國立臺北大學自然資源與環境管理研究所
111 學年度第一學期『環境工程科學概論』

課程講義(09-10)：水質管理與水處理技術
Water Quality Management and Water Treatment Technology

- INTRODUCTION
  - □ Water Bodies and Water Uses =>地面水體分類及水質標準
  - □ Self Clarification, Self Purification, Assimilation Capacity, Carrying Capacity
  - □ Effluent Standards 放流水標準; Emerging Pollutants; and Water Pollution Fee
  - □ River Pollution Index (RPI) 河川污染指數 => WQI 水質指數
  - □ Total Maximum Daily Loads (TMDLs) vs. Total Mass Control
  - □ Water Reclamation and Water Reuse =>再生水資源發展條例
  - □ Public Water Supply, Sewage Systems, Industrial Wastewater, Water Reuse
  - □ Tap Water vs. Drinking Water =>自來水、飲用水
    ⇒Infrastructure vs. Environmental Protection => Public Utility
    ⇒社區自設公共給水設備、簡易自來水
  - □ Drinking Water Quality Standard 飲用水水質 vs. Tap Water Quality Standard
    ⇒飲用水水質標準
    ⇒自來水水質標準
    ⇒板新地區供水改善計畫、翡翠原水管工程計畫

- WATER POLLUTANTS AND THEIR SOURCES
  - □ Point Sources vs. Non-point Sources
  - □ Oxygen-Demanding Material: Organic Pollutants => “Equivalent”
  - □ Nutrients => N&P => CTSI (卡爾森指數 Carlson Trophic State Index)
  - □ Pathogenic Organisms: Virus, Bacteria, Protozoa...
  - □ Suspended Solid => SS => Air Pollutants: Particulate Matter (PM) and TSP
  - □ Salts (Dissolved Solid) => TDS and Salinity
  - □ Toxic Metals and Toxic Organic Compounds
  - □ Heavy Metals and Heat => Arsenic, 核電廠溫排水=>燃煤電廠海水法除硫

- WATER QUALITY MANAGEMENT IN RIVERS
  - □ Effect of Oxygen-Demanding Wastes on Rivers
  - □ Biochemical Oxygen Demand (BOD)
    ⇒Chemical Oxygen Demand (COD)
    ⇒Decay (Aerobic Decomposition): First Order Reaction
  - □ Dissolved Oxygen and Water Quality: Temperature and Indicator Species
  - □ Laboratory Measurement of BOD => 5-Day BOD
  - □ DO Sag Curve (De-oxygenation and Re-aeration)
  - □ Effects of Other Pollutants on Water Bodies
  - □ Biological Indicators

- WATER SUPPLY ENGINEERING
  - □ 自來水到我家：取水、導水、淨水、送(配)水
  - □ 自來水工程、給水工程、上水道工程
    - ⇒集水工程 Collection Works
    - ⇒輸(導)水工程 Transmission Works
    - ⇒抽水工程 Pumping Works
    - ⇒淨水工程 Purification Works
    - ⇒配水工程 Distribution Works

- WATER TREATMENT ENGINEERING (PURIFICATION WORKS)
  - □ Water Treatment Units
    - ⇒Gas Transfer; Ion Transfer; Solid Transfer
    - ⇒Solute Stabilization => Desalination
    - ⇒Sanitation, Hygiene and Aesthetical Considerations (Potability)
  - □ Water Treatment Components (Steps)
    - ⇒Gridding and Screening
    - ⇒Coagulation（混凝）and Flocculation（膠凝）=> PAC
    - ⇒Sedimentation => Primary and Secondary (even Tertiary sedimentation)
    - ⇒Filtration and Disinfection => THM (Tri-Halogen Methane)
  - □ Advanced Water Treatment: Potability and other Aesthetical Considerations
    - ⇒Ion Exchange; Reverse Osmosis (RO); Ultra-filtration: Membrane; UV & O_3

- SEWAGE ENGINEERING AND WASTEWATER TREATMENT ENGINEERING
  - □ Sewage Systems or Sewers: Sanitary Wastewater and Stormwater Runoff
    - ⇒Combined vs. Separate Sewage Systems
    - ⇒Pipelines vs. Channels: Pipe Flow vs. Open Channel (Open Surface) Flow
  - □ Classification of Wastewater Treatment Plants
    - ⇒Primary Treatment 一級處理
    - ⇒Secondary (Biological) Treatment 二級（生物）處理
    - ⇒Tertiary (Advanced) Treatment 三級（高級）處理
  - □ Sludge Treatment
    - ⇒Anaerobic Digestion; Dewatering and Drying => Water Content; Disposal
    - ⇒Sludge and Biomass: Integrated Wastewater Treatment Plant

- OTHER CONSIDERATIONS
  - □ Water Bill: 水費單 => 台灣自來水公司；台北自來水事業處
  - □ 水源保護區劃設、管理、回饋 => 自來水法、飲用水管理條例
  - □ 水質淨化現地處理；水質淨化工程篇；水質自然淨化工法
  - □ 中水道系統、雨水收集利用、民生污水回收再利用、再生水資源

- HOMEWORK #6 (2022/11/29 Due)：請整理《放流水標準》規範之「事業」與「污水下水道系統」類別項目，並彙整公共污水下水道系統之氨氮放流水標準規定，以討論台北市自主加嚴污水處理廠氨氮管制限值之事件發展。