The Clean Water Act and Water Quality Problems today

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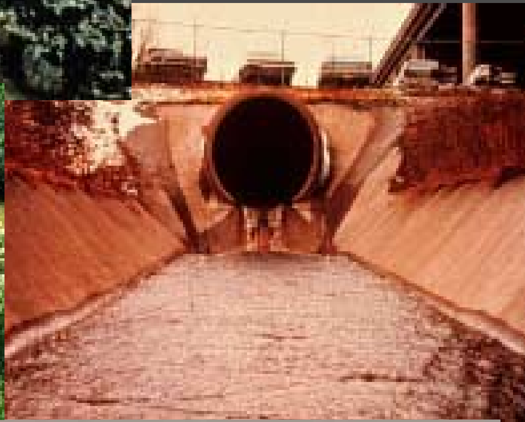
Water Quality – the major foci

- Chemical, Physical and Biological Attributes of Water Bodies (Rivers, Lakes…)
  - Human Exposure, Endangered Species or other Biota, Fisheries
- Chemical and Biological Constituents of Drinking Water
  - Human Health

Beneficial Use Impairments

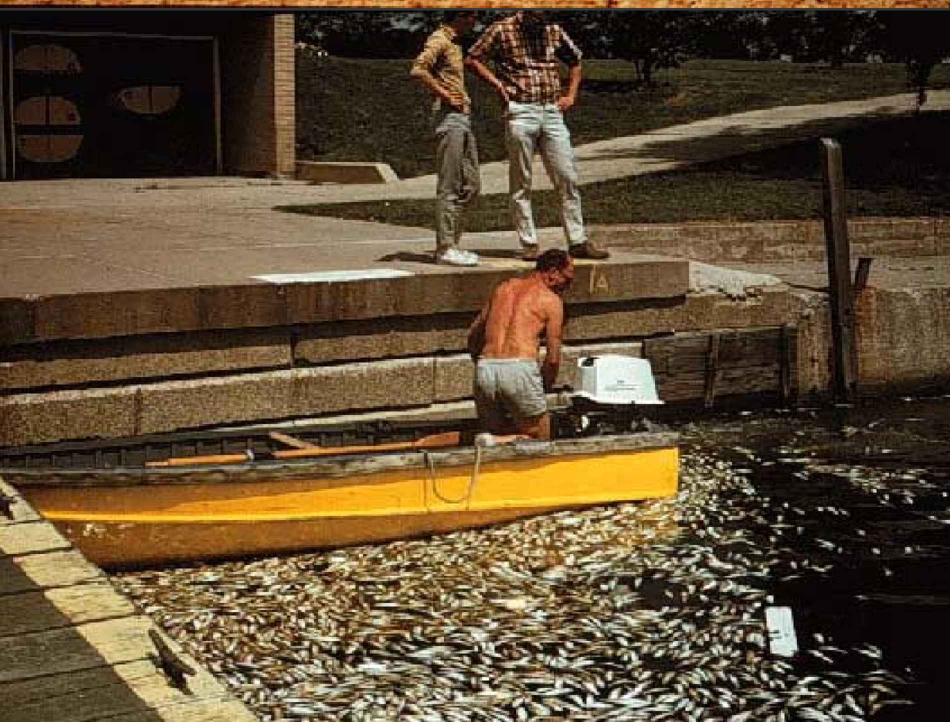
- ✓ Restrictions on Fish & Wildlife Consumption
- ✓ Tainting of Fish & Wildlife Flavor
- ✓ Degradation of Fish & Wildlife Populations
- ✓ Fish Tumors or Other Deformities
- ✓ Bird or Animal Deformities or Reproductive Problems
- ✓ Degradation of Benthos
- ✓ Restrictions on Dredging Activities
- ✓ Eutrophication or Undesirable Algae
- Restrictions on Drinking Water Consumption, or Taste & Odor
- ✓ Beach Closings
- ✓ Degradation of Aesthetics
- ✓ Degradation of Phytoplankton & Zooplankton Populations
- Added Cost to Agriculture & Industry
- ✓ Loss of Fish & Wildlife Habitat

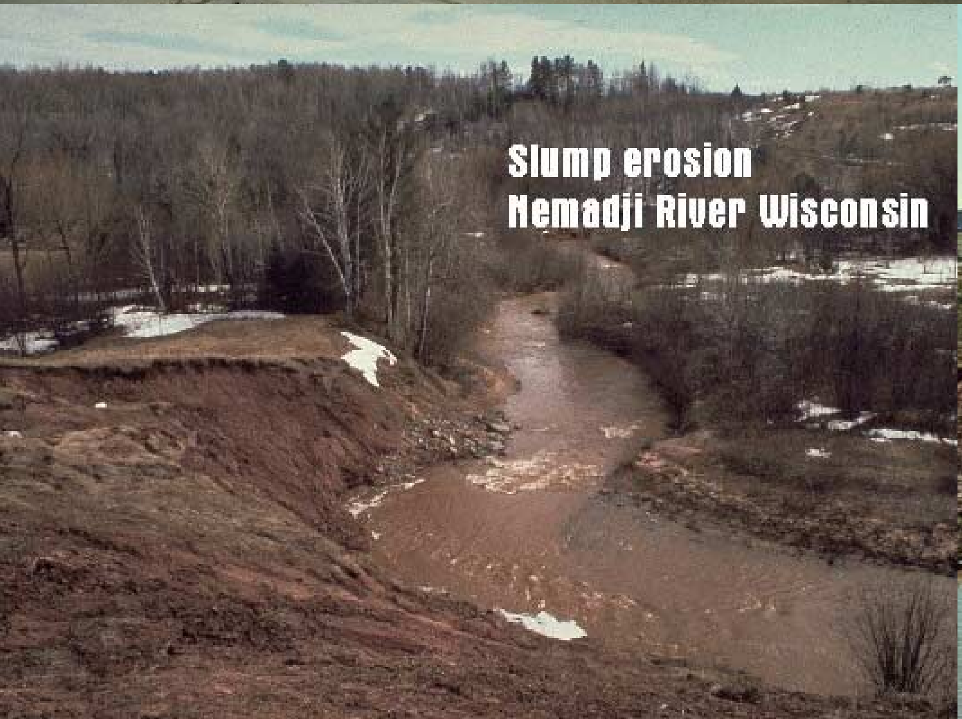
Fires plagued the Cuyahoga beginning in 1936 when a spark from a blow torch ignited floating debris and oils. Fires erupted on the river several more times before June 22, 1969, when a river fire captured national attention when Time magazine described the Cuyahoga as the river that "oozes rather than flows" and in which a person "does not drown but decays." This event helped spur an avalanche of pollution control activities resulting in the Clean Water Act, Great Lakes Water Quality Agreement, and the creation of the federal and state Environmental Protection Agencies.




WARNING
HIGH POLLUTION READINGS
ARE OFTEN FOUND IN
THESE WATERS...
Bathe at your own risk


POLLUTED WATER
Lake Erie beach, 1971





Non-Point Source Pollution is now the major concern

USEPA *R/V Lake Guardian* Regularly Tests Water, Sediment, and Biological Quality of the Great Lakes

Sampling with Vertical Water Sampler

Processing Samples Collected with Rosette Water Sampler

Lowering Box Corer to Collect Sediment Samples from Lake Bottom

Key Legislation mandating EPA's role in Water

National Environmental Policy Act, 1969: Environmental Assessments (EA's) and Environmental Impact Statements (EIS's) for all federal activities

Federal Water Pollution Control Act 1972 : Regulates discharges of pollutants to waters

Endangered Species Act, 1973: Conservation of threatened/endangered plants and animals and the habitats in which they are found

The Safe Drinking Water Act, 1974, 1996: Protect the quality of all waters actually or potentially designed for drinking use, whether from above ground or underground sources. EPA to establish safe standards of purity and required all public water systems to comply with primary (health) standards. State governments, also encourage attainment of secondary standards (nuisance).

