

**2013**

**WATER SAMPLING**

**RESULTS**

**FOR SELECTED**

**MS4 SITES**

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## IN-STREAM SAMPLING PROTOCOLS FOR MS4 SITES

Beginning mid-April and ending the last week of September, the Storm Water Section of the Environmental Health Division conducted surface water testing on a weekly basis throughout the county on ditches, creeks, lakes and the Elkhart River. The sampling provides data to help prioritize sites with a high illicit discharge potential, characterizes water quality problems, helps determine critical areas, and documents the long term success of the illicit discharge and elimination program.

The sites are selected by storm water representatives from the cities of Elkhart and Goshen, the town of Bristol, and Elkhart County which meet annually to determine if changes need to be made to the locations. One change was the elimination of three sites on the St. Joseph River and three sites on the Elkhart River. These sites were sampled by the city of Elkhart Laboratory staff in order to comply with the requirements of their combined sewer overflow elimination program. The standard procedure is to obtain a minimum of three years of data in order to identify any trends. The following is a list of the sites from the 2013 season:

Rock Run Creek, County Road 21 & County Road 34  
Horn Ditch, County Road 31  
Shaffer Ditch, County Road 113  
Hoke Ditch, County Road 11  
Owl Creek, County Road 11  
Yellow Creek, County Road 32; County Road 138; County Road 11 & County Road 18  
Little Yellow Creek, County Road 13  
Weaver Ditch, County Road 44  
Turkey Creek, County Road 17 & County Road 50  
Swoveland Ditch, County Road 21  
Christiana Creek, County Road 4  
Elkhart River, County Road 43; County Road 40; Indiana Avenue, Goshen & Old County Road 17  
Heaton Lake, Ideal Beach & 22892 Lake Shore  
Simonton Lake, 51093 Beach Drive & 51330 State Road 19

The sampling form noted whether the sample was considered wet or dry and whether it was raining at the time of sample collection. A wet weather event is defined as a rain event with precipitation greater than .1 inches of rain within a twenty-four hour period. A dry weather event is defined as a sampling event with no precipitation twenty-four hours prior to collection. The parameters and methods of collection are explained in detail below.

Data gathered for nitrates, dissolved oxygen, pH, temperature, and conductivity are obtained in the field by using a YSI Professional Plus Instrument Probe. Calibration of the instrument probe is done in accordance with the owner's manual. The instrument probe is lowered into the approximate center of the waterway and placed below the surface of the water to obtain actual real time data. At the sites with piers (Simonton Lake sites and Heaton Lake sites) the instrument probe is lowered into the water at the end of the piers.

Test for chlorides, phosphorus, total suspended solids, and E. coli are grab samples in which a certain volume of water is obtained. The time is noted and the sample is placed in a prepared sample bottle and then analyzed. Water samples were collected using one of two methods. For low flow sampling and sites with piers, a dipper was used. The dipper is rinsed three times at each site prior to collection

to prevent cross contamination between sample sites. For high flow sampling, a sampling tube is used. The sampling tube is lowered into the approximate center of the waterway and placed below the water surface for a minimum of twenty seconds with the ends open to allow rinsing of the unit between sampling sites. A weight is then dropped on a line striking a triggering mechanism which tightly closes each end of the tube at the same time. This captures the free flowing water to be sampled. All samples are placed in pre-labeled and prepared sample bottles.

All samples collected are immediately placed in a cooler with chill packs in order to maintain proper temperature requirements during transportation per standard methods protocol.

Chloride and phosphorus samples are collected for analysis in the Elkhart County Health Department Laboratory using a Hach portable spectrophotometer. Chain of custody procedures are required and implemented. These include labeling the bottles with the sample site number and all other information as recorded on the water sampling form. Items on the water sampling form include the sampling site identification, sampling date and time, sampling number, dry or wet event, raining at the time of collection, and the name of the individuals who collected the sample.

