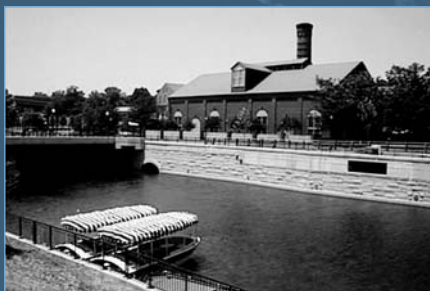




# Report to Congress

## Impacts and Control of CSOs and SSOs



# On the Cover

Large photo in background: Oklahoma City PVC sewer pipe stockpile. In response to problems from an aging sewer system made up of more than 2,000 miles of pipe, Oklahoma City implementing a capital improvement planning program with the goal of replacing sewer lines at the rate of 1% per year. The City opted for replacing aging pipes with PVC pipes as a more affordable, flexible and corrosion-resistant alternative. *Photo courtesy of Julia Moore, Limno-Tech, Inc..*

Top inset: Former Denny Way CSO outfall in Seattle, WA. The Denny Way outfall as shown was the largest volume CSO discharge in the King County System. Through a joint effort of King County and the City of Seattle, the Denny Way/Lake Union CSO Project was implemented to control over 600 million gallons of combined sewage from overflowing annually into Lake Union and Elliott Bay. Under way since May 2000, construction is expected to be complete in 2005. Progress to date includes the demolition of the pictured outfall, restoration of the shoreline, and revitalization of the surrounding public park. *Photo courtesy of King County.*

Second inset: Monitoring team responding to sewer overflow. *Photo provided by ADS.*

Third inset: City of Richmond, VA Canal Walk. The City of Richmond incorporated downtown revitalization, historical interpretation, and combined sewer overflow planning as part of a large-scale redevelopment of their downtown river front area. The riverfront redevelopment was made possible, in part, by the environmental improvements achieved by the Richmond CSO Control Program. The resulting Canal Walk extends for more than a mile along the Haxall and Kanawha Canals and includes under canal routing of combined sewage while providing a pathway of access to revitalized businesses, museums and new outdoor public vistas and arenas. *Photo courtesy of City of Richmond.*

Fourth inset: Orange County, CA. Orange County Health Care Agency's Environmental Health Ocean Water Protection Program administers a beach water quality monitoring program to ensure public recreational waters meet bacteriological water quality standards for full body contact recreational activities such as swimming, surfing and diving. Beach closure or advisory signs are posted at Orange County beaches when high levels of bacteria are measured or when a sewage spill contamination of ocean or bay waters occurs. *Photo courtesy of OCHCA EH Ocean Water Protection Program.*

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# List of Acronyms

AIDS– Acquired Immune Disorder Syndrome	CDC– Centers for Disease Control and Prevention	FWPCA– Federal Water Pollution Control Act
AMSA– Association of Metropolitan Sewerage Agencies	CFR– Code of Federal Regulations	GAO– Government Accounting Office
AO– Administrative Order	cfs– Cubic Feet per Second	GIS– Geographic Information System
APO– Administrative Penalty Orders	CIPP– Cured-in-place Pipe	GPRA– Government Performance and Results Act
APWA– American Public Works Association	CMOM– Capacity, Management, Operation, and Maintenance	HUD– Housing of Urban Development
ASCE– American Society of Civil Engineers	CSO– Combined Sewer Overflow	I/I– Infiltration & Inflow
BAT– Best Available Technology Economically Achievable	CSS– Combined Sewer System	ISSC– Interstate Shellfish Sanitation Conference
BCT– Best Conventional Pollutant Control Technology	CTP– Central Treatment Plant	LGEAN– Local Government Environmental Assistance Network
BEACH Program– Beaches Environmental Assessment and Coastal Health Program	CWNS– Clean Watersheds Needs Survey	LID– Low Impact Development
BMP– Best Management Practice	CWSRF– Clean Water State Revolving Fund	LOV– Letter of Violation
BOD <sub>5</sub> – Biochemical Oxygen Demand (measured over 5 days)	ECD– Enforcement and Compliance Docket	LTCP– Long-Term Control Plan
CAFO– Concentrated Animal Feeding Operation	ENR– <i>Engineering News Record</i>	MAG– Office of Water Management Advisory Group
CATAD– Computer Augmented Treatment and Disposal	EPA– Environmental Protection Agency	MDE– Maryland Department of the Environment
CBO– Congressional Budget Office	FEB– Flow Equalization Basins	MDEQ– Michigan Department of Environmental Quality
CCTV– Closed Circuit Television	FAC– Federal Advisory Committee	MG– Million Gallons
	FOG– Fats, Oils, and Grease	mgd– Million Gallons per Day
	FR– <i>Federal Register</i>	ml– Milliliter
	FY– Fiscal Year	

