Field Demonstration of a Multi-Layered Permeable Reactive Barrier in Mortandad Canyon

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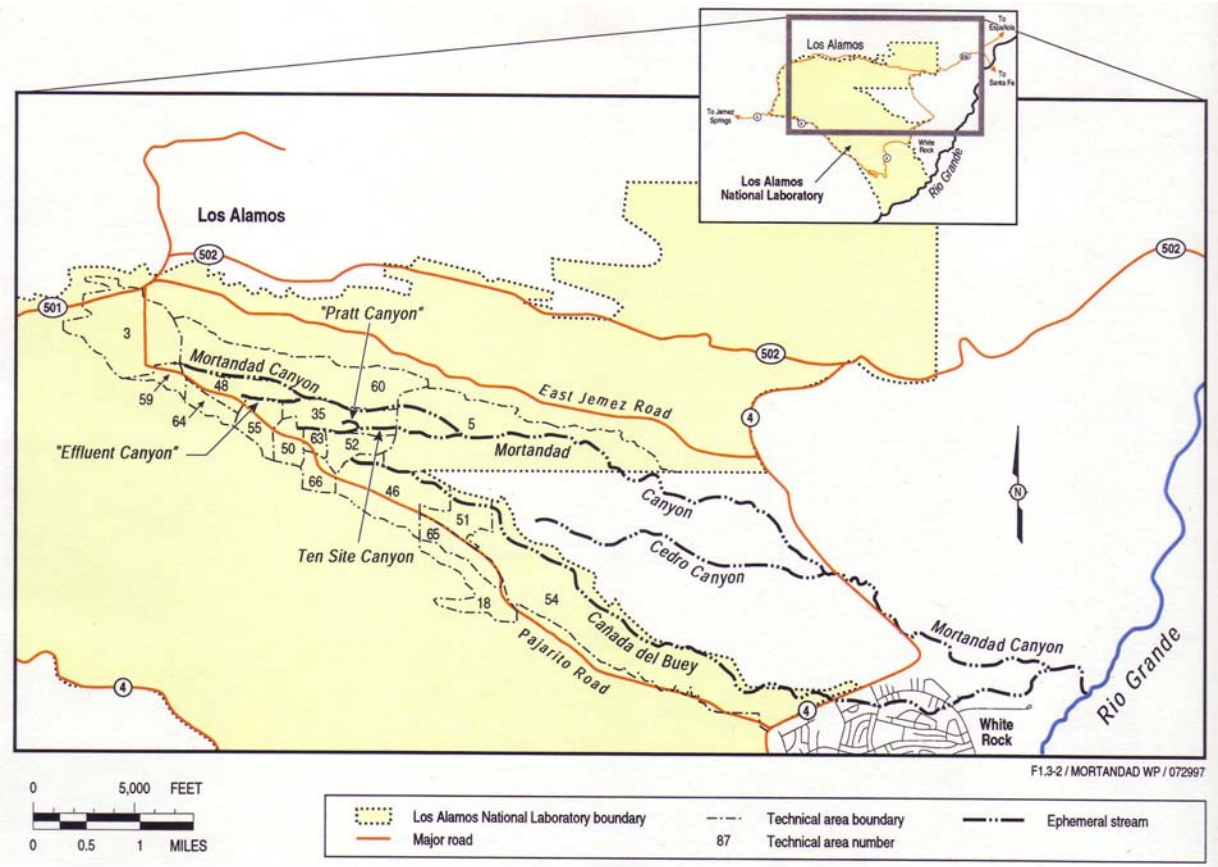
LA-UR-03-3063

Goal for PRB in Mortandad Canyon

Plan, design, and install a multi-layered permeable reactive barrier system (multi-barrier) in Mortandad Canyon to demonstrate *in-situ* treatment of contaminant suite (Sr, Pu, Am, nitrate and perchlorate).

First system to treat groundwater at LANL.



Project Drivers, Benefits, and Customers

Driver: Radionuclides, including ^{90}Sr, $^{238,239,240}Pu$, and ^{241}Am, are in alluvial groundwaters within Mortandad Canyon. Nitrate occurs, and perchlorate has become a concern. Groundwater in the canyons recharges the regional aquifer.