The Clean Water Act 1977: **Focus on toxics.** EPA gets authority to set effluent standards on an industry basis (technology-based) and water quality standards for all contaminants in surface waters. The CWA makes it unlawful for any person to discharge any pollutant from a point source into navigable waters unless a permit (NPDES) is obtained.

Comprehensive Environmental Response, Compensation, and Liability Act, 1980: Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment

The Clean Water Act 1987: authorized citizen suit provisions, and funded sewage treatment plants (POTW's) under the Construction Grants Program. EPA can delegate many permitting, administrative, and enforcement aspects of the law to state governments.

Resource Conservation & Recovery Act, 1976, 1986: Underground Storage Tanks, Non-Haz Waste

The Clean Water Act of 1977 amends the Federal Water Pollution Control Act of 1972, to set a basic structure for regulating discharges of pollutants to waters of the United States.

The law gave EPA the authority to set effluent standards on an industry basis (technology-based) and continued the requirements to set water quality standards for all contaminants in surface waters.

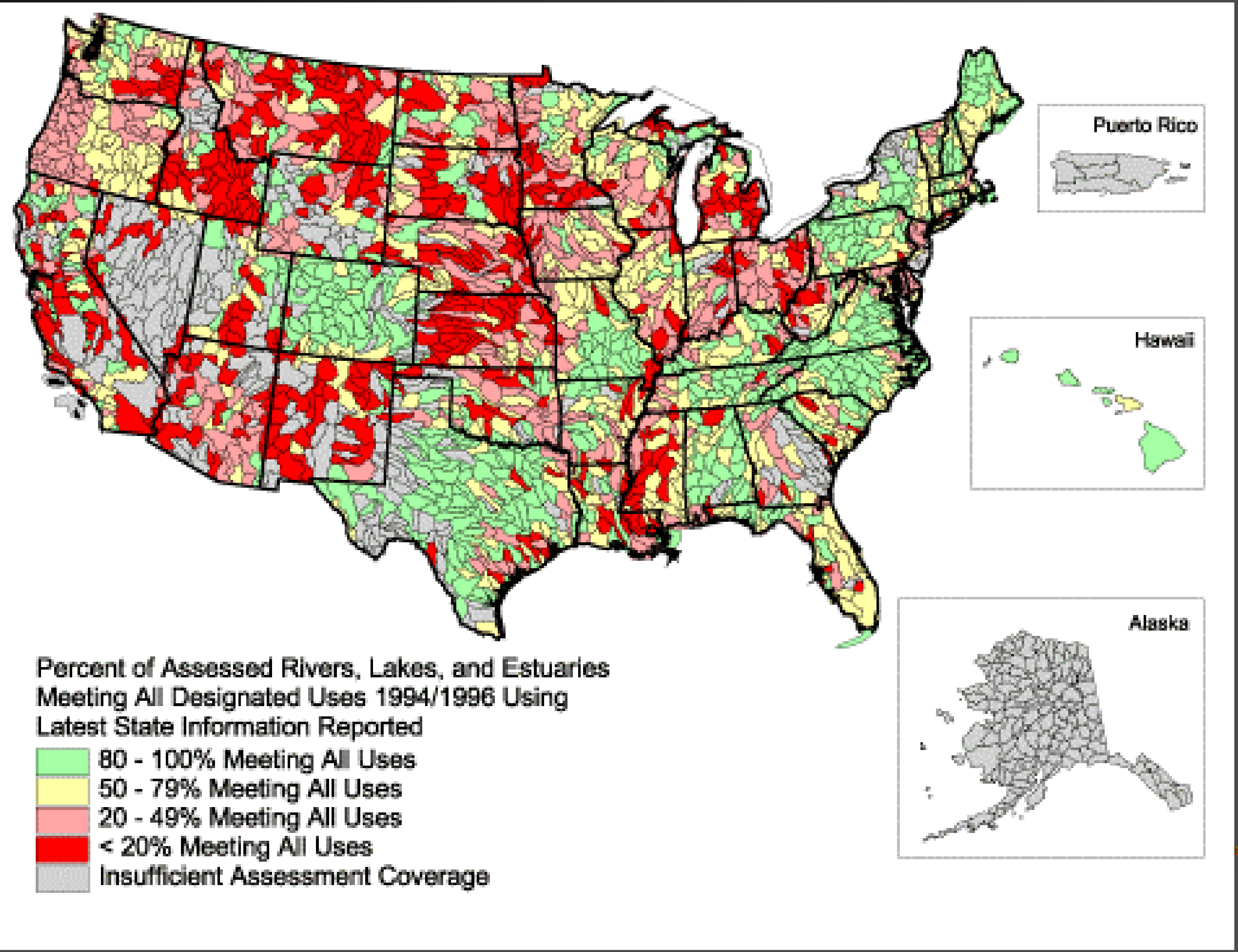
The CWA makes it unlawful for any person to discharge any pollutant from a point source into navigable waters unless a permit (NPDES) is obtained under the Act.

The 1977 amendments focused on toxic pollutants.

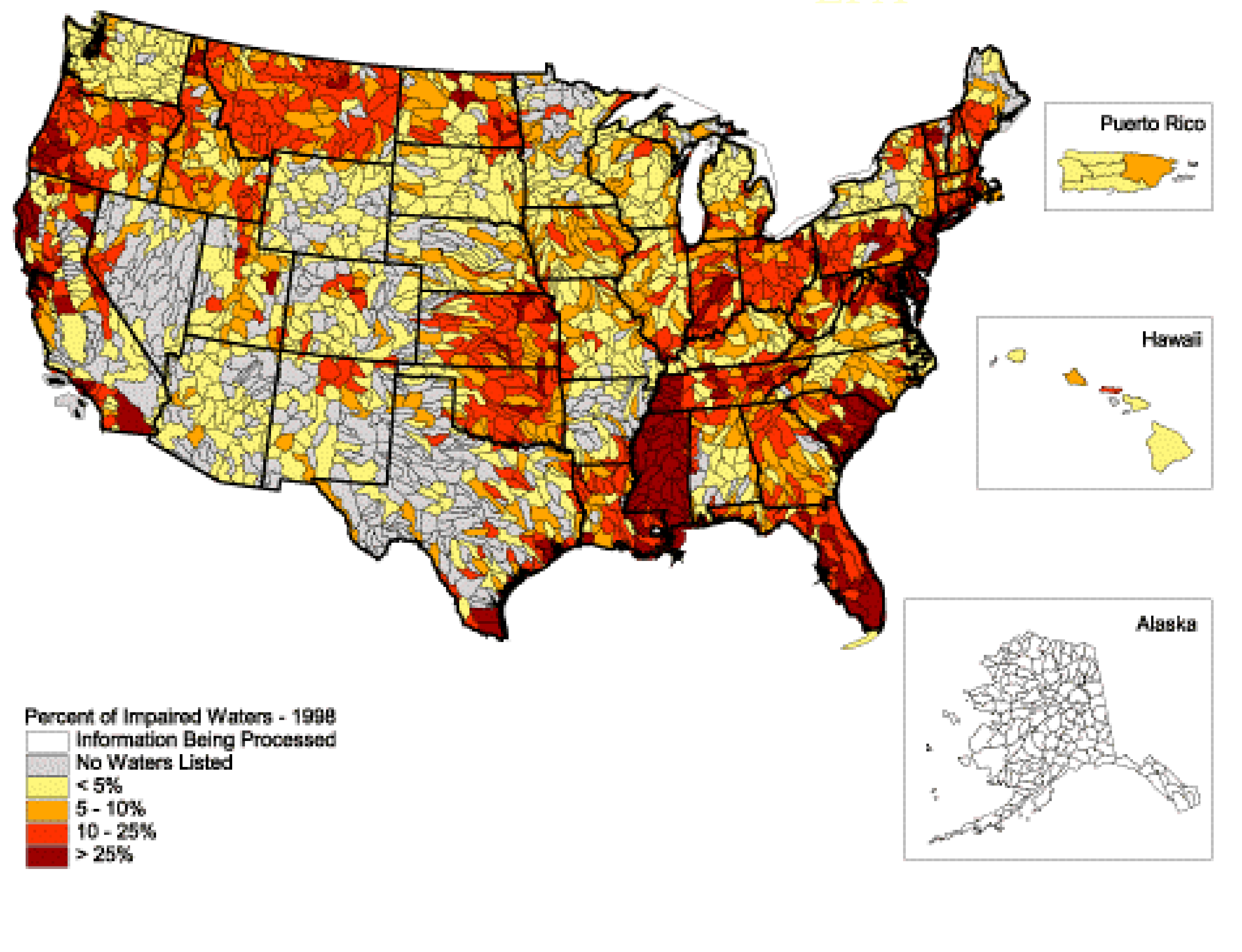
In 1987, the CWA was reauthorized and again focused on toxic substances, authorized citizen suit provisions, and funded sewage treatment plants (POTW's) under the Construction Grants Program.

