	nc	nc	nc	nc	nc	nc	nc
5	PPB E	4	1.8	1.6	1.0	2.9	0	0	-0.24	0.76	0.59	0.41	0.05	0.95	0.12	0.88
6	PPB F	2	95.7	95.7	73.4	118.0	2	0	nc	nc	nc	nc	nc	nc	nc	nc
7	PPB G	6	17.5	12.5	3.1	56.3	3	0	0.20	0.71	0.20	0.70	0.30	0.57	-0.03	0.96
8	CC 1	2	64.1	64.1	76.4	114.0	2	0	nc	nc	nc	nc	nc	nc	nc	nc
9	Sher 2	3	114.6	22.4	14.5	307.0	3	0	1.00	0.00	1.00	0.02	1.00	0.02	0.96	0.18
10	Sher 3	4	2.0	2.1	0.7	3.2	0	0	0.03	0.97	0.03	0.97	0.03	0.97	0.03	0.97
11	AP 1	2	13.0	13.0	10.5	15.4	1	0	nc	nc	nc	nc	nc	nc	nc	nc
12	AP 3	2	135.0	135.0	121.0	149.0	2	0	nc	nc	nc	nc	nc	nc	nc	nc
13	PM 1	6	7.6	5.3	2.8	17.1	1	0	0.07	0.88	0.07	0.88	0.16	0.74	0.56	0.20
14	PM 3	3	2.1	2.5	1.0	2.9	0	0	0.52	0.65	0.52	0.65	0.52	0.65	-0.54	0.63
15	PM 4	4	17.0	16.5	12.0	22.4	2	0	-0.10	0.90	-0.10	0.90	-0.10	0.90	0.60	0.40
16	PM 5	7	25.9	8.4	2.6	96.6	2	0	-0.35	0.44	-0.33	0.48	-0.29	0.52	-0.11	0.81
17	Pennoyer	4	17.9	20.9	1.4	28.5	3	0	0.85	0.15	0.85	0.15	0.85	0.15	nc	nc
18	40th St	5	23.4	12.9	6.7	71.6	2	0	0.07	0.91	0.03	0.96	-0.01	0.98	nc	nc
19	43rd St	3	5.5	5.4	4.7	6.3	0	0	-0.53	0.64	-0.40	0.74	-0.25	0.84	nc	nc
20	50th 1	5	28.9	8.7	4.5	72.6	2	0	0.94	0.02	0.95	0.01	0.79	0.11	-0.09	0.88
21	50th 3	6	2.2	1.9	1.0	5.4	0	0	0.18	0.74	0.19	0.72	0.43	0.40	0.58	0.23
22	Simmons A	5	42.7	5.2	2.3	192.0	1	0	-0.45	0.45	-0.45	0.45	-0.49	0.40	-0.24	0.69
23	Simmons B	6	6.1	2.1	0.7	26.8	1	0	0.24	0.64	0.36	0.49	0.27	0.61	-0.15	0.78
24	HP52	7	7.7	7.2	0.9	25.6	1	0	0.30	0.51	0.30	0.51	0.50	0.25	0.20	0.67
25	HP 54th B	5	3.2	2.3	1.1	8.5	0	0	-0.12	0.85	-0.12	0.85	-0.12	0.85	-0.60	0.28
26	HP 54th C	1	0.7	0.7	0.7	0.7	0	0	nc	nc	nc	nc	nc	nc	nc	nc
28	HP 54th E	7	101.2	5.1	1.1	348.0	2	0	-0.12	0.80	-0.12	0.80	-0.17	0.72	-0.77	0.04
29	HP Marina Out	2	8.5	8.5	2.3	14.6	1	0	nc	nc	nc	nc	nc	nc	nc	nc
30	60th St	6	12.9	12.4	4.9	24.8	3	0	-0.40	0.43	-0.25	0.63	-0.25	0.63	0.27	0.61
31	Kemper	6	6.7	3.7	1.2	16.3	1	0	0.30	0.57	0.30	0.57	0.18	0.73	-0.99	0.00
32	71st St	4	4.1	3.4	2.6	6.9	0	0	-0.55	0.45	-0.34	0.66	0.02	0.98	nc	nc
33	73rd St	6	5.0	3.1	0.8	16.0	1	0	0.90	0.01	0.83	0.04	0.67	0.14	nc	nc
34	75th St	4	6.2	6.0	2.9	9.7	0	0	0.40	0.60	0.36	0.64	0.35	0.65	nc	nc
35	Southport 1	5	9.6	4.7	3.1	22.5	1	0	-0.57	0.31	-0.57	0.31	-0.57	0.31	-0.60	0.29
36	Southport 2	6	3.8	3.1	1.4	7.1	0	0	0.41	0.42	0.41	0.42	0.39	0.44	0.03	0.96
37	K1	6	18.8	10.0	1.4	70.4	3	0	-0.35	0.49	-0.35	0.49	-0.35	0.49	0.36	0.48
38	K2	5	145.3	203.0	31.6	213.0	5	0	0.36	0.55	0.36	0.55	0.51	0.38	0.93	0.02
39	KIP	5	3.8	3.9	2.4	5.5	0	0	0.67	0.21	0.61	0.27	0.59	0.29	0.31	0.61