MMSD– Milwaukee Metropolitan Sewerage District	NWQI– National Water Quality Inventory	WDR– Waste Discharge Requirements
MOM– Management, Operation, and Maintenance	O&M– Operation and Maintenance	WEF– Water Environment Federation
MPN– Most Probable Number	ODEQ– Oklahoma Department of Environmental Quality	WERF– Water Environment Research Foundation
MWWSSB– Montgomery Water Works and Sanitary Sewer Board	OMB– Office of Management and Budget	WISE– Watershed Initiative for a Safe Environment
MS4– Municipal Separate Storm Sewer System	ORD– Office of Research and Development	WWTP– Wastewater Treatment Plant
NCDENR– North Carolina Department of Environmental and Natural Resources	PCBs– Polychlorinated biphenyls	
NEEAR Water Study– National Epidemiological and Environmental Assessment of Recreational Water Study	PCS– Permit Compliance System	
NIH– National Institutes of Health	P.L.– Public Law	
NHD– National Hydrography Dataset	POTW– Publicly Owned Treatment Works	
NJDEP– New Jersey Department of Environmental Protection	REAP– Rural Economic Assistance Program	
NMC– Nine Minimum Controls	RWQCB– Regional Water Quality Control Board	
NMDSP– National Marine Debris Survey Program	SRF– State Revolving Fund	
NMP–National Municipal Policy	SSO– Sanitary Sewer Overflow	
NOAA–National Oceanic and Atmospheric Administration	SSS– Sanitary Sewer System	
NPDES– National Pollutant Discharge Elimination System	TKN– Total Kjeldahl Nitrogen	
NRDC– Natural Resources Defense Council	TMDL– Total Maximum Daily Loads	
NURP– Nationwide Urban Runoff Program	TSS– Total Suspended Solids	
	USGS– United States Geological Survey	
	UV– Ultraviolet	
	WATERS- Watershed Assessment, Tracking, & Environmental ResultS	

# Glossary

*This glossary includes a collection of the terms used in this manual and an explanation of each term. To the extent that definitions and explanations provided in this glossary differ from those in EPA regulations or other official documents, they are intended for use in understanding this manual only.*

## A

**Acute Toxicity**– The ability of a substance to cause severe biological harm or death soon after a single exposure or dose. Also, any poisonous effect resulting from a single short-term exposure to a toxic substance.

## B

**Bacteria**– Microscopic, unicellular organisms, some of which are pathogenic and can cause infection and disease in animals and humans. Most often, non-pathogenic bacteria, such as fecal coliform and enterococci, are used to indicate the likely presence of disease-causing, fecal-borne microbial pathogens.

**Best Available Technology Economically Achievable (BAT)**– Technology-based standard established by the Clean Water Act as the most appropriate means

available on a national basis for controlling the direct discharge of toxic and nonconventional pollutants to navigable waters.

**Best Conventional Pollutant Control Technology (BCT)**– Technology-based standard for the discharge from existing industrial point sources of conventional pollutants including BOD, TSS, fecal coliform, pH, oil and grease. The BCT is established in light of a two-part “cost reasonableness” test, which compares the cost for an industry to reduce its pollutant discharge with the cost to a POTW for similar levels of reduction of a pollutant loading. The second test examines the cost-effectiveness of additional industrial treatment beyond BPT. EPA must find limits, which are reasonable under both tests before establishing them as BCT.

**Biochemical Oxygen Demand (BOD)**– A measure of the amount of oxygen consumed by microorganisms from the decomposition of organic

material in water over a specified time period (usually 5 days, indicated as BOD<sub>5</sub>). The BOD<sub>5</sub> value is used for many applications, most commonly to indicate the effects of sewage and other organic wastes on dissolved oxygen in water.

## C

**Chronic Toxicity**– The capacity of a substance to cause long-term poisonous health effects in humans, animals, fish, and other organisms.

**Clean Water Act**– The Clean Water Act is an act passed by the U.S. Congress to control water pollution. It was formerly referred to as the Federal Water Pollution Control Act of 1972 or Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500), 33 U.S.C. 1251 et. seq., as amended by: P.L. 96-483; P.L. 97-117; P.L. 95-217, 97-117, 97-440, and 100-04.



