

Appendix 9. Common Pollutants, Sources and Water Quality Standards

Sources of water pollution are broken down into two categories: point source pollution and nonpoint source pollution. Point source pollution is the release of a discharge from a pipe, outfall or other direct input into a body of water. Common examples of point source pollution are factories and wastewater treatment facilities. Facilities with point source pollution discharges are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit to ensure compliance with water quality standards under the Clean Water Act. They are also required to report to the Michigan Department of Environmental Quality on a regular basis. This process assists in the restoration of degraded water bodies and drinking water supplies.

Sixty percent of water pollution is from non-point source pollution. Polluted runoff is caused when rain, snowmelt, or wind carries pollutants off the land and into water bodies. Roads, parking lots, driveways, farms, home lawns, golf courses, storm sewers, and businesses collectively contribute to nonpoint source pollution.

Nonpoint source pollution, also known as polluted runoff, is not as easily identified. It is often overlooked because it can be a less visible form of pollution. Polluted runoff is caused when rain, snowmelt, or wind carries pollutants off the land and into water bodies. Roads, parking lots, driveways, farms, home lawns, golf courses, storm sewers, and businesses collectively contribute to nonpoint source pollution.

The State of Michigan's Part 4 Rules (of Part 31, Water Resources Protection, of Act 451 of 1994) specify water quality standards, which shall be met in all waters of the state. Common water pollutants and related water quality standards are described below. Note that not all water quality pollutants have water quality standards established.

Sediment

Sediment is soil, sand, and minerals that can take the form of bedload, suspended or dissolved material. Sediment harms aquatic wildlife by altering the natural streambed and increasing the turbidity of the water, making it "cloudy". Sedimentation may result in gill damage and suffocation of fish, as well as having a negative impact on spawning habitat. Increased turbidity from sediment affects light penetration resulting in changes in oxygen concentrations and water temperature that could affect aquatic wildlife. Sediment can also affect water levels by filling in the stream bottom, causing water levels to rise. Lakes, ponds and wetland areas can be greatly altered by sedimentation. Other pollutants, such as phosphorus and metals, can bind themselves to the finer sediment particles. Sedimentation provides a path for these pollutants to enter the waterway or water body.



Removing trees and building close to the river's edge can cause bank erosion.

Related water quality standards

Total Suspended Solids (TSS) - Rule 50 of the Michigan Water Quality Standards (Part 4 of Act 451) states that waters of the state shall not have any of the following unnatural physical properties in quantities which are or may become injurious to any designated use: turbidity, color, oil films, floating solids, foam, settleable solids, suspended solids, and deposits. This kind of rule, which does not establish a numeric level, is known as a "narrative standard." Most people consider water with a TSS concentration less than 20 mg/l to be clear. Water with TSS levels between 40 and 80 mg/l tends to appear cloudy, while water with concentrations over 150 mg/l usually appears dirty. The nature of the particles that comprise the suspended solids may cause these numbers to vary.

Nutrients

Although certain nutrients are required by aquatic plants in order to survive, an overabundance can be detrimental to the aquatic ecosystem. Nitrogen and phosphorus are generally available in limited supply in an unaltered watershed but can quickly become abundant in a watershed with agricultural and urban development. In abundance, nitrogen and phosphorus accelerate the natural aging process of a water body and allow exotic species to better compete with native plants. Wastewater treatment plants and combined sewer overflows are the most common point sources of nutrients. Nonpoint sources of nutrients include fertilizers and organic waste carried within water runoff. Excessive nutrients increase weed and algae growth impacting recreational use on the water body. Decomposition of the increased weeds and algae lowers dissolved oxygen levels resulting in a negative impact on aquatic wildlife and fish populations.

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Related water quality standards

Phosphorus - Rule 60 of the Michigan Water Quality Standards (Part 4 of Act 451) limits phosphorus concentrations in point source discharges to 1 mg/l of total phosphorus as a monthly average. The rule states that other limits may be placed in permits when deemed necessary. The rule also requires that nutrients be limited as necessary to prevent excessive growth of aquatic plants, fungi or bacteria, which could impair designated uses of the surface water.

Dissolved Oxygen - Rule 64 of the Michigan Water Quality Standards (Part 4 of Act 451) includes minimum concentrations of dissolved oxygen, which must be met in surface waters of the state. This rule states that surface waters designated as coldwater fisheries must meet a minimum dissolved oxygen standard of 7 mg/l, while surface waters protected for warmwater fish and aquatic life must meet a minimum dissolved oxygen standard of 5 mg/l.