Assessed Rivers, Lakes, and Estuaries Meeting All Designated Uses

1994/1996 Using Latest State Information Reported - EPA

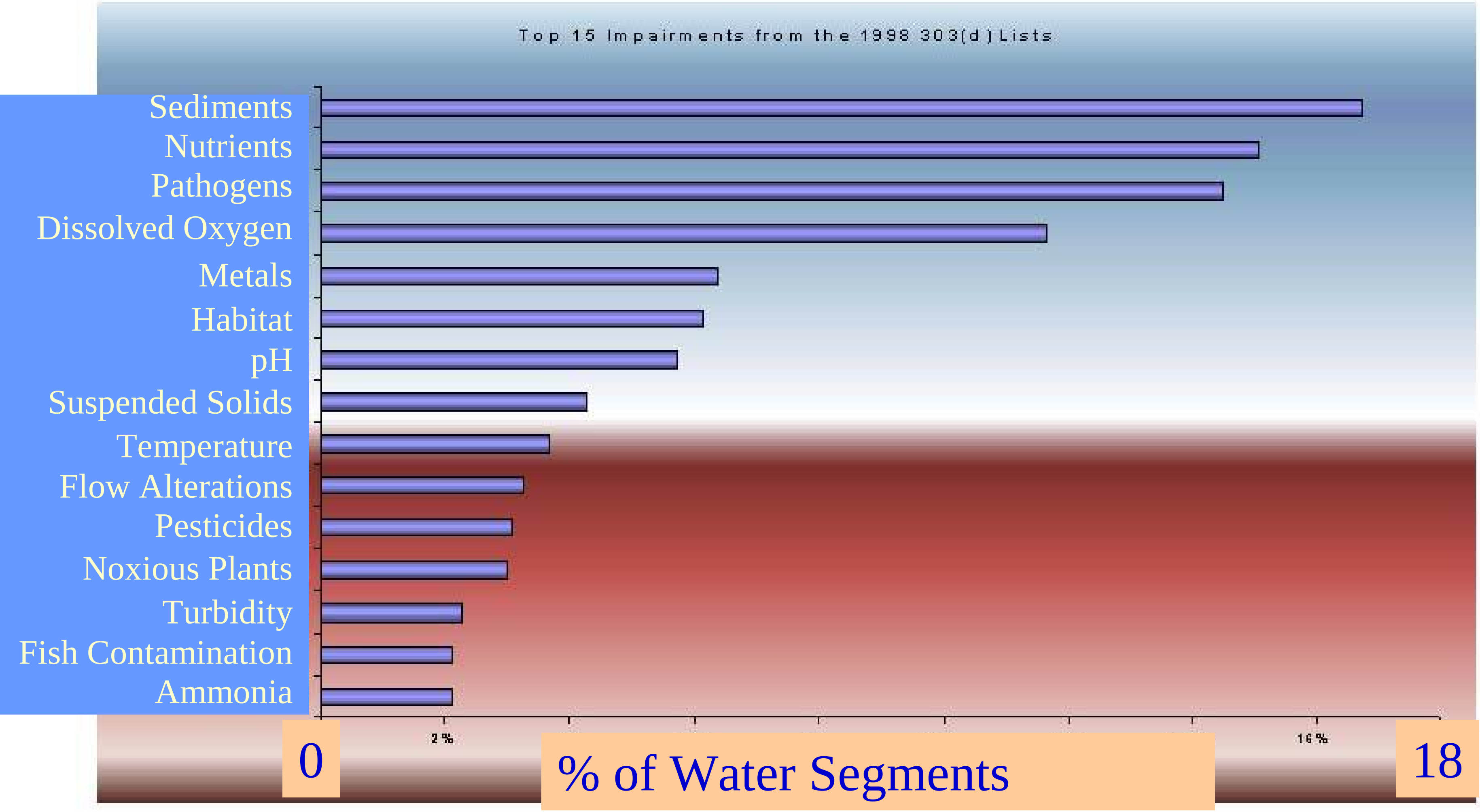


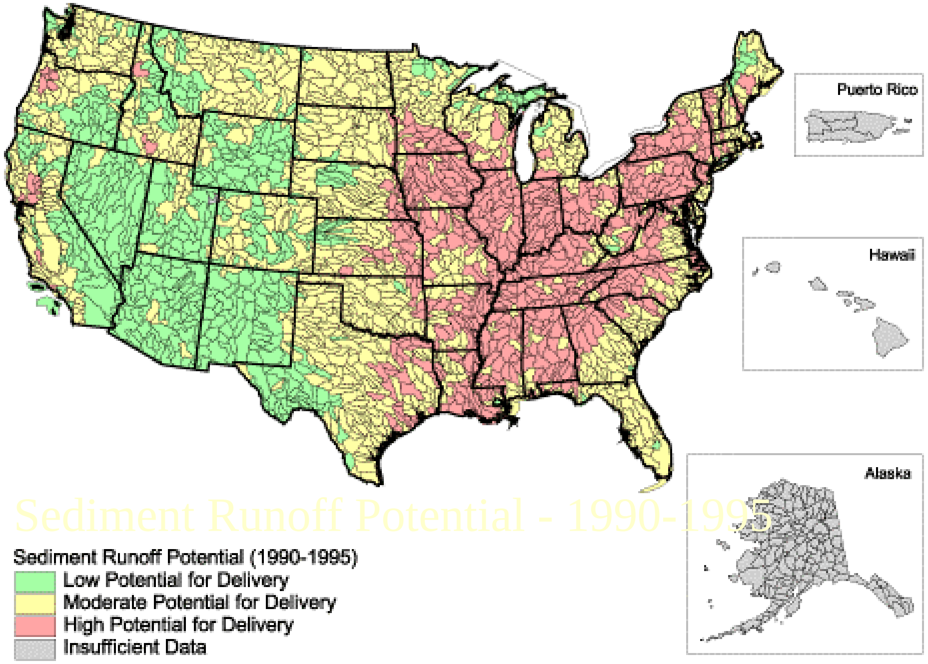
Percent of Impaired Waters - 1998
-EPA

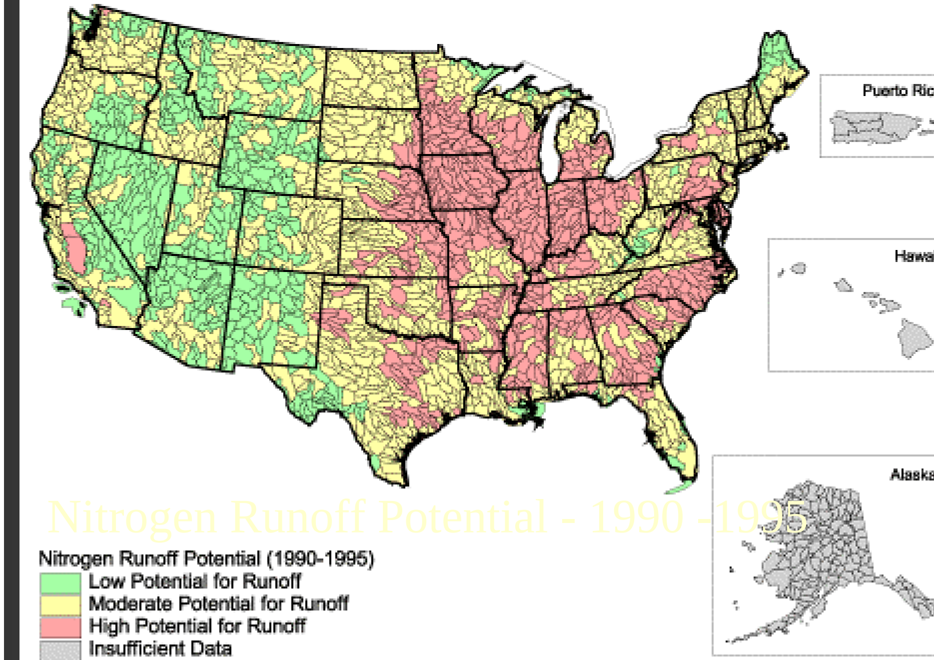


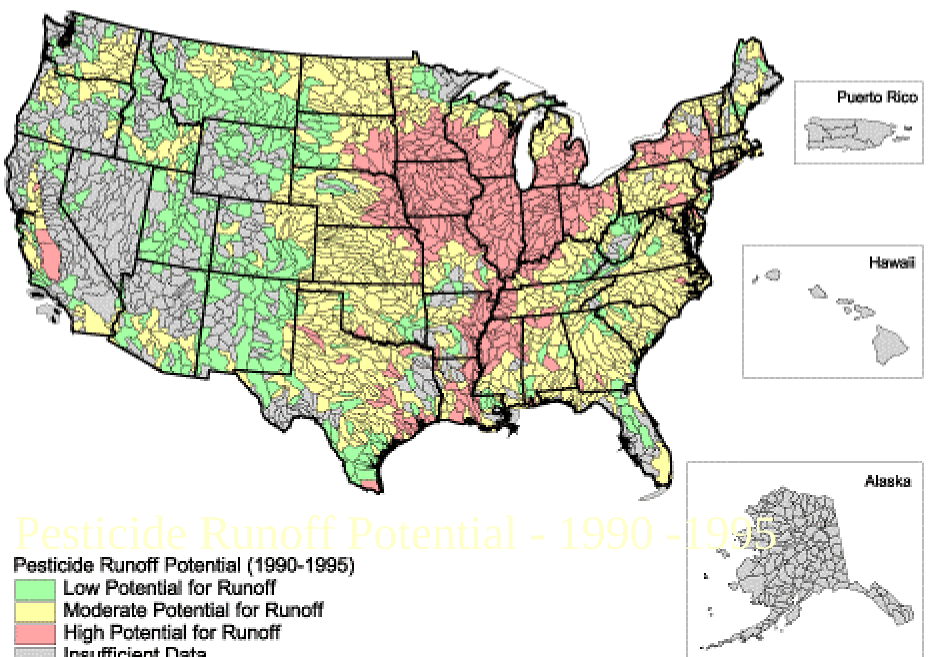
Top 15 Impairments

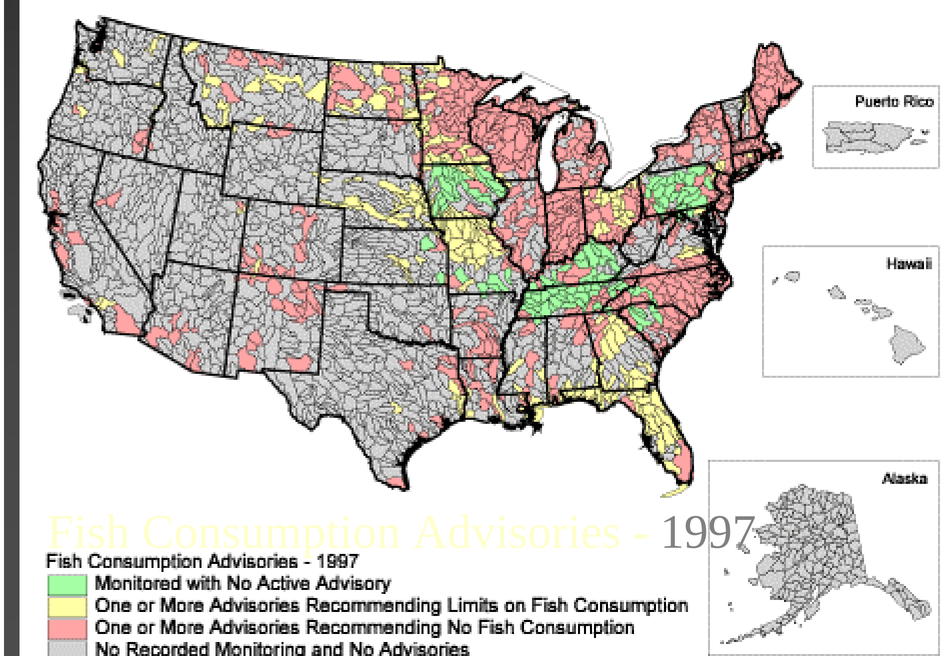
-EPA




Puerto Rico
Hawaii
Alaska
Sediment Runoff Potential - 1990-1995
Sediment Runoff Potential (1990-1995)
Low Potential for Delivery
Moderate Potential for Delivery
High Potential for Delivery
Insufficient Data

