WATER POLLUTION

Water, air, land ….

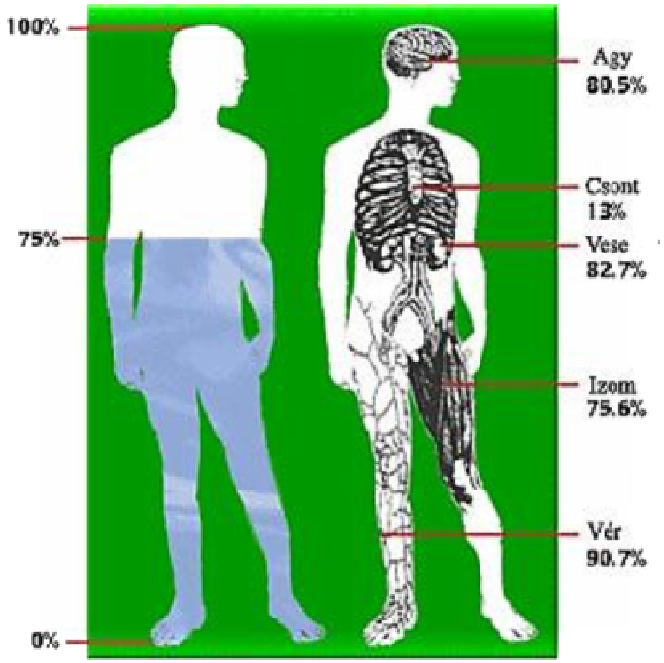
The solution against pollution is dilution.

Water makes life on Earth.

The body of an adult human consists of 75% water:

Water is:

- 78% of the brain;
- 86% of the blood;
- 77% of the heart;
- 84% of the liver;
- 70% of the muscles



Physiological significance

- Recommended daily water consumption: 1,5-2 litres. A man can not stand more than 2-3 days without water.

Clean water is essential:

- in industry;
- in agriculture;
- in household;
- in other important areas of life;

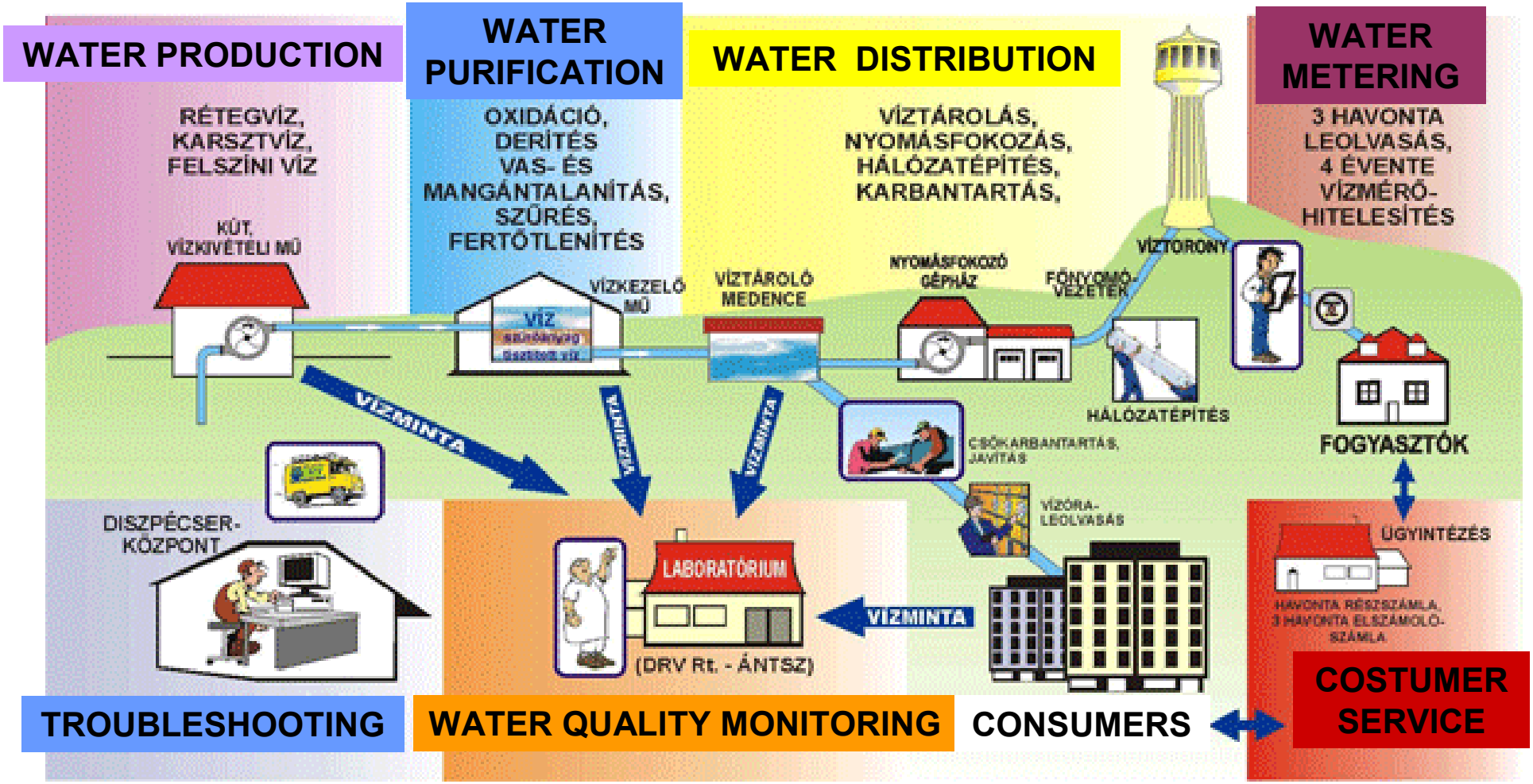
The role of clean water in our everyday life

Why is clean water important to our body?

- nutrient transport;
- temperature control;
- flexibilty;
- detoxification;
- digetsion;
- prevents dehydration;

water distribution
water metering

The way of water

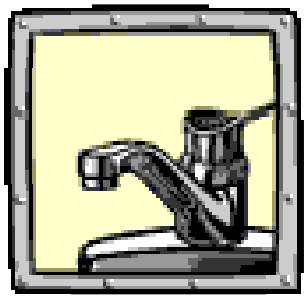


Running water → **Scouring** → New pollution

New pollution → ***Chlorine***

Chlorine → Bad taste, odour water

Bad taste, odour water → Buying bottled water



- irritating eye and skin;
- contacting with acids toxic gas are liberated;
- do not mix it with other household cleaners;

Contaminants in the tap

- *Physical contaminants*:
  organic substances, suspended solids
- *Biological contaminants*: bacteria,
  spores, fungi…
- *Chemical contaminants*:
  chlorine, hormones, urine residues

Wastewater treatment

Types of wastewater:

- ***Rainwater:*** it is no wastewater – it is wastewater due to the environmental pollutants getting into it from the neighbourhood;
- ***Municipal wastewater:*** contaminated due to human activities;
- ***Settlement wastewater:*** see above + contaminantes of industrial activities;
- ***Industrial wastewaters:*** its rate difffers from industry to industry;

Pollutants

I. ***Organic pollutants***

- persistent substances
- microbial contaminants

I. ***Inorganic pollutants***

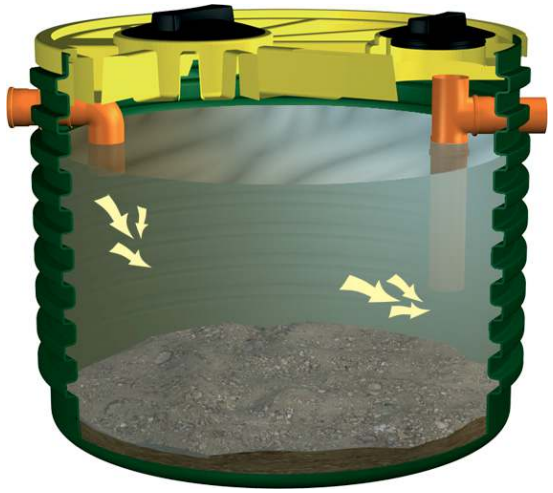
- nitrogen
- phosphorus
- cyanides
- toxic metals

Cleaning groundwater

- ***Its most common contaminants:***
  - aggressive CO_2;
  - dissolved iron – Fe II salt;
  - manganese;
- ***Possible solutions:***
  - de-acidification;
  - removal of iron;
  - removal of manganese;

Physical waste water treatment

- stone, gravel grip;
- grid;
- sand trap;
- grease trap;
- decanters;



Disinfection

Purpose: to destroy microorganisms, eliminate their infectivity;
It is done through *irreversible* influence of enzyme systems;

Irreversible!

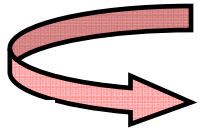
Destruction of a living organism;

Home water purification

- ***More and more pollutants:***
  - in bones;
  - in brain;
  - in kidney;
  - in liver;
- e.g. heavy metals ⟹ dioxins ⟹ cancer, diabetes;
- purchase of water purification equipment is recommended;
- Their proce is high, but insures more productive environment;

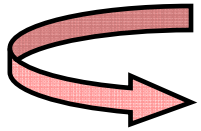
Hormones in drinking water

- Budapest: 20 tons of drug gets into the water per year;
- mainly in urine;
- they have impact on aquatic organisms;
- female sex hormones: reduced reproductive ability of frogs, as well as the proportion of male fish reduces;



Drinking water and cancer

- drinking water with changed structure helps patients;
- *e.g.:* water with reduced deuterium content;
- tumors develop only in an acidic environment;



- reversing the aging process;
- Neutralization of the deposited materials;
- pain relief, strengthening, immune system stimulant;
- intestinal detoxification;
  - external use;
  - emollient, treatment of acne;
  - eczema, insect bytes, diabetic ulcers, treatment of fungal;
  - food disinfection;

Alkaline water – aerated water

Key questions

- What are the main types and effects of water pollution?
- How to measure water quality?
- Point source vs non-point source
- What are the main sources of water pollution?

Organic compounds

- Compounds containing carbon atoms
  - natural examples: sugars, amino-acids and oils;
  - examples of human origin: pesticides, solvents, industrial chemicals and plastics;

Table 22.2 Some Synthetic Organic Compounds Found in Polluted Water

Compound	*Some Reported Health Effects*
Aldicarb (pesticide)	Attacks nervous system
Benzene (solvent)	Associated with blood disorders (bone marrow suppression); leukemia
Carbon tetrachloride (solvent)	Possibly causes cancer; liver damage; may also attack kidneys and vision
Chloroform (solvent)	Possibly causes cancer
Dioxins (TCDD) (chemical contaminants)	Some cause cancer; may harm reproductive, immune, and nervous systems
Ethylene dibromide (EDB) (fumigant)	Probably causes cancer; attacks liver and kidneys
Polychlorinated biphenyls (PCBs) (industrial chemicals)	Attack liver and kidneys; possibly cause cancer
Trichloroethylene (TCE) (solvent)	Probably causes cancer; induces liver cancer in mice
Vinyl chloride (plastics industry)	Causes cancer

Inorgnaic compounds

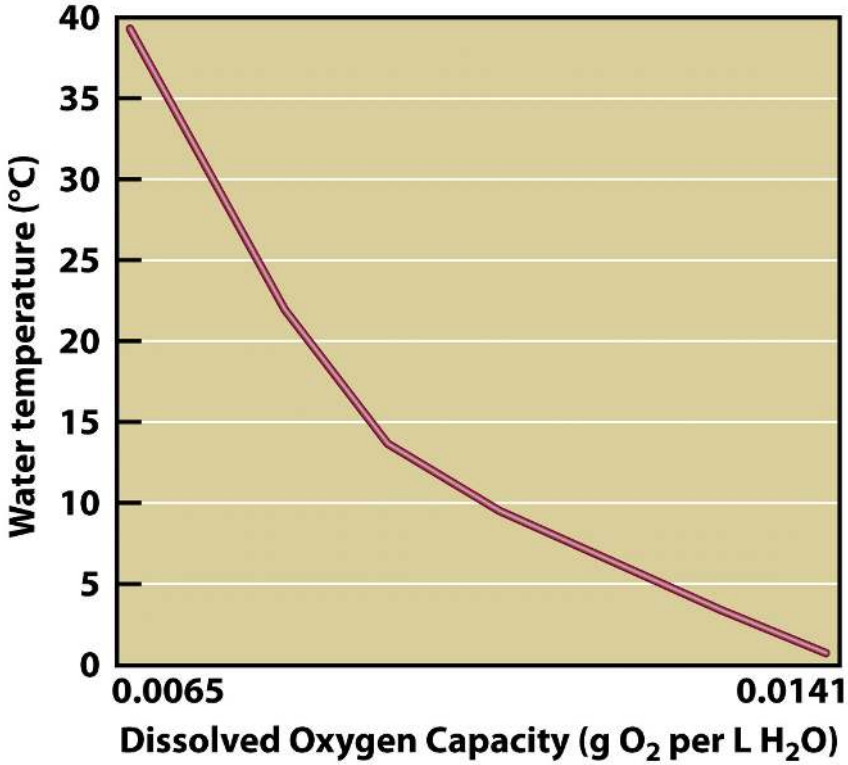
- Compounds containing other elements instead of coal;
  - examples: acids, salts and heavy;
- poorly degradable;
- lead;
  - in old paints, industrial pollutants and leaded fuels;
- mercury;
  - accumulates in muscles of top predators in the open ocean;

Radioactive materials

- comprise unstable isotope atoms, which radiate spontaneously;
- sources:
  - mining;
  - processing of radioactive material;
  - nuclear power plants;
  - natural resources;

Heat pollution

- It occours when hot water generated by industrial processes is emitted into watercourses;
- Involved organizations
  - The temperature influences the reproductive cycle, thhe intensity of digestion and respiration;
  - Hot water contains less dissolved oxygen (DO) than cold water;

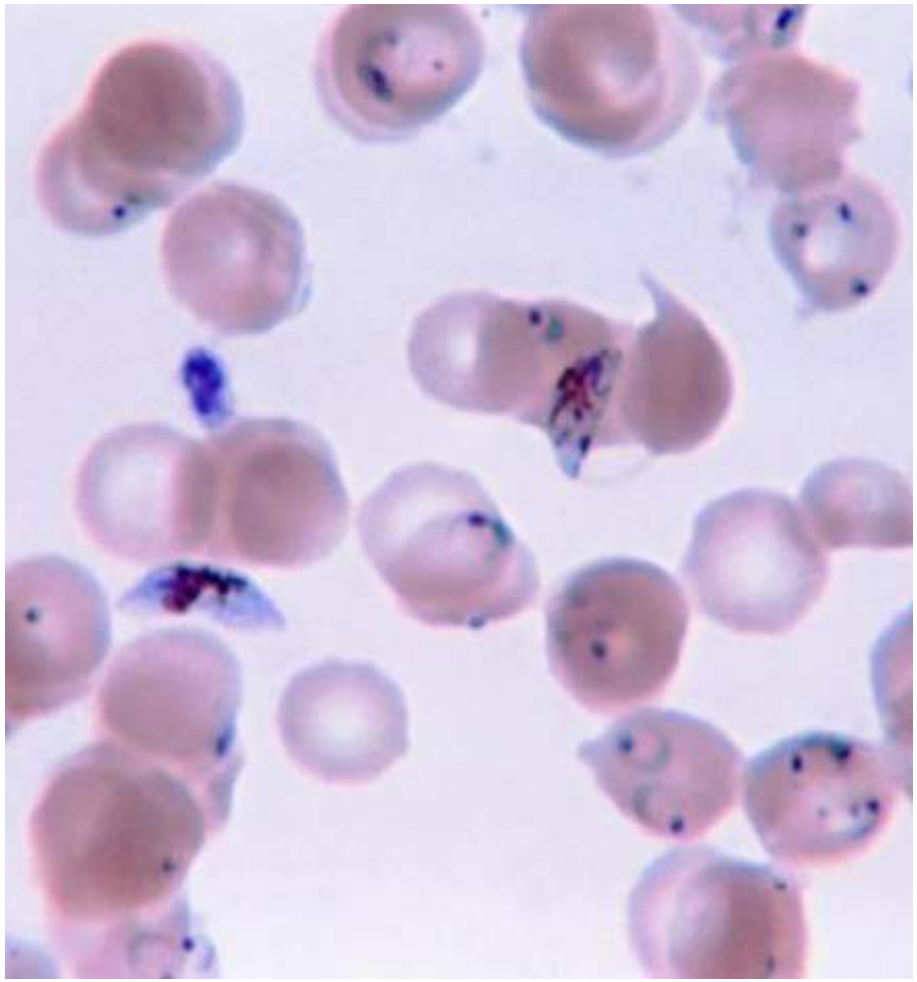


Water-associated diseases

- Primary causes of water-associated diseases:
  - indigestion, which can be fatal;
  - At the beginning of the 1990s widespread cholera epidemics occurred in South America that often resulted in death;
  - In North-America there may happen water-associated diseases;

- The biggest epidemics in US history
  - Cryptosporidium
  - Stomach parasitesthat cause symptoms similar to influenza;
  - Fecal Coliform – intestinal bacteria;
    - ;
    - It indicate sthat stool is in the water;
    - Human and animal intestines from natural organisms;

