U.S. DEPARTMENT OF ENERGY | Legacy Management

Improvements in Cover Performance at Engineered Disposal Cells When Working With Nature to Inform Environmental Design

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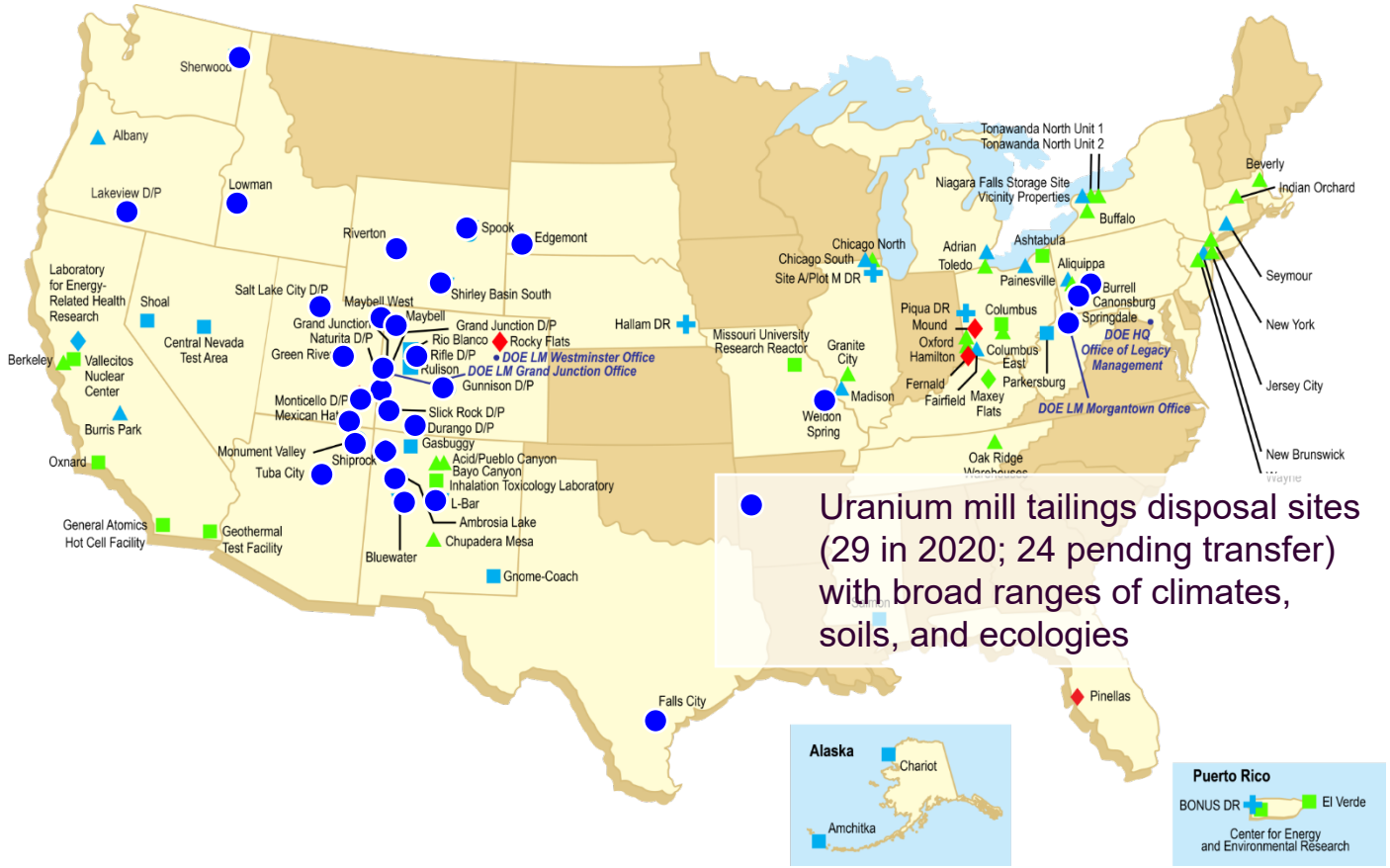
LM Sites

Mission

"…ensure the future protection of human health and the environment."