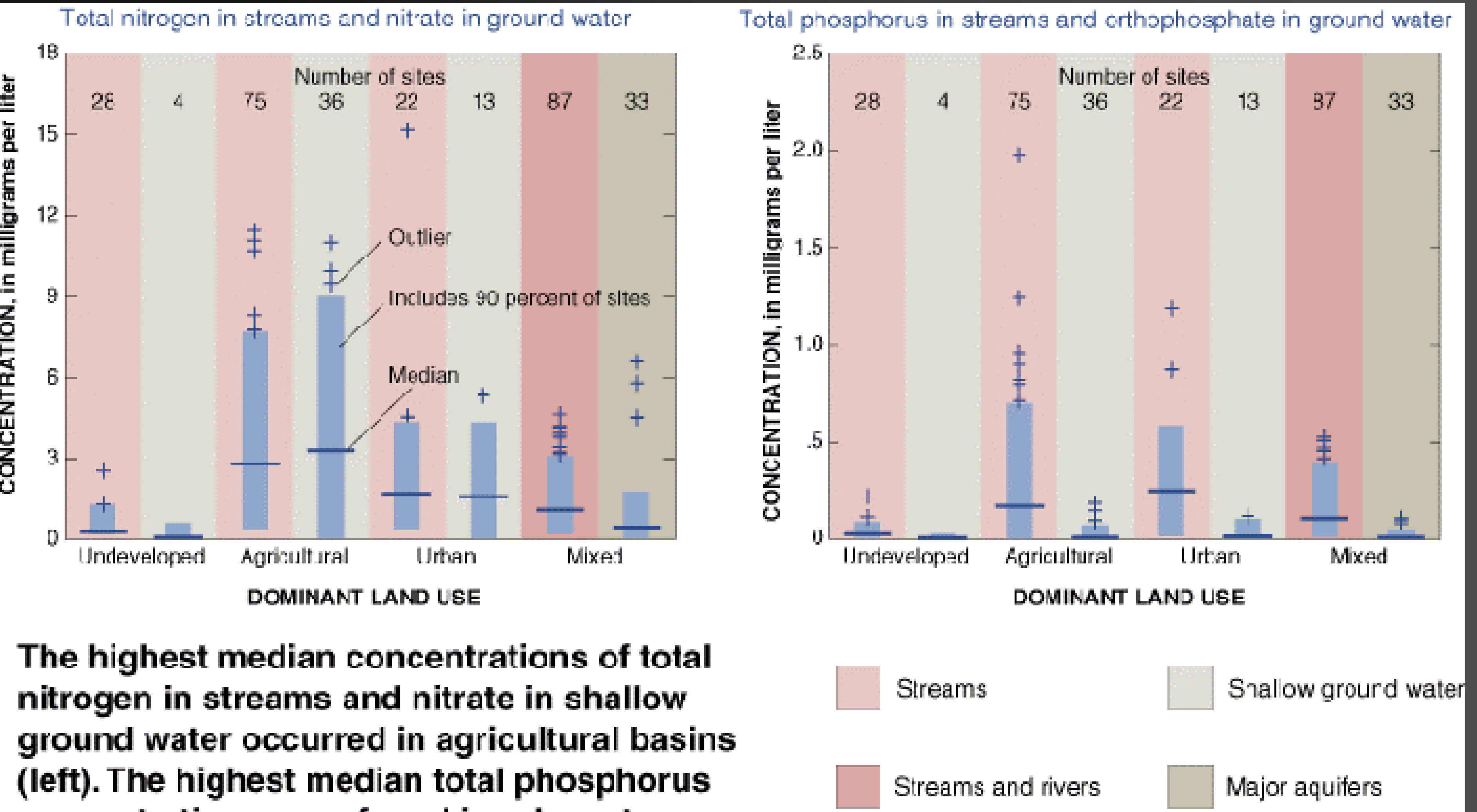

Puerto Rico
Hawaii
Alaska
Nitrogen Runoff Potential - 1990 -1995
Nitrogen Runoff Potential (1990-1995)
Low Potential for Runoff
Moderate Potential for Runoff
High Potential for Runoff
Insufficient Data


Puerto Rico
Hawaii
Alaska
Pesticide Runoff Potential - 1990 -1995
Pesticide Runoff Potential (1990-1995)
Low Potential for Runoff
Moderate Potential for Runoff
High Potential for Runoff
Insufficient Data


Puerto Rico
Hawaii
Alaska
Fish Consumption Advisories - 1997
Fish Consumption Advisories - 1997
Monitored with No Active Advisory
One or More Advisories Recommending Limits on Fish Consumption
One or More Advisories Recommending No Fish Consumption
No Recorded Monitoring and No Advisories

