

Sources of water pollution

Sources of water pollution are broadly grouped into point sources and nonpoint sources.

1- **Point sources** are defined as localized discharges of contaminants and include industrial and municipal wastewater outfalls, septic tank discharges, and hazardous-waste spills.

- **Types of point sources:**

- i. Domestic Wastewater Discharges.✓
- ii. Combined-Sewer Overflows.
- iii. Storm water Discharges.
- iv. Industrial Discharges. ✓
- v. Animal Feeding Operations.
- vi. Spills.

**i- Domestic Wastewater Discharges****GENERAL CHARACTERISTICS OF DOMESTIC RETURN WATERS :**

Three terms are used to describe sewage generally. All are of significance in sewage treatment, they are:

1. Condition. (الحالة)
2. Concentration. (التركيز)
3. Composition. (المكونات أو التركيبة)

1. **Condition:** refer to the age of sewage. Three categories of condition are usually identified and defined:

- a. **Fresh Sewage** (الفضلات الحديثة): in which the dissolved oxygen concentration is not less than that of the municipal water supply which went into it. In terms of the concept of biodegradation,

the oxygen-demanding processes of decomposition have not yet become evident.

- b. **Stale Sewage** (الفضلات القديمة): in which the dissolved oxygen content has been depleted near zero by biological degradation.
 - c. **Septic Sewage** (الفضلات المتعفنة): in which biodegradation has set in.
2. **Concentration** : refers to the strength of a sewage, usually measured by its 5-day, 20°C BOD, although it may be measured in terms of relative amounts of (biodegradable) solids. Commonly used categories are:
- a. **Weak Sewage** in which the BOD is below about 180 mg/liter.
 - b. **Medium Sewage** in which the BOD is in the range of from 200 to 250 mg/liter.
 - c. **Strong Sewage** which has a BOD above 280 to 300 mg/liter.
3. **Composition**: of sewage refers to its content of various waste-contributed quality factors, oxygen-demanding potential, products of biodegradation, etc.

TABLE 3.2 Typical Domestic Wastewater Compositions

Pollutant	Concentration, mg/l		
	Weak	Average	Strong
Total solids	350	800	1200
Total suspended solids	100	240	350
Total dissolved solids	250	500	850
Settleable solids (ml/l)	5	10	20
Volatile suspended solids	80	180	280
Volatile dissolved solids	100	260	300
Ammonia nitrogen	10	20	35
Total nitrogen	20	35	80
Phosphorus	5	10	15
Alkalinity as CaCO ₃	50	100	250
Oil & grease	50	100	150
5-Day biochemical oxygen demand	120	225	400
Chemical oxygen demand	175	325	575
Total organic carbon	65	125	220

Effect of domestic wastewater discharge:

Most municipal wastewater treatment plants discharge their effluent into rivers, lakes, or oceans. For river discharges of municipal wastewater, the effect of the effluent on the dissolved oxygen and nutrient levels in the river are usually of most concern. Decreased oxygen levels in rivers can cause harm to the aquatic life, and increased nutrient levels stimulate the growth of algae, which consume oxygen. Domestic wastewater discharged from septic tanks contains large

numbers of pathogenic microorganisms, with viruses of particular concern because of the ability of viruses to move considerable distances in ground water. Approximately 50 million residents of the United States, 29% of the population, dispose of their sewage by individual on-site (septic) systems. Septic tanks represent the highest total volume of wastewater discharged directly to ground water and are the most common source of ground-water contamination.

Domestic wastewater contains vast numbers of bacteria – up to 20 million organisms per milliliter – originating in the wastes discharged from the human body and on other material introduced into the sewer. Some of the bacteria in human wastes are pathogens, such as (typhoid, paratyphoid, cholera, ... etc.).

TABLE 2.1 Municipal Sources of Wastewater

Classification	Remarks	Average flow/ person/day	BOD ₅ person per day
Municipality	Residential	100 gallons	0.20 lb.
Subdivision	Residential	100 gallons	0.20 lb.
Colleges		100 gallons	0.20 lb.
Hospitals	Per bed	200 gallons	0.40 lb.
Nursing homes		100 gallons	0.20 lb.
Schools, high	With cafeteria & showers	25 gallons	0.06 lb.*
Schools, elementary	With cafeteria & showers	20 gallons	0.06 lb.*
Factory or office bldg.	With showers/shift	35 gallons	0.06 lb.
Factory or office bldg.	Without showers/shift	25 gallons	0.06 lb.
Motels	Per unit	100 gallons	0.12 lb.
Restaurants			
Ordinary rest. (not 24 hours)	Per seat	35 gallons	0.20 lb.
24 hour rest.	Per seat	50 gallons	0.28 lb.
24 hour rest. on interstate	Per seat	70 gallons	0.40 lb.
Tavern	Per seat	20 gallons	0.12 lb.
Curb service	Per car space	50 gallons	0.28 lb.
Trailer park	2–1/2 Persons per trailer	50 gallons	0.20 lb.
Country clubs	Per member	50 gallons	0.20 lb.
Shopping center	Without food service or laundry	0.1 gal/sq. ft. of floor space based on flow	200 ppm

*When garbage grinders are used, the BOD₅ loading shall be increased to 0.07 lb. BOD₅ / person.

iv. Industrial Discharges

Introduction:

There are wide varieties of industrial wastewaters, and elevated levels of nutrients, heavy metals, heat, and toxic organic chemicals are common in industrial wastewaters. Some industries provide pretreatment prior to discharging their wastewaters either directly into surface waters or into municipal sewer systems for further treatment in combination with domestic wastewater. In many countries, industries are permitted to discharge their wastewater without adequate pretreatment, and the resulting human and environmental impacts are usually noticeable.

