

# Geological Engineering Program:

A multidisciplinary program

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# Geological Engineering

- Integrates two major disciplines:
  - *Geology/Geophysics and Engineering*
- Geological engineers apply knowledge of earth materials and processes to design:
  - Rock/soil structures (*foundations, dams & tunnels*)
  - Mitigation of geologic hazards (*earthquakes & landslides, shore erosion, tsunamis*)
  - Remediation of polluted sites
  - Restoration of contaminated aquifers
  - Disposal of radioactive, toxic and other wastes

# Role of Geological Engineers

- Design foundation structures
- Design reservoir storage, dam foundations, structure and associated tunnels (spillways)
- Assess flood hazards
- Plan highway routes, other construction and obtain construction materials
- Design plans for mineral removal, waste containment, remediation
- Design stabilization methods for hillsides, eroding shorelines
- Evaluate and mitigate groundwater contamination

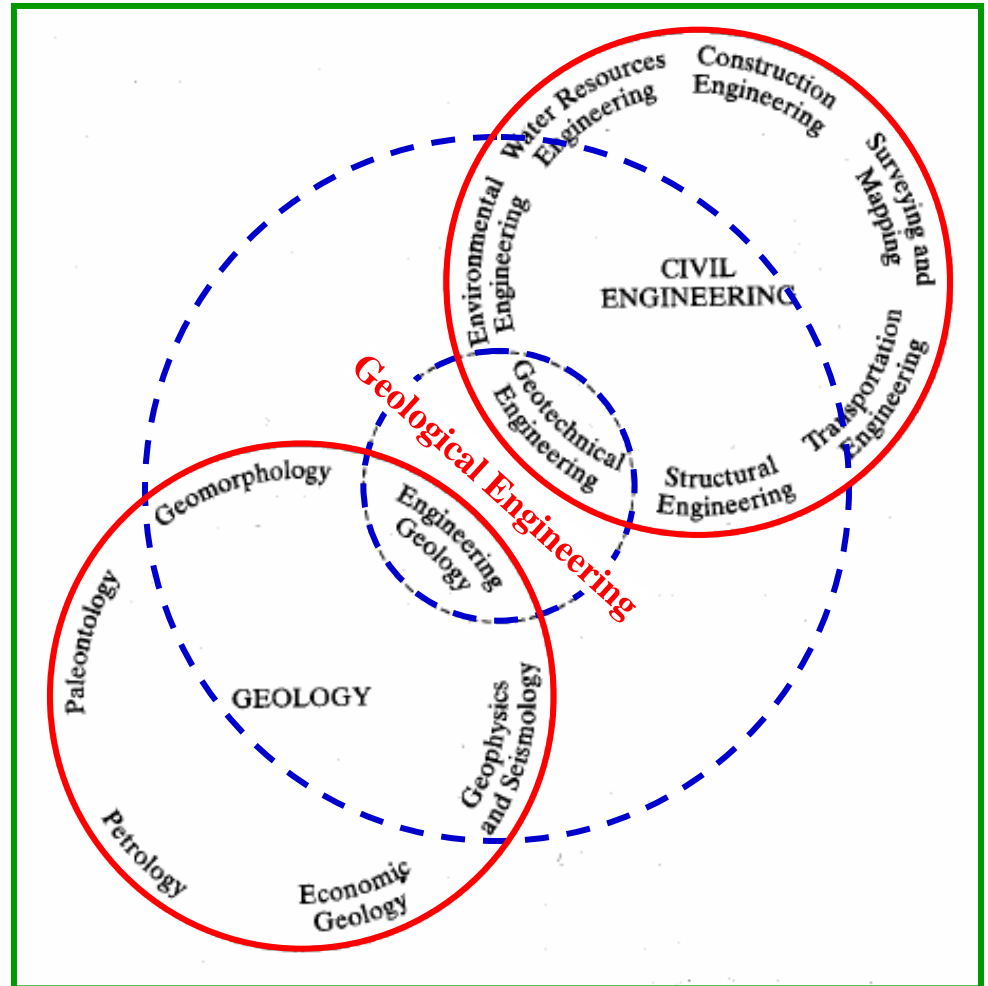
# Geological Engineering

- Virtually every structure is supported by soil or rock. Those that aren't either fly, float, or fall over.



# Geological Engineering

- Geological or GeoEngineering is the joint effort from geology and engineering.



