



# STORMWATER MONITORING: POLLUTANTS, SOURCES, AND SOLUTIONS

As part of the federal government’s National Pollutant Discharge Elimination System Permit (NPDES) program, administered in South Carolina by the Department of Health and Environmental Control (SCDHEC), Richland County is required to apply stormwater pollution control measures. In particular, Richland County must identify key pollutants that are prevalent in the existing waterways and develop programs to reduce these pollutants. Richland County Stormwater Management Division currently maintains four programs designed to identify, reduce, and monitor stormwater pollutants. This document details the pollutants tracked in two of the programs: *wet weather monitoring* and *ambient water quality monitoring*.

*Wet weather monitoring* involves the collection and testing of stormwater runoff during storm events. Once a rainfall event begins, a sample of runoff is collected and analyzed to determine the types of pollution in the water. This sample includes collecting the “first flush” as well as a distributed sample throughout the rainfall event. The collection of “first flush”, or typically the first half-inch of runoff during a storm event, is important in that this provides information related to what type of pollutants are being washed into the stormwater system. The first flush typically contains higher levels of pollutants that have been deposited on the ground between rain events.

*Ambient water quality monitoring* involves testing of streams, rivers and lakes during normal flow conditions. Samples are taken and tested when the effect of runoff from rainfall events is not present. This provides information regarding the overall quality of the water at these locations. The natural water quality of our rivers, lakes and streams can be influenced by a variety of factors that are detected through ambient testing.

## AMBIENT MONITORING

### Surfactants

**Description:** Surfactants are agents found in detergents that lower the surface tension of water allowing grease and sediments to be cleaned from surfaces.

**Natural Sources:** There are no significant natural sources of surfactants in surface waters.

**Human-caused Sources:** Industrial Facilities, Household Cleaners, Soaps

**Effects on Watershed / Health:** Surfactants can cause significant problems in aquatic environments where they can be acutely toxic to aquatic organisms, can damage fish gills

by removing natural oils, and can produce an unsightly sheen on surface waters which can promote algal blooms. Surfactants are persistent in the environment and may have by-products that are known carcinogens or affect reproductive health.

How to Correct:

- Wash cars on the lawn instead of the driveway to allow soaps to infiltrate into the soil rather than enter the storm drain.
- Use low-phosphorus, biodegradable soaps.

## Residual Chlorine

Description: Residual chlorine is a pollutant that is primarily associated with treated water supplies and industrial discharges.

Natural Sources: There are no significant natural sources of residual chlorine in surface waters.

Human-caused Sources: Municipal Drinking Water, Chemical Treatment Facilities, Food and Paper Industries, Swimming Pools, Irrigation

Effects on Watershed / Health: Residual chlorine in surface waters is acutely toxic to many aquatic species, especially fish and invertebrates at concentrations below 1 mg/L. There are no known effects to humans at concentrations typically found in surface waters.

How to Correct:

- Repair leaking or broken pipes.
- Allow swimming pool water to turn green before draining or drain to sanitary sewer system.
- Do not over water lawns to the point of runoff (municipal water).

## Fecal Coliform

Description: Bacteria found in the digestive systems of warm blooded organisms

Natural Sources: Human, Wildlife, and Livestock Waste

Human-caused Sources: Pet Waste, Failing Septic Systems, Sanitary Sewer Overflows, Animal Feeding Operations

Effects on Watershed / Health: Fecal coliform does not pose a health threat but serves as an indicator for bacteria that can cause illness in humans and aquatic life. High bacteria levels can limit the uses of water for swimming or contaminate drinking water in groundwater wells.

How to Correct:

- Pick up pet waste.
- Ensure proper functioning of septic systems.
- Connect to municipal sewers.

## Total Phosphorus

Description: Phosphorus is a nutrient, along with nitrogen, necessary for the growth of algae and other plants. It aids in photosynthesis and usually is found in low levels in surface waters.