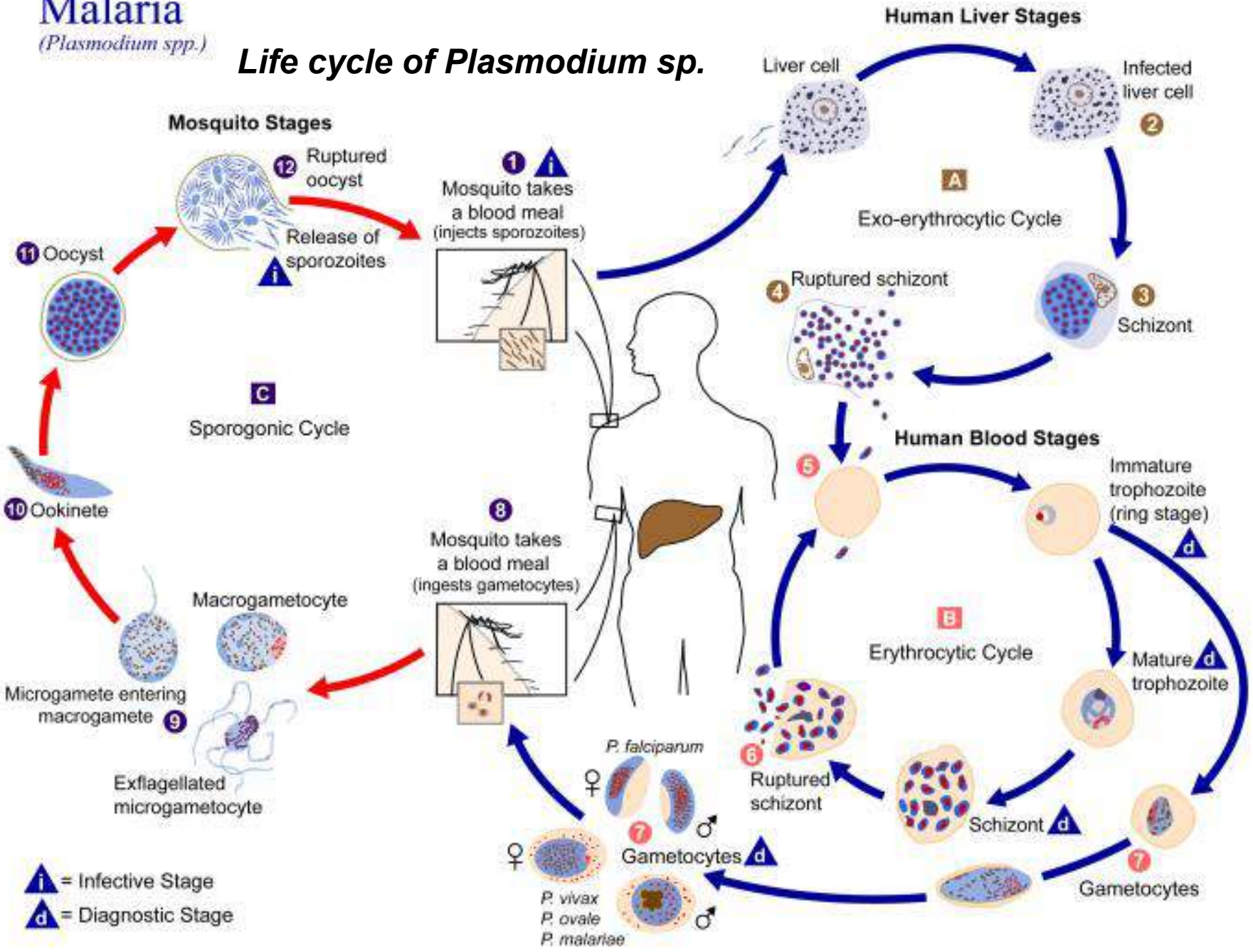
- **tea consumption;**
- **malaria;**



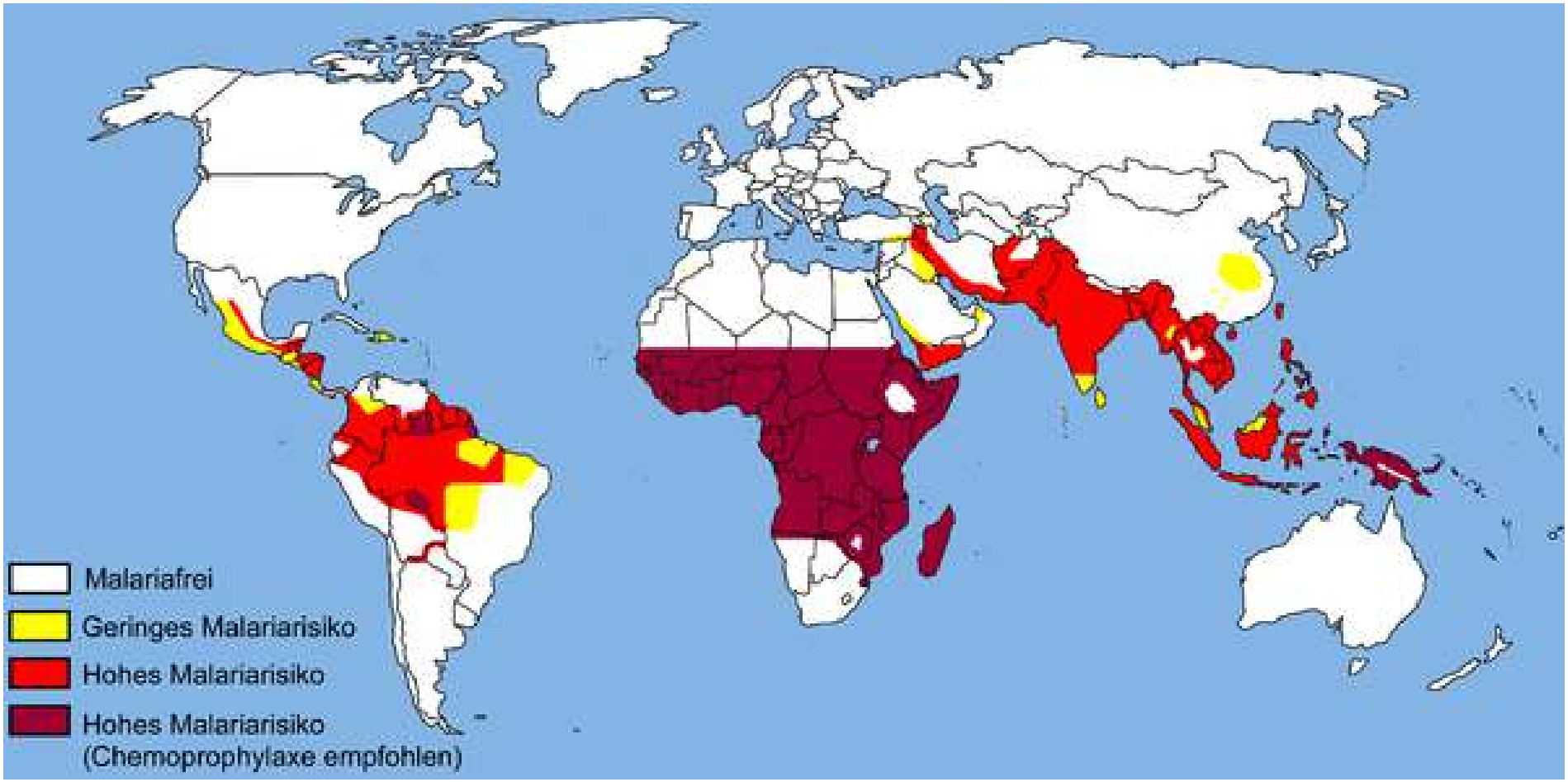
Plasmodium falciparum ring-forms and gametocytes in human blood.

Malaria
(Plasmodium spp.)

Life cycle of Plasmodium sp.



Plasmodium	Latency period	Form of malaria	Comeback of bouts
P. falciparum	7–30 days (90%) longer (10%)*	Malaria tropica	Irregular or continuing
P. malariae	16–50 days	Malaria quartana	Every 72 hours
P. ovale	12–18 days longer (10%)*	Malaria tertiana	Every 48 hours
P. vivax	12–18 days longer (10%)*	Malaria tertiana	Every 48 hours



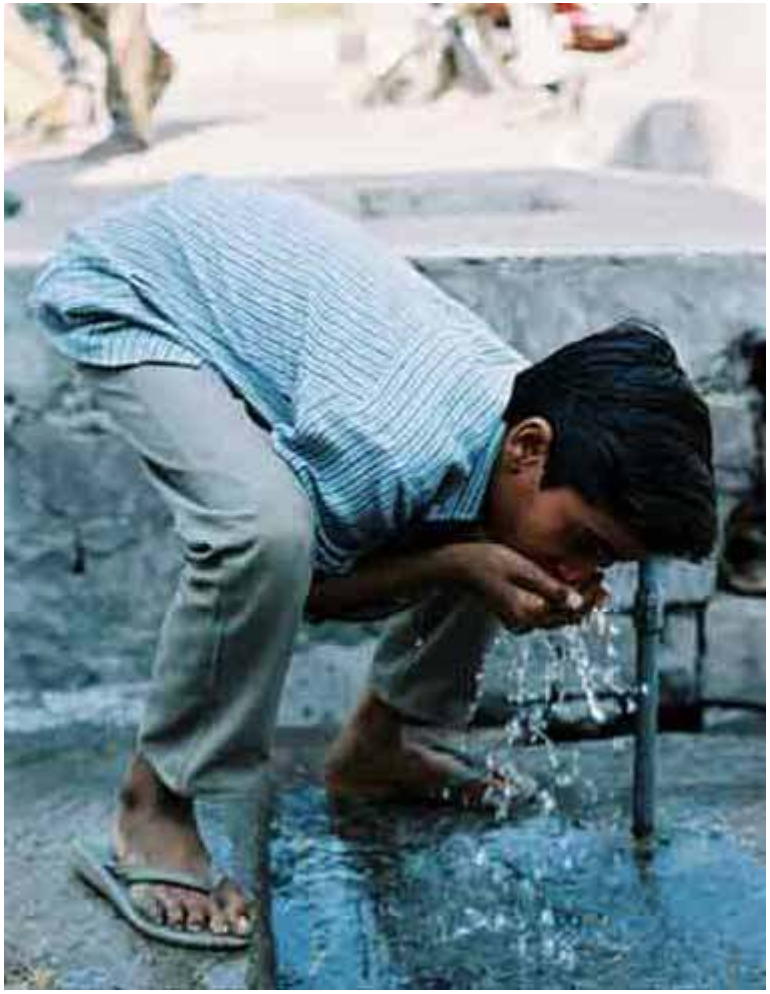
Malaria risk areas
Legends – *white:* free, *yellow:* rare, *red:* risk, *burgundy:* great risk, profilaxis (preventive treatment) recommended


MUNICIPAL WATERSHED
THIS IS YOUR
DRINKING WATER
HELP KEEP IT CLEAN

What is water pollution?

Any chemical, biological or physical changes of water quality that has an adverse impact on living organisms or makes water unsuitable for the intended use.

What is water pollution?



WHO:

- 3.4 million premature death per year, due to illnesses from water;
- 1.9 million death per year, due to diarrhea;
- USA: 1.5 million diseases per year;

What is water pollution?

Infectious pathogens:
bacteria and viruses derived from animal carcasses;

Oxygen requiring waste:
paper mills and food processing by-products, organic waste which need oxygen;

Inorganic chemicals:
acids and toxic chemicals often derived from runoff, industrial by-products and household cleaners;

What is water pollution?

Organic chemicals:

oil, gas, plastics, detergents, often resulting from the influence of industrial by-products and cleaning products;

Plant-derived nutrients:

often from agriculture, urban waste water from soluble fertilizers, nitrates, ammonia and phosphates;

Sediment:

soils and sludges from soil erosion may disrupt photosynthesis, may destroy spawning-grounds, may clog rivers and other waterways;

Thermal pollution and radioactivity:

mainly from thermal power plants;

How to measure water quality?

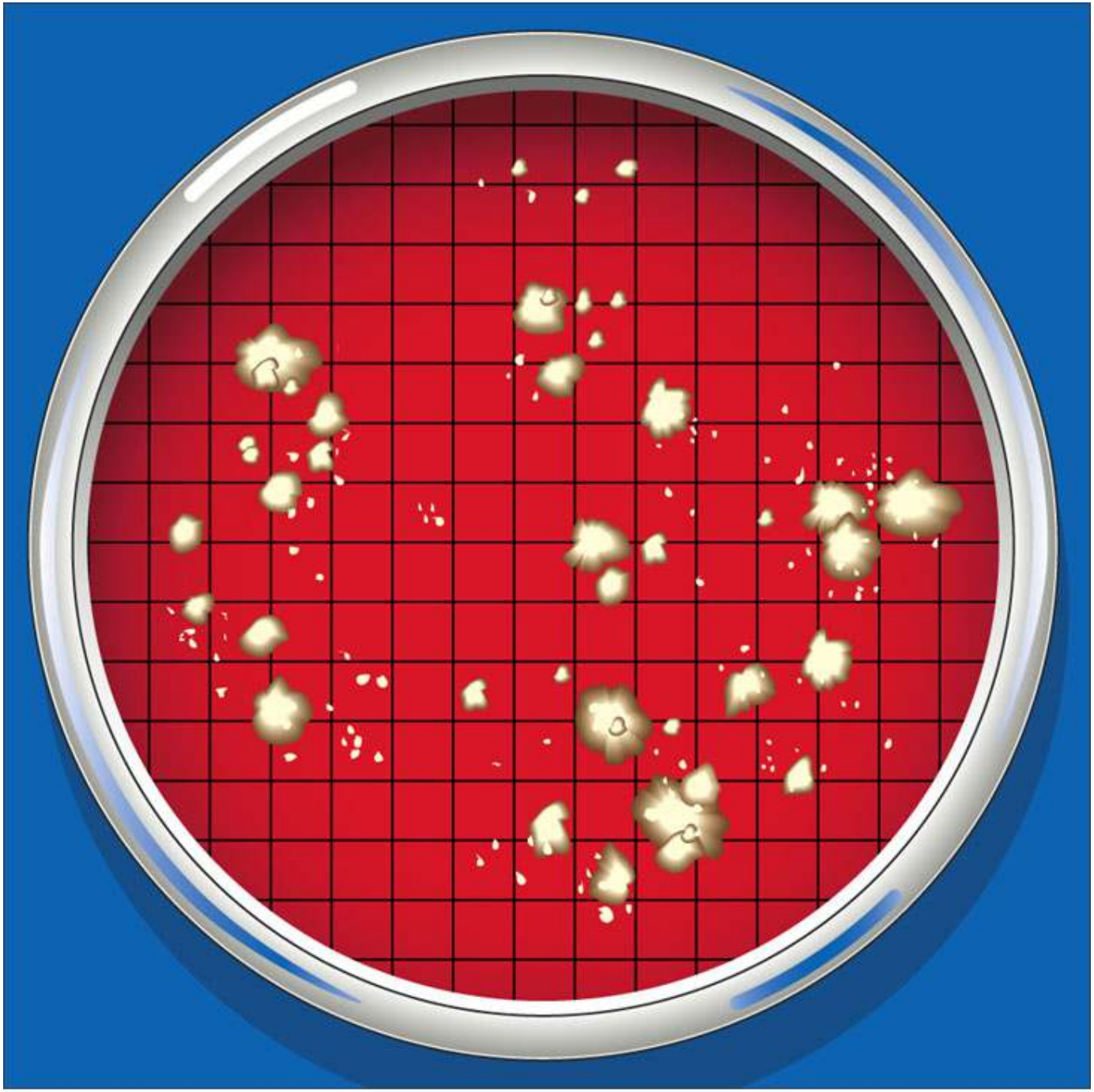
Bacteria numbers:

„fecal coliform" bacteria from the intestine of warm-blooded animals;

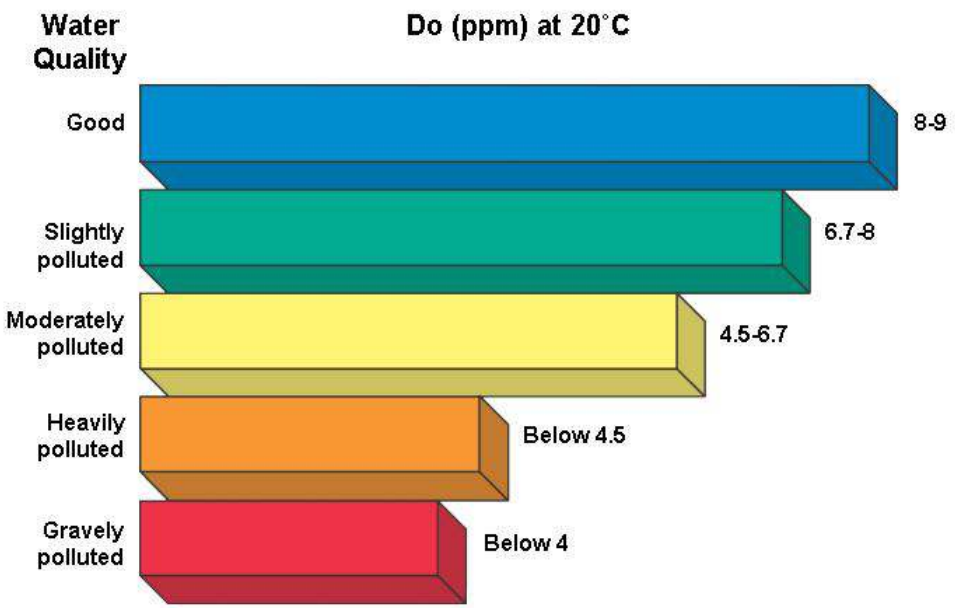
- **Fresh water quality:**
  if 100 ml of water is free from bacteria;
- **Avalaible for swimming:**
  if < 200 bacteria is found in 100 ml of water;

Sources:

human sewage, animals birds, raccoons, etc.



How to measure water quality?



Dissolved oxygen:

BOR (Biological Oxygen Requirement)… the amount oxygen consumed by depleting organisms in the water;

Chemical analysis:

examination of the presence of inorganic or organic compounds;

Suspended sediment:

water purity;

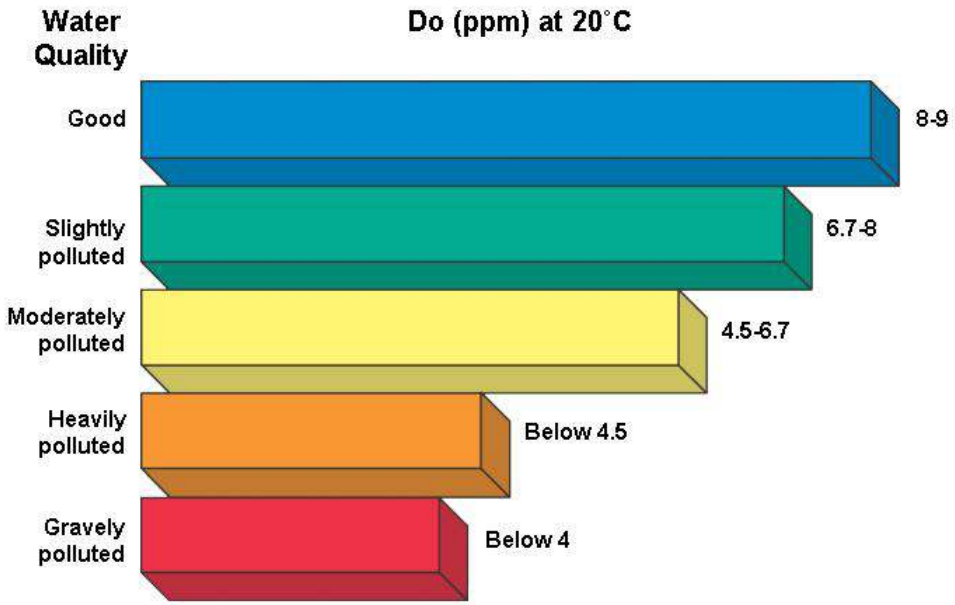
How to measure water quality?

Indicator species:

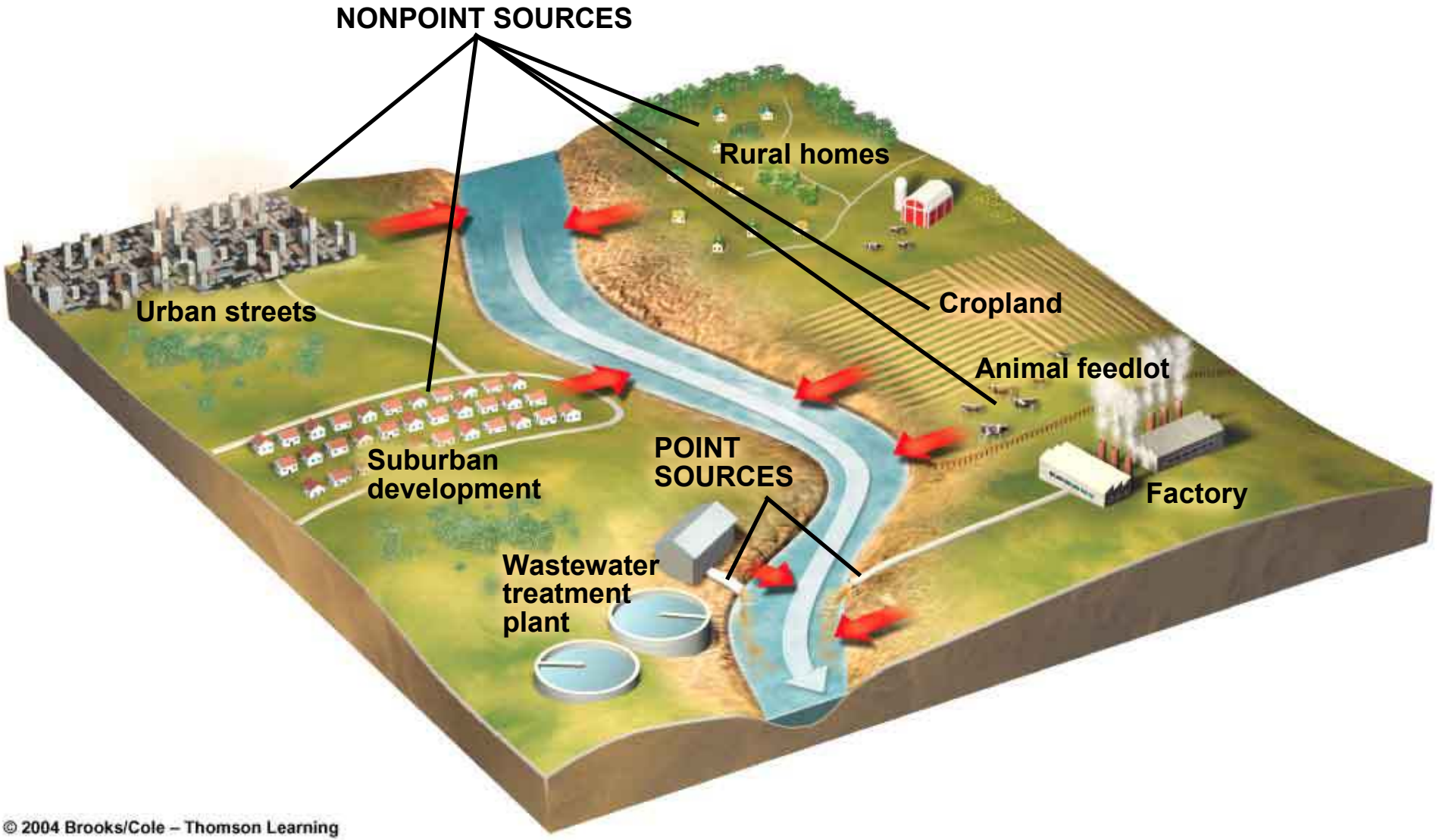
- organizations that provide information on the health status of water tested;
- oysters and mussels filter the water;

Sources, types and effects of water pollution

- **Point sources**
- **Non-point sources**
- **Water quality**



Point- and non-point sources



Major sources of water pollution

Agriculture:

- sediments, fertilizers, bacteria from animals, food processing, and salts from over-irrigation;

Industry:

factories and power plants;

Mining:

surface toxic materials, acids, sediments;


PHOTO: FARM SANCTUARY

Key questions

- Freshwater pollution: What are the biggest problems of the rivers?
- Developed vs developing countries
- Pollution of lakes: Why the lakes and reservoirs are more vulnerable?
- What is eutrophication?