USGS

N and P occurrence by land use

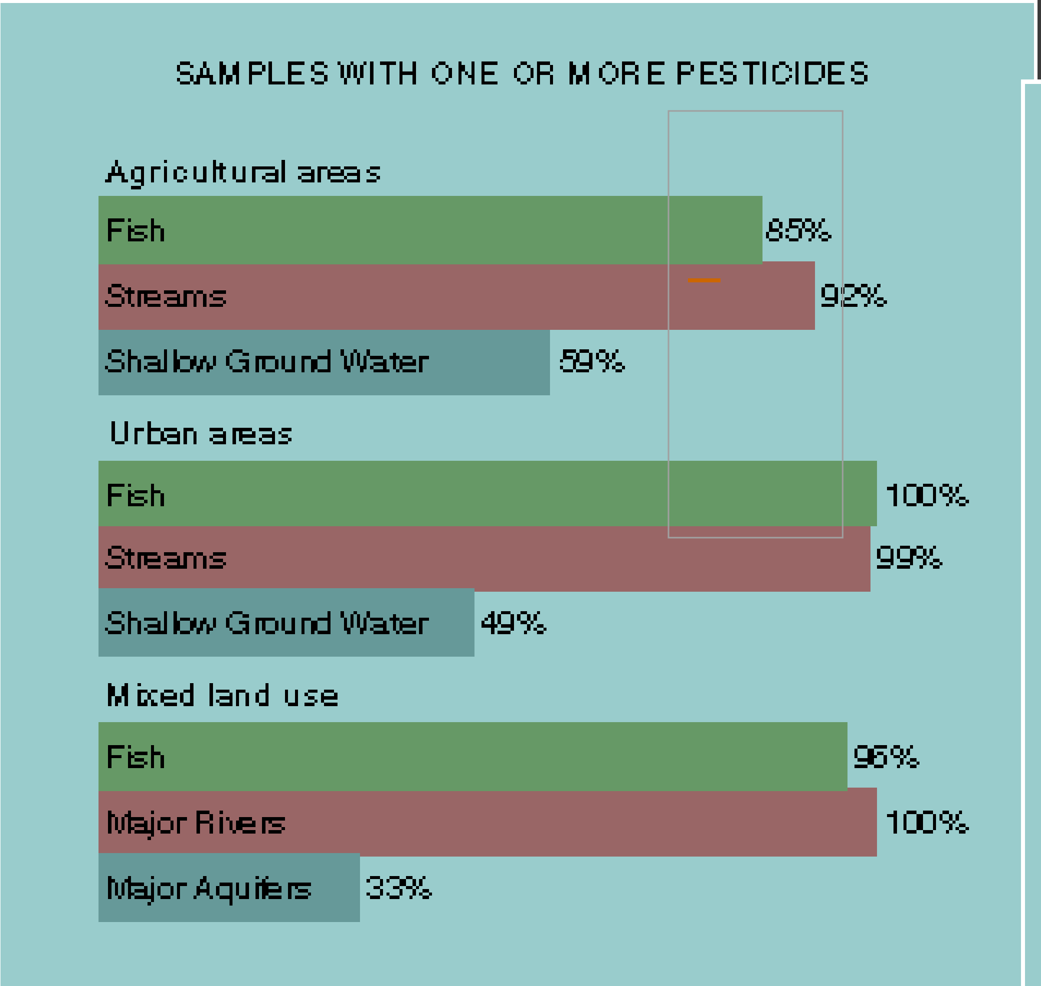


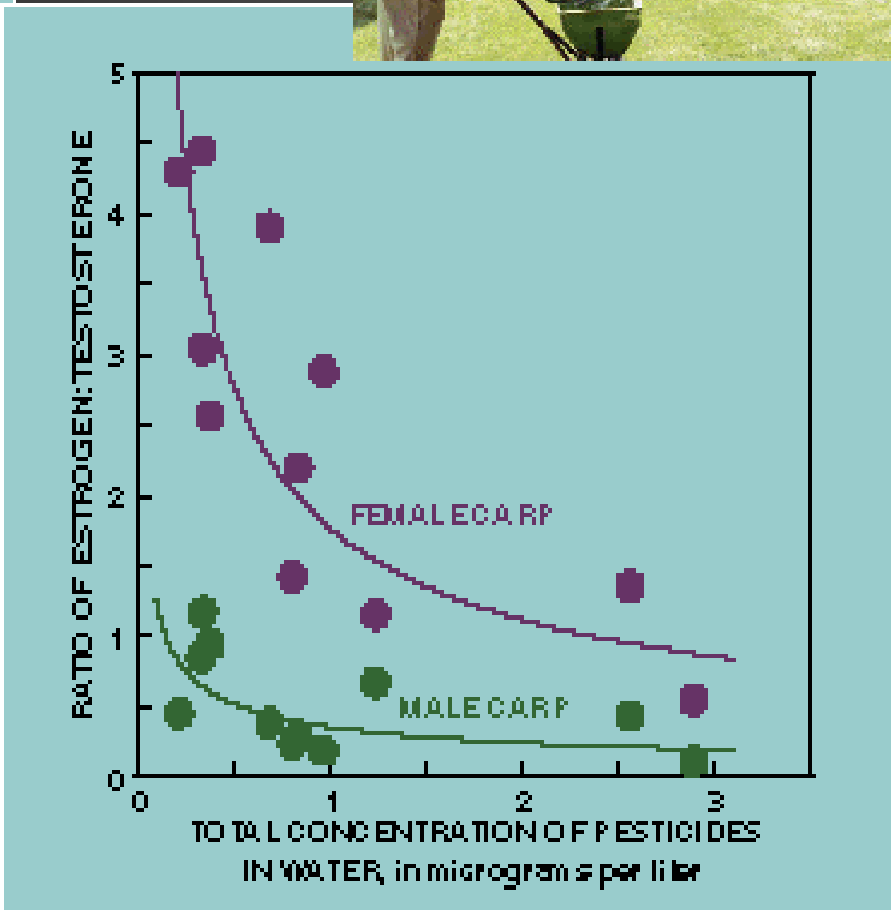
The highest median concentrations of total nitrogen in streams and nitrate in shallow ground water occurred in agricultural basins (left). The highest median total phosphorus concentrations were found in urban streams, but orthophosphate concentrations in ground water were low everywhere (right).

The Otter Tail River, Minnesota which supports a healthy growth of wild rice, and Fir Creek, Oregon which contributes to Portland's drinking-water supply, are examples of streams with low nutrient concentrations

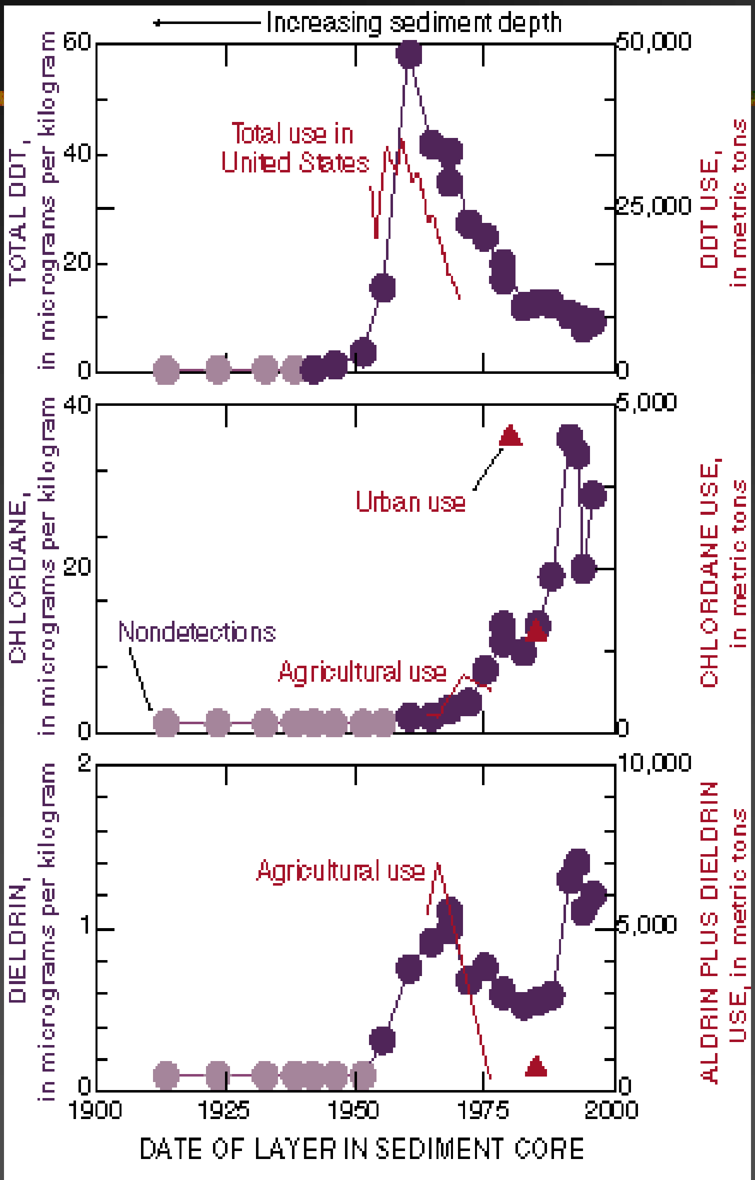