Natural Sources: Soil and Rocks

Human-caused Sources: Fertilizers, Failing Septic Systems, Waste Water Treatment Plant (WWTP) Discharges, Pet Waste, Livestock and Farm Animals, Disturbed Land Areas, Drained Wetlands, and Commercial Cleaning Preparations

Effects on Watershed / Health: Since phosphorus is the nutrient in short supply in most fresh waters, even a modest increase in phosphorus can, under the right conditions, set off a whole chain of undesirable events in a stream including accelerated plant growth, algae blooms, low dissolved oxygen, and the death of certain fish, invertebrates, and other aquatic animals.

How to Correct:

- Do not over fertilize lawns or over water to the point of runoff.
- Do not dump grass clippings, leaves, or other yard debris near streams or rivers.
- Pick up and dispose of pet waste properly.

## Total Kjeldahl Nitrogen

Description: Total Kjeldahl Nitrogen (TKN) is the total amount of organic nitrogen and ammonia nitrogen present in water.

Natural Sources: Decaying Plant Debris, Wildlife

Human-caused Sources: Fertilizers, Failing Septic Systems, Waste Water Treatment Plant (WWTP) Discharges, Pet Waste, Livestock and Farm Animals

Effects on Watershed / Health: Excessive concentrations of nutrients can overstimulate aquatic plant and algae which can lead to depletion of dissolved oxygen (DO) levels in the water.

How to Correct:

- Do not over fertilize lawns or over water to the point of runoff.
- Do not dump grass clippings, leaves, or other yard debris near streams or rivers.
- Pick up and dispose of pet waste properly.

## Dissolved Oxygen

Description: Dissolved oxygen is the amount of oxygen present within the water and is necessary for fish respiration. The stream system both produces and consumes oxygen. It gains oxygen from the atmosphere and from plants as a result of photosynthesis. Running water, because of its churning, dissolves more oxygen than still water, such as that in a reservoir behind a dam. Respiration by aquatic animals, decomposition, and various chemical reactions consume oxygen. DO levels fluctuate seasonally and over a 24-hour

period. They vary with water temperature and altitude. Cold water holds more oxygen than warm water and water holds less oxygen at higher altitudes.

Effects on Watershed / Health: Low dissolved oxygen levels are not adequate to support aquatic life and can lead to fish kills.

How to Correct:

- Decrease the amount of oxygen consuming nutrients entering the water.
- Aerate water to increase dissolved oxygen levels by mixing colder water with warm surface water.
- Decrease activities which raise the temperature of the water.

## Oil and Grease

Description: Oil and Grease is a non-definitive description of organic compounds that include oils derived from animals, vegetables and petroleum.

Natural Sources: Petroleum

Human-caused Sources: Automotive Oils, Cooking Oils

Effects on Watershed / Health: Petroleum based oils can be acutely lethal to many aquatic organisms as evidenced by the aftermaths of many petroleum (oil and fuel) spills. Chronic exposure to oils can also affect feeding and reproductive processes in aquatic organisms. Oil and Grease also cause a human public health concern by 1) decreasing the supply of edible aquatic species, 2) increasing the possibility of ingesting carcinogenic elements that have bio-accumulated in the organisms tissues, and 3) through direct contact with known carcinogens found in oil. Oils of animal or vegetable origin are generally nontoxic to humans and aquatic life. Floating oils of any origin on surface waters cause a variety of harmful effects to waterfowl, fish, and invertebrate species and create poor aesthetics on water surfaces and shorelines.

How to Correct:

- Properly dispose of used motor oil at a recycling center.
- Install grease traps to prevent oil and grease from entering wastewater streams.

## Conductivity

Description: Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, nitrate, sulfate, and phosphate anions (ions that carry a negative charge) or sodium, magnesium, calcium, iron, and aluminum cations (ions that carry a positive charge).

Natural Sources: Native Geology

Human-caused Sources: Industrial Discharges, Failing Sewage Systems

Effects on Watershed / Health: Conductivity outside normal ranges may not support certain fish or macroinvertebrate species.

## pH

Description: The pH of natural waters is a measure of the acid-base equilibrium achieved by the various dissolved compounds, salts, and gases. Specifically, pH is the measure of the amount of free hydrogen ions in water. A pH of 7 is considered to be neutral. Acidity increases as pH values decrease, and alkalinity increases as pH values increase. Most natural waters have a pH between 7-7.5. Changes in pH affect the toxicity of many compounds found in water.