Total suspended solids are collected every Tuesday at the ditches and creeks for analysis by the Elkhart Public Works and Utilities Laboratory. Every other Thursday, total suspended solids are collected at the river sites, Rock Run Creek and Horn Ditch for analysis by the City of Goshen Waste Water Treatment Plant Laboratory. For all E. coli samples and the Tuesday total suspended solids samples, a label is filled out with the site number, location, collection date, who collected the sample, who transported and relinquished the sample. These documents are attached to the sample container. Upon arrival at the Elkhart Public Works and Utilities Laboratory, time is also added to the label. The label includes a space to acknowledge who received the sample. The Elkhart County Health Department's water sampling form is also signed by the Elkhart laboratory representative with the time of sample delivery and a copy is made and kept in their laboratory records. This procedure is implemented to verify chain of custody. For the Thursday total suspended solids, the sample is collected in a pre-labeled container with the site number, location, time, date, and who collected the sample. The time is added to the sampling form when the sample is delivered to the City of Goshen Waste Water Treatment Plant Laboratory. Upon delivery, Elkhart County Health Department representatives place the total suspended solid samples into a refrigerated unit to ensure proper temperature requirements before analysis.

During the 2013 sampling season, the YSI probe was inoperable on several occasions and parts of the probe were replaced. Therefore, some data is omitted.



## PARAMETER DEFINITIONS AND THEIR IMPORTANCE

CHLORIDES are found in groundwater, streams, and lakes and may be of natural mineral origin or from human or animal sewage, industrial process wastewaters, agricultural fields and roadway deicing salts. It is recommended if very high levels (500 mg/l or more) are found, further investigation should take place to locate the source.

CONDUCTIVITY (SpC) is a measure of how easily electricity flows through water. It is strongly correlated with total dissolved solids. It is useful as a general measure of water quality. Each water body has a fairly constant range of conductivity that can be used for baseline readings. Significant changes in conductivity may be an indicator that a discharge or some other source of pollution has entered the water way. If this occurs, it is recommended that further investigation should take place to locate the source.

DISSOLVED OXYGEN (DO) is considered to be one of the most important parameters of water quality in streams, rivers, and lakes. All aquatic organisms need dissolved oxygen in the water to survive. Stream systems produce and consume oxygen. If more oxygen is consumed than produced, dissolved oxygen levels decline and some organisms move away, weaken, or die. Higher concentrations of dissolved oxygen equate to better water quality. Aquatic life is stressed at levels below 5.0 mg/l and levels below 2 mg/l will not support fish. Dissolved oxygen is very sensitive to temperature. The solubility of oxygen in water decreases as temperature increases. A waste discharge can have a dramatic effect on the oxygen balance of a water body by raising water temperature or introducing pollutants which remove the dissolved oxygen.

E. COLI is a species of fecal coliform bacteria that is specific to fecal matter from humans and other warm-blooded animals. E. coli indicates the possible presence of pathogenic bacteria, viruses, and protozoa that also live in the digestive systems of humans and animals. Their presence in a water body suggests pathogens might be present and that swimming/full body contact recreation can be a health risk. As required by the United States Environmental Protection Agency, total maximum daily load (TMDL) calculations have been established by the Indiana Pollution Control Board (327 IAC 2-1-6 Section 6(d)) for E. coli using membrane filter count and are the following numeric Standards:

“Concentrations shall not exceed 125 cfu/100 ml as a geoemetric mean based on not less than five samples equally spaced over a 30-day period nor exceed 235 cfu/100 ml in any one sample in a 30-day period.”

NITRATES (N03) are one of the four forms of nitrogen in the nitrogen cycle. They are essential plant nutrients but in excess amounts they can cause significant water quality problems. Together with phosphorus they can cause increase in plant growth and changes in the types of plants and animals that live in surface water. In turn this affects dissolved oxygen and temperature. Excess nutrients can cause hypoxia which is a condition characterized by low levels of dissolved oxygen when the plants decay. The natural level of nitrates in surface water is typically low, less than 1 mg/l. Sources of nitrates include failing onsite septic systems, runoff from animal manure storage areas, fertilizer runoff from lawns and cropland, wastewater treatment plants and industrial discharges that contain corrosion inhibitors.

The pH scale measures the logarithmic concentration of hydrogen and hydroxide ions which make up water. Pure water, equal ion concentrations, is neutral with a pH of 7.0. Below 7.0 the water is acidic and above 7.0 the water is alkaline. pH affects many chemical and biological processes in water. The

majority of aquatic organisms survive and thrive at a range of 6.5-8.0. pH outside of this range reduces the diversity of the water way because it stresses the physiological systems of most organisms and can reduce reproduction. Low pH also allows toxic elements and compounds to become soluble and available for uptake by aquatic plants and animals. Some industrial discharges contain very high 12-14 pH or very low 1-3 pH. pH is a good monitoring parameter and significant fluctuations need to be investigated.