Effluent can make up a substantial part of the streamflow in some areas. For example, wastewater treatment plants annually contribute about 69 percent (and at times 100 percent) of the flow in the South Platte River downstream from Denver, Colorado. About 1,200 tons of phosphorus enter the South Platte River Basin every year from wastewater treatment plants.

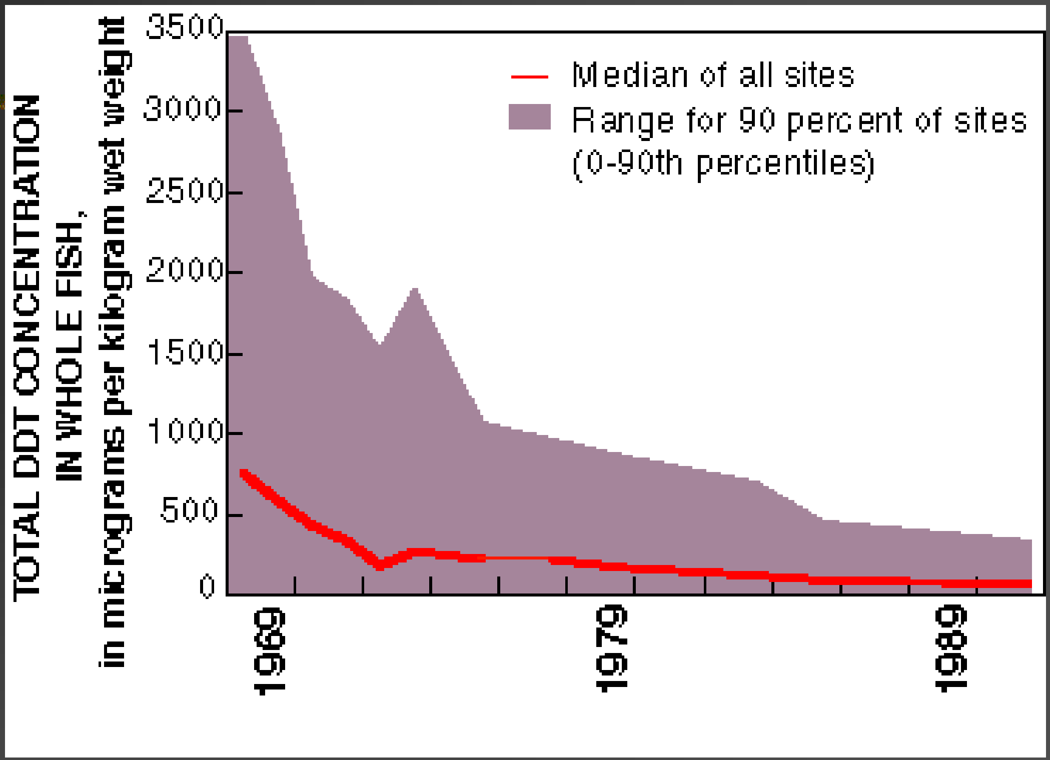
Pesticides


SAMPLES WITH ONE OR MORE PESTICIDES
Agricultural areas
Fish
85%
Streams
92%
Shallow Ground Water
59%
Urban areas
Fish
100%
Streams
99%
Shallow Ground Water
49%
Mixed land use
Fish
96%
Major Rivers
100%
Major Aquifers
33%