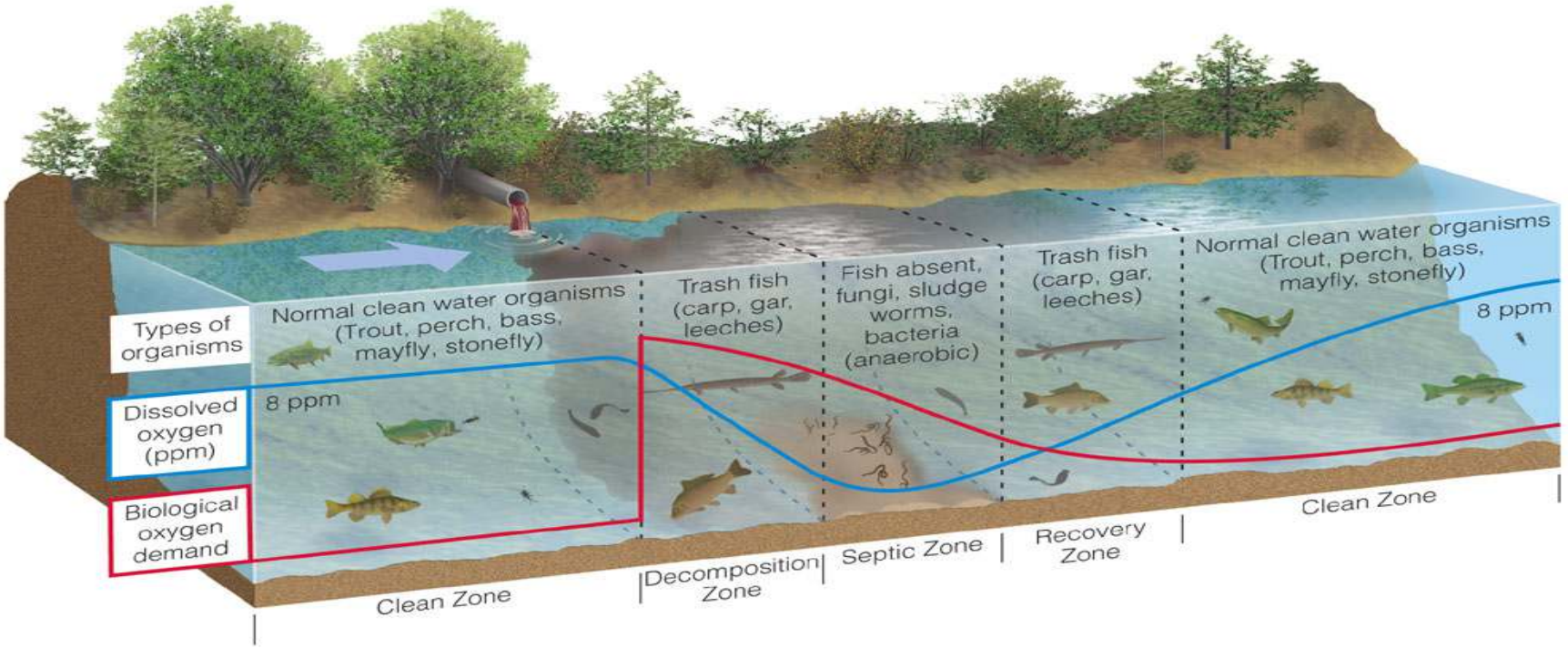
Pollution of running waters

The natural state of rivers and streams can recover quickly after a moderate water pollution if the flow is not reduced.

- The process natural biodegradation;
- It does not operate, if it is overloaded or the flow rate is reduced
- It does not operate in case of non-biodegradation polution

Pollution of running waters

- **Curve: decline of oxygen levels**
- **Factors affecting the improvement of water quality**



What factors affect the reduction in oxygen levels?

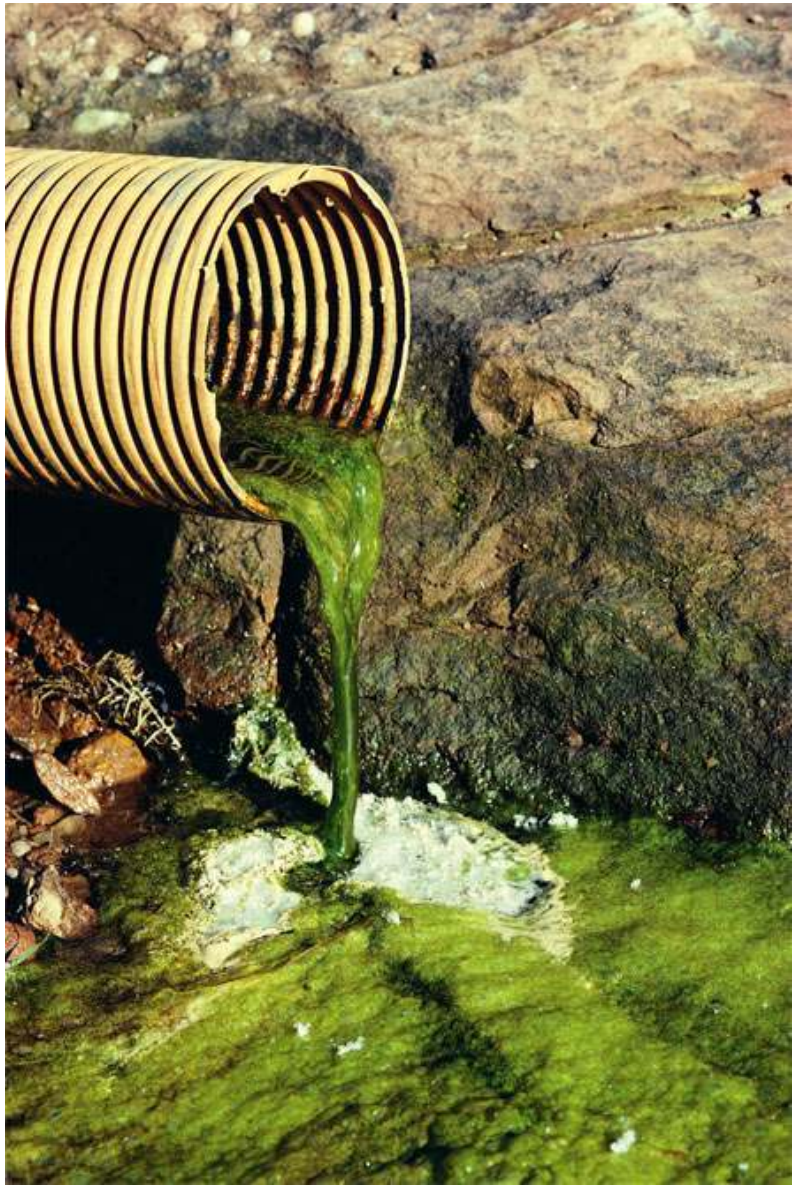
Two worlds

Developed countries

The US and other developed countries, despite the population increase and economic growth, significantly reduced emissions from point sources;

- The problem is the non-point sources;
- Toxic chemicals also pose a problem toxic chemicals also pose a problem;
- Success:the Thames;

Two worlds



Developing countries:

Serious and growing problems

- half of the world's 500 largest rivers are heavily polluted;
- wastewater treatment would require a minimum financial contribution;
- impeachment of polluters cumbersome;
- in China, 10% of waste water is cleaned;
- a small percentage of economic growth would be sufficient to clean waste waters;

Ganges, India

- holy river (one million people per day immerse into it in holy piety);
- 350 million people (third-of the country's population) live in its drainage basin;
- slight sewage treatment;
- used for bathing, drinking, household, etc.;
- dead bodies (ashes, or non-burnt bodies) are thrown into the river;
- **GOOD NEWS:** the Indian government is working on the problem;


THE YOGA
SCHOOL OF
RAJU

Pollution of lakes

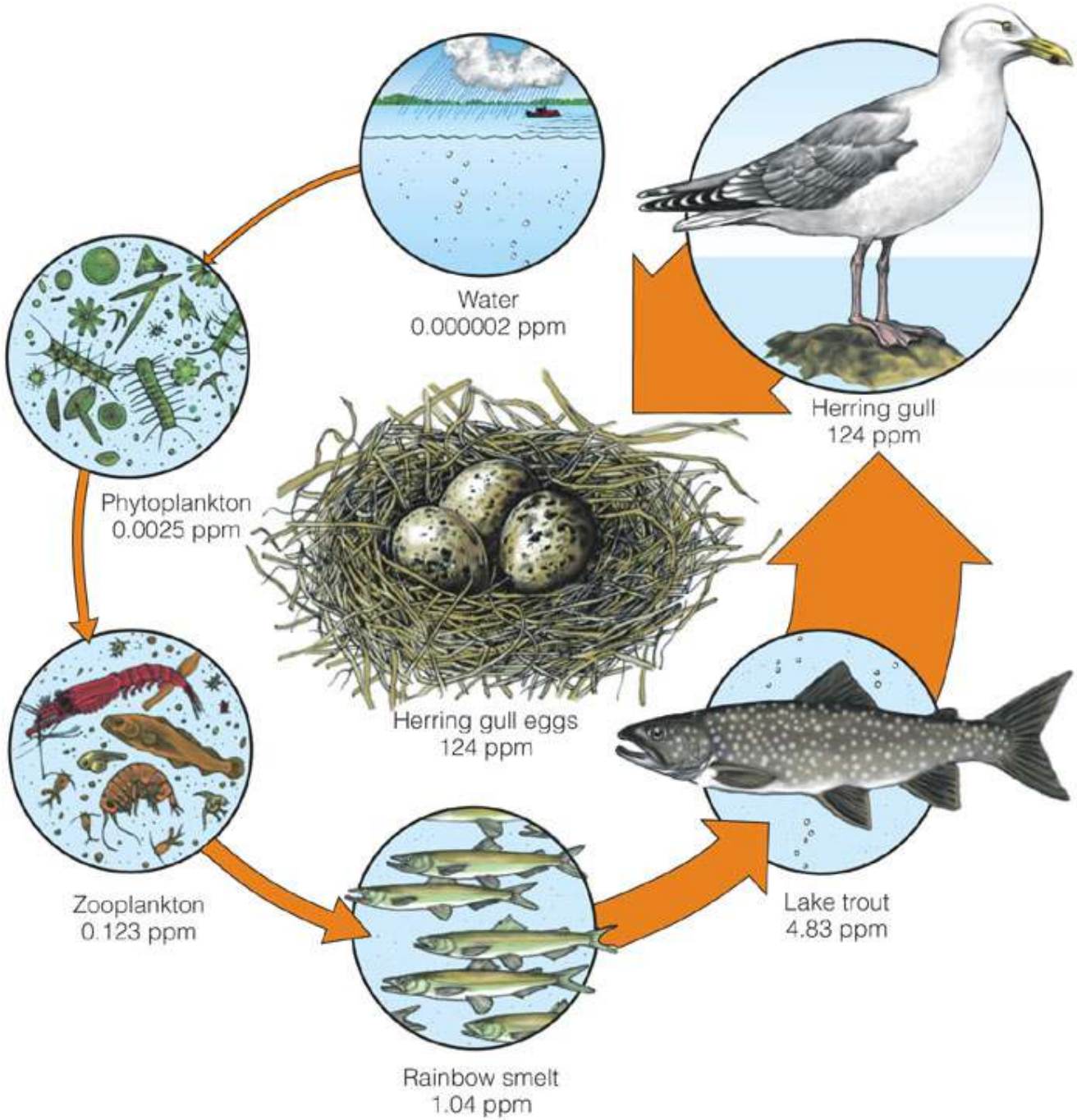
Dilution as a way of solution for the lakes are less effective:

- slight vertical mixing
- low water flow

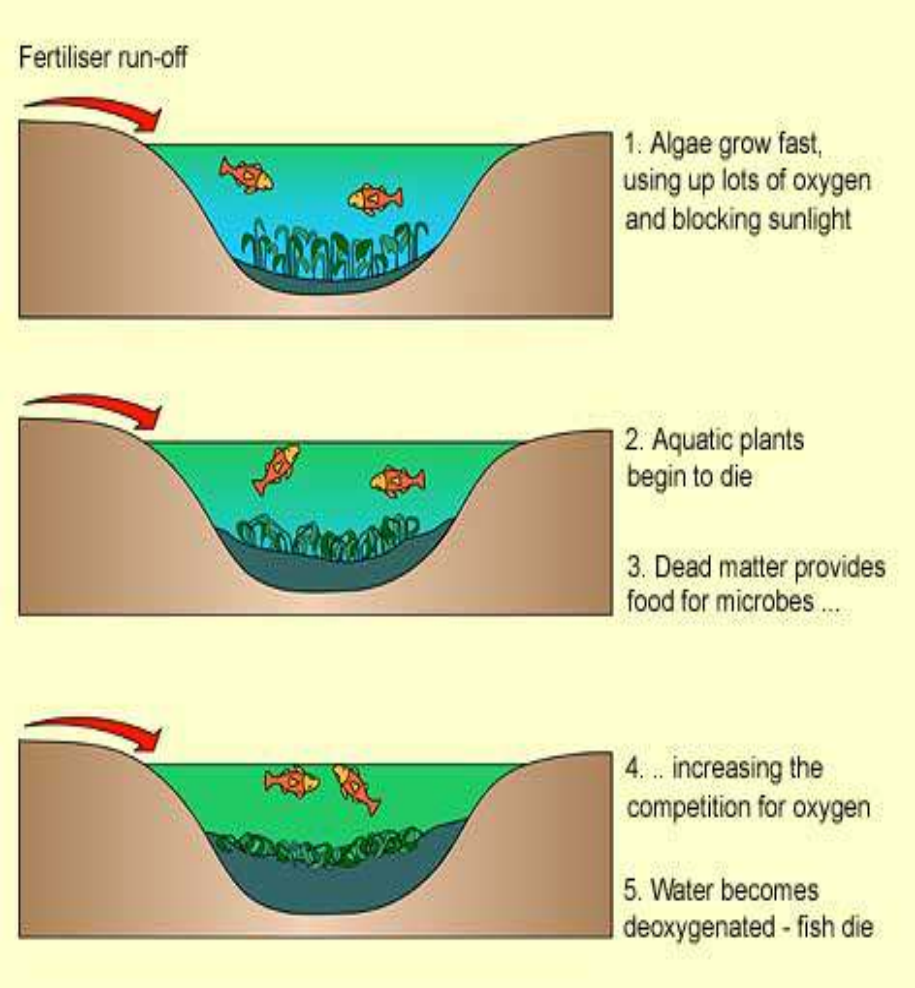
makes them more vulnerable

- toxins are depositing
- the ykill living creatures of the lake bed;
- atmospheric deposition;
- disruptions in the food chain;

Aquatic food chain at Great Lakes



Eutrophication of lakes



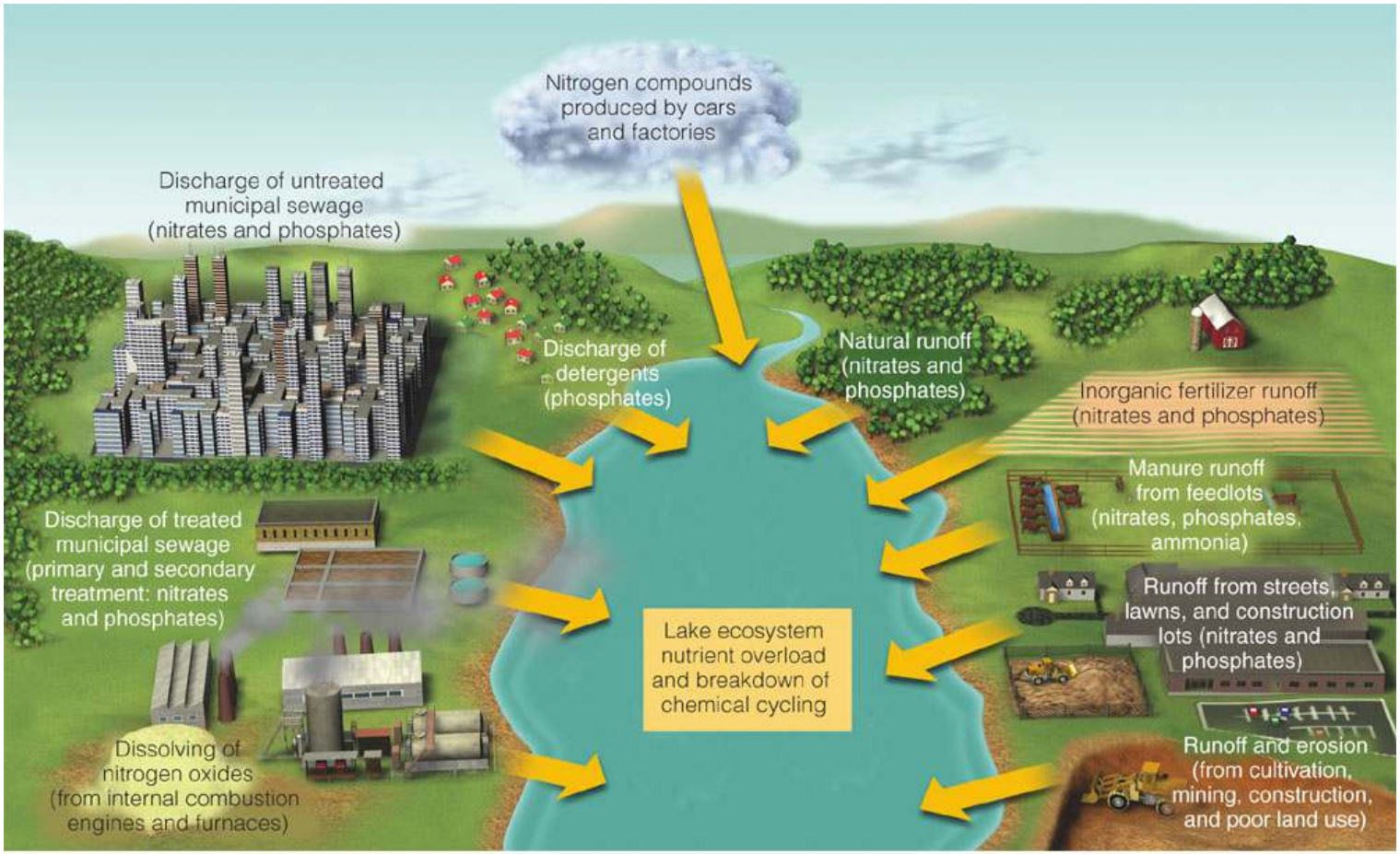
Eutrophication:

nutrient supply of lakes mostly comes from plant nutrients (nitrates and phosphates) nutrient supply of lakes mostly comes from plant nutrients (nitrates and phosphates);

- ❑ warm and dry weather favours for blooming of algae;
- ❑ reduces photosynthesis;
- ❑ deuterium level in the water reduces by decaying algae;
- ❑ decaying fish smell bad;

Pollution of lakes

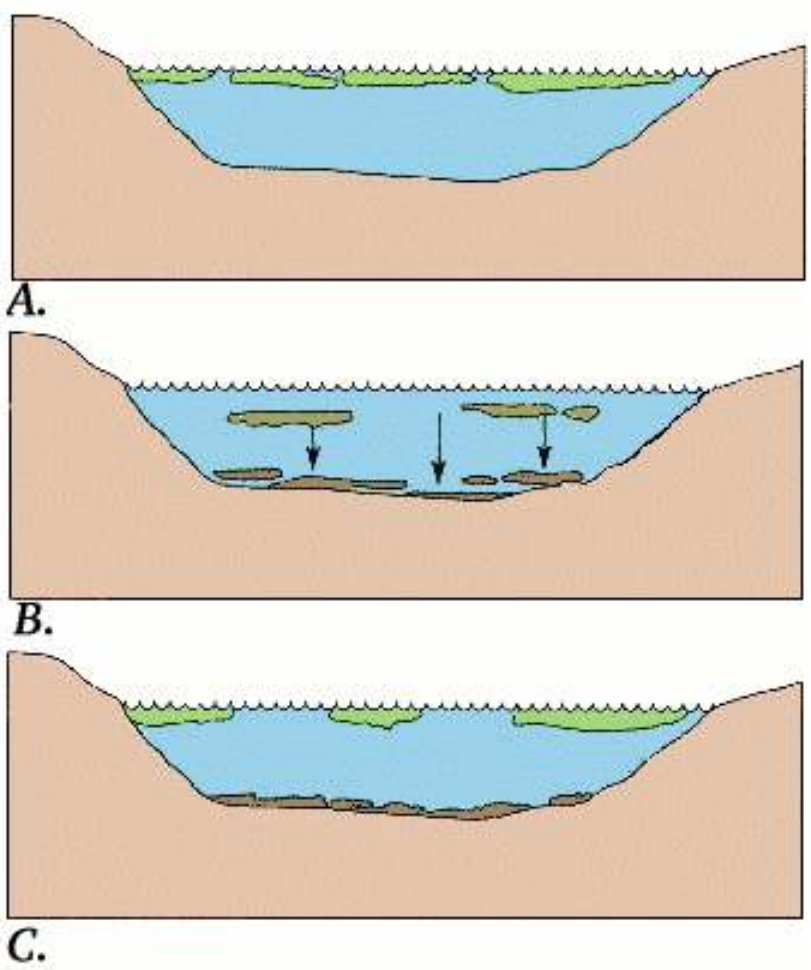
Eutrophication



Eutrophication of lakes

Solutions:

- advanced wastewater treatment (N, P);
- household detergents;
- soil protection;
- removing weeds along the lake;
- intake oxygen or fresh water admission;

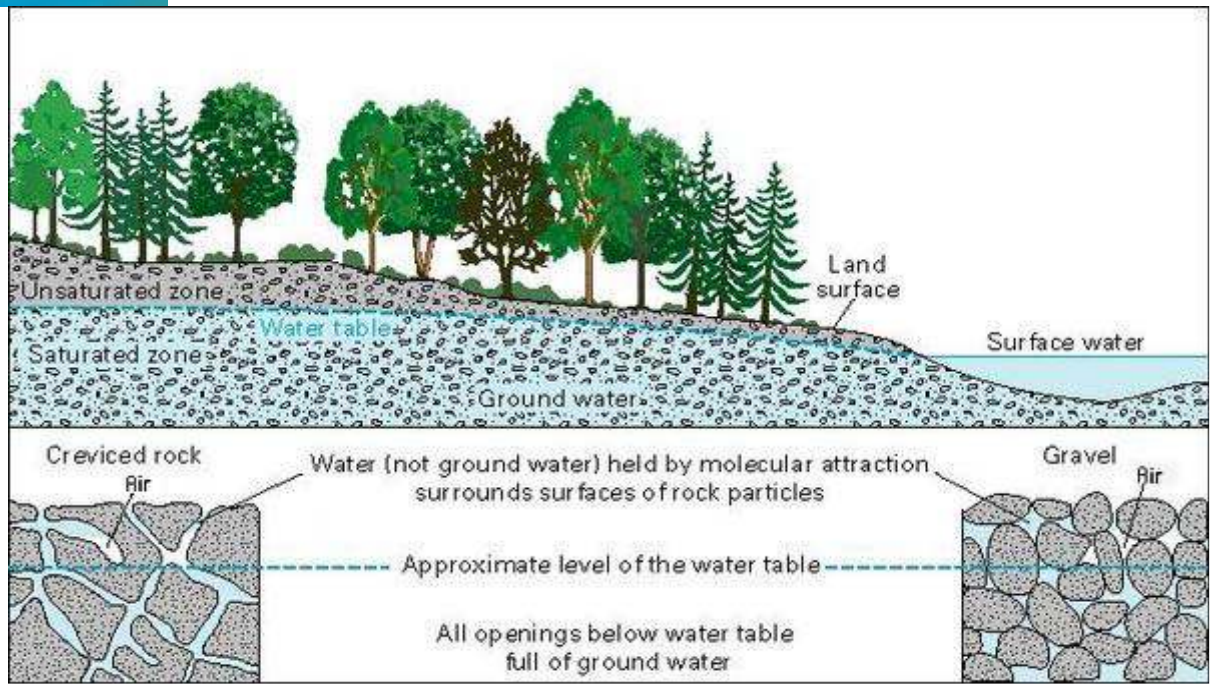


Schematic Diagram showing effects of algal bloom on water quality. (A) Abundant growth of algae in sunlit shallow water when nutrients are abundant. (B) In colder weather, algae die and sink to the lake bottom. (C) The next growing season, more algae thrive at the surface while older material decays at the bottom, increasing BOD and releasing more nutrients to fuel new growth.