Effects on Watershed / Health: The pH of water affects the solubility of many toxic and nutritive chemicals which affects the availability of these substances to aquatic organisms. High alkaline waters can be unpalatable and cause gastrointestinal discomfort.

## Total Suspended Solids (TSS)

Description: Total Suspended Solids (TSS) is a term used to describe the amount of organic and inorganic particulate matter suspended in water. TSS is also related to turbidity.

Natural Sources: Erosion, Seasonal Changes in Algae Population

Human-caused Sources: Land Development

Effects on Watershed / Health: High TSS concentrations interfere with recreational uses and the aesthetic enjoyment of water. They also can have negative impacts on fish and aquatic life in many ways including, preventing the successful development of fish eggs and larvae, modifying natural migrations, reducing the amount of food available, and by reducing growth rates and disease resistance or causing death. TSS can also impact invertebrate populations and decrease dissolved oxygen levels if the material is organic.

How to Correct:

- Limit land disturbing activities.
- Use proper sediment and erosion controls.
- Sweep sediments from paved surfaces to prevent them from entering storm drains.

## Turbidity

Description: Turbidity is a measure of water clarity. Suspended materials, including soil particles (clay, silt, and sand), algae, plankton, microbes, and other substances, impact clarity in the water. These materials are typically in the size range of 0.004 mm (clay) to 1.0 mm (sand). Turbidity is an approximation of the amount of TSS in water.

Natural Sources: Soil Erosion, Excessive Algae Population, Large Numbers of Bottom Feeding Fish

Human-caused Sources: Waste Discharge, Land Development and Urban Runoff

Effects on Watershed / Health: Higher turbidity increases water temperatures because suspended particles absorb more heat. This, in turn, reduces the concentration of dissolved oxygen (DO) because warm water holds less DO than cold. Higher turbidity also reduces the amount of light penetrating the water, which reduces photosynthesis and the production of DO. Suspended materials can clog fish gills, reducing resistance to disease in fish,

lowering growth rates, and affecting egg and larval development. As the particles settle, they can blanket the stream bottom, especially in slower waters, and smother fish eggs and benthic macroinvertebrates.

How to Correct:

- Limit land disturbing activities.
- Use proper sediment and erosion controls.
- Sweep sediments from paved surfaces to prevent them from entering storm drains.

## Nitrites and Nitrates

Description: Nitrates are a form of nitrogen, which is found in several different forms in terrestrial and aquatic ecosystems. These forms of nitrogen include ammonia (NH<sub>3</sub>), nitrates (NO<sub>3</sub>), and nitrites (NO<sub>2</sub>). Nitrates are essential plant nutrients, but in excess amounts they can cause significant water quality problems.

Natural Sources: Leaves and Woody Debris, Dead Plants and Animals, and Animal Manure

Human-caused Sources: Fertilizers, Failing Septic Systems, Waste Water Treatment Plant (WWTP) Discharges, Pet Waste, Livestock and Farm Animals, Industrial Discharges

Effects on Watershed / Health: Together with phosphorus, nitrates in excess amounts can accelerate eutrophication, causing dramatic increases in aquatic plant growth and changes in the types of plants and animals that live in the stream. This, in turn, affects dissolved oxygen, temperature, and other indicators. Excess nitrates can cause hypoxia (low levels of dissolved oxygen) and can become toxic to warm-blooded animals at higher concentrations (10 mg/L or higher) under certain conditions. The natural level of ammonia or nitrate in surface water is typically low (less than 1 mg/L); in the effluent of wastewater treatment plants, it can range up to 30 mg/L.

How to Correct:

- Do not over fertilize lawns or over water to the point of runoff.
- Do not dump grass clippings, leaves, or other yard debris near streams or rivers.
- Pick up and dispose of pet waste properly.

## Ammonia

Description: Nitrates are a form of nitrogen, which is found in several different forms in terrestrial and aquatic ecosystems. These forms of nitrogen include ammonia (NH<sub>3</sub>), nitrates (NO<sub>3</sub>), and nitrites (NO<sub>2</sub>). Nitrates are essential plant nutrients, but in excess amounts they can cause significant water quality problems.

