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# **Monitoring Guidance for Determining the Effectiveness of Nonpoint Source Controls**

**MONITORING GUIDANCE FOR  
DETERMINING THE EFFECTIVENESS  
OF NONPOINT SOURCE CONTROLS**

**FINAL**

U.S. Environmental Protection Agency  
Nonpoint Source Control Branch  
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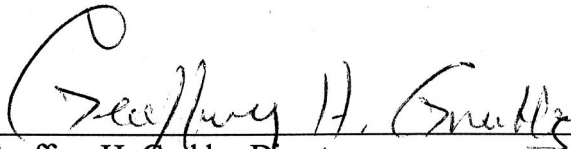
## FOREWORD

The diffuse nature of nonpoint sources (e.g., agriculture, forestry, urban areas) and the variety of pollutants generated by them create a challenge for their effective control. Although progress has been made in the protection and enhancement of water quality, much work is still needed to identify nonpoint source management strategies that are both effective and economically achievable under a wide range of conditions. Monitoring will play an important role in this effort.

This nonpoint source monitoring and evaluation guide is written for use by both those who monitor and those who evaluate and fund monitoring proposals. For example, the federal, State, and Tribal agencies that support monitoring activities might use the guide to assess the technical merits of proposed monitoring and evaluation plans. These same agencies, university personnel, and others that carry out the monitoring and evaluation might use this guide to formulate their plans.

This guidance addresses the design of water quality monitoring programs to assess both impacts from nonpoint source pollution and the effectiveness of control practices and management measures. There are diverse opinions regarding the most effective way to design a monitoring program. Since each situation is different and may need a unique monitoring approach, this guidance presents the theory and information needed to design monitoring programs tailored to particular situations.

Readers are encouraged to consult, as well, the additional resources listed in this document. For example, companion documents, *Techniques for Tracking, Evaluating, and Reporting the Implementation of Nonpoint Source Control Measures: I. Agriculture, II. Forestry, and III. Urban* (USEPA, 1997), present guidance on determining the extent of and trends in implementation of nonpoint source control practices and management measures. In addition to these resources, readers are urged to contact monitoring and quality assurance experts in academia and at the local, State, Tribal, and federal levels for assistance in developing monitoring plans.

  
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## CREDITS

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## GLOSSARY

**Atomic absorption spectrophotometry:** A method to determine the elemental composition of a substance by vaporizing the sample and measuring at specific wavelengths the amount of radiation absorbed, which is proportional to the concentration of the element in the sample.

**Bathymetry:** The measurement of depths of water in oceans, seas, and lakes; also, information derived from such measurements.

**Biomagnify:** The process by which chemical pollutants become increasingly concentrated in animal tissue as the pollutants are passed up the food chain.

**Biological oxygen demand (BOD):** the amount of oxygen required by aerobic organisms to carry out oxidative metabolism in water containing organic matter, such as sewage.

**Chemical oxygen demand (COD):** a measure of the quantity of oxidizable components present in water.

**Coliform bacteria:** Bacteria present in mammalian feces, used as an indicator of the presence of human feces, bacteria, viruses, and pathogens in the water column.

**Congener:** An organism that is a member of the same genus as another animal or plant; a chemical substance that is related in some way to another.

**Coriolis effect:** The deflection relative to the earth's surface of an object that is moving on or above the earth, due to the action of the Coriolis force. An object that is moving horizontally above the earth's surface in the Northern Hemisphere tends to show a rightward deflection, and one in the Southern Hemisphere tends to show a leftward deflection.

**Dissolved oxygen:** The concentration of free molecular oxygen in the water column.

**Diurnal:** Active primarily during daylight hours.

**Estuarine drainage area:** The land and water component of a watershed that drains directly into estuarine waters.

**Eutrophic:** Rich in nutrients and hence having excessive plant growth, which removes oxygen from the water.

**Eutrophication:** The process of becoming eutrophic.

**Fluvial drainage area:** land and freshwater portions of watersheds upstream of estuarine drainage areas.

**GIS (geographic information system):** A computer system specialized for storage, manipulation, and presentation of geographical information, such as topography, political subdivisions, geology, vegetation, flood plains, etc. *[Note: Do not confuse GIS with GPS, global positioning system.]*

**Habitat alteration:** Changes in a habitat that make it less suitable for the organisms inhabiting it, create conditions favorable to invasion by species not present prior to the changes, or limit its ecosystem function.

**Hydraulic residence time (HRT):** amount of time necessary to fill a lake, or average amount of time water entering a lake stays in the system, calculated as lake volume/flow rate

**Hydromodification:** Alteration of the hydrologic characteristics of coastal and noncoastal waters, which in turn could cause degradation of water resources.

**Impervious:** The characteristic of a surface that prevents or retards the entry of water into or through it and causes water to run off the surface.

**Ion chromatography:** A technique for separating components from a mixture using ionic attraction by placing the mixture in a mobile phase that is passed over a stationary phase.

**Macroinvertebrate:** Invertebrate organisms that can be seen with the naked eye.

**Macrophyte:** Plants visible to the naked eye.

**Nonpoint source:** Generally, any unconfined and diffuse source of contamination, such as stormwater or snowmelt runoff, or atmospheric pollution. Legally, a nonpoint source of water pollution is any source of water pollution that does not meet the legal definition of “point source” in section 502(14) of the Clean Water Act.

**Oligotrophic:** Poorly nourished; describes a lake with low plant productivity and high transparency.

**Onsite disposal system (OSDS):** Sewage disposal system designed to treat wastewater at a particular site. Septic tank systems are common OSDS.

**Oxygen-demanding substance:** A substance whose decomposition in water uses oxygen.

**Pervious:** The characteristic of a surface that allows the entry of water into or through it and causes little water to run off the surface.

**Phytoplankter:** An organism of phytoplankton—microscopic algae and microbes that float freely in open water of lakes and oceans.

**Point source:** Any discernable, confined or discrete conveyance (pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft) from which pollutants are or may be discharged.

**Pollution (water):** The presence of excessive amounts of dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste in water.



**Riparian areas:** Vegetated ecosystems along a waterbody through which energy, materials, and water pass. Riparian areas characteristically have a high water table and are subject to periodic flooding and influence from the adjacent waterbody.

**SAV (submerged aquatic vegetation):** Macrophytes that are rooted and grow beneath the water surface.

**Sluice gate:** A gate for regulating or stopping flow in a conduit or passage where surplus water is carried off

**Substrate:** The substance, base, or nutrient on which an organism lives and grows, or the surface to which a fixed organism is attached.

**Suspended sediment:** The very fine soil particles that remain in suspension in water for a considerable period of time.

**Turbidity:** A cloudy condition in water due to suspended silt or organic matter.

**Vadose zone:** The subsurface zone in soil that contains air or gases generally under atmospheric pressure, between the land surface and the zone of saturation.

**Weir:** A device for measuring or regulating the flow of water.