Soil water

- Why groundwater pollution is a serious problem?
- How big is the problem?
- What are the solutions?

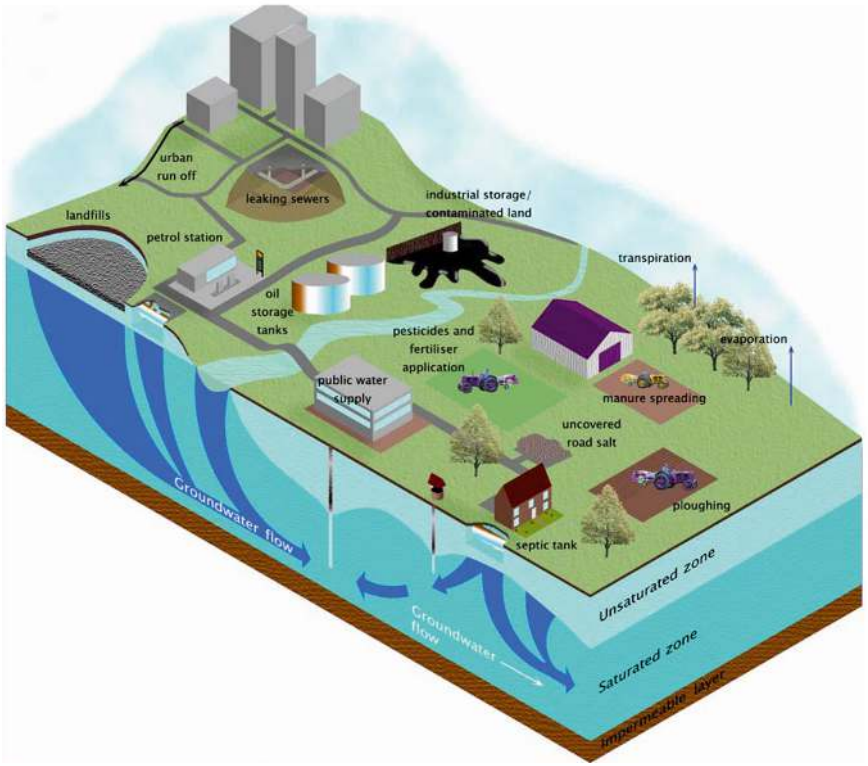

Water table
Saturated Zone
(Aquifer)


Land
surface
Unsaturated zone
Water table
Saturated zone
Surface water
Ground water
Creviced rock
Air
Water (not ground water) held by molecular attraction
surrounds surfaces of rock particles
Gravel
Air
Approximate level of the water table
All openings below water table
full of ground water

Soil water

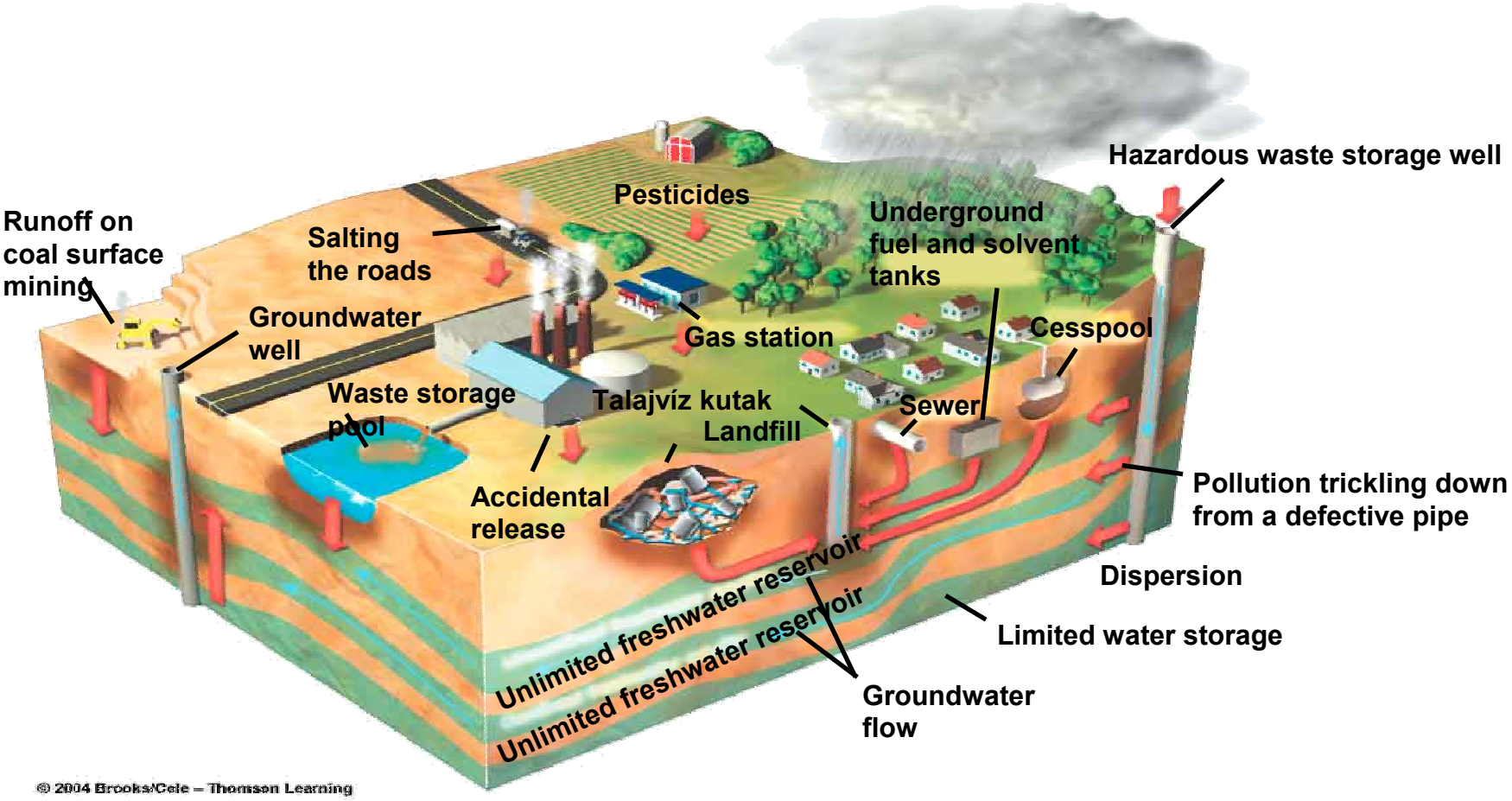
Soil water can be contaminated

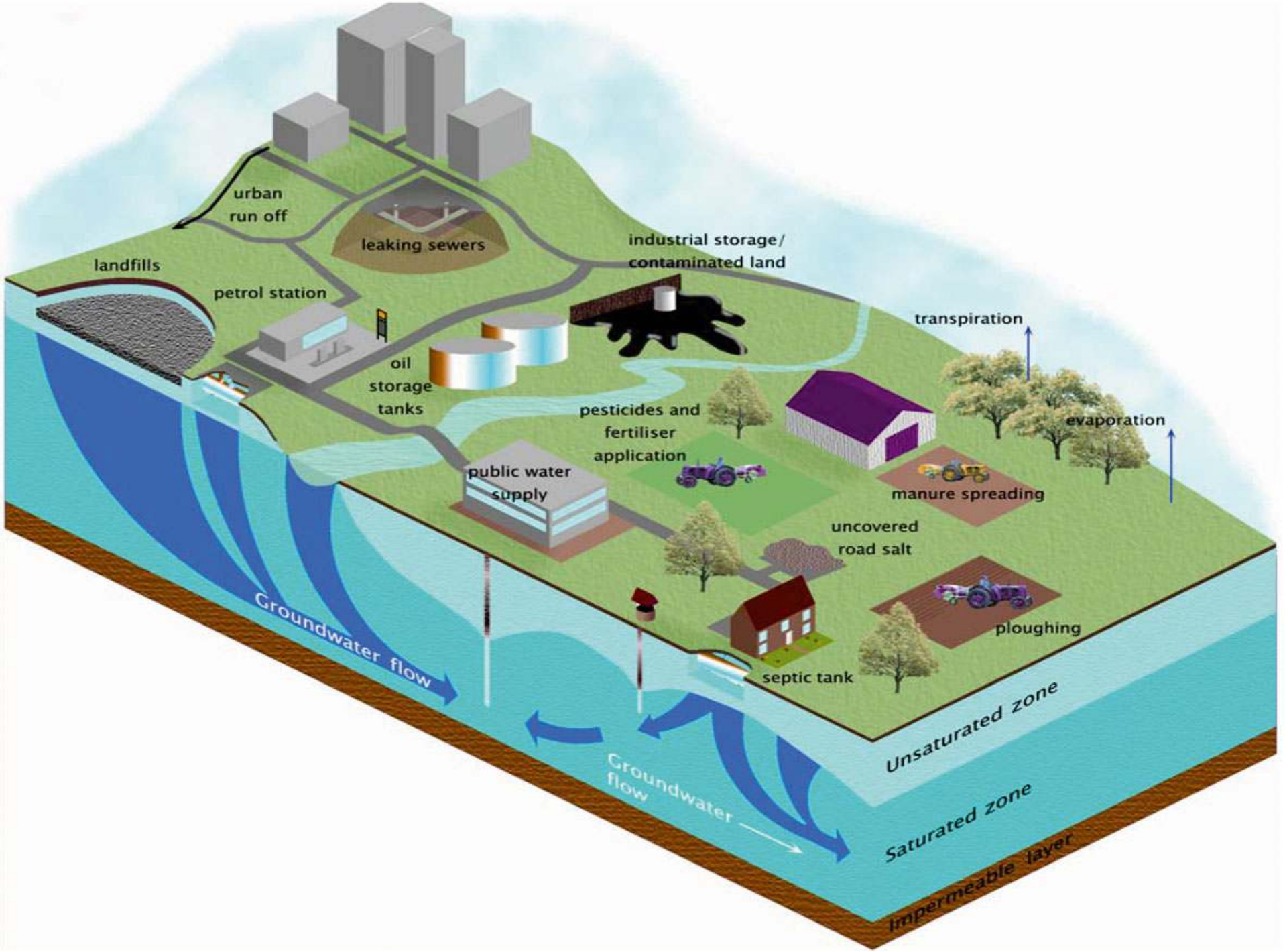
- it can not be cleaned;
- low dilution and distribution;
- invisible pollution;
- primary source of water for irrigation and drinking water;
- removal of pollutants is **DIFFICULT**!



Pollution of soil water

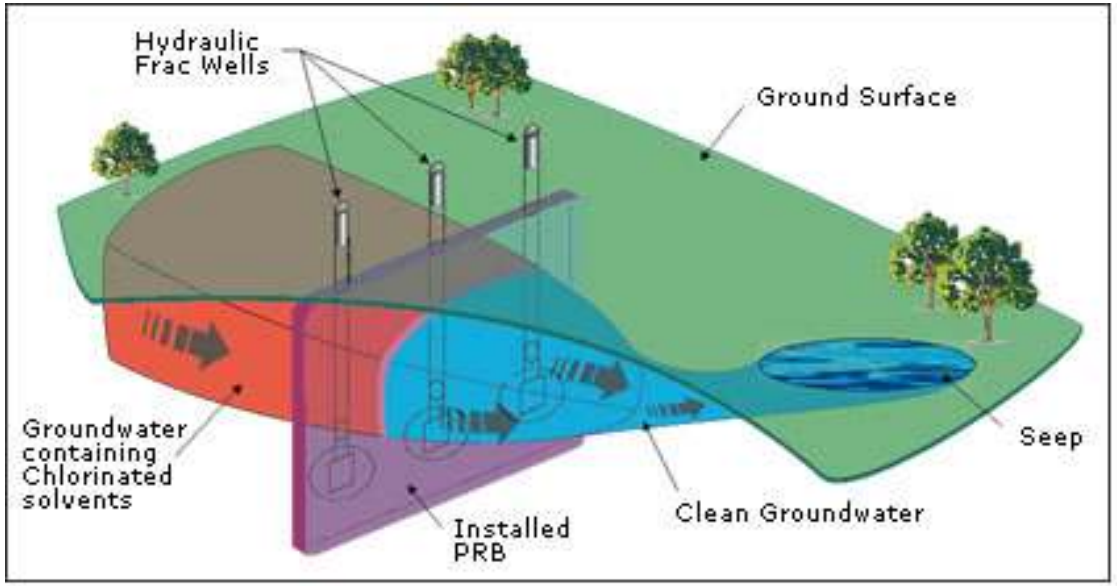
- Low flow rate
- Low oxygen concentration
- Few bacteria
- Low temperature




urban
run off
leaking sewers
industrial storage/
contaminated land
landfills
petrol station
transpiration
oil
storage
tanks
pesticides and
fertiliser
application
evaporation
public water
supply
manure spreading
uncovered
road salt
ploughing
septic tank
Groundwater flow
Groundwater
flow
Unsaturated zone
Saturated zone
Impermeable layer

Soil water

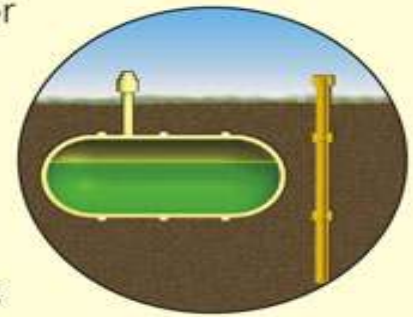
- pollution passes in plumes;
- soil, rocks, etc. act as a sponge;
- the treatment does not work (low oxygen level, low flow, low temperature);
- non-degradable materials accumulate;



Solutions

Groundwater Pollution

Prevention	Cleanup
Find substitutes for toxic chemicals	Pump to surface, clean, and return to aquifer (very expensive)
Keep toxic chemicals out of the environment	
Install monitoring wells near landfills and underground tanks	Inject microorganisms to clean up contamination (less expensive but still costly)
Require leak detectors on underground tanks	
Ban hazardous waste disposal in landfills and injection wells	Pump nanoparticles of inorganic compounds to remove pollutants (may be the cheapest, easiest, and most effective method but is still being developed)
Store harmful liquids in aboveground tanks with leak detection and collection systems	



Prevention is the most effective and the cheapest!

Prevention of soil pollution

- Watch aquifers!
- Use less hazardous components!
- Apply leakage reseraching systems!
- Strictly regulate the operation of hazardous waste landfills!
- Hazardous maetrilas should be stored above the ground!

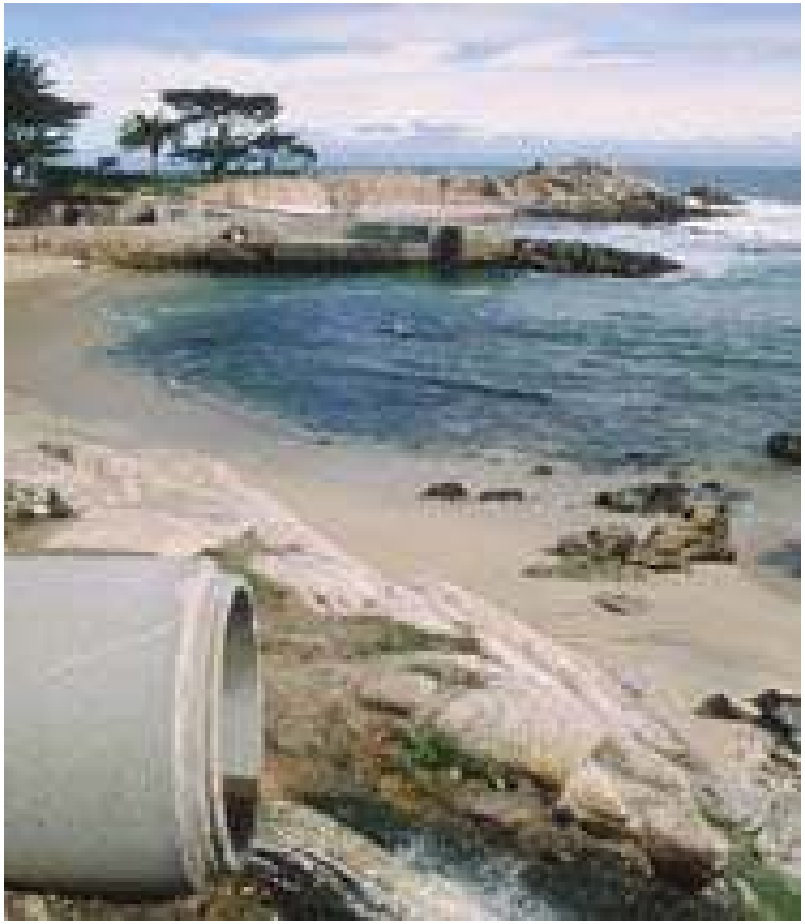
Pollution of oceans

- How much pollution can tolerate the ocean?
- Coastal Zones: How does the pollution influence coastal zones?
- What are the most important sources of ocean pollution, and what to do?
- Oil spills

Pollution of oceans

The oceans can disperse a large amount of pollution if they are not overloaded.