# Geological Engineering

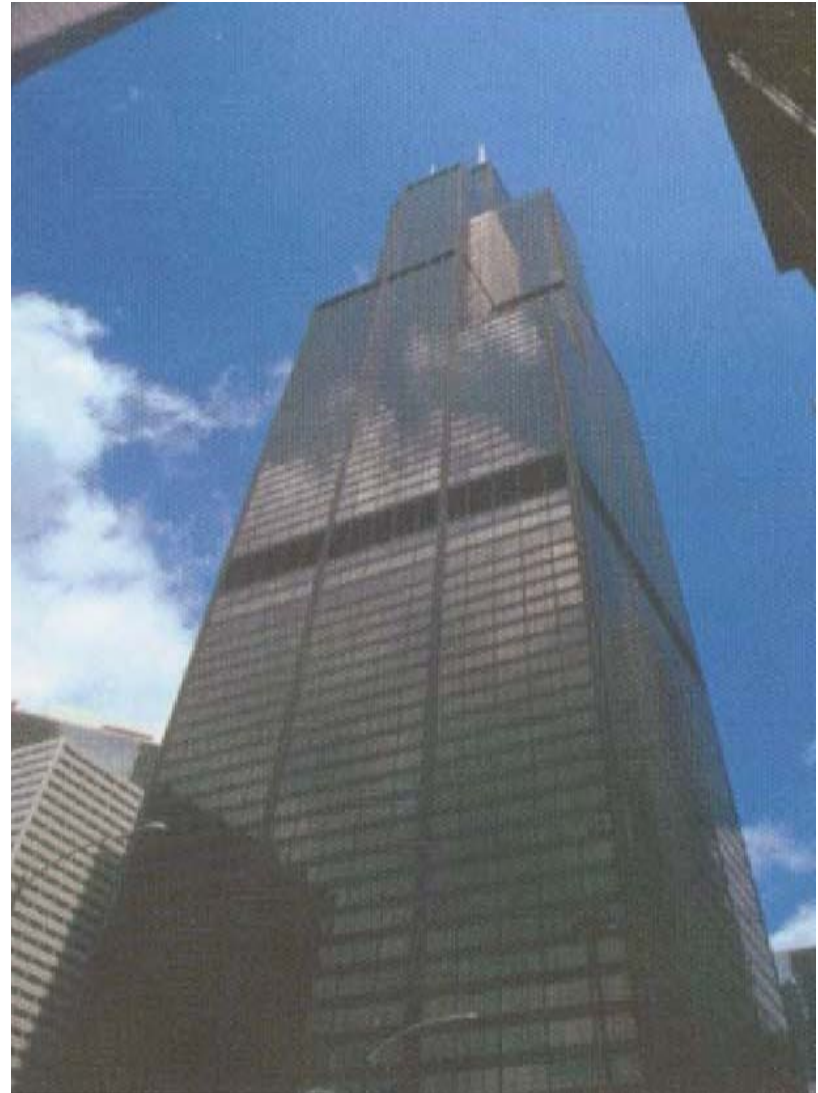
- Can the soils and rocks beneath a construction site safely support the proposed project?
- Are the natural or proposed earth slopes stable? If not, what must we do to stabilize them?
- How will the site respond to potential earthquakes?
- What groundwater conditions currently exist, how might they change in the future, and what impact do they have on the project?
- Has the ground become contaminated with chemical or biological materials? If so, are they a threat and what must we do to rectify the problem?

# Geological Engineering

- Buildings

The Sears Tower in Chicago is one of the tallest buildings in the world. It needs massive foundations to transmit the structural loads into the ground.

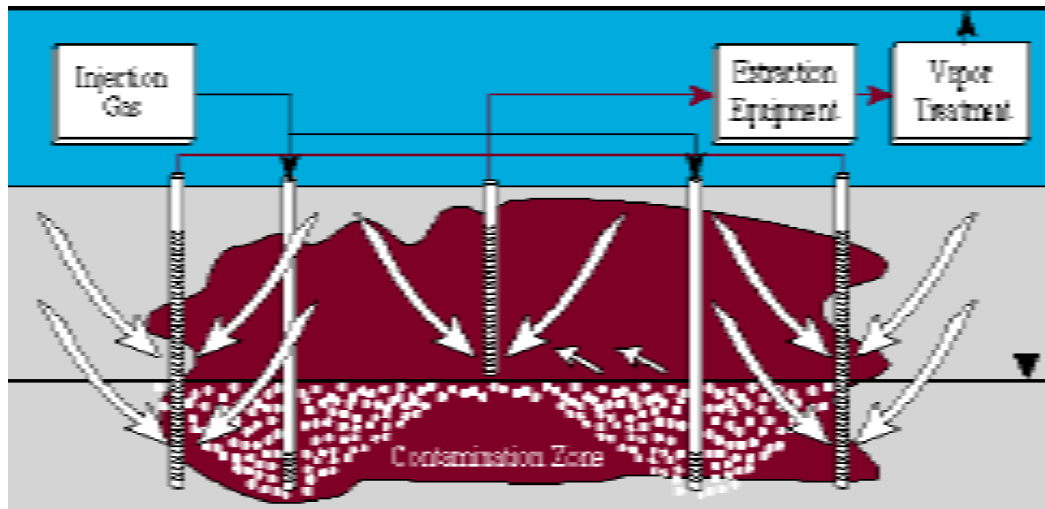
Geoengineers are responsible for assessing soil conditions and developing suitable foundation designs.