Comparison of industrial and domestic wastewater:

- 1- Total organic load of industry's only about one-half that of domestic use.
- 2- Many industries discharge process waters carrying compounds that are never found in natural waters, such as metal ions (mostly toxic), exotic organic and inorganic chemicals, and many refractory compounds are among the most significant.
- 3- Another significant difference between industrial and domestic use of water is the percentage of water consumed (Extreme variability in water usage from one industry to another).

***Industry's waste return to the pool may be estimated as:**

- 1- One-third of withdrawal returned with the salt content approximately doubled.
- 2- One-third of withdrawal contaminated with a spectrum of organic and inorganic solids originated in process waters.
- 3- One-third of withdrawal consumed by incorporation in product or loss to the atmosphere.

Nature of industrial wastes:

The organic wastes from industry are particularly significant in comparison with domestic wastes because of the exceptionally (على نحو) high BOD of many such discharges.

Its generally estimated that the average BOD of organic industrial discharges, when process, washdown, and other return streams from the industrial plant are combined, is of the order (مقدار) 3,500 mg/l – more than ten times that of a strong domestic sewage. See table (5-5;5-6;5-7)

Effect of industrial wastes :

Table (5-5;5-6;5-8) show the wide variety of quality – degrading factors and their effects . Some of these factors are in themselves toxic to aquatic life and higher animals. Others can create aesthetically objectionable conditions. Still others might interfere with various uses by reason of minerals or biochemically unstable organic matter.

- 2- Non-point sources of pollution** include contaminant sources that are distributed over large areas or are a composite of many point sources, including runoff from agricultural operations, the atmosphere, and urban runoff. Surface runoff that collects in storm sewers and discharges via a pipe is still considered nonpoint-source pollution since it originates as diffuse runoff from the land surface.

iv. Agriculture Operations

Introduction :

It has been said that every civilization that has depended upon irrigated agriculture for its existence (الحياة) has failed.

Types of impacts:

As indicated in Table 1 the impacts of agriculture on water quality are diverse (مختلف أو متنوع).

Agricultural activity	Impacts	
	Surface water	Groundwater
Tillage (أرض محروثة)	Sediment/turbidity: sediments carry phosphorus and pesticides; siltation يمتلئ بالغرين of river beds and loss of habitat بيئة الأحياء etc.	
Fertilizing التسميد	Runoff جرف of nutrients, especially phosphorus, leading to eutrophication causing taste and odour in public مدني water supply, excess algae growth leading to deoxygenation of water and fish kills.	Leaching of nitrate to groundwater; excessive levels are a threat تهديد to public health.
Pesticides	Runoff of pesticides leads to contamination of surface water; dysfunction وظيفي of ecological system in surface waters by loss of top predators مفترس due to prevent growth and reproductive تولد failure; public health impacts from eating contaminated fish.	Some pesticides may leach into groundwater causing human health problems from contaminated تلوث wells.
Feedlots /animal corrals	Contamination of surface water with many pathogens (bacteria, viruses, etc.) leading to chronic مزمنة public health problems. Also contamination by metals contained in urine and faeces.	Potential leaching of nitrogen, metals, etc. to groundwater.
Irrigation	Runoff of salts leading to salinization of surface waters; runoff of fertilizers and pesticides to surface waters with ecological damage.	Enrichment of groundwater with salts, nutrients (especially nitrate).

Public health impacts:

Polluted water is a major cause of human disease and death. According to the World Health Organization (WHO), as many as 4 million children die every year as a result of diarrhoea caused by water-borne infection. The bacteria most commonly found in polluted water are coliforms excreted by humans. Surface runoff and consequently non-point source pollution contributes significantly to high level of pathogens in surface water bodies.

water quality impacts :

- 1- Salt content in rivers exceeds standard by factors of 2-3.
- 2- High levels of turbidity in water resources.
- 3- High levels of pesticides in surface waters.
- 4- Excessive pesticide in food products.
- 5- Loss of soil fertility (خصوبة).
- 6- Decline and extinctions (انقراض) of animal, fish and vegetation الحياة النباتية.
- 7- Destruction تدمير of major ecosystems الرئيسية.
- 8- Destruction تخريب of commercial fishery تجارة صيد الأسماك.

Mismanagement of Agriculture is the root cause السبب الأساسي

- 1- Increase in irrigation area and water withdrawals.
- 2- Rising (ارتفاع) groundwater.
- 3- Extensive monoculture (الاكتفاء بزراعة محصول واحد) and excessive use of persistent (دائمي) pesticides.
- 4- Increased salt runoff leading to salinization of the rivers.
- 5- Increased frequency of dust storms and salt deposition ترسب.
- 6- return flows to main rivers will contain highly mineralized, pesticide.
- 7- Excessive use of fertilizers.