- pollution is the most critical at the most populous coastal zones;
- wetlands, estuaries, coral reefs, mangrove swamps;
- 40% of the world's population lives within a 100-km distance from the coasts;



Mangrove marshes

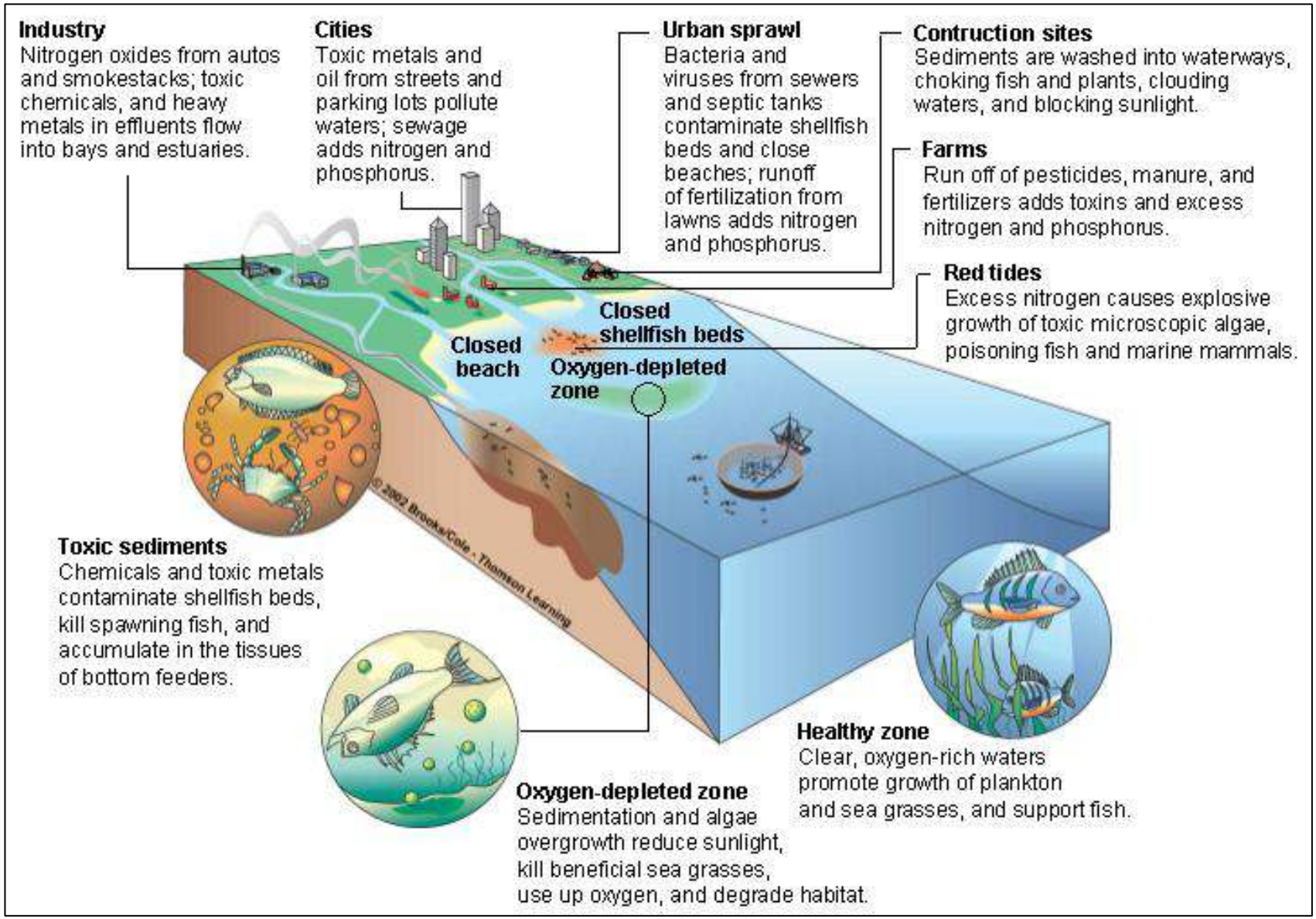

Philadelphia
Wilmington
Atlantic City
Baltimore
Cape May
Cape Henlopen

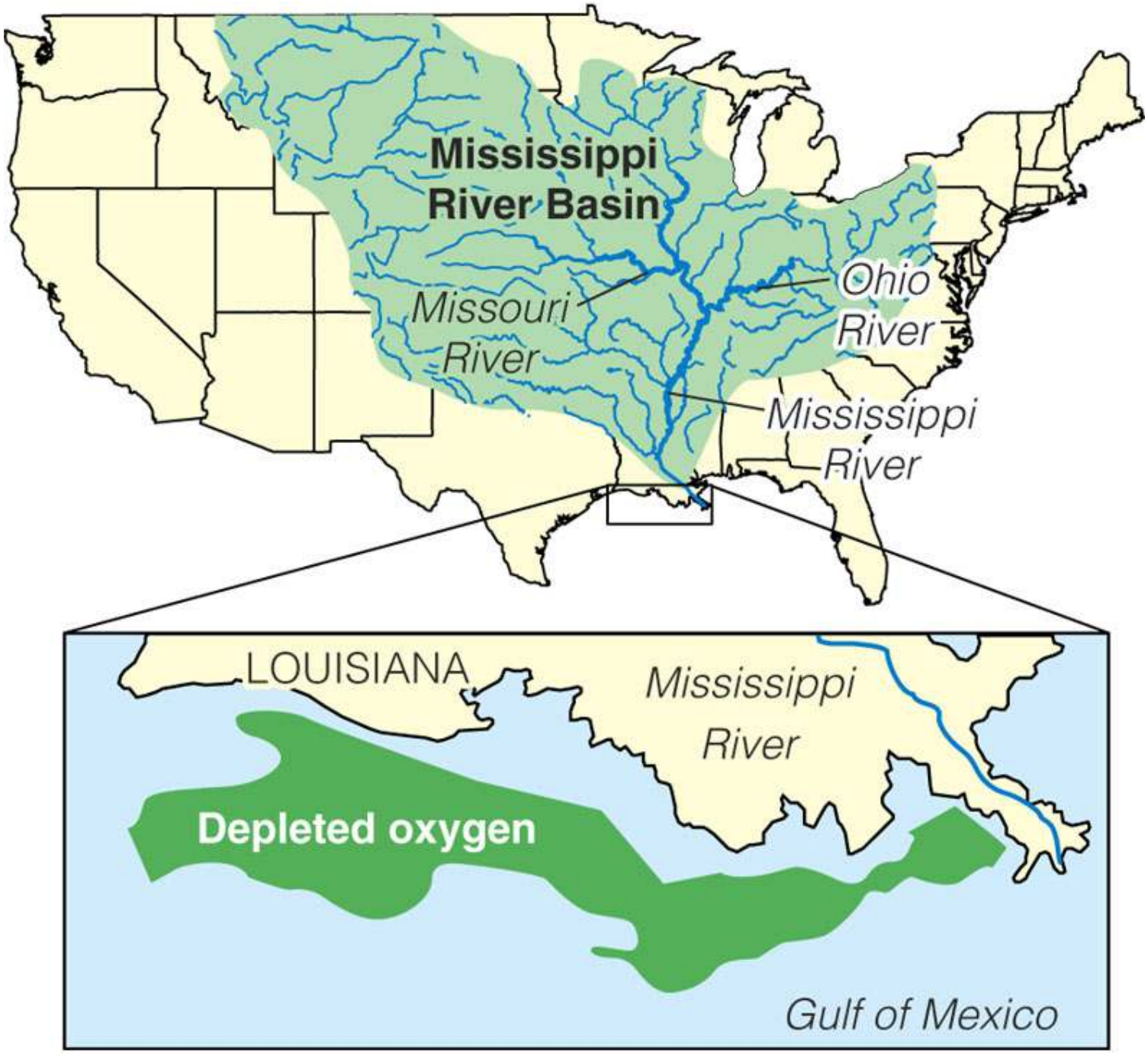
Estuaries

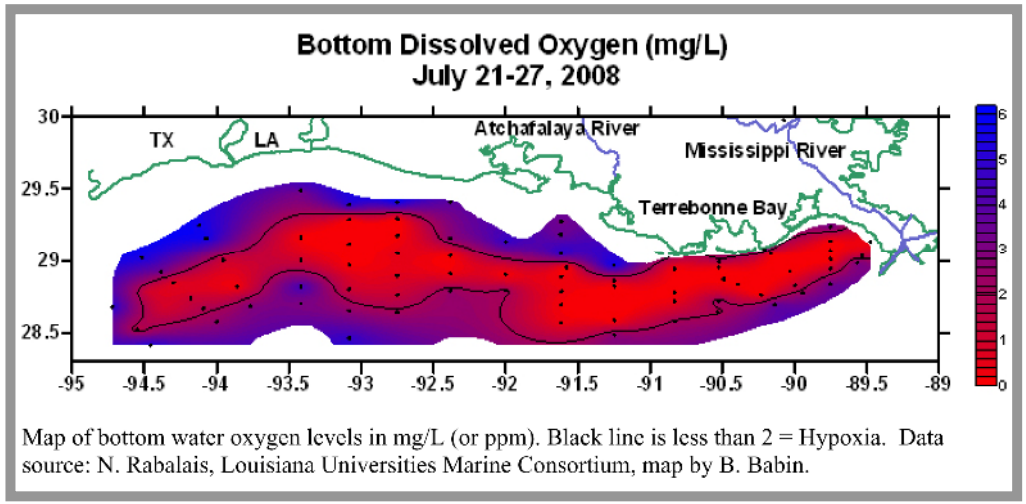
Pollution of oceans

- large amounts of untreated sewage (viruses);
- leaking sewage settling tanks;
- runoff;
- algae bloom facilitating by the nutrient-rich environment;
- death zones (NO, DO);
- air-born toxins;
- oil spills;

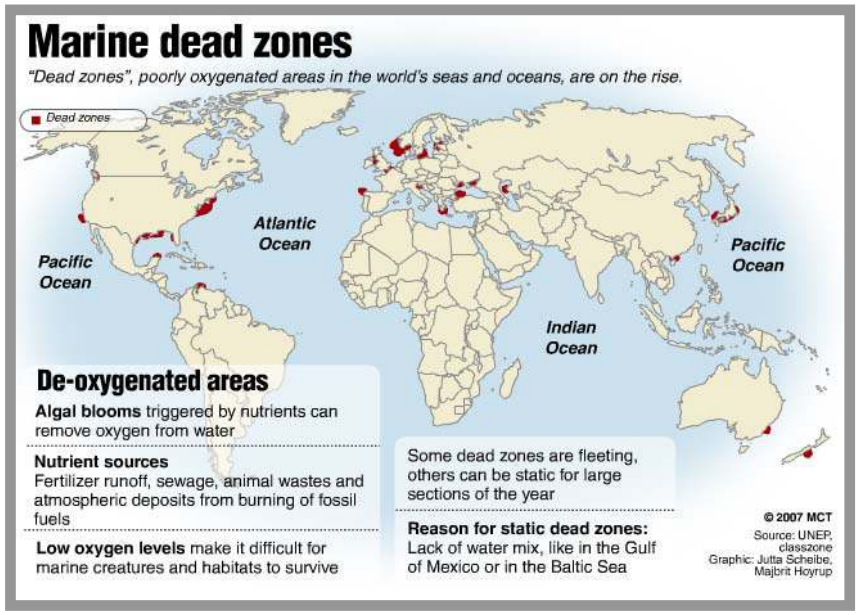
Pollution of oceans

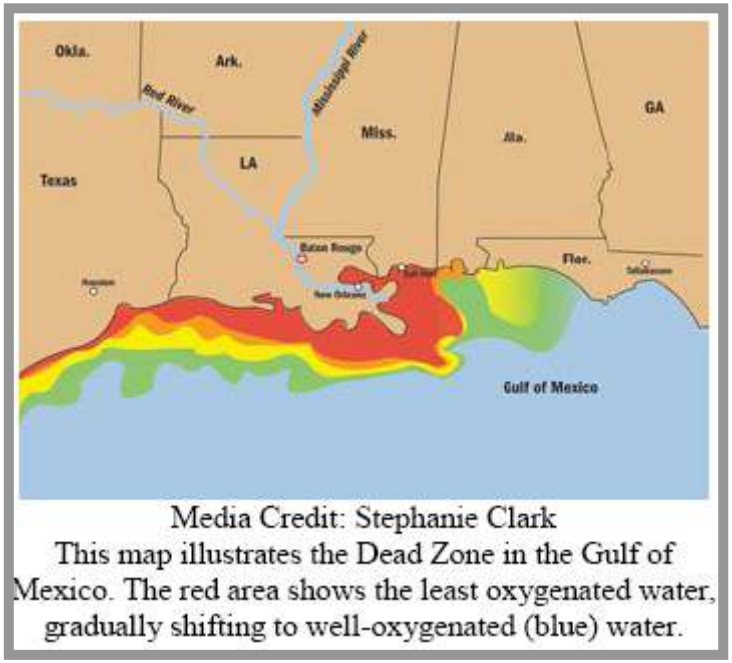






Map of bottom water oxygen levels in mg/L (or ppm). Black line is less than 2 = Hypoxia. Data source: N. Rabalais, Louisiana Universities Marine Consortium, map by B. Babin.

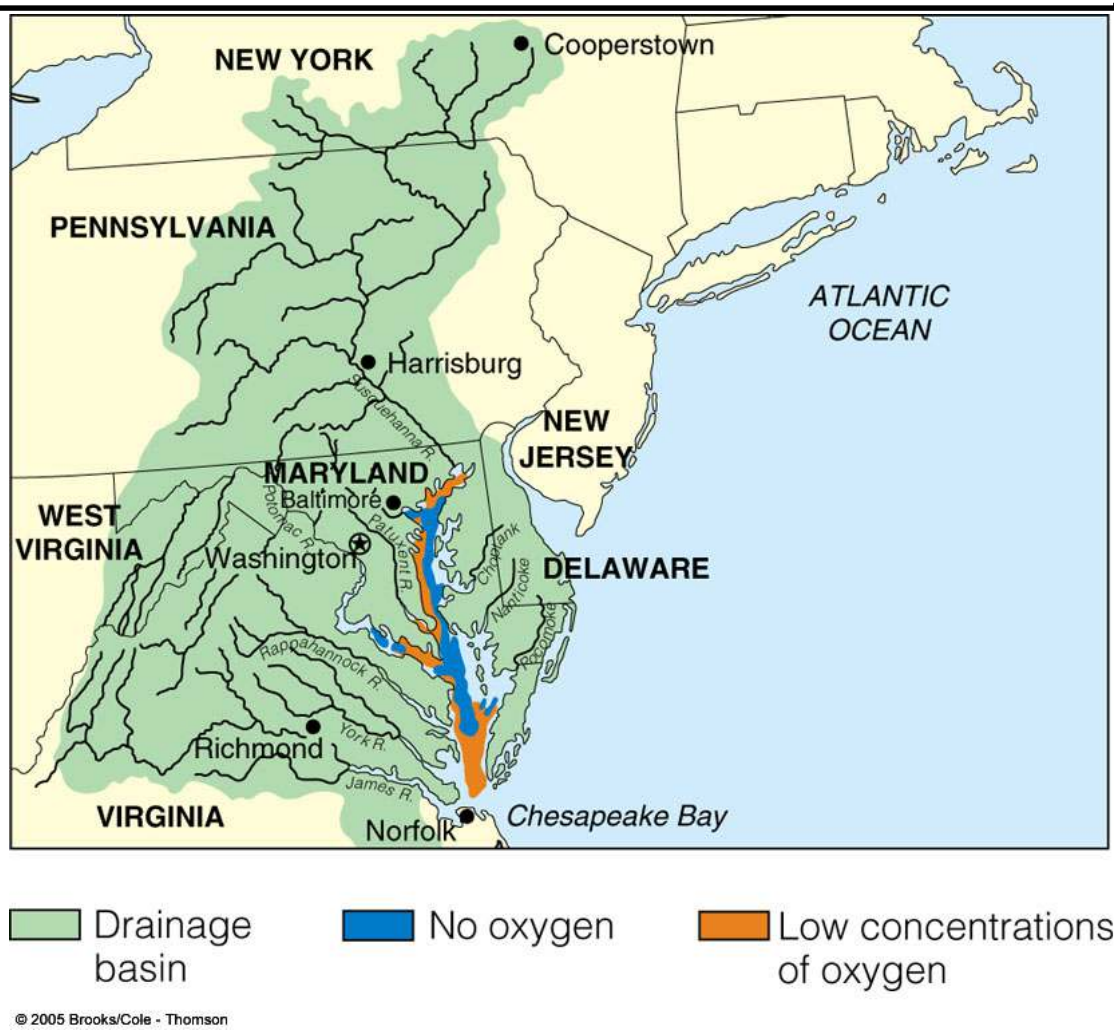




Media Credit: Stephanie Clark
This map illustrates the Dead Zone in the Gulf of Mexico. The red area shows the least oxygenated water, gradually shifting to well-oxygenated (blue) water.

A case study: Chesapeake bay

- **The largest river estuary the USA;**
- **Relatively shallow;**
- **The water slowly flows into the Atlantic ocean;**

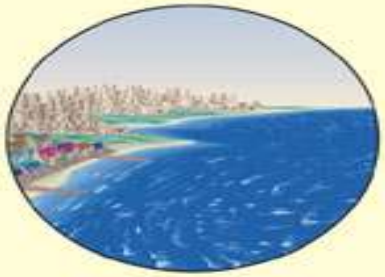


- **The biggets problem is the low dissolved oxygen level;**

Solutions

Coastal Water Pollution

Prevention	Cleanup
Reduce input of toxic pollutants	Improve oil-spill cleanup capabilities
Separate sewage and storm lines	
Ban dumping of wastes and sewage by maritime and cruise ships in coastal waters	Sprinkle nanoparticles over an oil or sewage spill to dissolve the oil or sewage without creating harmful byproducts (still under development)
Ban ocean dumping of sludge and hazardous dredged material	
Protect sensitive areas from development, oil drilling, and oil shipping	Require at least secondary treatment of coastal sewage
Regulate coastal development	
Recycle used oil	Use wetlands, solar-aquatic, or other methods to treat sewage
Require double hulls for oil tankers	

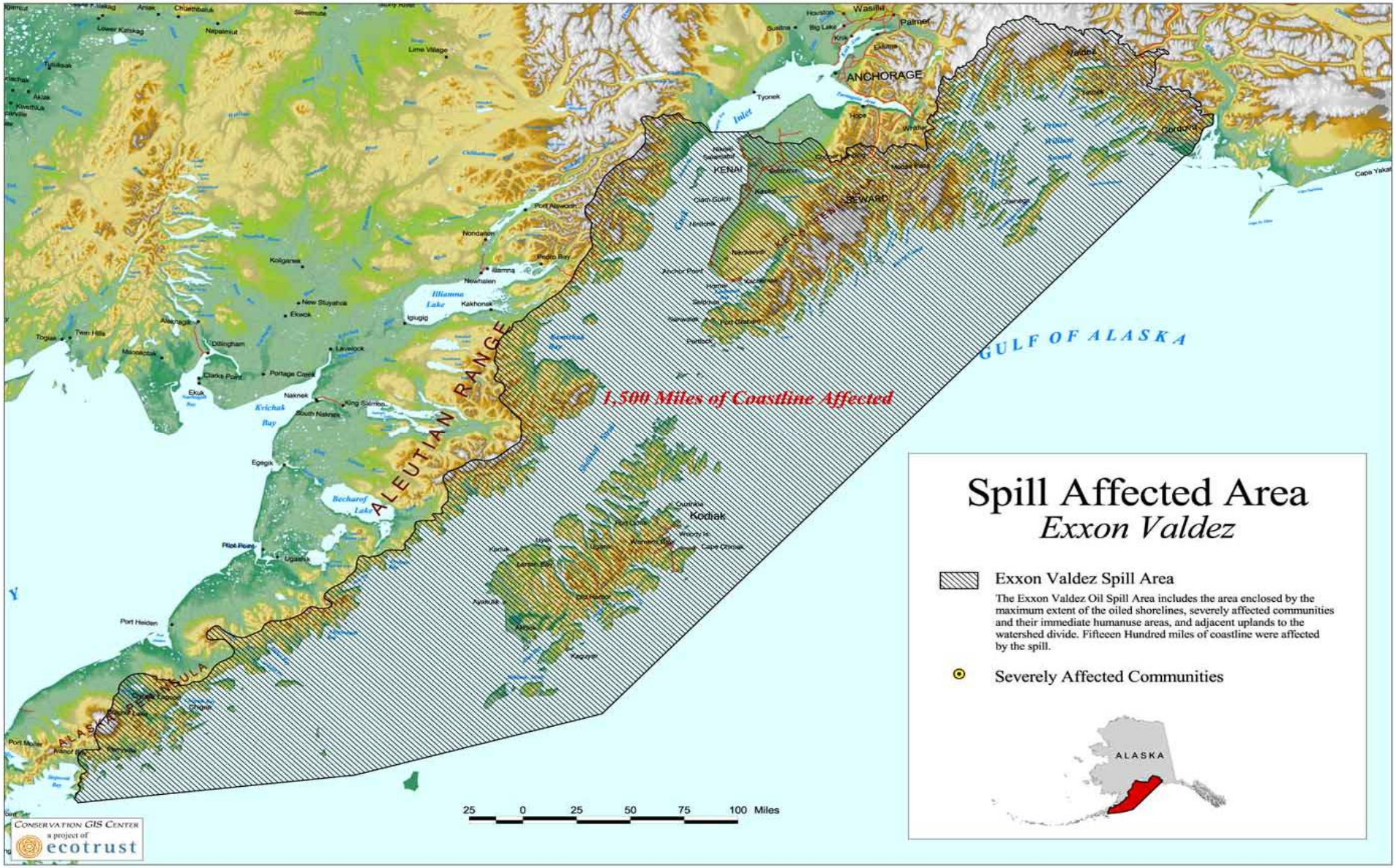


The key task for protecting oceans is to reduce or prevent the flow of pollution from land and from watercourses to the oceans.