Combined Sewer Overflow (CSO)— A discharge of untreated wastewater from a combined sewer system at a point prior to the headworks of a publicly owned treatment works (POTW).

Combined Sewer System (CSS)— A wastewater collection system owned by a municipality (as defined by Section 502(4) of the Clean Water Act) that conveys domestic, commercial and industrial wastewater and storm water runoff through a single pipe system to a POTW.

Concentrated Animal Feeding Operation (CAFO)— New and existing animal feeding operations of a sufficient size that are required to develop and implement a nutrient management plan as a condition of a NPDES permit (defined at 40 CFR 122.23).

Construction Grants Program— Federal assistance program authorized under Section 201 of the Clean Water Act intended to assist with the development and implementation of waste treatment management plans and practices that will achieve the goals of the Act.

Conventional Pollutants— As defined by the Clean Water Act, conventional pollutants include: BOD, TSS, fecal coliform, pH, and oil and grease.

## D

Dissolved Oxygen (DO)— The oxygen freely available in water, vital to fish and other aquatic life and for the prevention of odors. DO levels are considered a most important indicator of a water body's ability to support desirable aquatic life. Secondary and advanced waste treatment are generally designed to ensure adequate DO in waste-receiving waters.

Diurnal— Relating to or occurring in a 24-hour period, or daily. A pattern that repeats itself over a daily cycle.

Dry Weather CSO— An unauthorized discharge from a combined sewer system that occurs during dry weather conditions.

Dry Weather SSO— A sanitary sewer overflow that occurs during dry weather conditions, most often as a result of blockages, line breaks, or mechanical/power failures in the collection system.

## E

Effluent Limits— Restrictions established by a state or EPA on quantities, rates, and concentrations in municipal or industrial wastewater discharges.

Environmental Impact— Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an

organization's activities, products or services.

Eutrophic Condition— The presence of excess nutrients in a receiving water body. During the later stages of eutrophication the water body can become choked by abundant plant life due to higher levels of nutritive compounds such as nitrogen and phosphorus.

## F

Federal Advisory Committee— Any committee, board, commission, council, conference, panel, task force, or other similar group, or any subcommittee or other sub-group thereof (hereafter in this paragraph referred to as "committee"), which in— (A) established by statute or organization plan, or (B) established or utilized by the President; or (C) established or utilized by one or more agencies; in the interest of obtaining advise and recommendations for the President or one or more agencies or offices of the Federal Government, except that such term excludes (i) any committee that is composed wholly of full-time, or permanent part-time, officers or employees of the Federal Government, and (ii) any committee that is created by the National Academy of Sciences of the National Academy of Public Administration.

First Flush— The occurrence of higher concentrations of pollutants in

storm water or CSO discharges at the beginning of a storm.

**Floatables and Trash**– Visible buoyant or semi-buoyant solids including organic matter, personal hygiene items, plastics, styrofoam, paper, rubber, glass and wood.

## H

**Headworks of a Wastewater Treatment Plant**– The initial structures, devices and processes provided at a wastewater treatment plant including screening, pumping, measuring, and grit removal facilities.

**Human Health Impacts**– Damage to the health of an individual or individuals due to a given exposure or a series of exposures.

## I

**Indicator Bacteria**– Bacteria that are common in human waste. Indicator bacteria are not harmful in themselves but their presence is used to indicate the likely presence of disease-causing, fecal-borne microbial pathogens that are more difficult to detect.

**Infiltration**– Storm water and groundwater that enter a sewer system through such means as defective pipes, pipe joints, connections, or manholes. (Infiltration does not include inflow).

**Infiltration/Inflow (I/I)**– The total quantity of water from both infiltration and inflow.

**Inflow**– Water, other than wastewater, that enters a sewer system from sources such as roof leaders, cellar drains, yard drains, area drains, foundation drains, drains from springs and swampy areas, manhole covers, cross connections between storm drains and sanitary sewers, catch basins, cooling towers, storm waters, surface runoff, street wash waters, or other drainage. (Inflow does not include infiltration).

## L

**Long-Term Control Plan (LTCP)**– Water quality-based CSO control plan that is ultimately intended to result in compliance with the Clean Water Act. Long-term control plans should consider the site-specific nature of CSOs and evaluate the cost effectiveness of a range of controls.

## M

**Major Facility**– Classification for wastewater treatment plants that are designed to discharge more than 1 mgd. Some facilities with smaller design flows are classified as major facilities when the NPDES authority deems it necessary for a specific NPDES permit to have a stronger regulatory focus.

