Parameter	Description	Target Levels for WMP
pH	pH is measured on a scale of 0 to 14. Smaller numbers are given to more acidic substances whereas higher numbers are given to more alkaline or "basic" substances. A pH of 7 is considered neutral. Naturally water tends to have a pH of between 6.5 to 8.5 but this can vary based on local characteristics such as geology. Sewage overflows, agricultural runoff, mining, and the burning of fossil fuels from industry or automobiles can alter pH by introducing high levels of nitric and sulfuric acids. Aquatic organisms are adapted to a specific range of pH and essential functions can be impaired when the pH is outside of this range. Also, pH plays a significant role in the toxicity of other substances. For example, ammonia is relatively harmless in acidic or neutral water but becomes highly toxic in basic waters. Many heavy metals become more toxic in acidic waters.	>6 and <9
Temperature	Thermal pollution can have significant impacts on aquatic life and water quality. When water temperatures rise so do metabolic rates of aquatic organisms, requiring more oxgen for respiration. However, warm water holds less oxgen compared to cooler water. High temperature levels can also make aquatic organisms more susceptible to predation, disease, parasitism, and various toxins. Common culprits of thermal pollution include industrial heating or cooling processes, runoff from impervious surfaces that hold in heat from the sun, suspended sediments which absorb heat, and lack of appropriate riparian cover to provide shade.	Monthly Standard Established by Indiana Administrative Code
Dissolved Oxygen (D.O.)	Dissolved oxygen is a measure of how much oxygen is available in water and is controlled by a number of variables. Cooler waters contain more oxygen than warmer waters as gases or more soluble at lower temperatures. Also, high levels of salt can limit the water-holding capabilities of local waterways. Flowing water usually has higher levels of dissolved oxgyen than still water due its ability to mix oxygen at the surface with deeper water. Plants and algae release oxygen into the water during photosynthesis but also consume oxygen during non-photosynthetic periods such as during evening hours or cloudy days. Various bacteria and microbes use oxygen to help break down waste and debris. Aquatic organisms become stressed when dissolved oxygen levels are outside of their preferred ranges. Also, as anaerobic conditions develop, compounds which may have been insoluble in oxygen-rich waters may become mobilized.	>4mg/L and <100%
E. coli	E. coli is a type of fecal coliform bacteria which are found in the digestive tracts of warm-blooded animals. Not all types and strains of fecal coliform bacteria are harmful. However, other dangerous bacteria, viruses, and pathogens can commonlly co-occur and E. coli levels are used as an indicator to determine when there is a risk to water quality. Common pollutant sources include septic systems and other sanitary systems, sewage overflows, areas of excessive animal waste, and manure runoff. When E. coli levels are high so is the threat to human health	125 Colony Forming Units/100mL
Total Phosphorus	Phosphorus is an essential nutrient for all plants and animals but becomes an issue for water quality when present at high levels. Under most circumstances, phosphorus is the most limiting nutrient in freshwater habitats and helps to regulate productivity of the system. When excessive phosphorus enters the system, plant production (e.g. algae blooms, weeds, etc.) increase rapidly. This can have detrimental side effects on water quality including increased turbidity, temperature, and a decrease in dissolved oxygen when these plants start to decompose. Common sources of phosphorus loading include wastewater treatment plants, soil erosion (phosphorus binds tightly with soil particles so when soil is on the move, so is phosphorus), organic matter (e.g. dead plants, animals, and waste producst), as well as farm and lawn fertilizers. It's also important to note that phosphorus doesn't have a geseous phase like other nutrients such as nitrogen. This means that once phosphorus enters the system, it stays until it is physcally taken out through removal of sediments, aquatic plants, and organic matter.	< 0.30mg/L
Nitrate+Nitrite	Nitrogen, like phosphorus, is an abundant and essential nutrient for plants and animals. And like phosphorus, when nitrogen levels begin to rise, so does the productivity of the system. This allows plant production to increase quickly causing secondary effects to water quality. Excessive nitrogen levels in the water can also cause serious health impacts such as illness. Nitrogen differs from phosphorus in that it dissolves in water much easier. This makes nitrogen is very mobile traveling through field tiles, storm sewers, and across the landscape. Common sources of nitrogen include human and animal waste (i.e. septic, sewage, animal feeding operations, manure, etc.), farm and lawn fertilizers, and decaying organic matter.	< 10mg/L
Total Suspended Solids (TSS)	Total suspended solids (TSS) is a measure of the particles (e.g sediment) that are suspended in the water column. High levels of TSS can have serious effects on water quality. Sediments increase the turbidity of the water which increases local water temperatures, decreases dissolved oxygen, smothering aquatic habitats, and disrupting essential functions of aquatic organisms. Contributers of particles and sediments to local waters include agricultural lands (especially when practicing conventional tillage), construction and developments sites that create bare soil areas, streambank erosion due to channel and hydrology modifications, and various livestock practices such as overgrazing or allowing animal access to waterways.	< 30mg/L
Qualitative Habitat Evaluation Index (QHEI)	The Qualitative Habitat Evaluation Index (QHEI) is a standardized, quantitative assessment of grading a streams physical qualities. The QHEI measures substrate quality and type, types and amounts of in-stream cover, channel morphology, riparian zone quality and width, pool and riffle quality, and stream gradient. Maximum total score is 100 with scores under 51 indicating less than desirable habitat.	> 51
Macroinvertebrate Index of Biotic Integrity (mIBI)	The Macroinvertebrate Index of Biotic Integrity (mIBI) is an assessment used to quantify the biological aspect of local waterways. Macroinvertebrates include aquatic insects, worms, clams, mussels, and crayfish. These organisms react more quickly (positively or negatively) to changes in water quality and because the live their entire lives within the stream help us see water quality changes over time. As such, macroinvertebrates are used as indicators of biological health in our local waters. For example, by collecting a variety of macroinvertebrates which have very specific tolerances to water quality and habitat we can assume that the stream is in pretty good health. On the other hand if we only collect a few types of macroinvertebrates that can tolerate lower water quality and habitat then we can assume that stream is suffering from one or multiple impairments. Maximum total score is 8 with scores less than 2.2 (using kick methods) or 1.8 (using artificial substrate methods) indicating low quality sites.	≥ 2.2 (using kick methods) ≥ 1.8 (using artificial substrate method)

Sources of Information

Indiana Department of Environmental Management
Hoosier Riverwatch Program
Indiana Adminstrative Code
Michigan Department of Environmental Quality

Oversimplified Concept Map of Water Quality Relationships

Rectangles = watershed inputs Circles = water quality parameters

Source: Hoosier Riverwatch Volunteer Stream Monitoring Manual