**PHOSPHORUS (PO<sub>4</sub>)** Like nitrogen, phosphorus is an essential nutrient for plants and animals that make up the aquatic food chain. Phosphorus in waterways accelerates plant growth and algae blooms and with their decomposition result in low dissolved oxygen and death of some fish, invertebrates and other aquatic species. There are many natural and human sources of phosphorus. These include soil and rocks, wastewater treatment plants, runoff from fertilized lawns and cropland, failing onsite septic systems, runoff from animal manure storage areas, disturbed land areas and commercial cleaning preparations. Phosphorus is the limiting nutrient in many aquatic environments and very small inputs greatly affect photosynthetic production and can precipitate a massive bloom of plants and algae in slow moving streams and ponds. These blooms are not desired and have a deleterious effect on the aquatic environments where phosphorus has been enriched.

**TEMPERATURE** is a very important water quality parameter and influences all biological and chemical reactions. Temperature influences the dissolved oxygen content of the water, the metabolism of all aquatic organisms, the rate of photosynthesis, and the sensitivity of organisms to pollutants such as toxic wastes and parasites. All aquatic organisms have optimal temperatures for their survival. Many factors affect temperature including stream flow, sunlight, shade, water depth, turbidity, bottom color and composition, soil erosion, storm water runoff, and seasonal changes. Temperature is measured in degrees Celsius.

**TOTAL SUSPENDED SOLIDS (TSS)** are particulates in water and can include many types of material such as silt, decaying plant and animal matter, sewage and industrial wastes. They cause the water to be milky or muddy looking due to the light scattering from very small particles in the water. This is called turbidity. Suspended solids can destroy fish habitat because they can settle to the bottom and smother the eggs of fish and aquatic insects and suffocate newly hatched insect larvae. High levels of suspended solids can clog the gills of fish and reduce their growth rates and reduce dissolved oxygen. Also, pollutants and contaminants adhere to the suspended solids. Total suspended solids are measured in mg/l. There are no numeric standards for total suspended solids however they must meet narrative standards which state in part: "all waters at all times and places, including the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges which are in amounts sufficient to injure, be acutely toxic to, or otherwise produce serious adverse physiological responses in humans, animals, aquatic life or plants."

**NOTE:** The above information was obtained from the United States Environmental Protection Agency, the Indiana Department of Environmental Management, The Center for Watershed Protection, and Purdue University Department of Agricultural and Biological Engineering.

## SAMPLING RESULTS AND CHARTS

Charts were prepared for E. coli, total suspended solids and dissolved oxygen. Appendix one contains the surface water sampling data. Appendix two contains the charts.



## SUMMARY AND CONCLUSION

According to the United States Environmental Protection Agency, "a water body is considered impaired when a water quality standard is violated, whether through exceedance of a numeric or narrative criterion, impairment of a designated use or violation of anti-degradation policy." The results of the 2013 sampling season indicated E. coli levels in excess of the total maximum daily load of 235 cfu/100 ml in all of the tributaries the majority of the time. Christiana Creek is the exception to this exceedance which is the control site. Heaton Lake also had high E. coli readings. These are likely due to the high number of geese observed on the lake. Heaton Lake and Simonton Lake are serviced by sanitary sewers and inputs from failing septic systems are no longer a source of E. coli entering the lakes. Weaver Ditch is grossly contaminated and continues to have the highest levels of E. coli and the lowest levels of dissolved oxygen.

The sources of E. coli are separated into rural and urban components. In rural areas sources include animal wastes, runoff from livestock operations, wildlife, and failing septic systems. In urban areas sources include leakage of sanitary sewers, combined sewer overflows, wildlife, and domestic animals.

All water bodies are capable of assimilating a certain amount of pollution without adverse effects because of the dilution and self-purification capabilities of natural processes. The ability of a water body to mitigate for an organic pollutant, such as E. coli is dependent on many factors such as stream flow, depth, dissolved oxygen, temperature, available sunlight, and time. However the high levels of E. coli indicate these pathogens are being infused at a rate greater than can be mitigated through natural processes resulting in these higher than acceptable numbers. Results such as these are indicators of illicit discharges entering the water bodies and will require further investigation to determine the sources.

For the 2014 water sampling season, the Elkhart County Storm Water Advisory Board members will meet to review the current sampling locations and determine if any changes need to be made.

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