Benefits

- Demonstrate multi-layered barrier technology for contaminant suite.
- Demonstrate passive treatment of radionuclides, nitrate, and perchlorate in canyon aquifer that recharges regional aquifer.
- Source control - mitigate possible vulnerabilities from contaminants moving downstream.

Customers

- DOE EM-50
- Environmental Restoration (ER) Project
- Cerro Grande Rehabilitation Project (CGRP)

Approach

- FY00
  - Treatability studies
  - Site selection
- FY01
  - Site Characterization w/ field study
  - Conceptual design, cost and schedule estimate
- FY02
  - Funding Issues
  - Final design
- FY03
  - Install multi-barrier
  - Evaluate performance (current)

Chemistry

Geology & Hydrology

Engineering

Project Management

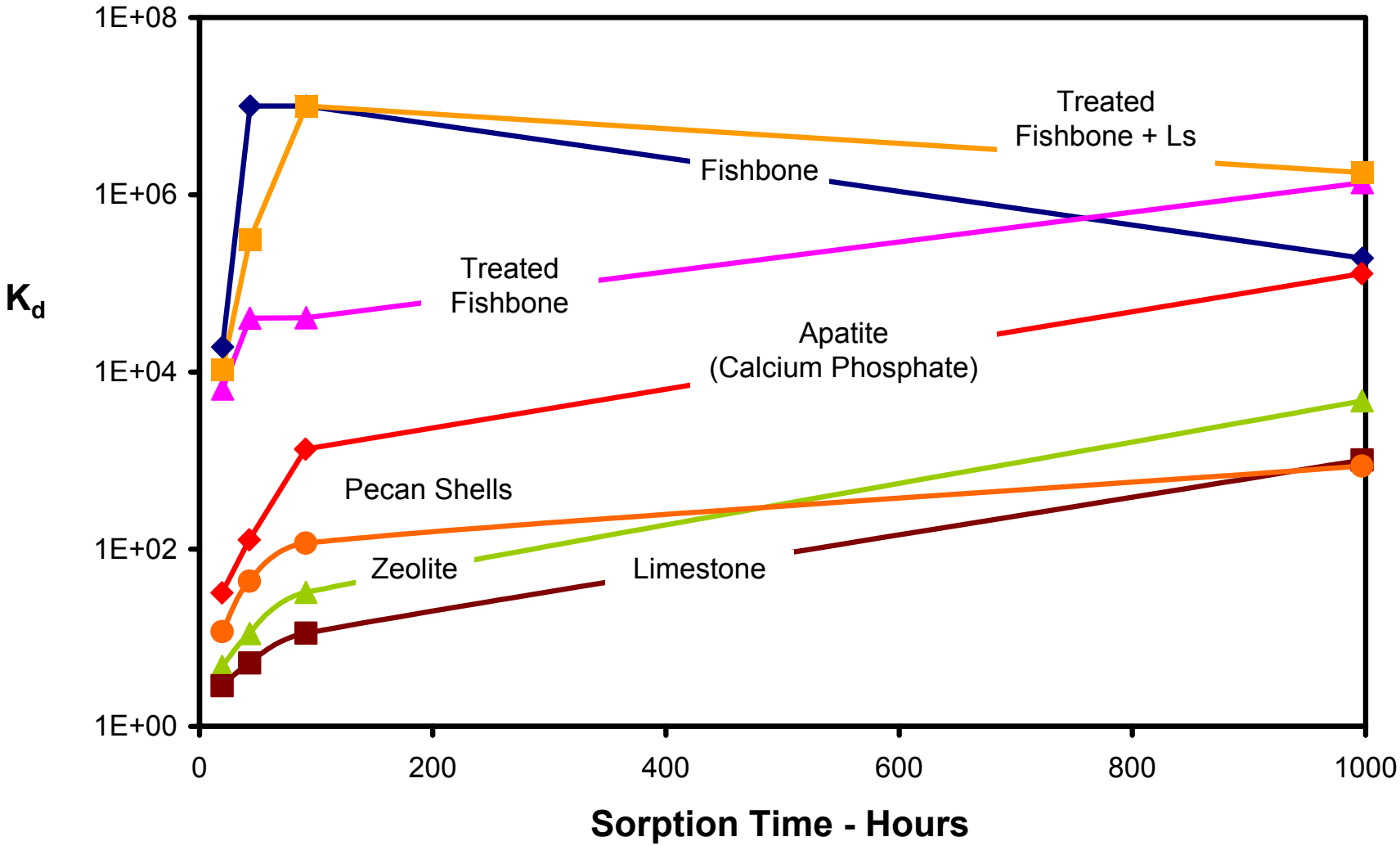
Engineering

Chemistry

<u>Team</u>

- Chemistry, Performance: LANL
- Field study, Design, Installation: Shaw E&I

Laboratory Studies – Batch Sorption of Pu-239



Laboratory Studies – Flow-Through

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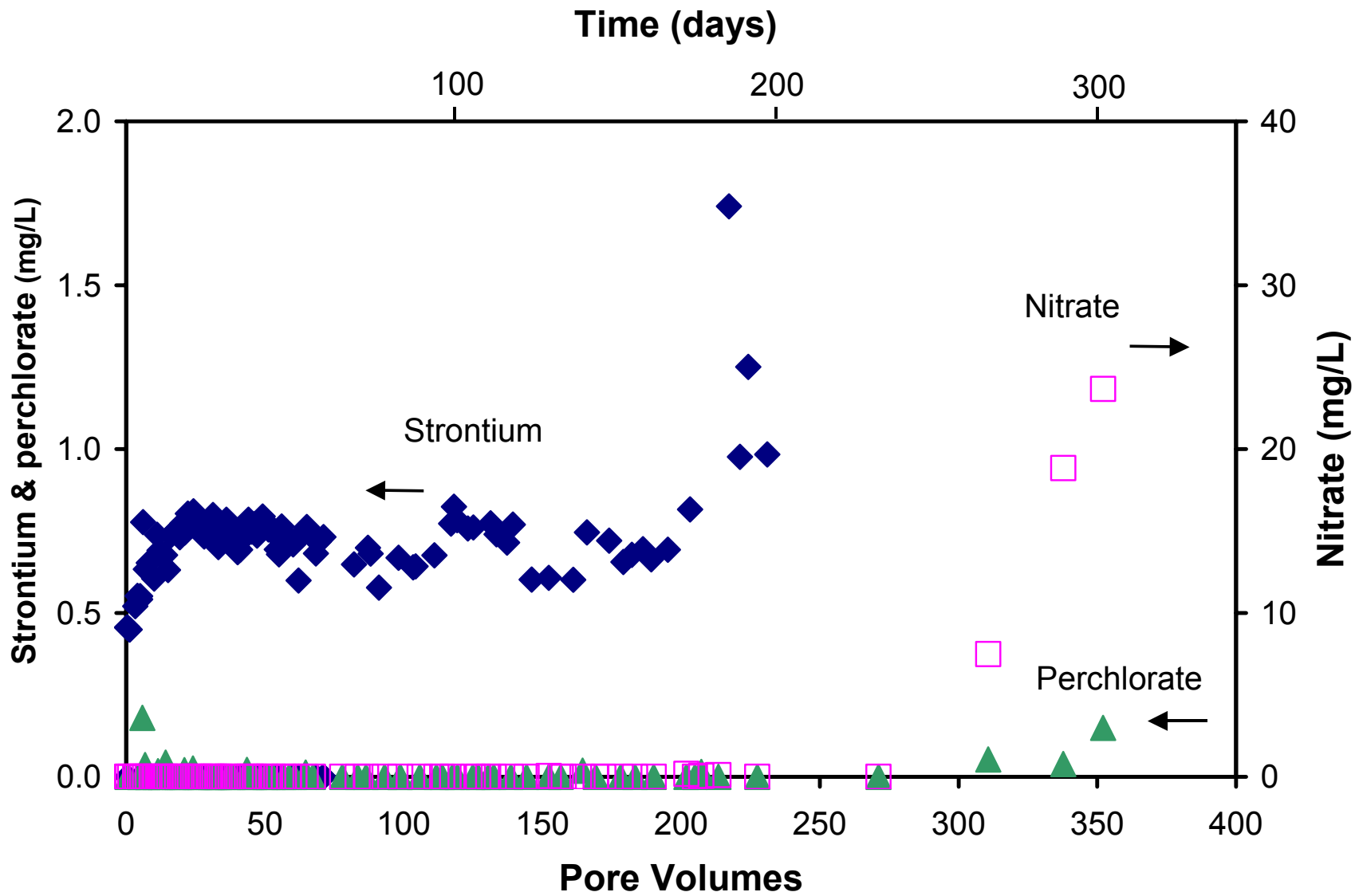
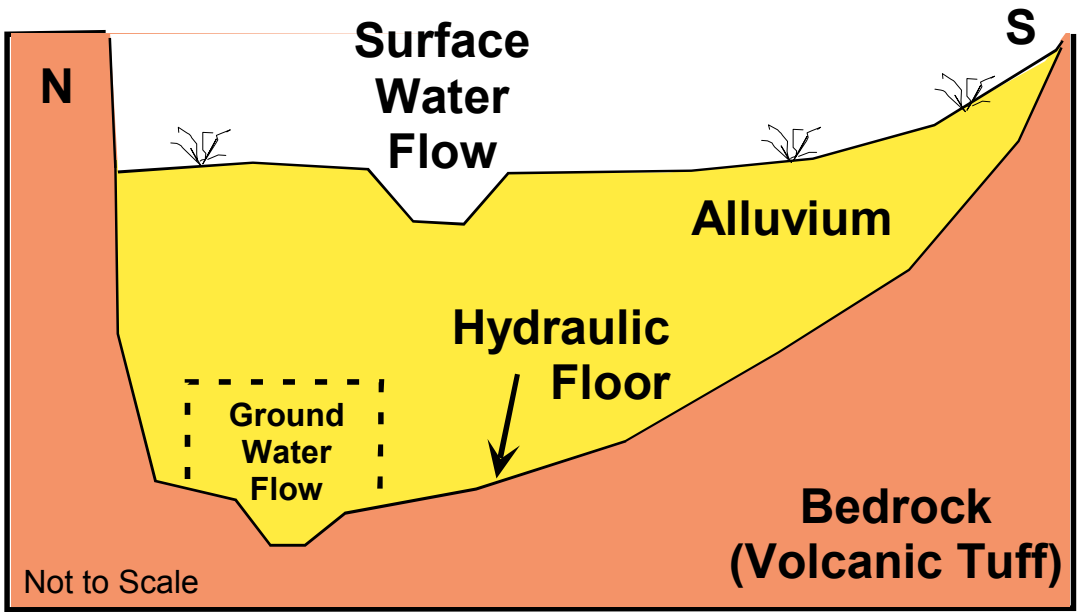