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum | r = correlation coefficient | Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = Recommended Standard for Surface Water: ≤ 14 NTU

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: > 1,000 NTU

Source: EPA, 2012; Brown et al, 2004

E. coli (MPN/100 ml) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas 5.17.12 - 5.21.13																	
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations								
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature		
									24hr		48hr		72hr				
									r	p	r	p	r	p	r	p	
1	PPB A	1	24,192	24,192	24,192	24,192	1	1	nc	nc	nc	nc	nc	nc	nc	nc	
2	PPB B	2	9,987	9,987	7,940	12,033	2	1	nc	nc	nc	nc	nc	nc	nc	nc	
3	PPB C	6	9,086	1,954	616	24,192	6	2	0.53	0.22	0.53	0.22	0.50	0.26	0.60	0.15	
4	PPB D	1	50	50	50	50	0	0	nc	nc	nc	nc	nc	nc	nc	nc	
5	PPB E	4	1,229	895	50	3,076	2	0	-0.14	0.86	-0.86	0.14	-0.47	0.53	-0.59	0.41	
6	PPB F	2	5,710	5,710	2,755	8,664	2	0	nc	nc	nc	nc	nc	nc	nc	nc	
7	PPB G	6	4,208	716	31	17,329	4	1	0.83	0.04	0.83	0.04	0.87	0.03	0.02	0.96	
8	CC 1	2	14,335	14,335	6,200	22,470	2	1	nc	nc	nc	nc	nc	nc	nc	nc	
14	Sher 2	3	14,221	12,996	5,475	24,192	3	2	0.11	0.93	0.09	0.94	0.08	0.95	-0.17	0.89	
15	Sher 3	4	626	347	31	1,779	2	0	-0.46	0.54	-0.46	0.54	-0.46	0.54	0.11	0.89	
16	AP 1	3	187	200	52	310	1	0	0.91	0.27	0.92	0.26	0.99	0.08	-0.72	0.48	
18	AP 3	2	39,520	39,520	2,030	77,010	2	1	nc	nc	nc	nc	nc	nc	nc	nc	
19	PM 1	6	11,409	9,156	510	24,192	6	3	0.42	0.35	0.42	0.35	0.44	0.32	0.90	0.01	
21	PM 3	3	8,111	100	40	24,192	1	1	1.00	0.04	1.00	0.04	1.00	0.04	0.49	0.67	
22	PM 4	4	302	345	51	510	2	0	0.61	0.39	0.61	0.39	0.61	0.39	-0.12	0.88	
23	PM 5	16	2,592	1,383	203	8,664	14	0	0.38	0.14	0.40	0.13	0.38	0.15	-0.71	0.00	
24	Pennoyer	15	3,432	393	5	24,192	10	2	0.52	0.05	0.53	0.04	0.51	0.05	nc	nc	
25	40th St	14	328	47	5	1,515	6	0	0.67	0.01	0.69	0.01	0.64	0.01	nc	nc	
26	43rd St	13	7,076	1,396	132	24,192	10	4	-0.22	0.48	-0.19	0.54	-0.15	0.63	nc	nc	
27	50th 1	5	447	86	20	1,785	2	0	0.56	0.32	0.67	0.21	0.61	0.27	0.00	1.00	
29	50th 3	6	1,183	35	10	6,488	2	0	0.61	0.20	0.54	0.27	0.73	0.10	0.61	0.20	
30	Simmons A	5	481	311	5	1,340	3	0	0.38	0.52	0.38	0.52	0.35	0.57	-0.51	0.38	
31	Simmons B	6	6,775	2,488	259	24,192	6	2	-0.18	0.73	-0.07	0.90	0.09	0.87	0.14	0.79	
32	HP52	7	2,974	31	5	12,033	3	1	0.76	0.05	0.76	0.05	0.85	0.02	0.03	0.95	
34	HP 54th B	5	305	5	5	1,480	1	0	0.95	0.01	0.95	0.01	0.95	0.01	0.26	0.67	
35	HP 54th C	1	10	10	10	10	0	0	nc	nc	nc	nc	nc	nc	nc	nc	
37	HP 54th E	7	923	97	5	4,106	2	0	0.75	0.05	0.75	0.05	0.86	0.01	0.33	0.47	
38	HP Marina Out	2	358	358	52	663	1	0	nc	nc	nc	nc	nc	nc	nc	nc	
45	60th St	18	5,164	1,528	161	24,192	16	3	-0.05	0.85	0.06	0.82	0.08	0.74	0.64	0.00	
46	Kemper	17	2,958	860	52	15,531	15	1	0.53	0.03	0.55	0.02	0.46	0.07	-0.85	0.00	
47	71st St	6	10,678	8,577	464	24,192	6	3	0.33	0.52	0.21	0.70	0.05	0.92	nc	nc	
48	73rd St	16	2,992	551	31	24,192	9	1	0.50	0.05	0.55	0.03	0.62	0.01	nc	nc	
49	75th St	14	416	87	5	2,909	5	0	0.76	0.00	0.74	0.00	0.77	0.00	nc	nc	
50	Southport 1	14	7,626	4,791	240	24,192	14	4	0.16	0.59	0.13	0.66	0.11	0.70	0.46	0.10	
51	Southport 2	6	1,406	957	601	3,010	6	0	0.66	0.16	0.66	0.16	0.58	0.23	0.62	0.19	
52	K1	6	307	305	10	740	3	0	0.58	0.23	0.58	0.23	0.61	0.20	-0.15	0.77	
53	K2	5	891	620	20	3,110	3	0	0.85	0.07	0.85	0.07	0.86	0.06	0.24	0.69	
56	KIP	5	1739.0	345.0	100.0	6200.0	3	0	0.67	0.22	0.67	0.22	0.70	0.19	0.42	0.48	

