WATER POLLUTION SOURCES

• **Point sources**
  – Wastewater that are discharge from *known sources* at an identifiable point
  – Can be reduced or eliminated through proper wastewater treatment prior to discharge

• **Non-point sources**
  – Characterized by *multiple discharge points* (eg: urban and agricultural runoff)
  – Much of non-point sources pollution occurs during rain storms.
  – Reduction generally requires changes in land use practices
POINT SOURCE

• Also defined as stationary locations or fixed facilities from which pollutants are actually discharged.

<table>
<thead>
<tr>
<th>Industrial/Commercial</th>
<th>Agricultural</th>
<th>Municipal</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Manufacturing and maintenance’s operation</td>
<td>• Animal feeding, animal waste treatment lagoons, storage, handling, mixing, cleaning operations</td>
<td>• Wastewater treatment plants, landfills, utility stations, motor pools and fleet maintenance facilities</td>
</tr>
<tr>
<td>• Solvents, petroleum products or heavy metals.</td>
<td>• Pesticides, fertilizers, petroleum</td>
<td></td>
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</tbody>
</table>
In Malaysia: DOE has recorded 17,991 water pollution point sources in 2004
NON-POINT SOURCE

• Deposition of contaminated rain falling from the sky
• Polluted melting snow
• Runoff (water flow on land) of polluted water
• Impure water draining down into the groundwater from many different sites on the surface.

Source: google.com
VIDEO ON SURFACE RUN-OFF (NPS)
TYPE OF NON-SOURCE POLLUTANT

- **Sediment**: From field, construction sites, mining or logging operations
- **Nutrient**: From cropland, nurseries, orchard, livestock and poultry farms, lawns and landfills
- **Heavy metals**: Fluids that leak out of vehicles, runoff from mine sites, roads and parking lots
- **Toxic chemical**: From farmland, nurseries, orchards, construction sites, lawns and landfill
- **Pathogens**: From sewage, farms, fluid leaking from landfill
NON-POINT SOURCE

- It is often difficult to trace the exact origin of these pollutants.
- Result from a wide variety of human activities on the land as well as natural characteristics of the soil, and topography.
• Reduce fertilizer runoff
  – not using excessive amount
  – using none on steeply sloped land
  – apply pesticides only when needed
  – reducing the usage of fertilizers and pesticides on golf courses and public parks
NPS: CONTROL SURFACE WATER POLLUTION

- Planting of permanent vegetation as buffer zone between farmland and rivers/lakes.

Source: http://msmam.com
NPS: CONTROL SURFACE WATER POLLUTION

- Reforestation of logged forest to control soil erosion

Source: thestar.com

Source: CIFOR
NPS: CONTROL SURFACE WATER POLLUTION

- Use of sedimentation basins or silt traps at construction sites

Silt fence

Inlet traps

Silt trap in Berinchang

Straw Bales

Source: google.com
NPS: CONTROL SURFACE WATER POLLUTION

- Road cleaning practices
NPS: CONTROL SURFACE WATER POLLUTION

- Efficient solid waste management
- Installation of waste traps at drainage system and rivers
WATER QUALITY PARAMETERS

• Dissolved Oxygen
  – Significant in protection of aesthetic qualities, as well as for the maintenance of aquatic life.
  – Concentration of 2 mg/L is the minimum to support normal aquatic life in the tropics.
  – A criteria level of above 5 mg/L is needed for the propagation of fish and aquatic wildlife.
  – A criteria level of above 4 mg/L is desirable in drinking water.
WATER QUALITY PARAMETERS

• Lead
  – Toxic to human, animals & plants
  – It is recommended that concentration in domestic water supplies should not exceed 0.05 mg/L.

• Mercury
  – High toxic potential
  – A level of 0.05 µg/L is recommended as a safe concentration for freshwater aquatic organisms.
  – For domestic water supply mercury levels should be less than 0.002 mg/L.
WATER QUALITY PARAMETERS

• Cadmium
  – High toxic potential
  – Factors such as pH affect the toxicity of Cd.
  – Cd in domestic water supply should not exceed 0.01 mg/L.
  – Certain fishes can tolerate a limit of 0.02 mg/L.

• Iron
  – Essential trace element required by plants and animals, however, can become toxic when present in high levels.
  – Recommended iron concentration in water supply is 0.3 mg/L with a minimum limit of 0.05 and maximum limit of 1.0 mg/L.
Manganese

- Although high concentration of manganese can be toxic, it is a vital nutrient for plants & animals.
- Desirable concentration in drinking water: 0.01 to 0.05 mg/L.
- Manganese caused brownish color to water and washed cloth.
- High concentration of manganese in drinking water produces undesirable taste.
WATER QUALITY ASSESSMENT AND MONITORING

BIOLOGICAL ASSESSMENT

- Most aquatic organism are sensitive to changes in their environment whether natural caused or human caused.
- Different organism response in different ways may include:

  - Death
  - Inhibition certain physiological process
TYPES OF BIOLOGICAL ASSESSMENT

1. Ecological methods
   - Analysis of communities in the water body
   - Presence or absence of specific species
   - An indicator organism will be selected for its sensitivity or tolerance to various kinds of pollution or its effects
     • Example: typical effects on water quality and the associated biota which may be observed downstream of a sewage outlet
VIDEO ON STREAM
ECOLOGICAL ASSESSMENT
Ecological methods

CLADOPHORA

- Research in 1960’s and 70’s linked Cladophora blooms to high phosphorus levels in the water.
- Due to tighter restrictions, phosphorus levels declined during the 1970’s and Cladophora blooms were largely absent in the 1980’s and 90’s.

Source: http://www.glwi.uwm.edu
Aquatic sludge worms of family Tubificidae are most tolerant to pollution and occurred in the most polluted areas.

Due to its short life cycle, small size and high density, different species of chironomids have been used in acute toxicity tests.

Source: google.com
2. Physiological & biochemical methods

- Respiration and growth of organism suspended in water
  - to determine the quantity of biodegradable organic compounds and the tendency for eutrophication

- Oxygen production and consumption, stimulation and inhibition.
  - example: measurement of Oxygen Production Potential (OPP) that can be carried out in the lab or on-site
3. The use of organism in control environment

- Assessment of the toxic effects on organism under defined laboratory conditions (bioassays)
- Biological assessment results are used to answer the question of whether waterbodies support survival and reproduction of desirable fish, shellfish, and other aquatic species
EXAMPLE OF WATER QUALITY MONITORING