Natural Sources: Leaves and Woody Debris, Dead Plants and Animals, and Animal Manure

Human-caused Sources: Fertilizers, Failing Septic Systems, Waste Water Treatment Plant (WWTP) Discharges, Pet Waste, Livestock and Farm Animals, Industrial Discharges

Effects on Watershed / Health: Together with phosphorus, nitrates in excess amounts can accelerate eutrophication, causing dramatic increases in aquatic plant growth and

changes in the types of plants and animals that live in the stream. This, in turn, affects dissolved oxygen, temperature, and other indicators. Excess nitrates can cause hypoxia (low levels of dissolved oxygen) and can become toxic to warm-blooded animals at higher concentrations (10 mg/L or higher) under certain conditions. The natural level of ammonia or nitrate in surface water is typically low (less than 1 mg/L); in the effluent of wastewater treatment plants, it can range up to 30 mg/L.

#### How to Correct:

- Do not over fertilize lawns or over water to the point of runoff.
- Do not dump grass clippings, leaves, or other yard debris near streams or rivers.
- Pick up and dispose of pet waste properly.

## Flourides

Description: Fluoride is a naturally occurring element found in the earth's crust.

Natural Sources: Fluoride can occur naturally in surface waters from the deposition of particles in the atmosphere and weathering of fluoride containing rocks and soils.

Human-caused Sources: Fluoride compounds are also utilized in industry applications for the production of semiconductors, fertilizers, high purity graphite, and nuclear applications

Effects on Watershed / Health: Fluoride is most toxic to freshwater aquatic life and to people undergoing dialysis. Fluoride accumulates in the long bones of vertebrates, causing fluorosis, when present in excessive amounts. Livestock receiving high-fluoride feed supplements are also at risk of fluorosis from fluoride pollution of their pastures or high fluoride in their drinking water.

#### How to Correct:

- Must be removed through expensive chemical treatment.

## Nitrate

Description: Nitrates are a form of nitrogen, which is found in several different forms in terrestrial and aquatic ecosystems. These forms of nitrogen include ammonia (NH<sub>3</sub>), nitrates (NO<sub>3</sub>), and nitrites (NO<sub>2</sub>). Nitrates are essential plant nutrients, but in excess amounts they can cause significant water quality problems.

Natural Sources: Leaves and Woody Debris, Dead Plants and Animals, and Animal Manure

Human-caused Sources: Fertilizers, Failing Septic Systems, Waste Water Treatment Plant (WWTP) Discharges, Pet Waste, Livestock and Farm Animals, Industrial Discharges

Effects on Watershed / Health: Together with phosphorus, nitrates in excess amounts can accelerate eutrophication, causing dramatic increases in aquatic plant growth and changes in the types of plants and animals that live in the stream. This, in turn, affects dissolved oxygen, temperature, and other indicators. Excess nitrates can cause hypoxia (low levels of dissolved oxygen) and can become toxic to warm-blooded animals at higher concentrations (10 mg/L or higher) under certain conditions. The natural level of

ammonia or nitrate in surface water is typically low (less than 1 mg/L); in the effluent of wastewater treatment plants, it can range up to 30 mg/L.

How to Correct:

- Do not over fertilize lawns or over water to the point of runoff.
- Do not dump grass clippings, leaves, or other yard debris near streams or rivers.
- Pick up and dispose of pet waste properly.

## Chlorophyll

Description: Chlorophyll is the green pigment in plants that allows them to create energy from light (photosynthesis). Measuring chlorophyll is an indirect measurement of the amount of photosynthesizing plants in the water.

Natural Sources: Plants

Human-caused Sources: None

Effects on Watershed / Health: High concentrations of chlorophyll in water indicate excessive amounts of algae. Some algae can be toxic to livestock and pets if ingested in water with high enough concentrations of the algae. Typically, chlorophyll is simply an indicator of other potential issues including excess nutrients and/or decreasing dissolved oxygen levels.

## Fecal Streptococci

Description: Fecal Streptococci is a bacteria commonly found in human and animal feces that is used as an indicator of possible sewage contamination.

Natural Sources: Human, Wildlife, and Livestock Waste

Human-caused Sources: Pet Waste, Failing Septic Systems, Sanitary Sewer Overflows, Animal Feeding Operations

Effects on Watershed / Health: Fecal streptococci do not pose a health threat but serve as an indicator for bacteria that can cause illness in humans and aquatic life. High bacteria levels can limit the uses of water for swimming or contaminate drinking water in groundwater wells.