Oil spills

- sources: coastal wells, tankers, oil pipelines and oil storages;
- consequences: destruction of organisms, animals are covered by oil and are isolated from air, buoyancy, drowning;
- significant economic impacts;
- mechanical purification: scraping and absorbing pollution;
- chemical cleaning: coagulants and dispersants;

Oil spills


ANCHORAGE
KENAI
SEWARD
Kodiak
ALEUTIAN RANGE
GULF OF ALASKA
1,500 Miles of Coastline Affected
Spill Affected Area
Exxon Valdez
Exxon Valdez Spill Area
The Exxon Valdez Oil Spill Area includes the area enclosed by the maximum extent of the oiled shorelines, severely affected communities and their immediate humanuse areas, and adjacent uplands to the watershed divide. Fifteeen Hundred miles of coastline were affected by the spill.
Severely Affected Communities
ALASKA
25 0 25 50 75 100 Miles
Conservation GIS Center
a project of
ecotrust

Prevention and control

- How surface water pollution can be moderated: point and non-point sources.
- How sewage treatment plants do work?
- How the US is successful to reduce water pollution? Clean Water Convention

Solutions: prevention and control of surface water pollution

Non-point sources

- reducing runoff;
- establishment of buffer zones of vegetation;
- reducing soil erosion;

Point sources

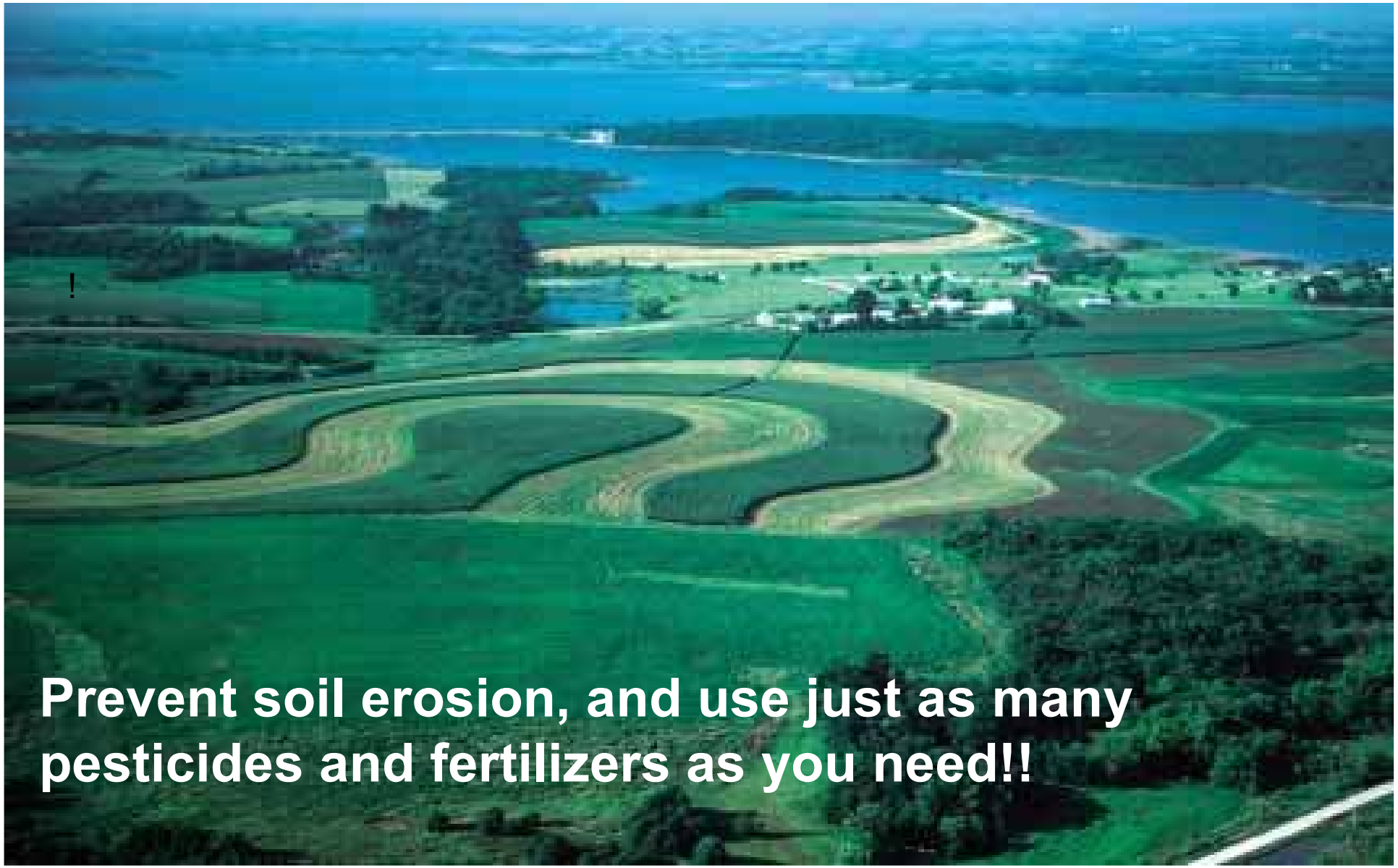
- Clean Water Convention;
- Water Quality Agreement

- Use just as many pesticides and fertilizer, as necessary!

Non-point sources

Non-point sources

Non-point sources



Point sources

The most developed countries regulate water pollution standards by law.

Federal Water Pollution Convention (Clean Water Act in 1972, 1977 and 1987);

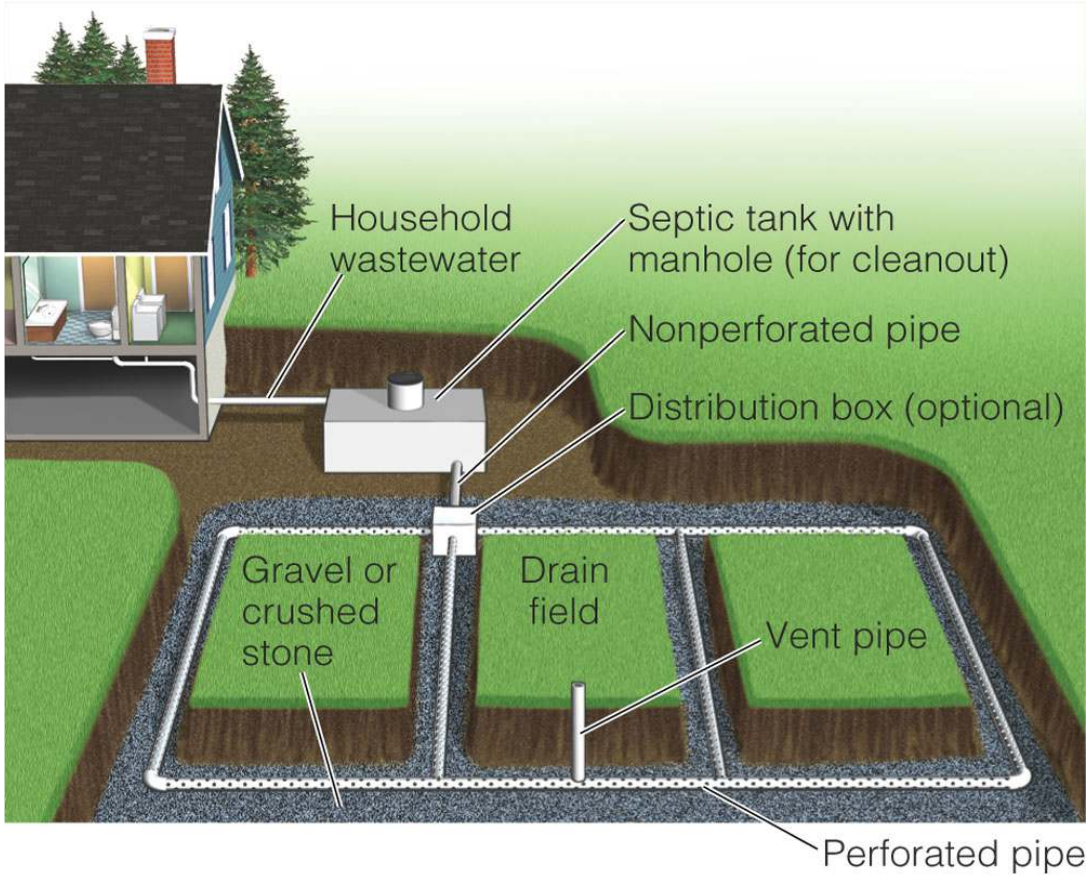
- it regulates water quality of the navigable waterways, streams, wetlands, rivers and lakes;

Clean Water Act

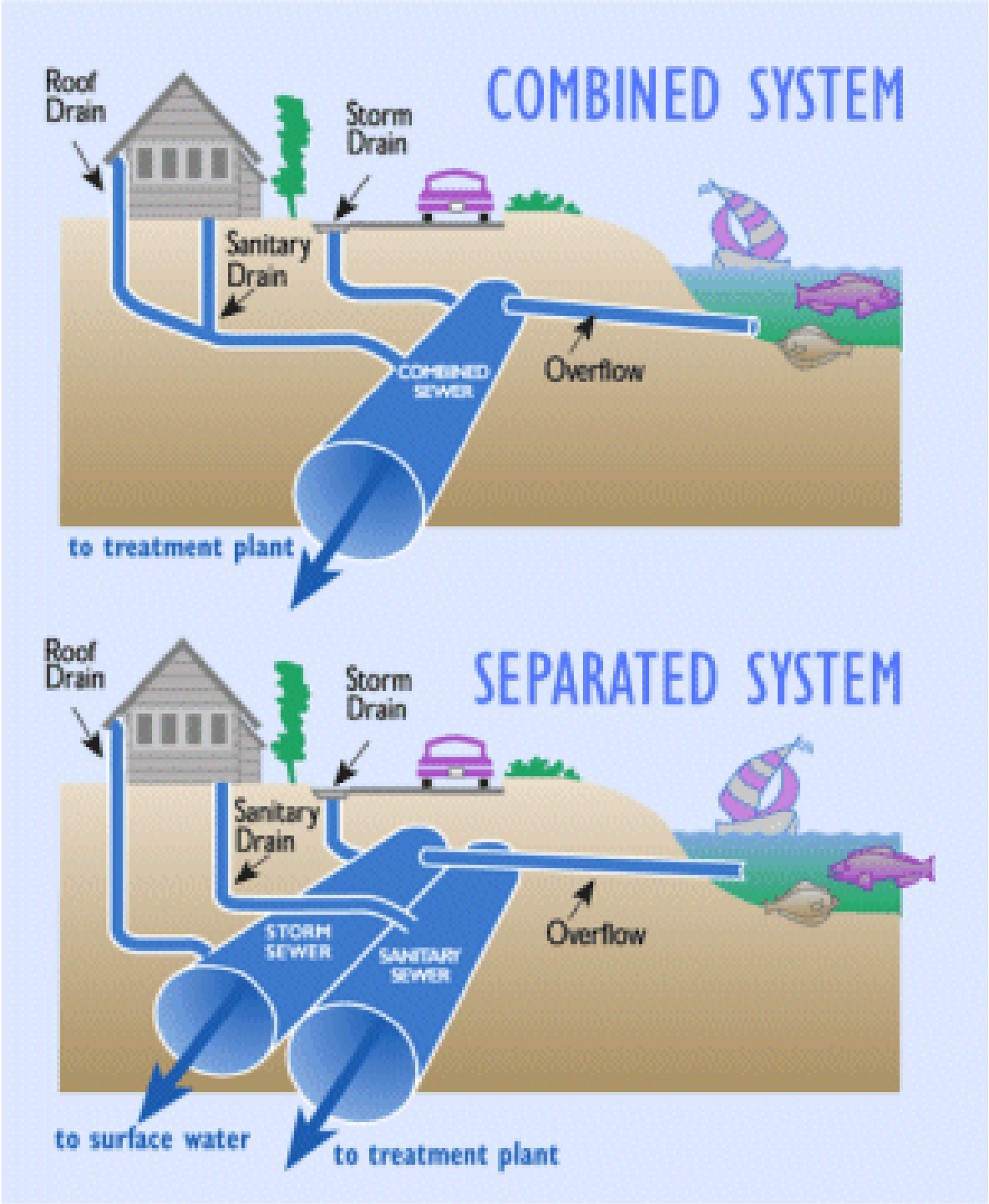
- Establish standards for the most important pollutants!
- Emissions should be regulated!
- Treatment of sewage should be prescribed!
- Destruction of wetlands should be performed under permission!
- It does not sufficiently deal with non-point sources of pollutants.
- It envisages that all waterways should be fished and swimming.

Technological approach: sewage systems

- **It requires proper soil and maintenance**



- **a quarter of American homes has sewage system;**
- **it can be used in car parks and other public areas;**

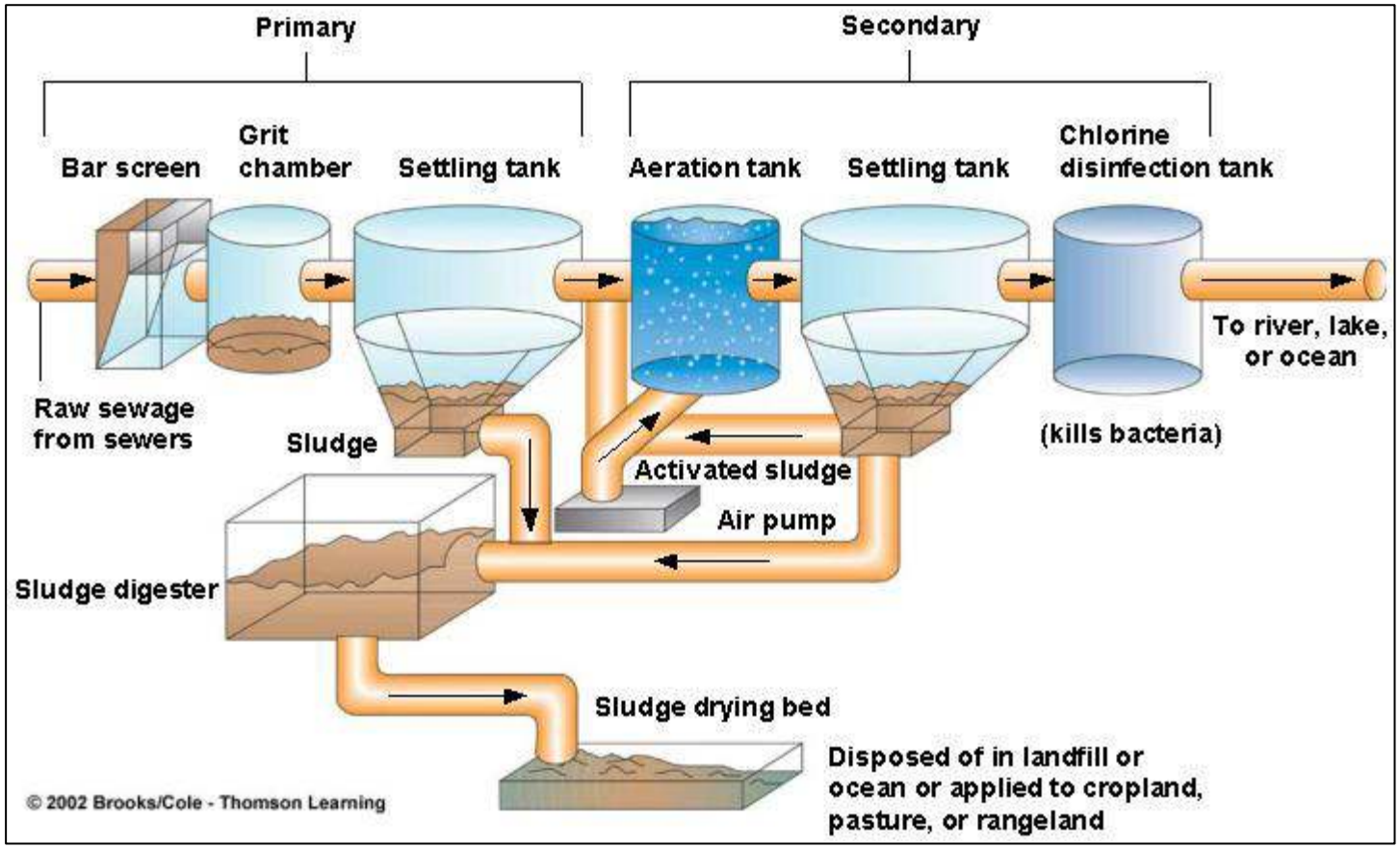


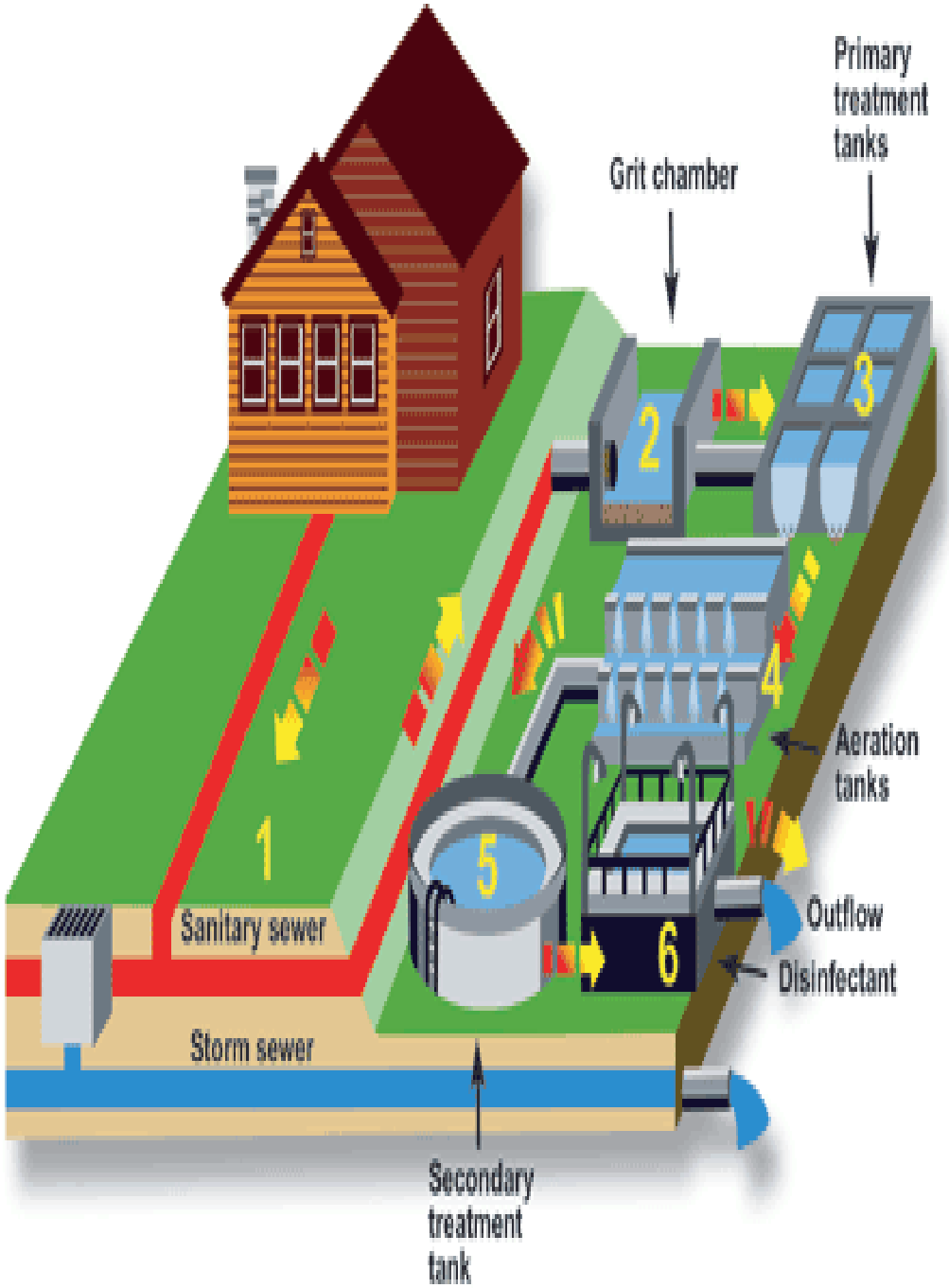
A combined sewer overflow is a problem in many older cities;

- EPA: 1.80 to 3.85 million patients because of bathing in contaminated water due to a sewer overflow;

Technological approaches: waste water treatment

- **Physical and biological treatment**





Primary:
removes 60% of solid pollutants and 30-40% of oxygen demanding waste (physically);

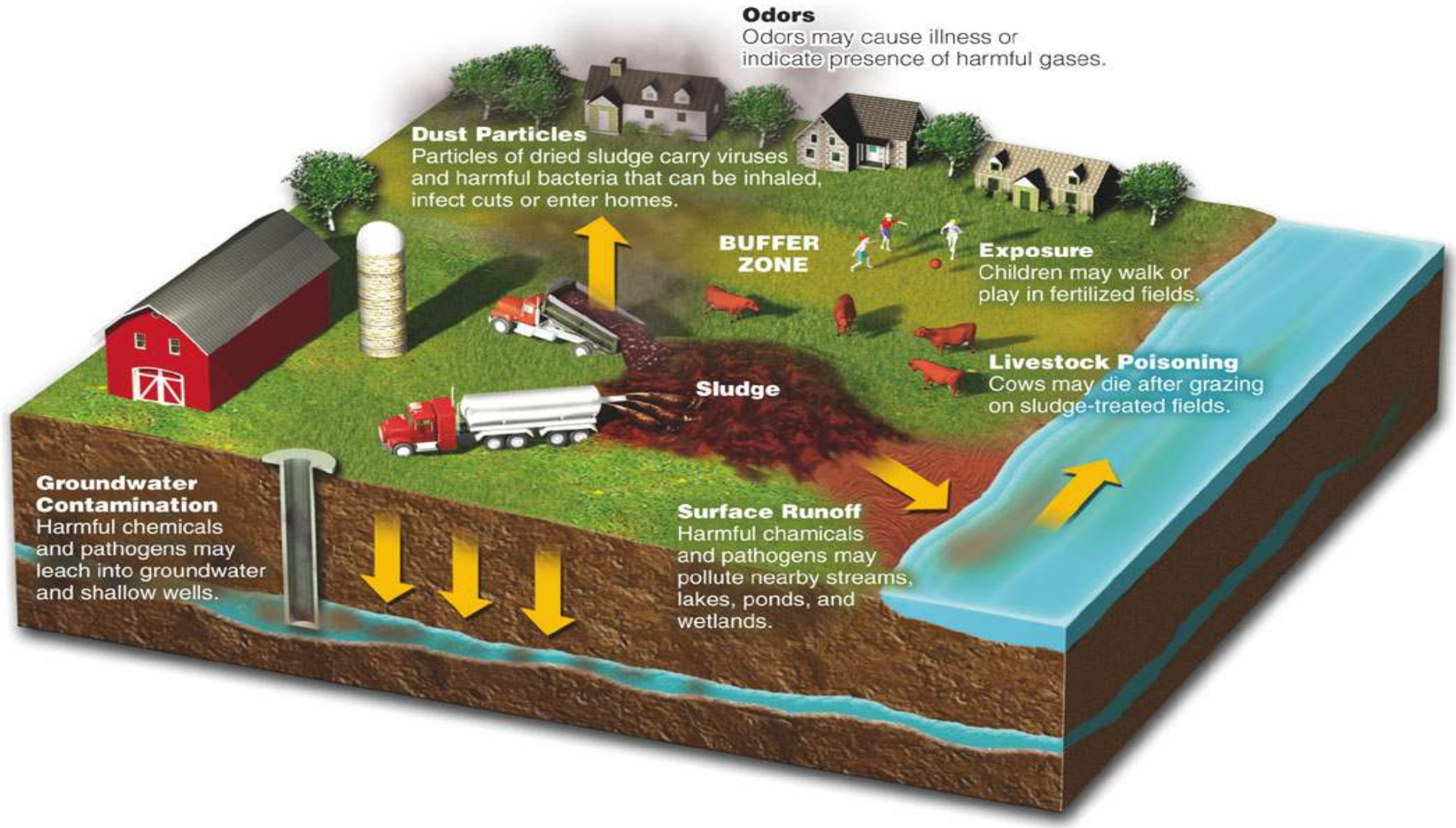
Secondary:
uses biological processes for breaking down at most 90% of biodegradable wastes;

Tertiary:
uses advanced technology (in the USA for decomposing of only 5% of all wastes)
EXPENSIVE!