LM Uranium Mill Tailings Sites



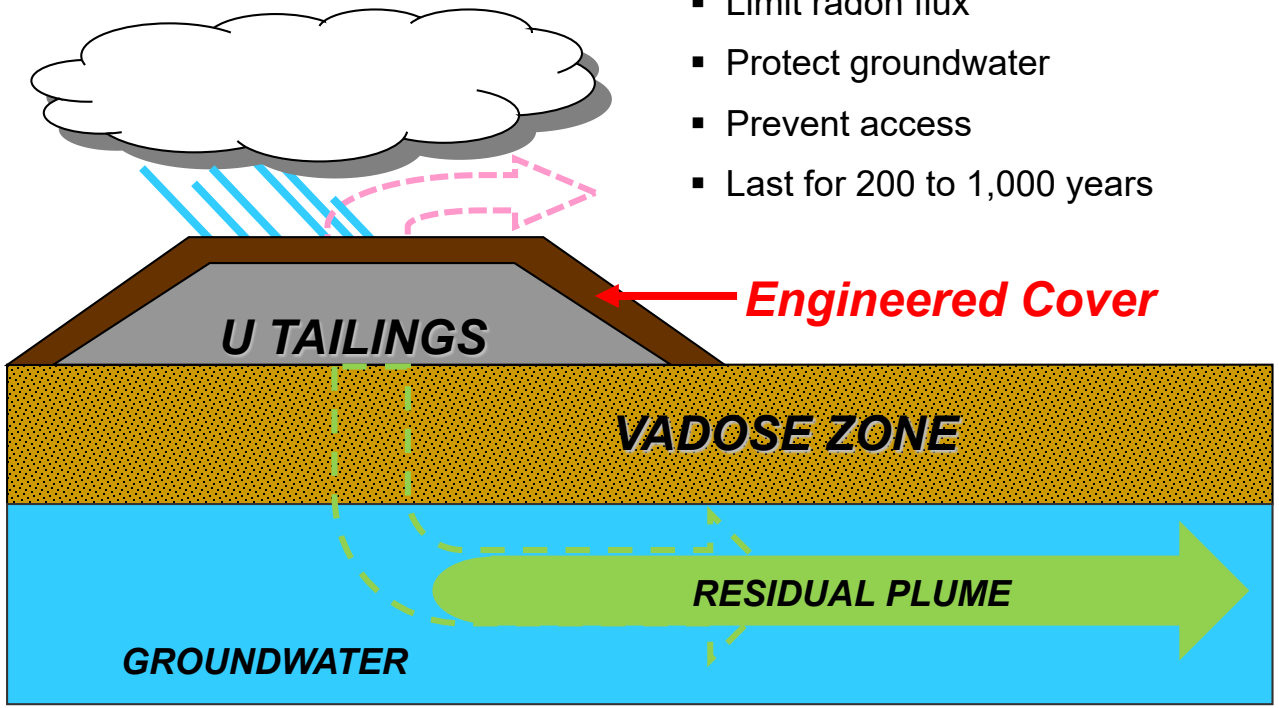
Uranium mill tailings disposal sites (29 in 2020; 24 pending transfer) with broad ranges of climates, soils, and ecologies