How to Correct:

- Pick up pet waste.
- Ensure proper functioning of septic systems.
- Connect to municipal sewers.



## WET-WEATHER MONITORING

### Biochemical Oxygen Demand (BOD)

Description: Biochemical Oxygen Demand (BOD) measures the amount of oxygen consumed by microorganisms in decomposing organic matter in water under aerobic conditions.

Natural Sources: Leaves and Woody Debris, Dead Plants and Animals, and Animal Manure

Human-caused Sources: Effluents from Pulp and Paper Mills, Wastewater Treatment Plants, Feedlots, and Food-Processing plants; Failing Septic Systems; and Urban Stormwater Runoff

Effects on Watershed / Health: BOD directly affects the amount of dissolved oxygen in rivers and streams. The greater the BOD, the more rapidly oxygen is depleted in the stream. This means less oxygen is available to higher forms of aquatic life. The consequences of high BOD are the same as those for low dissolved oxygen: aquatic organisms become stressed, suffocate, and die.

### Chemical Oxygen Demand (COD)

Description: Chemical oxygen demand (COD) does not differentiate between biologically available and inert organic matter, and it is a measure of the total quantity of oxygen required to oxidize all organic material into carbon dioxide and water.

Natural Sources: Leaves and Woody Debris, Dead Plants and Animals, and Animal Manure

Human-caused Sources: Effluents from Pulp and Paper Mills, Wastewater Treatment Plants, Feedlots, and Food-Processing plants; Failing Septic Systems; and Urban Stormwater Runoff

Effects on Watershed / Health: COD directly affects the amount of dissolved oxygen in rivers and streams. The greater the COD, the more rapidly oxygen is depleted in the stream. This means less oxygen is available to higher forms of aquatic life. The consequences of high COD are the same as those for low dissolved oxygen: aquatic organisms become stressed, suffocate, and die.

### Total Suspended Solids (TSS)

Description: Total Suspended Solids (TSS) is a term used to describe the amount of organic and inorganic particulate matter suspended in water. TSS is also related to turbidity.

Natural Sources: Erosion, Seasonal Changes in Algae Population

Human-caused Sources: Land Development

Effects on Watershed / Health: High TSS concentrations interfere with recreational uses and the aesthetic enjoyment of water. They also can have negative impacts on fish and aquatic life in many ways including, preventing the successful development of fish eggs and larvae, modifying natural migrations, reducing the amount of food available, and by reducing

growth rates and disease resistance or causing death. TSS can also impact invertebrate populations and decrease dissolved oxygen levels if the material is organic.

How to Correct:

- Limit land disturbing activities.
- Use proper sediment and erosion controls.
- Sweep sediments from paved surfaces to prevent them from entering storm drains.

## Total Dissolved Solids (TDS)

Description: Total Dissolved Solids (TDS) is a term generally associated with freshwater systems and consists of inorganic salts, small amounts of organic matter, and dissolved materials in water. The inorganic anions include carbonates, chlorides, sulfates, and nitrates, and the cations include sodium, potassium, calcium, and magnesium.

Natural Sources: Leaching from Soils

Human-caused Sources: Agricultural and Urban Runoff, Industrial and Waste Water Treatment Plant Discharges

Effects on Watershed / Health: High concentrations of TDS have a number of undesirable effects to both aquatic organisms and humans. All species of fish and aquatic life tolerate a range of TDS concentrations; however exceeding these limits could harm fish or lead to a fish kill. Excess dissolved solids can eliminate desirable food and habitat forming plants, as well as destroy crops, and make drinking water unpalatable. Dissolved solids also cause corrosion and encrustation on metal surfaces.

How to Correct:

- Limit land disturbing activities.
- Use proper sediment and erosion controls.
- Sweep sediments from paved surfaces to prevent them from entering storm drains.

## Total Kjeldahl Nitrogen (TKN)

Description: Total Kjeldahl Nitrogen (TKN) is the total amount of organic nitrogen and ammonia nitrogen present in water.