Temperature/Flow

Removal of streambank vegetation decreases the shading of a water body, which can lead to an increase in temperature. Impounded areas can also have a higher water temperature relative to a free-flowing stream. Heated runoff from impervious surfaces

and cooling water from industrial processes can alter the normal temperature range of a waterway. Surges of heated water during rainstorms can shock and stress aquatic wildlife, which are adapted to "normal" temperature conditions. Increased areas of impervious surfaces, such as parking lots and driveways, and reduced infiltration from other land use types, such as lawns and bare ground, leads to an increase in runoff. Increased runoff reduces groundwater recharge and leads to highly variable flow patterns. These flow patterns can alter stream morphology and increase the possibility of flooding downstream.

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Related water quality standards

Temperature - Rules 69 through 75 of the Michigan Water Quality Standards (Part 4 of Act 451) specify temperature standards which must be met in the Great Lakes and connecting waters, inland lakes, and rivers, streams and impoundments. The rules state that the Great Lakes and connecting waters and inland lakes shall not receive a heat load which increases the temperature of the receiving water more than 3 degrees Fahrenheit above the existing natural water temperature (after mixing with the receiving water). Rivers, streams and impoundments shall not receive a heat load, which increases the temperature of the receiving water more than 2 degrees Fahrenheit for coldwater fisheries, and 5 degrees Fahrenheit for warmwater fisheries. These waters shall not receive a heat load, which increases the temperature of the receiving water above monthly maximum temperatures (after mixing). Monthly maximum temperatures for each water body or grouping of water bodies are listed in the rules. The rules state that inland lakes shall not receive a heat load, which would increase the temperature of the hypolimnion (the dense, cooler layer of water at the bottom of a lake) or decrease its volume. Further provisions protect migrating salmon populations, stating that warmwater rivers and inland lakes serving as principal migratory routes shall not receive a heat load which may adversely affect salmonid migration.

Bacteria/Pathogens

Bacteria are among the simplest, smallest, and most abundant organisms on earth. While the vast majority of bacteria are not harmful, certain types of bacteria cause disease in humans and animals. Concerns about bacterial contamination of surface waters led to the development of analytical methods to measure the presence of waterborne bacteria. Since 1880, coliform bacteria have been used to assess the quality of water and the likelihood of pathogens being present. Combined sewer overflows in urban areas and failing septic systems in residential or rural areas can contribute large numbers of coliforms and other bacteria to surface water and groundwater. Agricultural sources of bacteria include livestock excrement from barnyards, pastures, rangelands, feedlots, and uncontrolled manure storage areas. Stormwater runoff from residential, rural and urban areas can transport waste material from domestic pets and wildlife into surface waters. Land application of manure and

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sewage sludge can also result in water contamination. Bacteria from both human and animal sources can cause disease in humans.

Related water quality standards

Bacteria - Rule 62 of the Michigan Water Quality Standards (Part 4 of Act 451) limits the concentration of microorganisms in surface waters of the state and surface water discharges. Waters of the state, which are protected for total body contact recreation, must meet limits of 130 Escherichia coli (E. coli) per 100 milliliters (ml) water as a 30-day average and 300 E. coli per 100 ml water at any time. The total body contact recreation standard only applies from May 1 to October 1. The limit for waters of the state, which are protected for partial body contact recreation, is 1000 E. coli per 100 ml water. Discharges containing treated or untreated human sewage shall not contain more than 200 fecal coliform bacteria per 100 ml water as a monthly average and 400 fecal coliform bacteria per 100 ml water as a 7-day average. For infectious organisms which are not addressed by Rule 62, The Department of Environmental Quality has the authority to set limits on a case-by-case basis to assure that designated uses are protected.

Chemical Pollutants

Chemical pollutants such as gasoline and oil can enter surface water through runoff from roads and parking lots, or from boating. Other sources can be approved processes such as permitted application of herbicides to inland lakes to prevent the growth of aquatic nuisance plants. Other chemical pollutants consist of pesticides and herbicide runoff from commercial, agricultural, municipal or residential uses. Impacts of chemical pollutants vary widely with the chemical.

Related water quality standards

pH - Rule 53 of the Michigan Water Quality Standards (Part 4 of Act 451) states that the hydrogen ion concentration expressed as pH shall be maintained within the range of 6.5 to 9.0 in all waters of the state.