ES473 Overview of Hydrogeologic Site Assessments and Remediation Studies

The following is an outline summary of reading review from the class web site:

Overview of Hydrogeologic Site Investigations
http://www.wou.edu/las/physci/taylor/g473/gwcont3.pdf

Groundwater Remediation Techniques
http://www.wou.edu/las/physci/taylor/g473/gwcont4.pdf

Use the outline below to read the above two web resources, and fill in the details of methodology included therein.

I. Site Investigation
   a. Geology
      i. Stratigraphy
      ii. Structure
      iii. Materials
   b. Hydrology
      i. Climate
      ii. Surface water
         1. Water budget
      iii. Groundwater
         1. Aquifer model
   c. Chemistry
      i. Site History / Anthropogenic Impacts
         1. Land use
         2. Industrial history
      ii. Geologic conditions
         1. Bedrock geochemistry
         2. Soils geochemistry
      iii. Contamination Sources
         1. Chemical constituents
      iv. Transport-Fate Pathways

II. Hydrogeology
   a. Hydrostratigraphic Model
      i. Aquifer materials
      ii. Aquitard/aquiclude materials
   b. Aquifer Type(s)
      i. Unconfined
      ii. Confined
   c. Aquifer Characterization
      i. Permeability /porosity / hydraulic conductivity
      ii. Thickness/aerial extent
   d. Groundwater Flow
      i. Groundwater maps
         1. Water table maps
         2. Confined potentiometric surfaces
      ii. Groundwater flow directions

III. Contaminant Pathways
   a. Source delineation
      i. Metals
      ii. Organic compounds
         1. LNAPL
         2. DNAPL
      iii. Volatile organic compounds

1. Flammable liquids
iv. Free product

b. Soil and Water Chemistry
i. Surface water (water sampling)
1. Streams
2. Storm water
ii. Groundwater (monitoring wells)
iii. Soils (test borings and sampling)

c. Contamination Footprint / Contaminant Plume
i. Soil contamination zone(s)
ii. Groundwater contamination zone(s)
iii. Surface contamination zones(s)

d. Contaminant Migration Pathways
i. Solids-liquids-gases
ii. Dissolved vs. non-dissolved states
iii. Transport rate
iv. Contaminate Fate (destination)

IV. Risk Assessment
a. Ecosystem Services (plants, animals, watershed function)
b. Human Interaction/Land use / population studies / demographics
c. Toxicology / Health Risks
d. Risk/Probability Assessment

V. Remediation Design and Planning
a. Source Removal
i. Contaminated soils and solids
ii. Source products, tanks, processes

b. Immobilization / Isolation of Contamination Zone from Ecosystem-Humans
i. Containment
1. Liner systems-grout curtains-cement vaults
2. Impermeable barriers and capping
ii. Hydraulic Controls
1. Surface water diversion
2. Groundwater flow alteration – pumping-cone of depression
iii. In-situ encasement
1. Concrete – grout mixing and solidification
2. Glass fusion / solidification

c. Mass reduction of contaminants / dilution
i. Bioremediation
ii. Pump and treat liquids – wastewater treatment
iii. Vapor extraction
iv. Passive treatment
1. Natural attenuation

VI. Environmental Monitoring
a. Groundwater
i. Hydraulics
ii. Chemistry

b. Surface Water
i. Hydraulics
ii. Chemistry

c. Atmospheric/Air