Site Selection and Characterization

Site Characteristics and Design Parameters



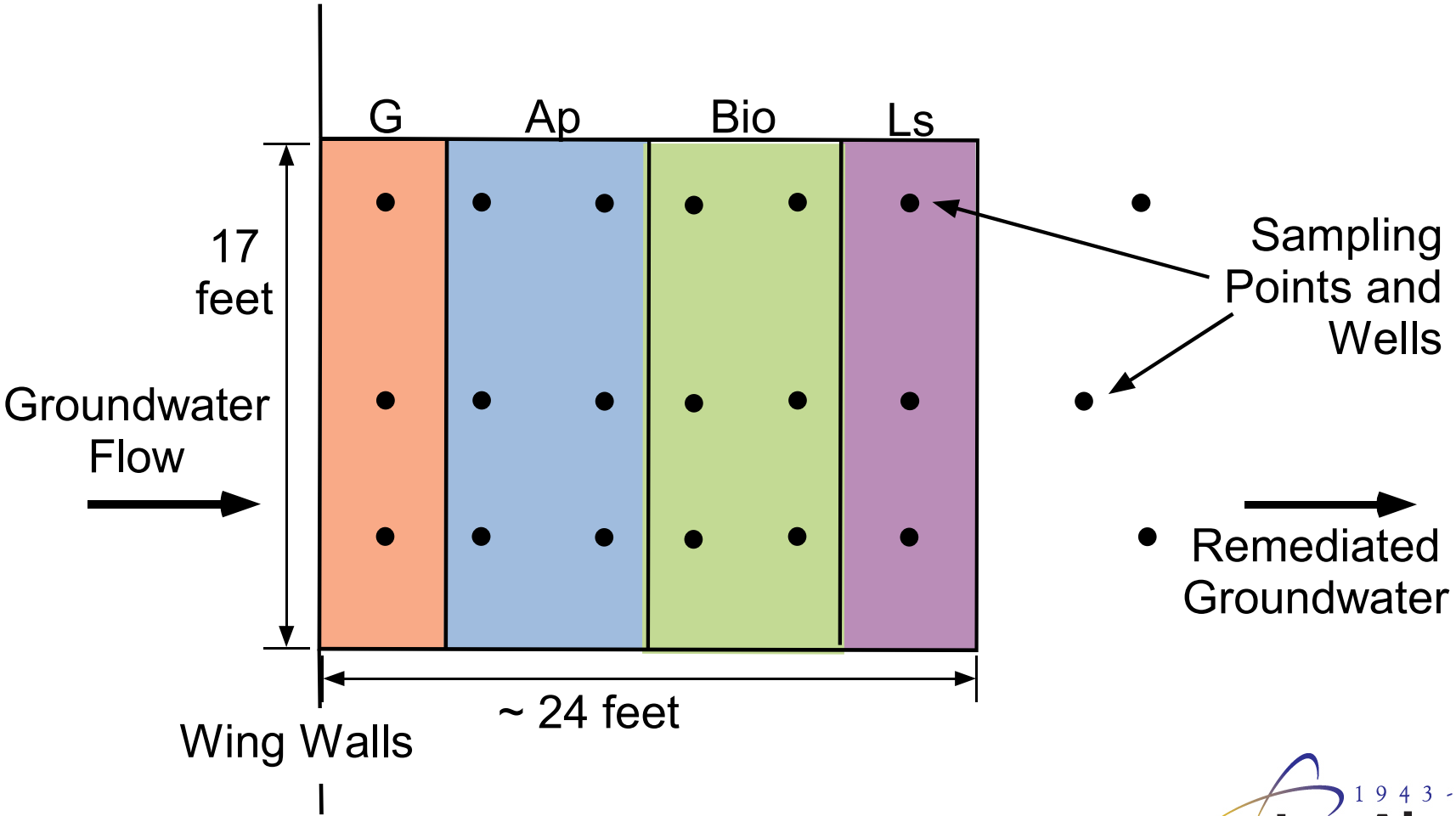
Mortandad Canyon

- Hydrologic funnel
- Hydraulic floor
- Groundwater flow ≠ surface water flow
- Low-level rad in soil
- Geotechnically feasible