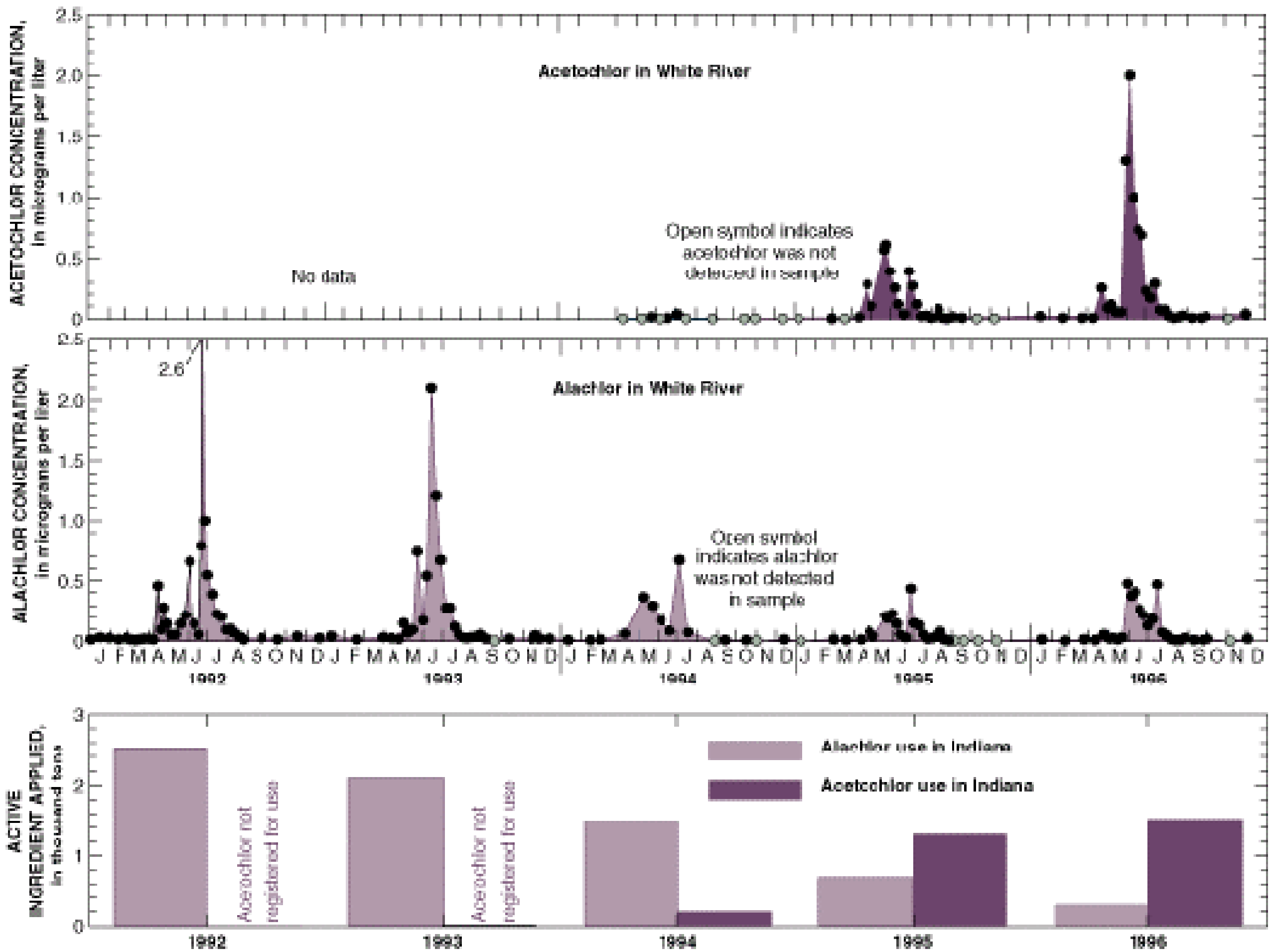

RATIO OF ESTROGEN:TESTOSTERONE
0
1
2
3
4
5
FEMALE CARP
MALE CARP
0
1
2
3
TOTAL CONCENTRATION OF PESTICIDES
IN WATER, in micrograms per liter

ORGANOCHLORINE PESTICIDE TRENDS IN SEDIMENT CORES FROM WHITE ROCK LAKE IN DALLAS, TEXAS, 1996



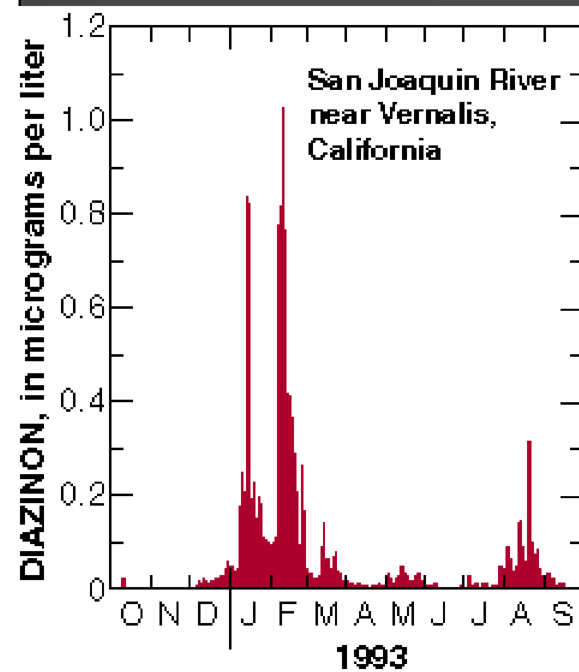


HIGH DIAZINON CONCENTRATIONS IN THE SAN JOAQUIN RIVER WERE COMMON FOLLOWING WINTER APPLICATION



TRENDS IN HERBICIDE USE WITH TIME ARE REFLECTED IN STREAM QUALITY

Alachlor concentrations in streams in the White River steadily declined from 1992 through 1996 and corresponded with a decline in alachlor use in the basin. Application of acetochlor, a corn herbicide registered for use in 1994, has partially replaced the use of alachlor in the basin. Acetochlor was detected at only trace concentrations during the 1994 growing season. By 1996, acetochlor was commonly detected in the White River, where a peak concentration of about 2 µg/L was measured.