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r = correlation coefficient

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = State Standard for Fish and Aquatic Life (FAL) Surface Water: ≤ 235 MPN/100 ml

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: ≥ 10,000 MPN/100 ml

Source: NR 102.12 (1). (communication with Larson, 2013).

Total Chlorine (mg/l) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore 5.17.12 - 5.21.13										
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances			
							Surface Standard	Rec. Guideline	24hr	
									r	p
2	PPB A	1	0.50	0.50	0.50	0.50	-	1	nc	nc
2	PPB B	2	0.0	0.0	0.0	0.0	-	0	nc	nc
3	PPB C	6	0.0	0.0	0.0	0.0	-	0	nc	nc
4	PPB D	1	0.0	0.0	0.0	0.0	-	0	nc	nc
5	PPB E	4	0.0	0.0	0.0	0.0	-	0	nc	nc
6	PPB F	2	0.0	0.0	0.0	0.0	-	0	nc	nc
7	PPB G	6	0.0	0.0	0.0	0.0	-	0	nc	nc
8	CC 1	3	0.0	0.0	0.0	0.0	-	0	nc	nc
14	Sher 2	3	0.0	0.0	0.0	0.0	-	0	nc	nc
15	Sher 3	4	0.0	0.0	0.0	0.0	-	0	nc	nc
16	AP 1	3	0.0	0.0	0.0	0.0	-	0	nc	nc
18	AP 3	2	0.0	0.0	0.0	0.0	-	0	nc	nc
19	PM 1	7	0.0	0.0	0.0	0.0	-	0	nc	nc
21	PM 3	3	0.0	0.0	0.0	0.0	-	0	nc	nc
22	PM 4	4	0.0	0.0	0.0	0.0	-	0	nc	nc
23	PM 5	6	0.0	0.0	0.0	0.1	-	1	nc	nc
24	Pennoyer	4	0.0	0.0	0.0	0.1	-	1	nc	nc
25	40th St	5	0.0	0.0	0.0	0.0	-	0	nc	nc
26	43rd St	3	0.0	0.0	0.0	0.0	-	0	nc	nc
27	50th 1	5	0.0	0.0	0.0	0.0	-	0	nc	nc
29	50th 3	6	0.0	0.0	0.0	0.1	-	0	nc	nc
30	Simmons A	5	0.0	0.0	0.0	0.0	-	0	nc	nc
31	Simmons B	6	0.0	0.1	0.0	0.1	-	0	-0.15	0.77
32	HP52	7	0.0	0.0	0.0	0.0	-	0	nc	nc
34	HP 54th B	5	0.0	0.0	0.0	0.0	-	0	nc	nc
35	HP 54th C	1	0.0	0.0	0.0	0.0	-	0	nc	nc
37	HP 54th E	7	0.0	0.0	0.0	0.0	-	0	nc	nc
38	HP Marina Out	2	0.0	0.0	0.0	0.0	-	0	nc	nc
45	60th St	6	0.0	0.0	0.0	0.0	-	0	nc	nc
46	Kemper	6	0.0	0.0	0.0	0.1	-	0	nc	nc
47	71st St	4	0.0	0.0	0.0	0.0	-	0	nc	nc
48	73rd St	6	0.0	0.0	0.0	0.0	-	0	nc	nc
49	75th St	4	0.0	0.0	0.0	0.0	-	0	nc	nc
50	Southport 1	5	0.0	0.0	0.0	0.1	-	1	nc	nc
51	Southport 2	6	0.0	0.0	0.0	0.0	-	0	nc	nc
52	K1	6	0.0	0.0	0.0	0.0	-	0	nc	nc
53	K2	5	0.0	0.0	0.0	0.0	-	0	nc	nc
56	KIP	5	0.0	0.0	0.0	0.0	-	0	nc	nc

