

## Second Question to Clarify: Vulnerability *TO WHAT?*

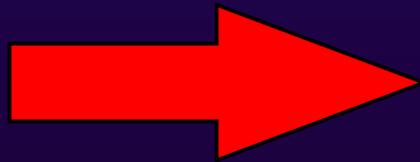
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- Naturally occurring contaminants?
- Manmade contaminants?
- Bacteria or chemicals?
- Fast traveling contaminants or degrading contaminants?

# What Factors Determine Vulnerability?

## Extrinsic Factors

- Landuse
- Spills
- Industrial standards / environmental management
- Agricultural management practices
- Urban planning



DWSAP:

✓ potent. contaminating activities

# Methods for Vulnerability Assessment

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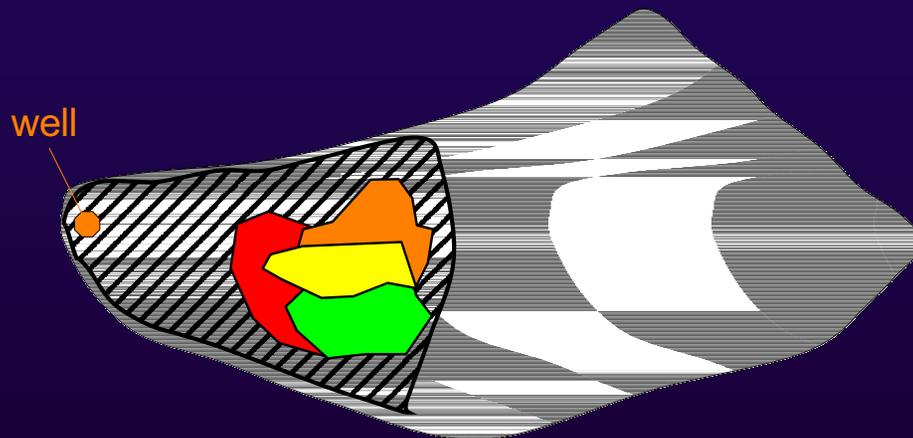
- Index and overlay methods
- Process-based computer simulations
- Statistical methods

# Vulnerability Assessment in DWSAP - Index & Overlay Method

## Purpose

- Determine to which PCAs the drinking water source is *MOST VULNERABLE*?

Need: => vulnerability ranking by PCA



# DWSAP Method

Point of View: Water Source (Intake, Well)

For each PCA:

- Score for PCA type

+

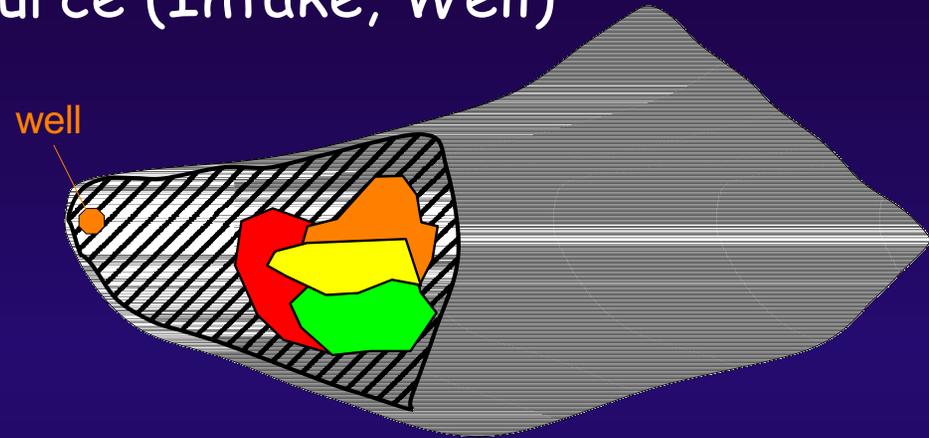
- Score for Physical Barrier Effectiveness

+

- Score for Travel Time (Protection Zone)

=

- FINAL VULNERABILITY POINTS



# DWSAP Vulnerability Assessment

## Surface Water



- Physical Barrier Effectiveness:
  - ▶ Size of reservoir
  - ▶ Detention time in reservoir
  - ▶ Topography
  - ▶ Geology
  - ▶ Soils
  - ▶ Vegetation
  - ▶ Precipitation
  - ▶ Groundwater recharge