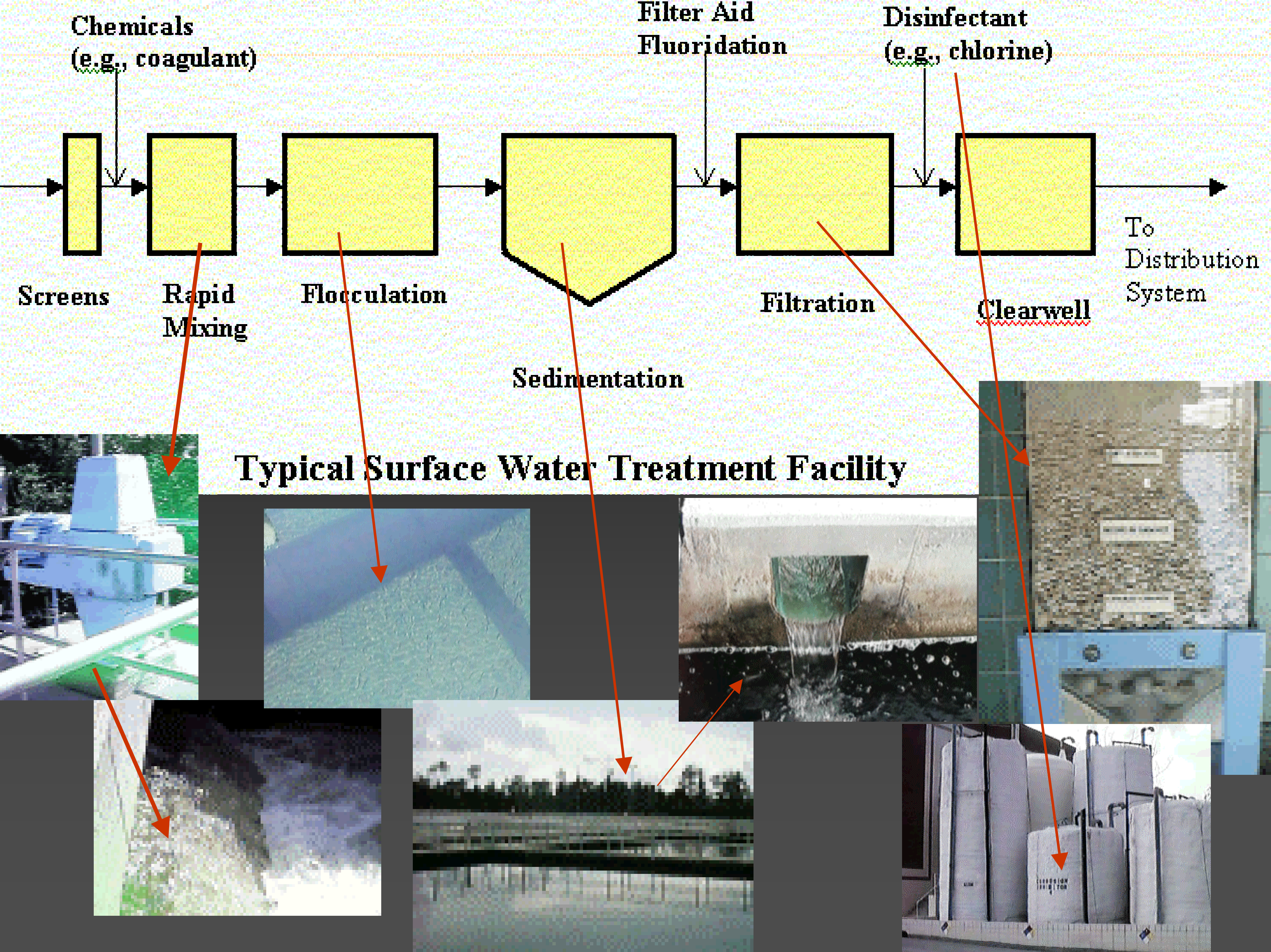
National Primary Drinking Water Regulations

Microorganisms	MCL/TT (mg/L)	Potential Health Effects	Sources in Drinking Water
Cryptosporidium	99% removal	Gastrointestinal illness	Human and animal fecal waste
Giardia lamblia	99.9% removal	Gastrointestinal illness	Human and animal fecal waste
Heterotrophic plate count		Total bacteria count.	Total bacteria count.
Legionella		Legionnaire's Disease	Natural; multiplies in heating systems
Total Coliforms (including fecal coliform and *E. Coli*)	5.0%	indicator that other potentially harmful bacteria may be present[5]	fecal coliforms and E. coli come from human and animal fecal waste.
Turbidity	5NTU	High turbidity indicates viruses, parasites & bacteria that can cause nausea, cramps, diarrhea, and associated headaches.	Soil runoff
Viruses (enteric)	99.99% removal	Gastrointestinal illness	Human and animal fecal waste

Disinfectants & Disinfection Byproducts	MCLG (mg/L)	Potential Health Effects	Sources in Drinking Water
Bromate	zero	Increased risk of cancer	Byproduct of disinfection
Chloramines (as Cl_2)	4	Eye/nose irritation; stomach discomfort, anemia	Water additive used to control microbes
Chlorine (as Cl_2)	4	Eye/nose irritation; stomach discomfort	Water additive used to control microbes
Chlorine dioxide (as ClO_2)	0.8	Anemia; infants & young children: nervous system effects	Water additive used to control microbes
Chlorite	0.8	Anemia; infants & young children: nervous system effects	Byproduct of disinfection
Haloacetic acids	0.06	Increased risk of cancer	Byproduct of disinfection
Total Trihalomethanes (TTHMs)	0.08	Liver, kidney or central nervous system problems; increased risk of cancer	Byproduct of disinfection

Inorganic Chemicals	MCLG (mg/L)[2]	Potential Health Effects from Ingestion of Water	Sources of Contaminant in Drinking Water
Antimony	0.006	blood cholesterol; decrease in blood glucose	petroleum refineries; fire retardants; ceramics; electronics; solder
Arsenic	0.05	Skin damage; circulatory system problems; risk of cancer	Erosion; runoff from glass & electronics production wastes
Asbestos (fiber >10 micrometers)	7 million per liter	risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion
Barium	2	Increase in blood pressure	drilling wastes; metal refineries; erosion
Beryllium	0.004	Intestinal lesions	metal refineries and coal-burning factories; electrical, aerospace, and defense industries
Cadmium	0.005	Kidney damage	Corrosion of galvanized pipes; erosion metal refineries; runoff from waste batteries and paints
Chromium (total)	0.1	allergic dermatitis	steel and pulp mills; erosion
Copper	1.3	Short term exposure: Gastrointestinal distress. Long term exposure: Liver or kidney damage.	Corrosion of household plumbing systems; erosion of natural deposits
Cyanide (as free cyanide)	0.2	Nerve damage or thyroid problems	steel/metal factories; plastic and fertilizer

Fluoride	4.0	Bone disease; Children may get mottled teeth.	Water additive;; fertilizer and aluminum factories
Lead	zero	Infants and children: Delayed physical or mental development. Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits
Mercury (inorganic)	0.002	Kidney damage	Erosion; refineries and factories; landfills & cropland runoff
Nitrate (measured as Nitrogen)	10	"Blue baby syndrome" in infants under six months -	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion
Nitrite (measured as Nitrogen)	1	"Blue baby syndrome" in infants under six months.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion
Selenium	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	petroleum refineries; erosion ; mines
Thallium	0.0005	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites; electronics, glass, and pharmaceutical companies



Chemicals
(e.g., coagulant)
Filter Aid
Fluoridation
Disinfectant
(e.g., chlorine)
Screens
Rapid
Mixing
Flocculation
Sedimentation
Filtration
Clearwell
To
Distribution
System
Typical Surface Water Treatment Facility

Summary

- The Clean Water Act has succeeded in regulating point sources of pollution
- Non-point source pollution is a major challenge since the sources are diffuse and varied (include atmospheric deposition) and chemicals of concern often degrade into a series of byproducts
- Land use and climate play a large role as sources and also in determining impacts
- Drinking water treatment technology is largely mature. However, improvements in reverse osmosis and desalination are opening a new chapter