# Geological Engineering

- Geoenvironmental Engineering

**Air sparging** involves injecting a gas (usually air/oxygen) under pressure into the saturated zone to volatilize groundwater contaminants and to promote biodegradation in soils.

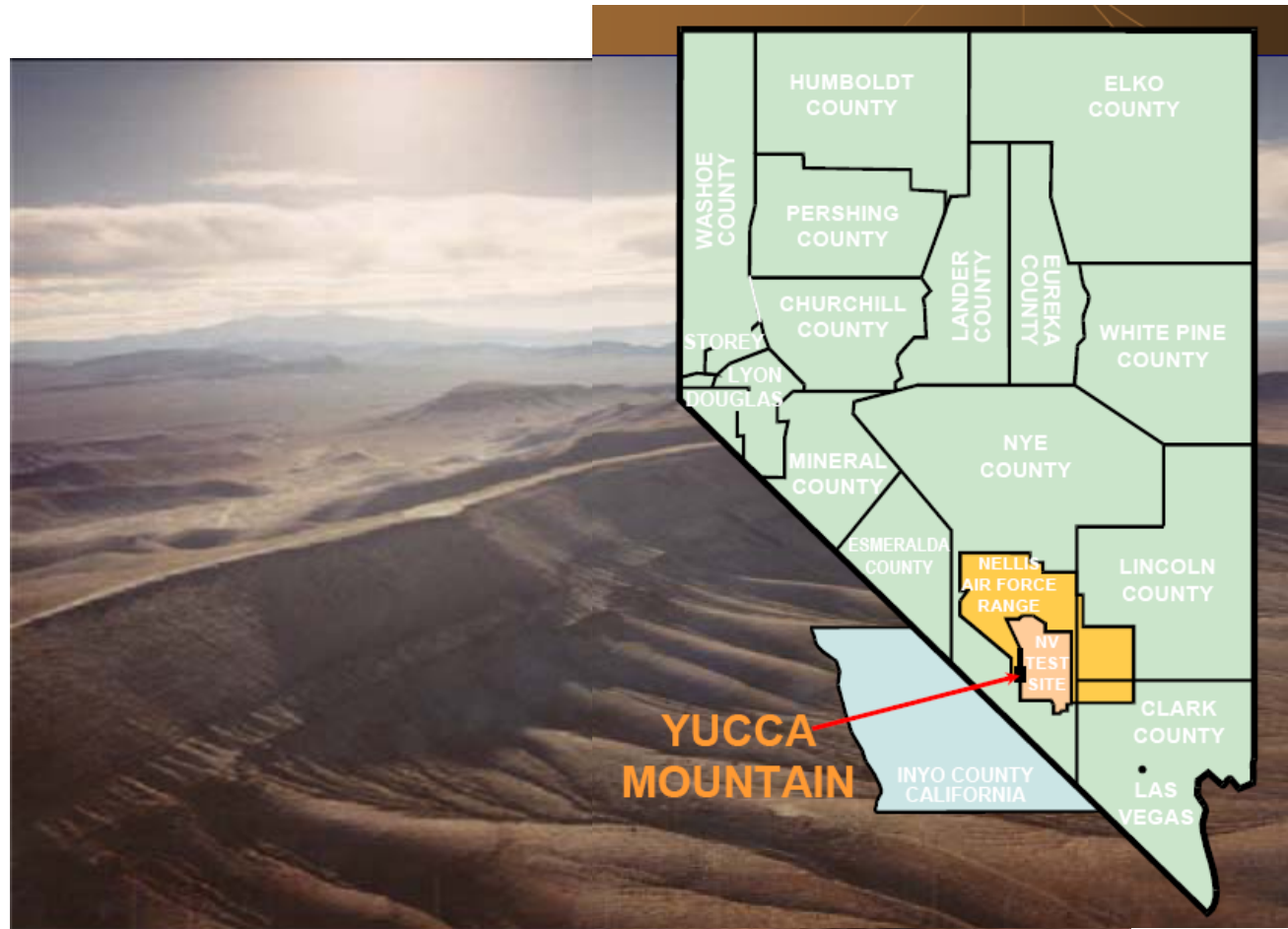


# Geological Engineering

- Energy Resources and Environmental Issues

## Yucca Mountain

- Located 100 miles northwest of Las Vegas, NV on western boundary of the Nevada Test Site,
- This is a DOE facility bounded by unpopulated land managed by the federal government.



# Geological Engineering

- Geology and Surface Use: Karst Formations



**CROIX NEWS** HAMMOND  
The **HEART** OF ST. CROIX COUNTY  
August 17, 1988 35c

the People™

## Pine Lake's bottom fell out

Pine Lake north of Baldwin has gone dry for the fourth time in the 20th century. A large sink hole opened up on the north end of the lake, just off the park, and drank a large part of Pine Lake dry.

The lake has been known for its extremely fluctuating water level and has been dry in 1919, 1936, 1959, and now in 1988, according to information given by nearby land owners.

The fluctuation of the lake is said to be due to the limestone bottom and consists of several sinkholes. It is a water table fed lake, and the drought of 1988 is probably as much a reason for the dry lake as the sinkholes.

Water reaches the lake by runoff and three small springs. Watersheds make up an approximately drainage area of 3,000 acres. Pine Lake itself has varied from 66 acres in 1958 to 105 and 114 acres in

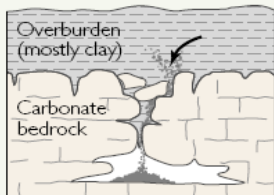
Pine Lake north of Baldwin is dry...again!

Sediments spill into a cavity.

As spalling continues, the cohesive covering sediments form a structural arch.

The cavity migrates upward by progressive roof collapse.

The cavity eventually breaches the ground surface, creating sudden and dramatic sinkholes.



# Geological Engineering

- Landslides

The Mamayes, Puerto Rico, landslide, 1985. This landslide destroyed 120 houses and killed at least 129 people. The catastrophic block slide was triggered by a tropical storm that produced extremely heavy rainfall.