=> unless *ALL* are effective,  
the overall PBE score is low

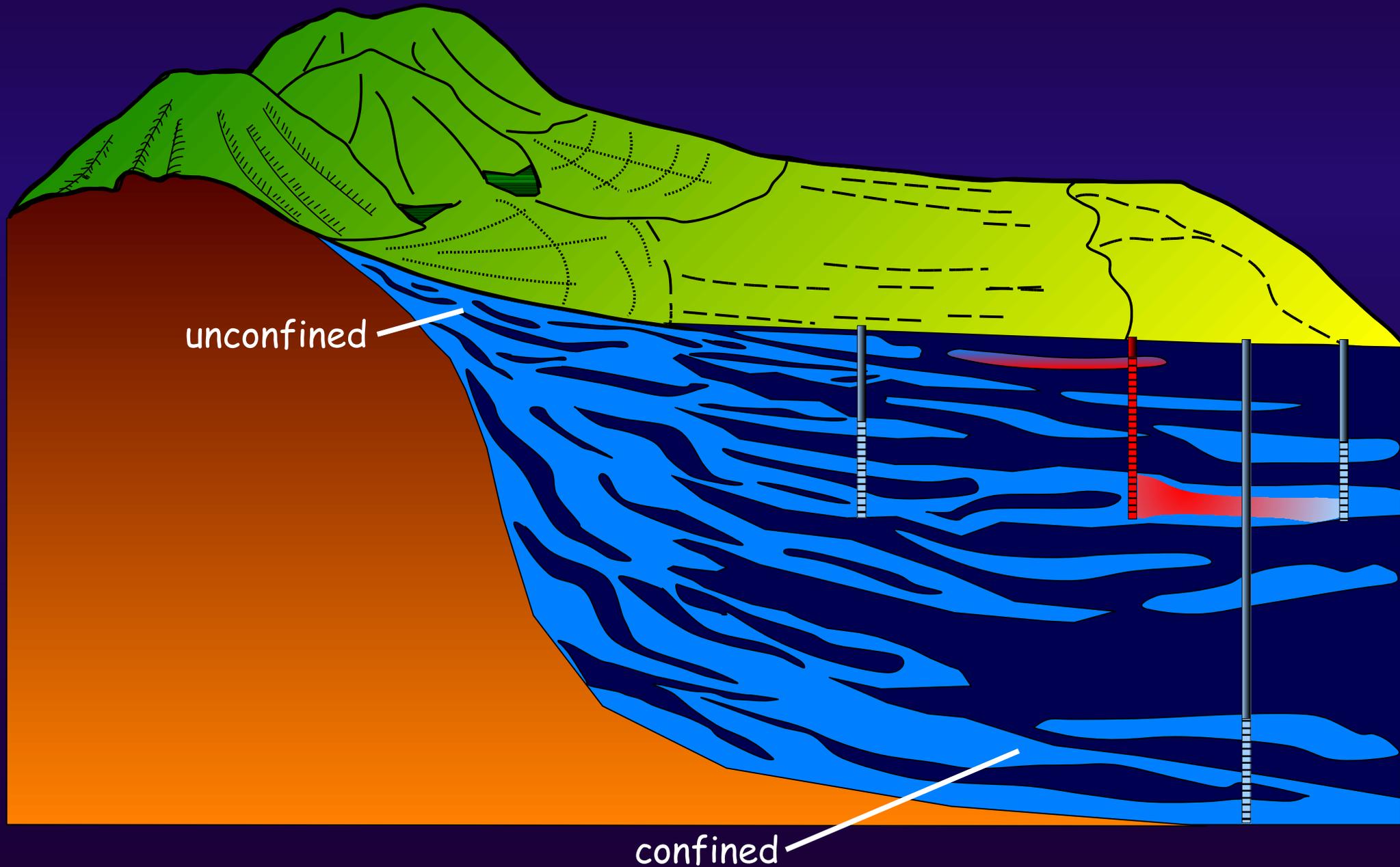
# DWSAP Vulnerability Assessment

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## Groundwater

- Physical Barrier Effectiveness of the WELL (drinking water source):
  - ▶ Sanitary Seal
  - ▶ Surface Seal
  - ▶ Flood hazard
  - ▶ Security at Site
- Physical Barrier Effectiveness of the AQUIFER AROUND THE SOURCE:
  - ▶ Porous Media/ Fractured Rock
  - ▶ Unconfined and semi-confined vs. Confined
  - ▶ Artesian conditions
  - ▶ Existence of abandoned wells
  - ▶ Depth to ground water
  - ▶ Well pumping operation

# Physical Barrier Effectiveness In Groundwater



# Source Problems

## Poor Construction

Courtesy of Leah Walker, California DHS



# Source Problems

## Poor Location

Courtesy of Leah Walker, California DHS