**Microbial Pathogens**– Minute life forms including bacteria, viruses and parasites that can cause disease in aquatic biota and illness or even death in humans.

**Million Gallons per Day (mgd)**– A unit of flow commonly used for wastewater discharges. One mgd is equivalent to a flow rate of 1.547 cubic feet per second over a 24-hour period.

**Minor Facility**– A classification for wastewater treatment plants that are designed to discharge less than 1 mgd.

## N

**National Pollutant Discharge Elimination System (NPDES)**– The national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 318, 402, and 405 of the Clean Water Act.

**Nine Minimum Controls (NMC)**– Technology-based CSO controls that do not require significant engineering studies or major construction.

**Nutrient**– Any substance assimilated by living things that promotes growth. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.

## O

### Oxygen Depleting Substances–

Materials including human waste and other organic matter that cause a loss of oxygen in water and wastewater, typically measured in terms of BOD<sub>5</sub>.

## P

**Parasites–** Animals or plants that live in and obtain nutrients from a host organism of another species.

**Pathogenic–** Capable of causing disease.

**Point Source–** Any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fixture, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft from which pollutants are or may be discharged.

**Primary Treatment–** First steps in wastewater treatment wherein screens and sedimentation tanks are used to remove most materials that float or will settle.

**Publicly Owned Treatment Works (POTW)–** A treatment works, as defined by Section 212 of the Clean Water Act that is owned by a state or municipality. This definition includes any devices and systems used in the storage,

treatment, recycling, and reclamation of municipal sewage or industrial wastes of a liquid nature. It also includes sewers, pipes, and other conveyances only if they convey wastewater to a POTW treatment plant [40 CFR §403.3].

## Q

**Sanitary Sewer Overflow (SSO)–** An untreated or partially treated sewage release from a sanitary sewer system.

**Sanitary Sewer System (SSS)–** A municipal wastewater collection system that conveys domestic, commercial and industrial wastewater, and limited amounts of infiltrated ground water and storm water, to a POTW. Areas served by sanitary sewer systems often have a municipal separate storm sewer system to collect and convey runoff from rainfall and snowmelt.

**Satellite Sewer Systems–** Combined or separate sewer systems that convey flow to a publicly owned treatment works owned and operated by a separate entity.

**Secondary Treatment–** Technology-based requirements for direct discharging municipal sewage treatment facilities. Standard is based on a combination of physical and biological processes for the treatment of pollutants in municipal sewage. Standards are expressed as a minimum

level of effluent quality in terms of: BOD<sub>5</sub>, suspended solids, and pH (except as provided for special considerations and treatment equivalent to secondary treatment).

**State Revolving Fund Program–** A federal program created by the Clean Water Act Amendments in 1987 that offers low interest loans for wastewater treatment projects.

## T

**Technology-Based Effluent Limit–** Effluent limitations applicable to direct and indirect sources, which are developed on a category-by-category basis using statutory factors, not including water quality effects.

**Total Suspended Solids (TSS)–** A measure of the filterable solids present in a sample of water or wastewater (as determined by the method specified in 40 CFR Part 136).

**Toxics–** Materials contaminating the environment that cause death, disease, and/or birth defects in organisms that ingest or absorb them. The quantities and length of exposure necessary to cause these effects can vary widely.

## W

**Water Quality Standard–** A law or regulation that consists of the beneficial use or uses of a waterbody, the numeric and

narrative water quality criteria that are necessary to protect the use or uses of that particular waterbody, and an antidegradation statement.

**Water Quality-Based Effluent**

**Limitations**– Effluent limitations applied to dischargers when technology-based limitations insufficient to result in the attainment of water quality standards. Usually applied to discharges into small streams.

**Waters of the United States**– All waters that are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters subject to the ebb and flow of the tide. Waters of the United States include but are not limited to all interstate waters and intrastate lakes, rivers, streams (including intermittent streams), mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, play lakes, or natural ponds. [See 40 CFR §122.2 for the complete definition.]

**Watershed Approach**– An initiative that promotes integrated solutions to address surface water, groundwater, and habitat concerns on a watershed basis. It is a decision-making process that reflects a common strategy for information collection and analysis and a common understanding of the roles, priorities and responsibilities of all stakeholders within a watershed.

**Wet Weather Event**– A discharge from a combined or sanitary

sewer system that occurs in direct response to rainfall or snowmelt.

**Wet Weather SSO**– A sanitary sewer overflow that results from the introduction of excessive inflow and infiltration into a sanitary sewer system, such that the total flow exceeds conveyance capacity.