Disinfection:
chlorine, ozone, UV

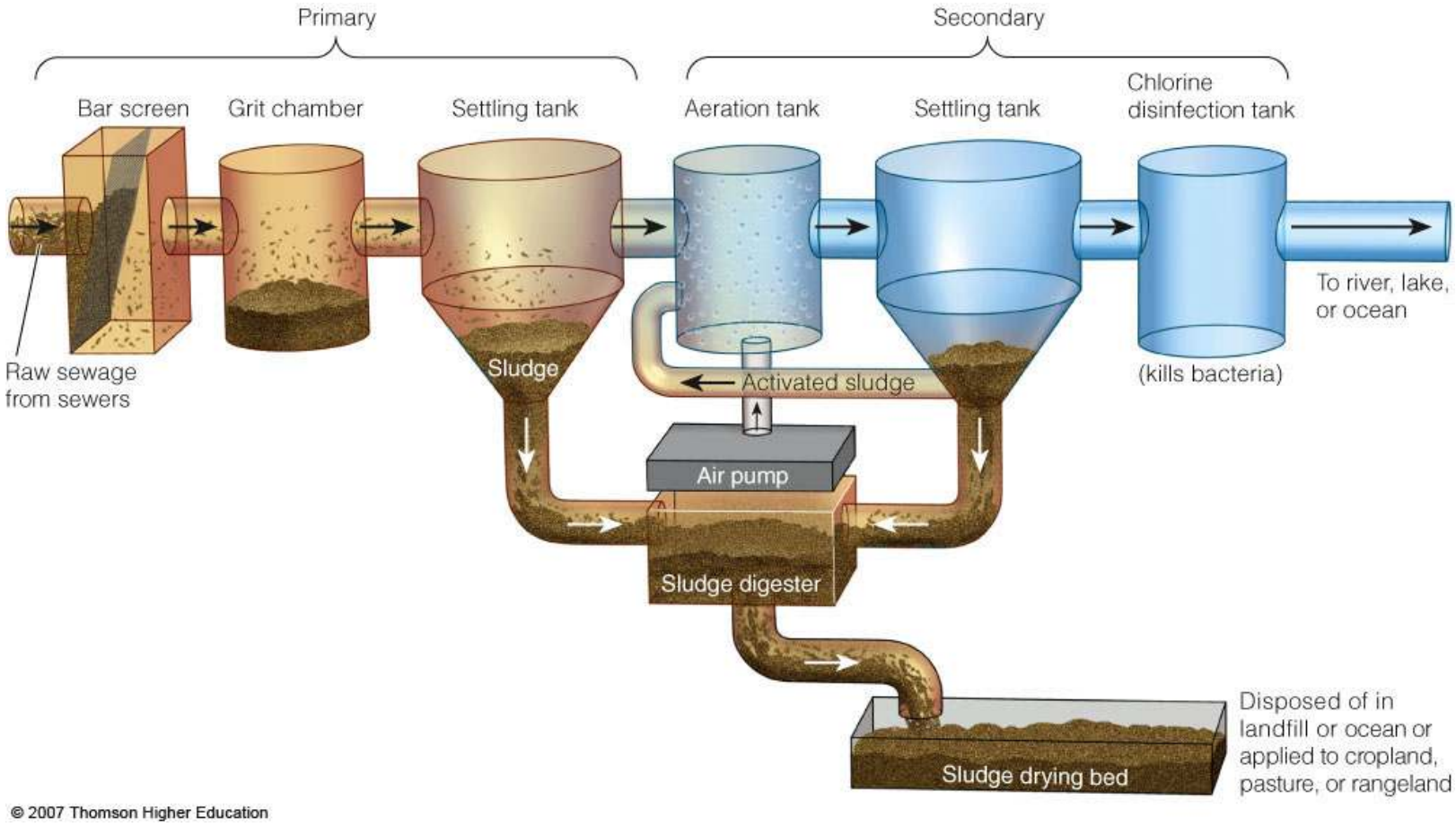
Technological approach: developed (terciary) waste water treatment

- uses physical and chemical processes;
- removes nitrates and phosphates;
- expensive;
- not widely used;



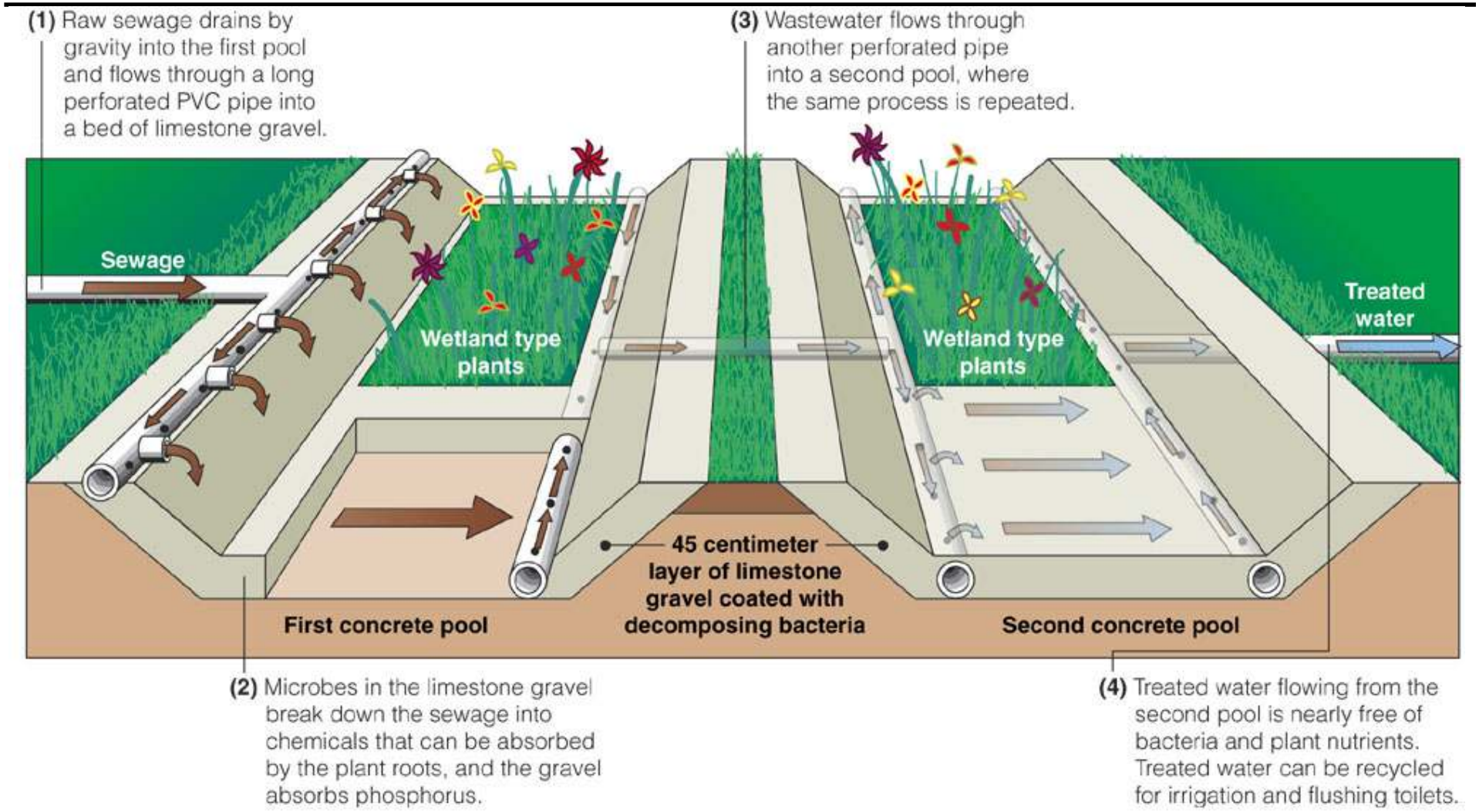
Sludge disposal … its use as fertilizer

Reducing water pollution with waste water treatment



- Primary and secondary waste water treatment

Technological approach: use of wetlands to treat waste water



Solutions

Water Pollution

- Prevent groundwater contamination
- Greatly reduce nonpoint runoff
- Reuse treated wastewater for irrigation
- Find substitutes for toxic pollutants
- Work with nature to treat sewage
- Practice four R's of resource use (refuse, reduce, recycle, reuse)
- Reduce resource waste
- Reduce air pollution
- Reduce poverty
- Reduce birth rates

Drinking water

- How to clean drinking water? By using advanced technology.
- How can we purify drinking water in developing countries?
- What is the Safe Drinking Water Act?
- Is the the bottled water a good response, or an expensive idea?

Quality of drinking water

- cleaning urban drinking water
- fear from terrorism
- cleaning rural drinking water
- Safety Drinking Water Act
- maximum contaminant levels (MCLs)
- bottled water

Cleaning of urban drinking water

Surface water:

to be removed from the reservoir to improve the quality;

it should be pumped to a treatment plant, to reach drinking water quality standards;

Ground water:

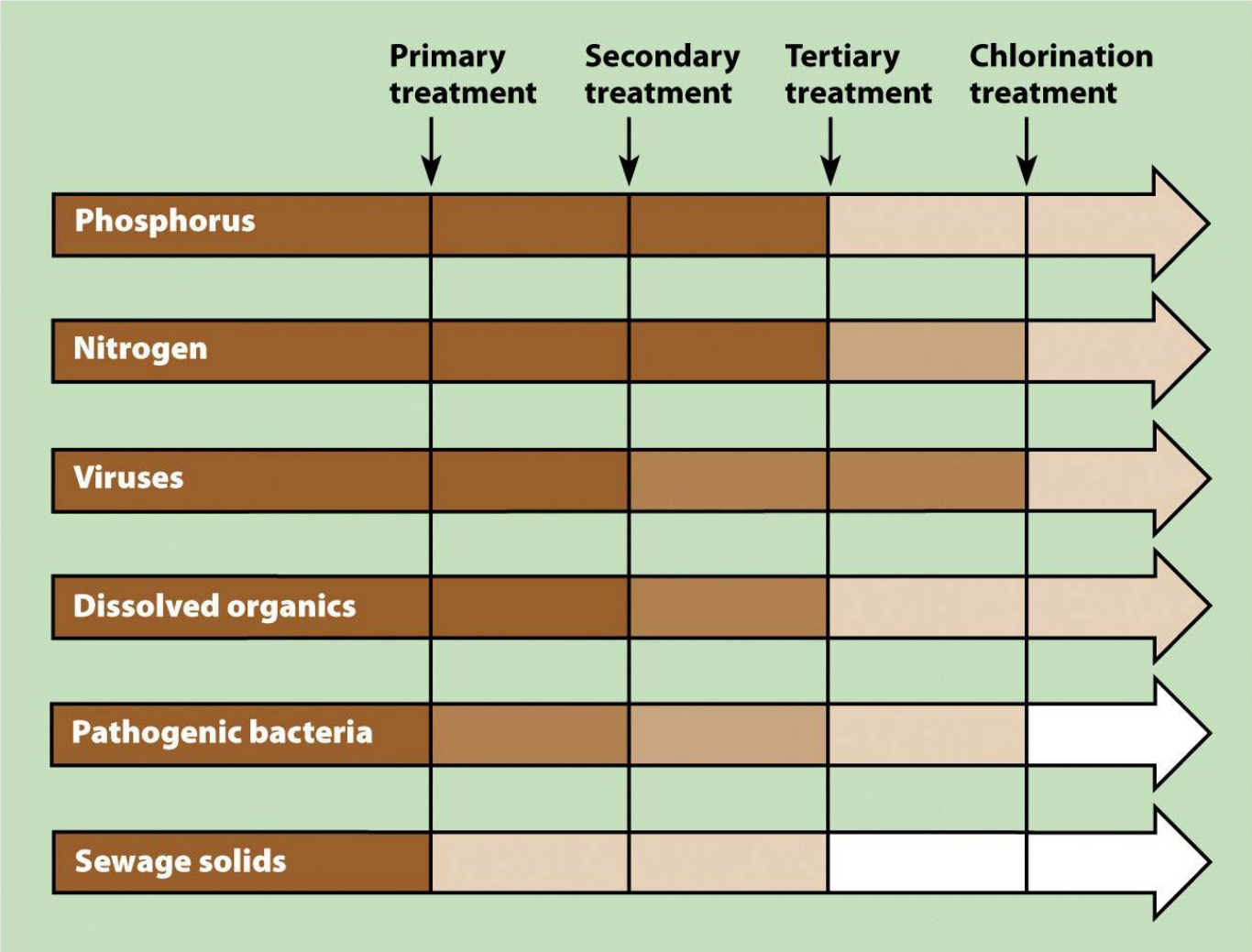
usually needs little treatment;

Cleaning of rural drinking water

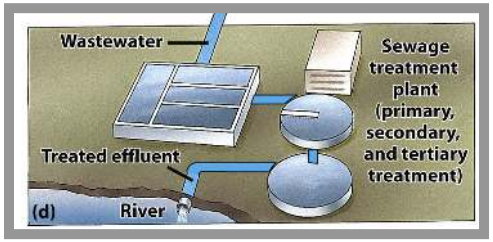
Water purification is also possible with simple devices:

- water should be exposed to heat and UV radiation;
- water should be filtered through a fine cloth;
- small amount of chlorine should be added to;

Waste water treatment



Cleaning of drinking water



- **Chlorine dilemma**
  - Chlorine destroys organisms causing diseases;
  - by-products of chlorine can be linked to many cancer diseases, miscarriage or birth disorders;
  - in Peru, chlorine was not used to purify drinking water:
    - 1991: huge cholera epidemic → 300,000 patients;

- **Fluorine dilemma**
  - It prevents dental diseases;
  - fluorinated drinking water may be associated with cancer and kidney diseases;

Safety Drinking Water Act

- 54 countries have law on drinking water;
- In the US, on the SDWA adopted in 1974, the liability is for EPA to set up standards for drinking water;
- Maximum contaminant levels (MCLs)

Safety Drinking Water Act

in the

- SDWA cannot be not applied to privately owned wells;
- where the drinking water does not meet the standard under SDWA, there punishment will be imposed;

Bottled water

Thanks to multi-billion USD investment, today the tap water is the safest in the US.

Bottled water is 240 times - 10,000 times more expensive than tap water.

25% of bottled water is tap water.

Bottled water

Every year, 1.4 million tons of plastic bottles go in the trash (USA).

During the bottling toxic vapours occur.

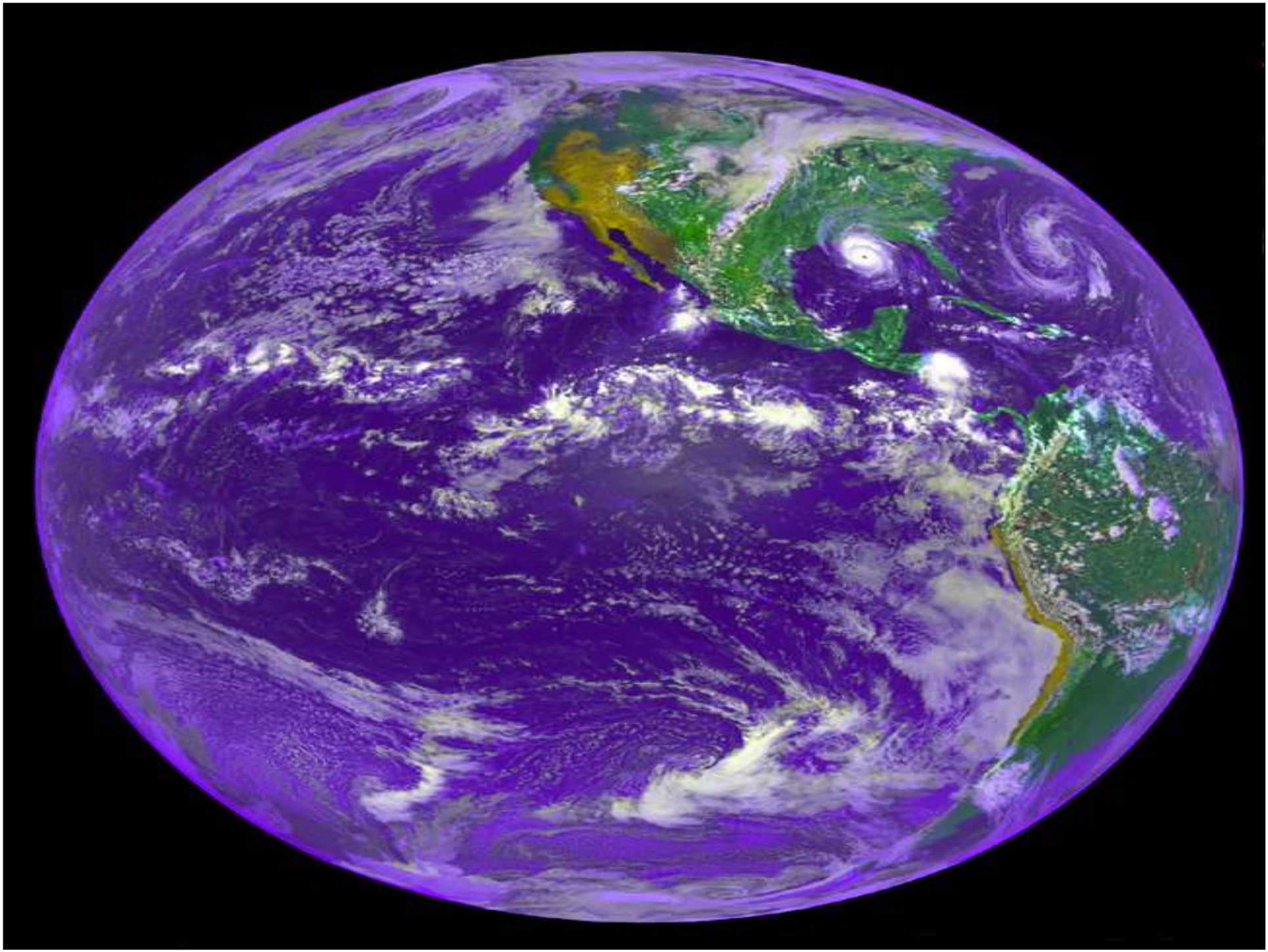
The bottles are made of oil-based plastics.

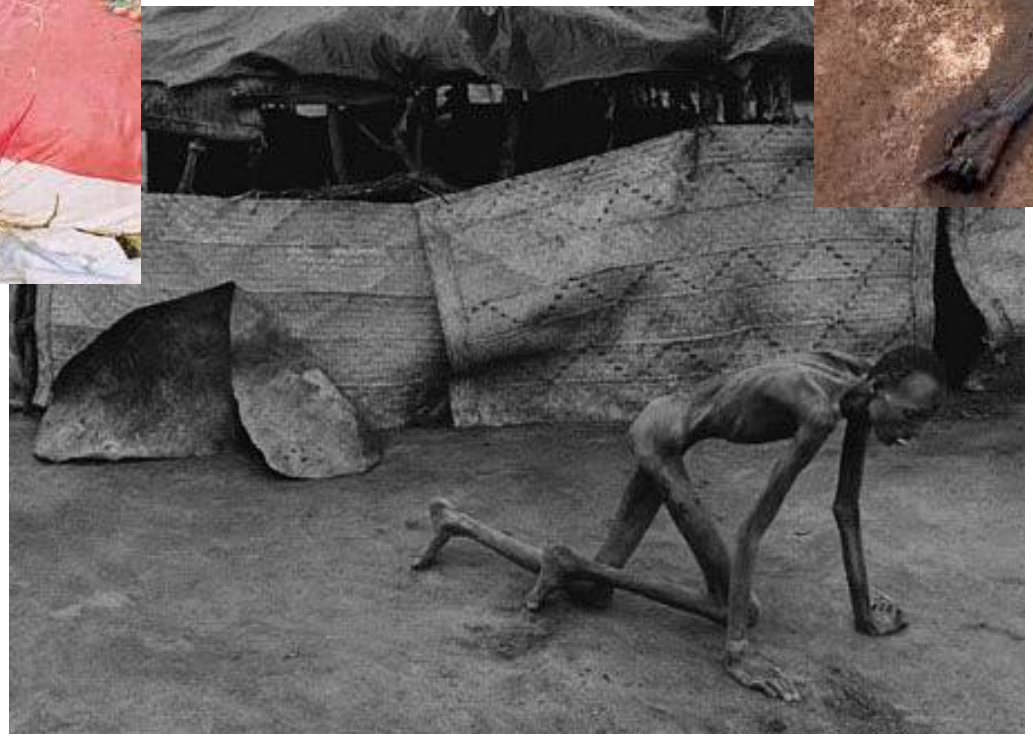
Bottled water does not need to meet the SDWA standards.