Shiprock, New Mexico, Mill — Circa 1960

Shiprock, New Mexico, Disposal Cell

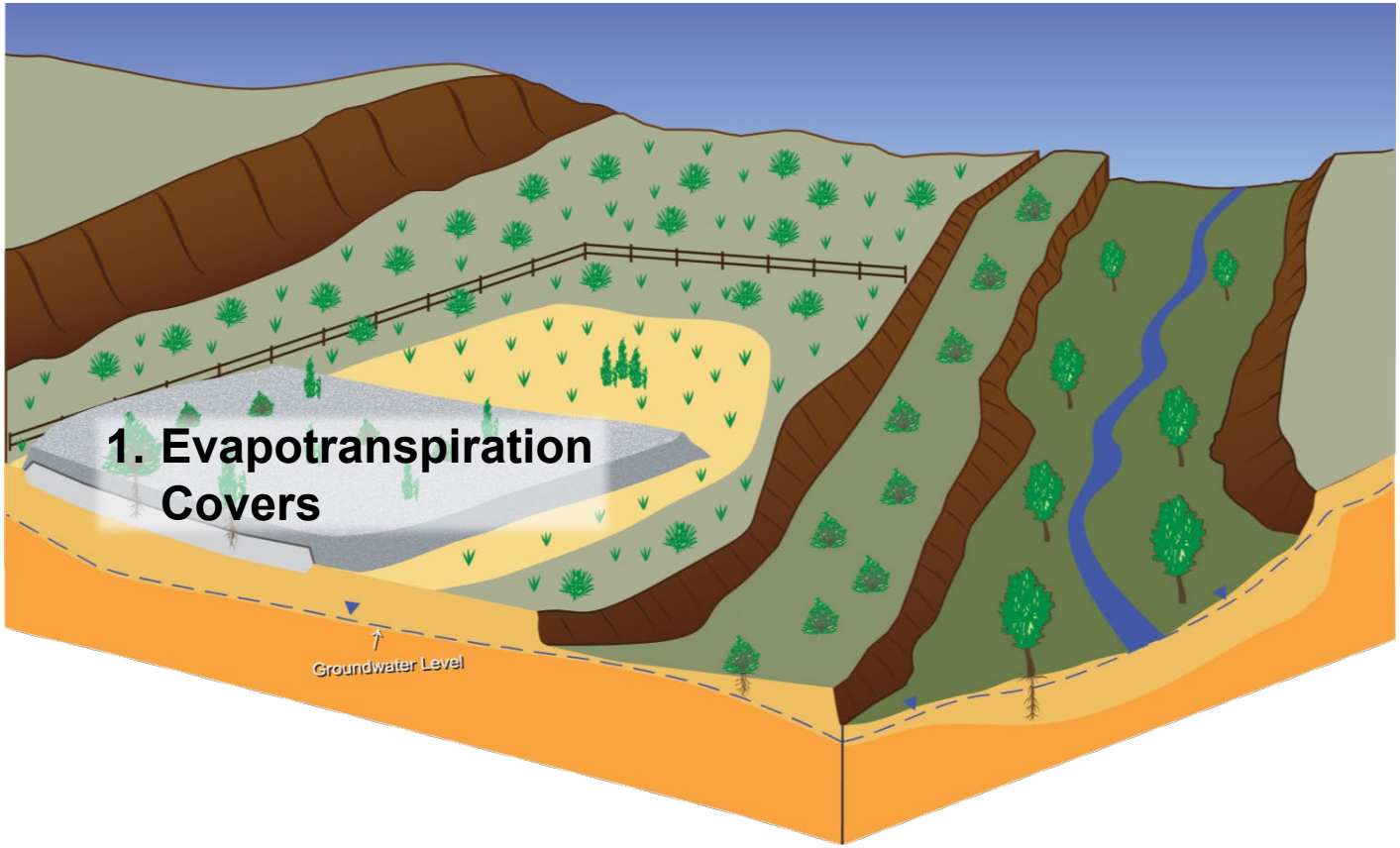
Uranium Mill Tailings Radiation Control Act of 1978

- Limit radon flux
- Protect groundwater
- Prevent access
- Last for 200 to 1,000 years

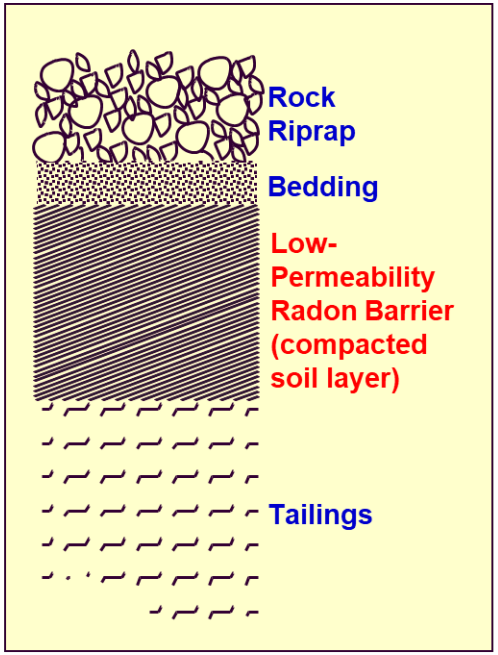


Uranium Mill Tailings (after reclamation)