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r correlatior

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) r	
Surface Standard = Recommended Standard for all flowing surface waters: 0.019 mg/L (acute toxicity)	**Rec. Guideline** = Recommended Guid 0.
Source: NR 105.06; Brown et al, 2004	

Lake Michigan Direct Drainage Areas					
Correlations					
Precipitation				Air Temperature	
48hr		72hr			
r	p	r	p	r	p
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
-0.27	0.61	-0.19	0.72	0.17	0.74
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
n coefficient		Significant p values < 0.05			

result throughout study period
leline for Determining Polluting Outfalls: ≥ 1 mg/l

Detergent (mg/l) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore La 5.17.12 - 5.21.13										
Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances			
							Surface Standard	Rec. Guideline	24hr	
									r	p
1	PPB A	1	0.00	0.00	0.00	0.00	-	0	nc	nc
2	PPB B	2	0.38	0.38	0.25	0.50	-	2	nc	nc
3	PPB C	6	0.33	0.25	0.20	0.50	-	5	-0.18	0.73
4	PPB D	1	0.63	0.63	0.63	0.63	-	1	nc	nc
5	PPB E	4	0.25	0.25	0.13	0.38	-	3	0.74	0.26
6	PPB F	2	0.25	0.25	0.25	0.25	-	2	nc	nc
7	PPB G	6	0.25	0.25	0.25	0.25	-	6	nc	nc
8	CC 1	2	0.23	0.23	0.20	0.25	-	1	nc	nc
14	Sher 2	3	0.42	0.50	0.25	0.50	-	3	-1.00	0.01
15	Sher 3	4	0.25	0.25	0.25	0.25	-	4	nc	nc
16	AP 1	3	0.50	0.25	0.25	1.00	-	3	-0.98	0.12
18	AP 3	2	0.38	0.38	0.25	0.50	-	2	nc	nc
19	PM 1	6	0.22	0.25	0.05	0.25	-	5	0.06	0.91
21	PM 3	3	0.25	0.25	0.25	0.25	-	3	nc	nc
22	PM 4	3	0.00	0.00	0.00	0.00	-	0	nc	nc
23	PM 5	6	0.31	0.25	0.15	0.50	-	5	-0.12	0.82
24	Pennoyer	4	0.25	0.25	0.25	0.25	-	4	nc	nc
25	40th St	5	0.09	0.10	0.00	0.25	-	1	nc	nc
26	43rd St	3	0.12	0.10	0.00	0.25	-	1	nc	nc
27	50th 1	5	0.13	0.13	0.10	0.15	-	0	0.56	0.32
29	50th 3	6	0.18	0.23	0.05	0.25	-	3	0.17	0.74
30	Simmons A	5	0.20	0.20	0.00	0.35	-	2	0.25	0.69
31	Simmons B	5	0.15	0.15	0.00	0.38	-	2	0.71	0.18
32	HP52	7	0.15	0.25	0.00	0.25	-	4	0.45	0.31
34	HP 54th B	5	0.06	0.00	0.00	0.25	-	1	nc	nc
35	HP 54th C	1	0.00	0.00	0.00	0.00	-	0	nc	nc
37	HP 54th E	7	0.16	0.20	0.00	0.40	-	3	0.41	0.36
38	HP Marina Out	2	0.13	0.13	0.00	0.25	-	1	nc	nc
45	60th St	6	0.22	0.25	0.10	0.25	-	4	-0.85	0.03
46	Kemper	6	0.21	0.23	0.15	0.25	-	3	-0.38	0.46
47	71st St	4	0.30	0.28	0.15	0.50	-	3	0.08	0.92
48	73rd St	6	0.19	0.24	0.00	0.25	-	4	0.67	0.14
49	75th St	4	0.10	0.13	0.00	0.15	-	0	1.00	0.00
50	Southport 1	5	0.19	0.25	0.05	0.25	-	3	-0.21	0.73
51	Southport 2	6	0.22	0.25	0.05	0.25	-	5	-0.07	0.90
52	K1	6	0.23	0.23	0.10	0.50	-	3	0.00	0.99
53	K2	5	0.21	0.25	0.15	0.25	-	3	0.43	0.47
56	KIP	5	0.22	0.25	0.15	0.25	-	3	0.46	0.43