What can we do?

Water pollution

- The soil of garden and courtyard should be improved by natural manure or compost and avoid fertilizer!
- Minimize the use of pesticides!
- Do not use fertilizer or pesticides near water body!
- Grow or buy organic nutrients!
- Do not use bottled water unless the tap water is not contaminated. Only recharge and re-use the plastic bottle with tap water!
- Compost food waste!
- Do not use water refreshing in the toilets!
- Do not discard unwanted drugs down the toilet!
- Do not pour out pesticides, paints, solvents, oils, antifreeze, or other products that contain harmful chemicals into the sewer or to the soil!





What is the situation in Hungary?

Water quality standarads

Spatial characteristics

Quality features and thresholds of surface waters (extract from standard MSZ 12749) (1)

OXYGEN BALANCE					
Component	I.	II.	III.	IV.	V.
	class				
Dissolved O_2, mg/L	7	6	4	3	<3
Oxygen saturation,%	80-100	70-80 100-120	50-70 120-150	20-50 150-200	< 20 > 200
BOI_5, mg/L	4	5	10	15	> 15
KOI_{ps}, mg/L	5	8	15	20	> 20
KOI_k, mg/L	12	22	40	60	> 60
Pantle-Buck index	1,8	2,3	2,8	3,3	> 3,3

Quality features and thresholds of surface waters (extract from standard MSZ 12749) (2)

NUTRIENT BALANCE					
Component	I.	II.	III.	IV.	V.
	class				
Ammonium-ion, mg/L	0,26	0,64	1,29	2,57	> 2,57
Nitrit-ion, mg/L	0,033	0,100	0,329	0,986	> 0,986
Nitrát-ion, mg/L	4,43	22,14	44,28	110,7	> 110,7
Total phosphorous[1] mg/L	100	200	400	1000	> 1000
Total phosphorous[2] mg/L	40	100	200	500	> 500
PO_4-P[1] mg/m^3	50	100	200	500	> 500
PO_4-P[2] mg/m^3	20	50	100	250	> 250
A-chlorophyll, mg/m^3	10	25	75	250	> 250

[1] in case of releasing into non-still water, [2]other

Quality features and thresholds of surface waters (extract from standard MSZ 12749) (3)

MICROPOLLUTANTS, TOXICITY					
Component	I.	II.	III.	IV.	V.
	class				
Phenols, mg/m^3	2	5	10	20	> 20
ANA-detergents, mg/m^3	100	200	300	500	60 500
Q-oil and its products, mg/m^3	20	50	100	250	> 250
OTHER CHARACTERISTICS					
pH	-	6,5-8,0	6,0-6,5 8,5-9,0	5,5-6,0 9,0-9,5	< 5,5 > 9,5
Conductivity at 20°C, μS/cm	500	700	1000	2000	> 2000

Quality system of surface water (MSZ 12749) (1)

Class I. high quality water:

- free from artificial contaminants;
- pure water of natural state;
- low solute content;
- oxygen saturation nearly complete;
- low nutrient pollution and practically no waste bacteria;

Quality system of surface water (MSZ 12749) (2)

Class II. good quality water:

- slightly loaded with external contaminants and bioavailable nutrients, mesotrophic type of water;
- diurnal and seasonal changes in the characteristics of the oxygen balance, as well as the amount of dissolved and suspended organic and inorganic materials do not deteriorate the conditions of life;
- biodiversity of aquatic organisms is high, however their number is small, including micro-organisms;
- water is of natural colour and odour;
- little sewage bacteria;

Quality sytem of surface water (MSZ 12749) (3)

Class III. acceptable water:

- moderately polluted water, in which bioavailable nutrient pollution may lead to eutrophication;
- sewage bacteria can be clearly detected;
- seasonal and diurnal fluctuations of the oxygen balance, as well as harmful substances may temporarily produce unfavourable living conditions;
- In the life communities, decrease in the number of species and mass proliferation of certain species may also cause water discolouration;
- occasionally, odor and colour referring to contamination also happens;

Quality system of surface water (MSZ 12749) (3)

Class IV. polluted water:

- nutrient-rich water with exogenous organic and inorganic materials, as well as wastewater;
- oxygen balance is between wide limits, anaerobic condition may also occur;
- biodegradation of a large amount of organic matter, as well as high bacterial and unicellular mass occurrence are characteristic;
- water is cloudy, sometimes its colour is changing, algal blooms may also occur;
- concentration of biologically harmful substances may sometimes reach chronic toxicity values;
- this water quality could adversely affect, higher aquatic plants and multicellular animals;

Quality sytem of surface water (MSZ 12749) (3)

Class V. strongly polluted water:

- heavily loaded with organic and inorganic materials and wastewater of different origin, sometimes toxic water;
- bacteria content of the water approaches to that in raw wastewaters;
- biologically harmful materials and the lack of oxygen limit conditions of life;
- transparency of the water is usually small, muddy, smelly, its colour is characteristics and changing;
- the concentration of decomposition products and pollutants is very high, with chronic and sometimes acute toxic levels for aquatic life;

FELSZÍNI VIZEK MINŐSÉGE

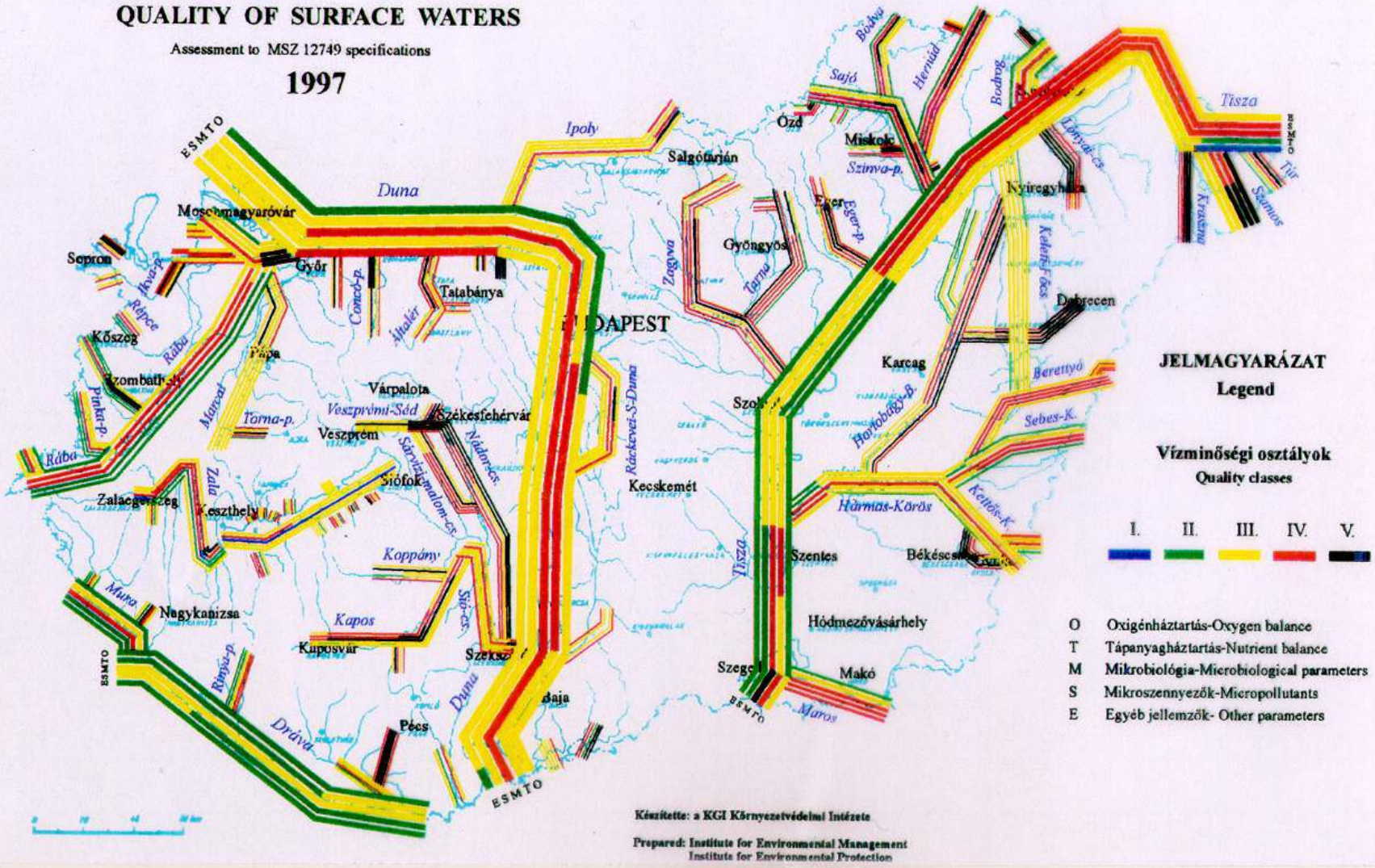
Értékelés az MSZ 12749 szabvány alapján

QUALITY OF SURFACE WATERS

Assessment to MSZ 12749 specifications

1997

III. melléklet
Annex 3



JELMAGYARÁZAT
Legend

Vízminőségi osztályok
Quality classes

I. II. III. IV. V.

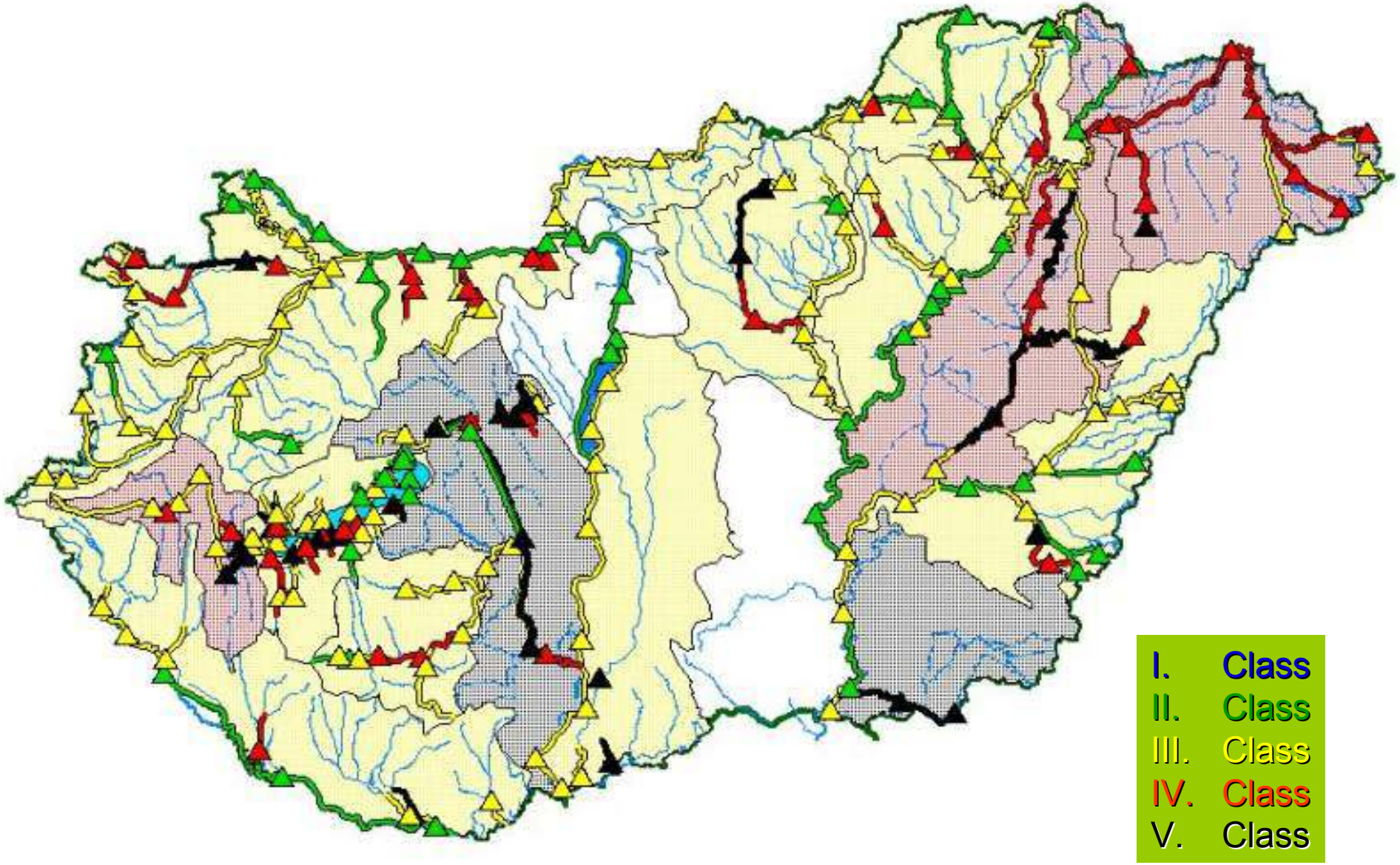
O Oxigénháztartás-Oxygen balance
T Tápanyagháztartás-Nutrient balance
M Mikrobiológia-Microbiological parameters
S Mikroszennyezők-Micropollutants
E Egyéb jellemzők- Other parameters

Készítette: a KGI Környezetvédelmi Intézete

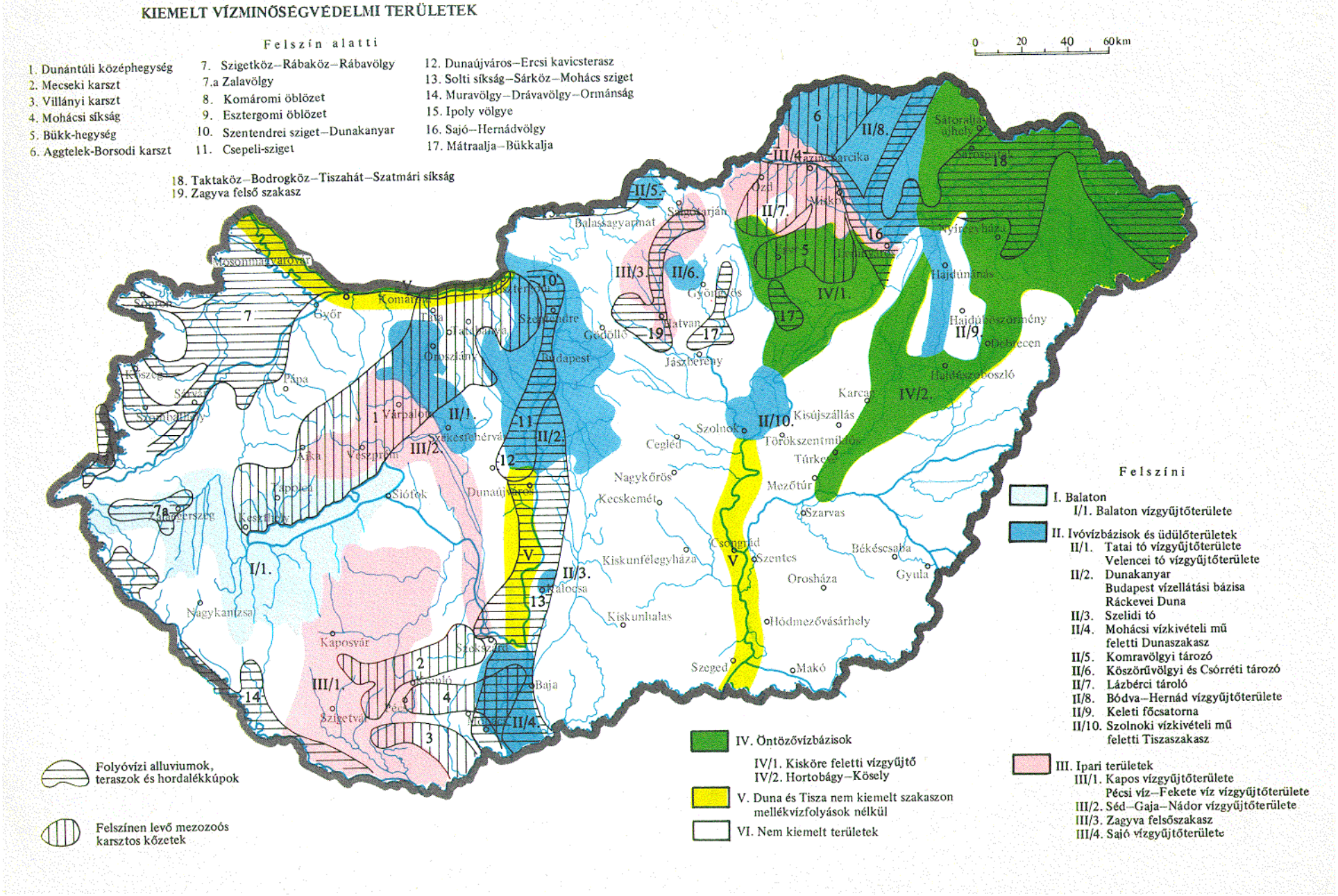
Prepared: Institute for Environmental Management
Institute for Environmental Protection

Quality of surface waters of Hungary, oxygen balance (BOI_5, KOI, O_2)

(Evaluation, water quality data, 2000, MSZ 12749)



Pollutant load capacity of surface waters and ground waters



We finished for today, goodbye!

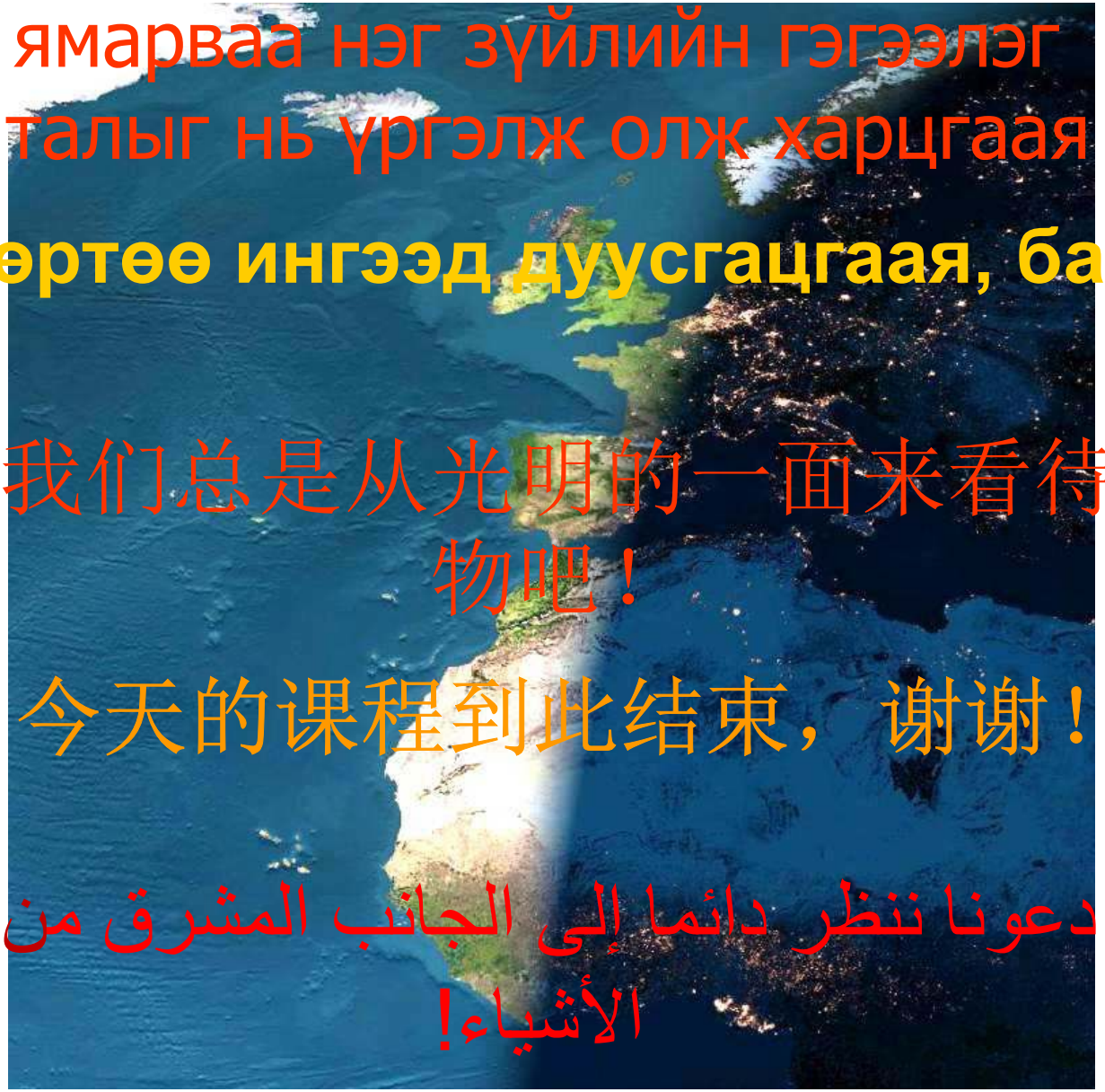
ямарваа нэг зүйлийн гэгээлэг
талыг нь үргэлж олж харцгаая

өнөөдөртөө ингээд дуусгацгаая, баяртай

让我们总是从光明的一面来看待事物吧！

今天的课程到此结束，谢谢！

دعونا ننظر دائما إلى الجانب المشرق من الأشياء!



انتهينا لهذا اليوم، وداعا!