Natural Sources: Decaying Plant Debris, Wildlife

Human-caused Sources: Fertilizers, Failing Septic Systems, Waste Water Treatment Plant (WWTP) Discharges, Pet Waste, Livestock and Farm Animals

Effects on Watershed / Health: Excessive concentrations of nutrients can overstimulate aquatic plant and algae which can lead to depletion of dissolved oxygen (DO) levels in the water.

How to Correct:

- Do not over fertilize lawns or over water to the point of runoff.
- Do not dump grass clippings, leaves, or other yard debris near streams or rivers.

- Pick up and dispose of pet waste properly.

## Nitrite & Nitrate Nitrogen

Description: Nitrates are a form of nitrogen, which is found in several different forms in terrestrial and aquatic ecosystems. These forms of nitrogen include ammonia (NH<sub>3</sub>), nitrates (NO<sub>3</sub>), and nitrites (NO<sub>2</sub>). Nitrates are essential plant nutrients, but in excess amounts they can cause significant water quality problems.

Natural Sources: Leaves and Woody Debris, Dead Plants and Animals, and Animal Manure

Human-caused Sources: Fertilizers, Failing Septic Systems, Waste Water Treatment Plant (WWTP) Discharges, Pet Waste, Livestock and Farm Animals, Industrial Discharges

Effects on Watershed / Health: Together with phosphorus, nitrates in excess amounts can accelerate eutrophication, causing dramatic increases in aquatic plant growth and changes in the types of plants and animals that live in the stream. This, in turn, affects dissolved oxygen, temperature, and other indicators. Excess nitrates can cause hypoxia (low levels of dissolved oxygen) and can become toxic to warm-blooded animals at higher concentrations (10 mg/L or higher) under certain conditions. The natural level of ammonia or nitrate in surface water is typically low (less than 1 mg/L); in the effluent of wastewater treatment plants, it can range up to 30 mg/L.

How to Correct:

- Do not over fertilize lawns or over water to the point of runoff.
- Do not dump grass clippings, leaves, or other yard debris near streams or rivers.
- Pick up and dispose of pet waste properly.

## Oil & Grease

Description: Oil and Grease is a non-definitive description of organic compounds that include oils derived from animals, vegetables and petroleum.

Natural Sources: Petroleum

Human-caused Sources: Automotive Oils, Cooking Oils

Effects on Watershed / Health: Petroleum based oils can be acutely lethal to many aquatic organisms as evidenced by the aftermaths of many petroleum (oil and fuel) spills. Chronic exposure to oils can also affect feeding and reproductive processes in aquatic organisms. Oil and Grease also cause a human public health concern by 1) decreasing the supply of edible aquatic species, 2) increasing the possibility of ingesting carcinogenic elements that have bio-accumulated in the organisms tissues, and 3) through direct contact with known carcinogens found in oil. Oils of animal or vegetable origin are generally nontoxic to humans and aquatic life. Floating oils of any origin on surface waters cause a variety of harmful effects to waterfowl, fish, and invertebrate species and create poor aesthetics on water surfaces and shorelines.

How to Correct:

- Properly dispose of used motor oil at a recycling center.
- Install grease traps to prevent oil and grease from entering wastewater streams.

## Total Recoverable Zinc

Description: Zinc is an essential element in trace amounts for plants and animals; it is involved in healing and other biological processes.

Natural Sources: Mineral deposits in the soil.

Human-caused Sources: Metal and other Manufacturing Industries, Fertilizers, Household Products, Pharmaceuticals

Effects on Watershed / Health: Zinc toxicity is not generally a problem, but heavy metals cause a variety of problems including interfering with vitamin uptake, neurological disorders, and disruption of renal function. These problems result from chronic and cumulative exposure.

How to Correct:

- Sweep grounds of industrial facilities and parking areas.
- Paint galvanized metal surfaces to prevent zinc coatings from being washed by rain.

## Dissolved Phosphorus

Description: Phosphorus is a nutrient, along with nitrogen, necessary for the growth of algae and other plants. It aids in photosynthesis and usually is found in low levels in surface waters.