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r correlatior

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) r	
Surface Standard = Recommended Standard for Surface Water: Not applicable	**Rec. Guideline** = Recommended Guid 0.2
Source: Brown et al, 2004	

ake Michigan Direct Drainage Areas

Correlations					
Precipitation				Air Temperature	
48hr		72hr			
r	p	r	p	r	p
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
-0.18	0.73	-0.10	0.85	0.08	0.88
nc	nc	nc	nc	nc	nc
-0.13	0.87	0.47	0.53	0.36	0.64
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
-1.00	0.01	-1.00	0.01	-0.97	0.17
nc	nc	nc	nc	nc	nc
-0.99	0.11	-0.99	0.07	0.87	0.33
nc	nc	nc	nc	nc	nc
0.06	0.91	0.08	0.88	0.82	0.05
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
-0.04	0.94	0.05	0.93	0.38	0.46
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
-0.05	0.93	-0.41	0.49	-0.98	0.00
0.09	0.87	-0.13	0.80	-0.33	0.52
0.25	0.69	0.11	0.87	-0.75	0.15
0.72	0.17	0.86	0.06	0.60	0.29
0.45	0.31	0.50	0.25	0.18	0.69
nc	nc	nc	nc	nc	nc
nc	nc	nc	nc	nc	nc
0.41	0.36	0.41	0.36	-0.11	0.81
nc	nc	nc	nc	nc	nc
-0.85	0.03	-0.85	0.03	0.90	0.01
-0.38	0.46	-0.59	0.22	-0.32	0.53
-0.15	0.85	-0.48	0.52	nc	nc
0.80	0.06	0.76	0.08	nc	nc
0.97	0.03	0.95	0.05	nc	nc
-0.21	0.73	-0.21	0.73	0.82	0.09
-0.07	0.90	-0.02	0.98	0.76	0.08
0.00	0.99	-0.05	0.92	0.10	0.86
0.43	0.47	0.58	0.31	0.88	0.05
0.46	0.43	0.42	0.48	0.29	0.63

n coefficient | Significant p values < 0.05

result throughout study period
leline for Determining Polluting Outfalls: ≥ 25 ppm

Copper (mg/l) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas
5.17.12 - 5.21.13

Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations							
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature	
									24hr		48hr		72hr			
									r	p	r	p	r	p	r	p
1	PPB A	1	0.00	0.00	0.00	0.00	-	0	nc	nc	nc	nc	nc	nc	nc	nc
2	PPB B	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
3	PPB C	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
4	PPB D	1	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
5	PPB E	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
6	PPB F	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
7	PPB G	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
8	CC 1	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
14	Sher 2	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
15	Sher 3	4	0.0	0.0	0.0	0.1	-	0	nc	nc	nc	nc	nc	nc	nc	nc
16	AP 1	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
18	AP 3	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
19	PM 1	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
21	PM 3	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
22	PM 4	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
23	PM 5	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
24	Pennoyer	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
25	40th St	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
26	43rd St	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
27	50th 1	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
29	50th 3	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
30	Simmons A	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
31	Simmons B	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
32	HP52	7	0.0	0.0	0.0	0.3	-	1	nc	nc	nc	nc	nc	nc	nc	nc
34	HP 54th B	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
35	HP 54th C	1	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
37	HP 54th E	7	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
38	HP Marina Out	2	0.1	0.1	0.0	0.1	-	0	nc	nc	nc	nc	nc	nc	nc	nc
45	60th St	6	0.0	0.0	0.0	0.1	-	0	nc	nc	nc	nc	nc	nc	nc	nc
46	Kemper	6	0.0	0.0	0.0	0.1	-	0	nc	nc	nc	nc	nc	nc	nc	nc
47	71st St	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
48	73rd St	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
49	75th St	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
50	Southport 1	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
51	Southport 2	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
52	K1	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
53	K2	5	0.1	0.0	0.0	0.5	-	1	nc	nc	nc	nc	nc	nc	nc	nc
56	KIP	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum

r correlation coefficient | Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = State Standard for all flowing surface waters: 0.0298 mg/l (acute toxicity)

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: >0.2mg/l

Source: NR 105.06; AECOM, 2009

Phenol (mg/l) Summary Data by Stormwater Outfall of the Pike River Watershed & Near-shore Lake Michigan Direct Drainage Areas
5.17.12 - 5.21.13

Site Code	Stormwater Outfall	#	χ	Med.	Min.	Max.	# of Exceedances		Correlations							
							Surface Standard	Rec. Guideline	Precipitation						Air Temperature	
									24hr		48hr		72hr			
									r	p	r	p	r	p	r	p
1	PPB A	1	0.10	0.10	0.10	0.10	-	1	nc	nc	nc	nc	nc	nc	nc	nc
2	PPB B	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
3	PPB C	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
4	PPB D	1	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
5	PPB E	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
6	PPB F	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
7	PPB G	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
8	CC 1	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
14	Sher 2	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
15	Sher 3	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
16	AP 1	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
18	AP 3	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
19	PM 1	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
21	PM 3	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
22	PM 4	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
23	PM 5	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
24	Pennoyer	4	0.0	0.0	0.0	0.1	-	1	0.67	0.33	0.67	0.33	0.67	0.33	nc	nc
25	40th St	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
26	43rd St	3	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
27	50th 1	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
29	50th 3	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
30	Simmons A	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
31	Simmons B	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
32	HP52	7	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
34	HP 54th B	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
35	HP 54th C	1	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
37	HP 54th E	7	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc
38	HP Marina Out	2	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
45	60th St	6	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc
46	Kemper	6	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc
47	71st St	4	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc
48	73rd St	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
49	75th St	4	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
50	Southport 1	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
51	Southport 2	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
52	K1	6	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc
53	K2	5	0.0	0.0	0.0	0.1	-	1	nc	nc	nc	nc	nc	nc	nc	nc
56	KIP	5	0.0	0.0	0.0	0.0	-	0	nc	nc	nc	nc	nc	nc	nc	nc

= number of samples; χ = mean; Med. = median; Min. = minimum; Max. = maximum | r correlation coefficient | Significant p values < 0.05

* beach proximity outfalls; nd= no data available; nc = no correlation due to 1 (or less) result throughout study period

Surface Standard = Recommended Standard for Surface Water: Not applicable

Rec. Guideline = Recommended Guideline for Determining Polluting Outfalls: ≥ 0.1 mg/l

Source: AECOM, 2009

Pike River Photos Attached

A. **Braun Rd** – Open water site located on the north branch in a highly channelized area surrounded by agricultural land. As evident in the photo, this site is in close proximity to drain tiles which empty directly into the river.

B. **Hwy E**- Open water site located on the south branch in a forested area downstream from farm-heavy land use. High flow rates during rain events contribute to erosion and down cutting of the stream banks, further increasing sediment loads.

C. 32-th Ave- Open water site a couple hundred meters upstream from the river mouth. The river is wide and shallow in this stretch, with high deposits of silt. Several storm water outfalls are within proximity of the site, both up and down stream, and found to be sources of bacterial pollution.

D. PM1 Outfall- Storm water outfall located approximately 100 m upstream from 32-7th Ave site. This outfall has elevated bacteria levels during wet and dry weather, and seems to be a possible source of sanitary infiltration.

E. **JR-Petrifying Springs-** (photo by Root-Pike WIN staff) A Racine Health Department research assistant shows Sparkles (Root-Pike Watershed Initiative Network's *Respect Our Waters* Campaign puppet) how water quality monitoring is conducted at the surface water site JR-Petrifying Springs in the popular Petrifying Springs County Park. Root-Pike WIN has spear-headed the drafting of the Pike River watershed plan as well as embarked on various grass root clean water campaigns, workshops and community events to educate area residents on steps they can take to improve the quality of local rivers and Lake Michigan.