Contributing factors could also have included sewage directly discharged into the ground in the densely populated area, and a leaking water pipe at the top of the landslide.



# Geological Engineering

## Coastal Protection



# Geological Engineering

- Flooding Protection

New Orleans (2005):  
Levee reconstruction  
after Katrina



# Opportunities for Geological Engineers

- Geoengineering
- Environmental
- Infrastructure
- Groundwater technology
- Consulting firms
- Geo-resource firms
- Oil industry
- Federal & State labs/agencies

# Our Program

## Geological Engineering Program at University of Wisconsin-Madison

- GLE is a BS, MS, and Ph.D. degree-granting interdisciplinary program administered by the College of Engineering.
- The Program is run by a select group of faculty from 5 departments: Geol/Geophys, CEE, EP & MS&E, and Soil Science.
- The curriculum integrates courses from a variety of departments to produce a relevant program for geologic engineers.

# Our Program

- Typical Courses with Engineering Science and/or Design Components
  - Rock, Soil & Fluid Mechanics
  - Slopes, Foundations & Tunnels
  - Field Methods in Geological Engineering
  - Land Information Systems
  - Remediation/Waste Geotechnics
  - Geologic Hazards
  - Analysis of Environmental Impact
  - Contaminant Hydrogeology

# Our Program

## Geology Courses provide a double major:

- Geologic fundamentals are essential for engineering within earth materials.
- GLE students can earn a *second major* in Geology without additional courses (4 credits are needed).
- Employers have told us that hiring a GLE graduate is a bargain; they have both a rock/soils/ground-water engineer and a geologist with just one person.

# Our Program

- Potential Employers:
  - USGS- Madison
  - Consulting firms- Many places
  - Oil Refinery, oil fields- Minneapolis, Texas
  - Forest Service- Oregon, Alaska
  - Mining Company- Australia
  - DNR, DOT
  - Graduate School: universities across the nation

# More Information

**Email: [gle@engr.wisc.edu](mailto:gle@engr.wisc.edu)**

***WEBPAGE URL:***

***<http://www.engr.wisc.edu/interd/gep/>***