Natural Sources: Soil and Rocks

Human-caused Sources: Fertilizers, Failing Septic Systems, Waste Water Treatment Plant (WWTP) Discharges, Pet Waste, Livestock and Farm Animals, Disturbed Land Areas, Drained Wetlands, and Commercial Cleaning Preparations

Effects on Watershed / Health: Since phosphorus is the nutrient in short supply in most fresh waters, even a modest increase in phosphorus can, under the right conditions, set off a whole chain of undesirable events in a stream including accelerated plant growth, algae blooms, low dissolved oxygen, and the death of certain fish, invertebrates, and other aquatic animals.

How to Correct:

- Do not over fertilize lawns or over water to the point of runoff.
- Do not dump grass clippings, leaves, or other yard debris near streams or rivers.
- Pick up and dispose of pet waste properly.

## Total Phosphorus

Description: Phosphorus is a nutrient, along with nitrogen, necessary for the growth of algae and other plants. It aids in photosynthesis and usually is found in low levels in surface waters.

Natural Sources: Soil and Rocks

Human-caused Sources: Fertilizers, Failing Septic Systems, Waste Water Treatment Plant (WWTP) Discharges, Pet Waste, Livestock and Farm Animals, Disturbed Land Areas, Drained Wetlands, and Commercial Cleaning Preparations

Effects on Watershed / Health: Since phosphorus is the nutrient in short supply in most fresh waters, even a modest increase in phosphorus can, under the right conditions, set off a whole chain of undesirable events in a stream including accelerated plant growth, algae blooms, low dissolved oxygen, and the death of certain fish, invertebrates, and other aquatic animals.

How to Correct:

- Do not over fertilize lawns or over water to the point of runoff.
- Do not dump grass clippings, leaves, or other yard debris near streams or rivers.
- Pick up and dispose of pet waste properly.

## Total Recoverable Copper

Description: Copper is a metal element widely used in industry.

Natural Sources: Copper is an element often found in very low concentrations in the natural environment.

Human-caused Sources: Metal Plating, Electrical Equipment, Pesticides, Paint Additives, and Wood Preservatives.

Effects on Watershed / Health: Heavy metals cause a variety of problems including interfering with vitamin uptake, neurological disorders, and disruption of renal function. These problems result from chronic and cumulative exposure.

How to Correct:

- Dispose of industrial by-products appropriately.
- Do not over fertilize lawns or over water to the point of runoff.

## Total Recoverable Lead

Description: Lead is a metal element widely used in industry.

Natural Sources: Lead is an element often found in very low concentrations in the natural environment.

Human-caused Sources: Batteries, Gasoline, Paint, Caulking, Rubber, and Plastics

Effects on Watershed / Health: Heavy metals cause a variety of problems including interfering with vitamin uptake, neurological disorders, and disruption of renal function. These problems result from chronic and cumulative exposure. Lead causes a variety of neurological disorders in humans, particularly inhibiting brain cell development in children. It also prevents the uptake of iron in the body leading to anemia.

#### How to Correct:

- Dispose of industrial by-products appropriately.

### Total Recoverable Cadmium

Description: Cadmium is a metal element widely used in industry and often found in industrial waste discharges.

Natural Sources: Cadmium is an element often found in very low concentrations in the natural environment.

Human-caused Sources: Widely used in industrial processes.

Effects on Watershed / Health: Heavy metals cause a variety of problems including interfering with vitamin uptake, neurological disorders, and disruption of renal function. These problems result from chronic and cumulative exposure. Cadmium is a cumulative toxicant that replaces zinc in the body; it is toxic to both humans and fish.

#### How to Correct:

- Dispose of industrial by-products appropriately.

### Fecal Coliform

Description: Bacteria found in the digestive systems of warm blooded organisms

Natural Sources: Human, Wildlife, and Livestock Waste

Human-caused Sources: Pet Waste, Failing Septic Systems, Sanitary Sewer Overflows, Animal Feeding Operations

Effects on Watershed / Health: Fecal coliforms do not pose a health threat but serve as an indicator for bacteria that can cause illness in humans and aquatic life. High bacteria levels can limit the uses of water for swimming or contaminate drinking water in groundwater wells.

#### How to Correct:

- Pick up pet waste.
- Ensure proper functioning of septic systems.
- Connect to municipal sewers.