Community and Commercial Stormwater Ponds

Common Impacts on Water Quality

Stormwater ponds are designed to help treat runoff water from impervious surfaces to prevent downstream impairment. The water quality of stormwater ponds is constantly changing as rain events occur, or water comes from various other sources. It's important to understand what water quality parameters are important to maintain in stormwater ponds and how they affect the surrounding systems. For additional information on water quality parameters, check out the LSU AgCenter's Think Down Stream Series (*www.lsuagcenter.com/portals/extension/agriculture-and-natural-resources/water-quality*).

Dissolved Oxygen

Dissolved oxygen is the oxygen in water that is available to support aquatic organisms. The oxygen in the water can be dissolved directly from the air or produced by aquatic plants during photosynthesis. In stormwater ponds, low dissolved oxygen impairments are most common due to nutrient imbalance. This can lead to hypoxic conditions, which cause stress and disrupt ecosystems. To mitigate the impact of low dissolved oxygen, nutrients entering the pond must be managed by identifying high-concentration areas or supplementing pond plants. In some cases, it may be necessary to enhance dissolved oxygen in a stormwater pond by adding aeration or water circulation systems.

Stagnant water in pond with low oxygen

Nutrients (Nitrogen and Phosphorus)

In many cases nutrients like nitrogen and phosphorus are defined as compounds that are readily available for biological conversion and a staple for growth. The common forms of nitrogen are nitrate (NO_3^-), nitrite (NO_2^-) and ammonium (NH_4^+). These different forms are present in many types of fertilizers or natural organic matter. Phosphorus is a chemical element that is essential for all living organisms. There are many different forms that can come from various sources, including fertilizers, pesticides, natural organic matter and soap products. Phosphorus is less bioavailable due to the binding affinity to soil. If soil is eroded or transferred as fine particles in runoff to aquatic systems, it can be broken down thus releasing phosphorus into the water.

While nitrogen and phosphorus are needed nutrients for balanced ecosystems, excess concentrations can cause impairment from excess algal growth. Depending on the species of algae, this can lead to clogging and/or a decrease in dissolved oxygen in stormwater ponds. Critical management strategies for addressing high nutrients involve identifying the source, educating residents or landscape professionals on fertilizer usage (i.e., application rates, timing), mitigating runoff from specific areas or planting more buffer areas for nutrients.

Fecal Coliforms/Enterococcus

Fecal coliforms and Enterococci are types of bacteria commonly found in the intestines of warm-blooded animals. The most common sources of these bacteria in stormwater ponds are from waterfowl (ducks and geese), turtles, fish and pet waste. These species of bacteria can cause potential health risks during recreational activities and impair water conditions. Cloudy water, unpleasant odors and increased oxygen demand are all associated with this type of impairment. For many of residential stormwater ponds, the best management practices to reduce unwanted bacteria in water are avoiding feeding local wildlife, picking up pet waste near ponds and proper maintenance of individual sewerage systems (like conventional septic systems).

Ducks and geese around pond edge can increase concentrations of fecal matter in water

Sediments

There are two water quality parameters that can be used to determine sediment loads in the water column: turbidity and total suspended solids (TSS). Turbidity is an optical measure of the clarity of water impacted by the presence of suspended particles, such as silt, clay, organic matter and microorganisms, while total suspended solids (TSS) is the concentration of solids in the water column. Both help determine the potential impact of sediments in stormwater ponds. Sediments can enter these ponds through erosion or high runoff events that pull clays or soils from new construction and excavation sites. This will lead to a build-up in the pond space, which can affect plant growth and contribute to clogs in outflow pipes. Some ways to manage sediment entering the pond could be a stormwater grass filter for job sites or reestablishing banks around the pond to prevent erosion. In some cases, a large buildup of sediment may need to be mitigated by dredging or mechanical removal.

Pond impacted by sediment and clay runoff

Temperature

The temperature of a water body will influence the metabolic rates and behavior of aquatic organisms, playing a critical role in the environmental ecosystems. This is an important parameter in shallow ponds as it can change the dynamics for plants and dissolved oxygen in the water column. Some factors that impact water temperature include sedimentation, shading from vegetation, and the velocity of water movement. In stormwater ponds, hot water holds less oxygen which creates hypoxic conditions. This is more prevalent in the summer, while cooler winters provide more optimal conditions for oxygen solubility in water. This can lead to stress on aquatic organisms and change many water quality dynamics. Shading from floating vegetation and maintaining terrestrial vegetation around ponds can help reduce increased water temperatures, but in some drastic cases, water circulation from pumps or aerators may be needed to stimulate movement and decrease temperature through evaporation.

▶Anthropogenic (Human-Generated) Compounds

These compounds can range from residential pesticides, industrial cleaners, paints, soaps or other human-generated compounds. Stormwater ponds act as a collection basin for runoff that transports any spilled or residual compounds, ultimately impacting the surrounding ecosystems. The most problematic compounds for stormwater ponds include herbicides that kill surrounding vegetation required to reduce nutrient filtering, while soaps from washing cars can kill aquatic organisms responsible for healthy pond processing and industrial cleaning supplies used on construction sites can eliminate microorganisms that process nutrients. Simple mitigation strategies can be applied to anthropogenic compounds if the source is identified. For instance, a controlled application or buffer zone for herbicides can be utilized to reduce excessive overspray. Phosphate-free soaps can be used for car washes to minimize nutrient input to stormwater drains. Designated spaces for industrial cleaning can be prepared to dispose of residual cleaners properly and prevent downstream impairments.

Urban runoff from paved surfacing

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