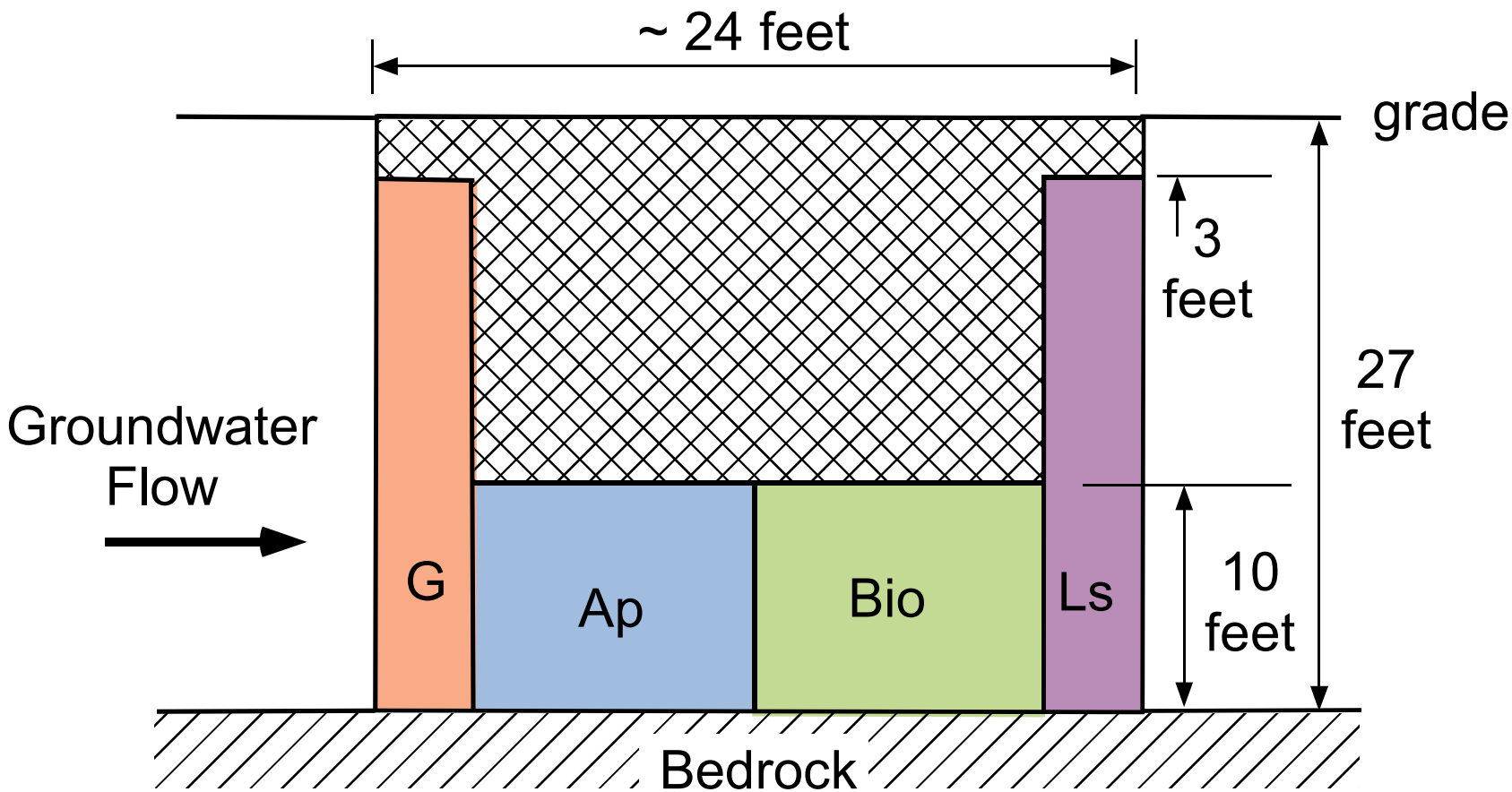
Design Parameters

- Target alluvial groundwater, minimize surface erosion/infiltration
- Optimize hydraulic capture, minimize reactive volume
- Minimize excavated soil requiring waste disposal
- Residence time in biobarrier, 1 day minimum
- Lifetime = 10 years
- Install ports for access to solids and aqueous fluids

Schematic Plan View



Schematic Cross Section



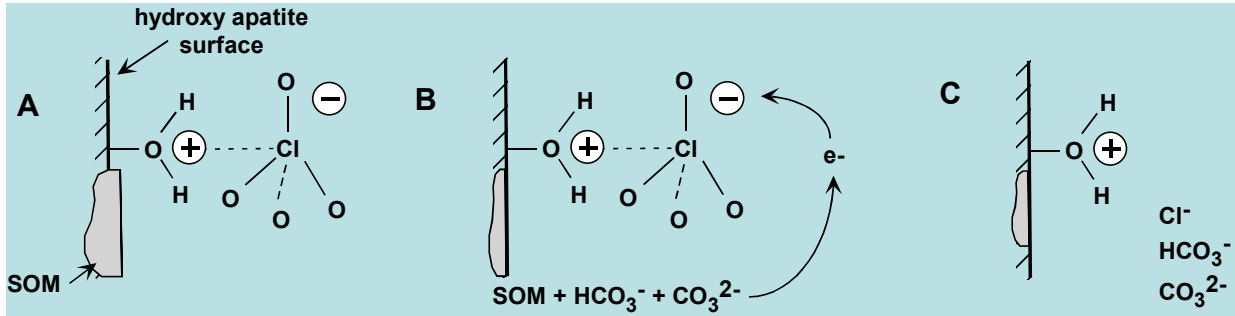
Installation

Installation

Installation

What Next? Performance Assessment and Science

Performance Assessment - How well does the PRB work?



<u>Science</u>

Identify geochemical/biogeochemical reactions/processes critical to reactive barrier success and failure.

Enable rational selection of measurement and performance elements that monitor these processes.

Facilitate barrier design and installation at other LANL/DOE sites.

Scaling issues (chemical potential, time)