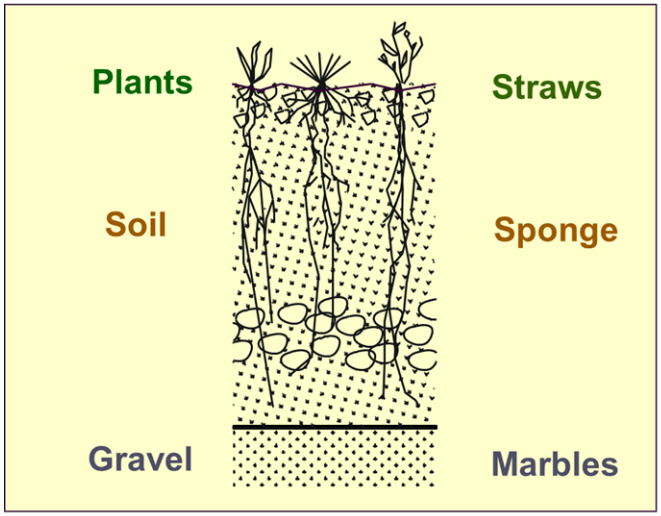
Evapotranspiration Covers for Tailings Disposal Cells



Comparing Disposal Cell Cover Designs

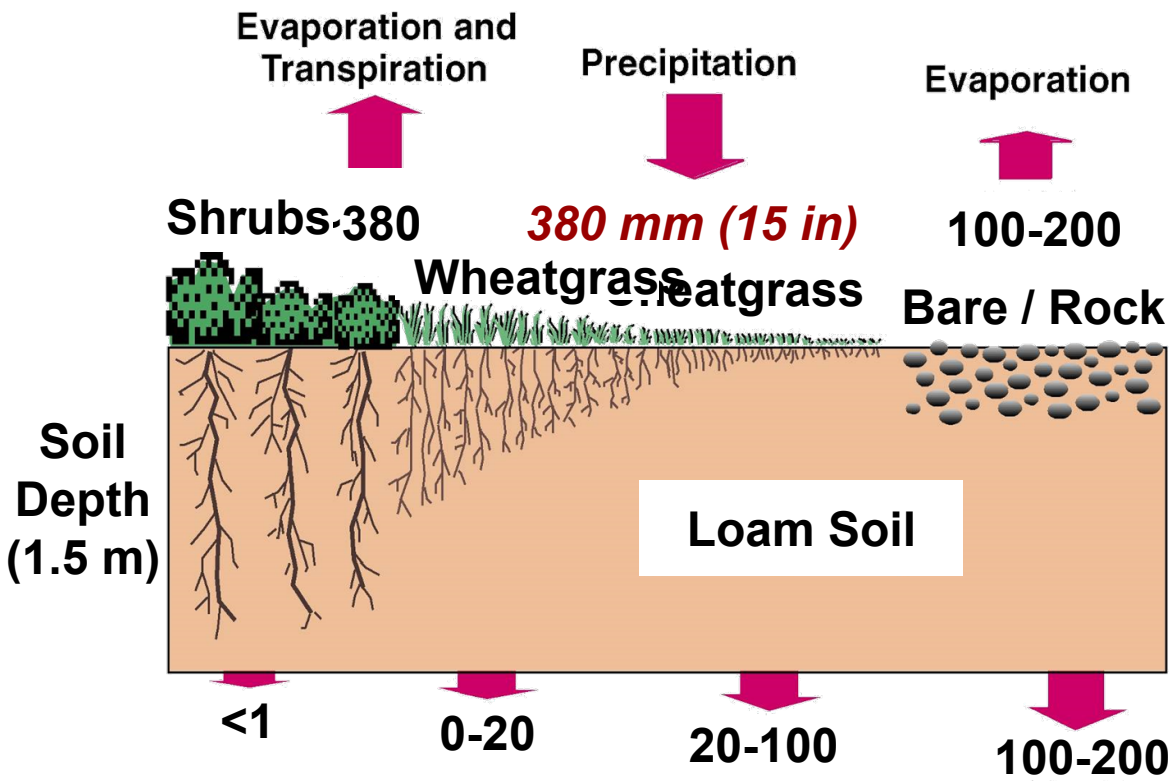


Conventional Rock Cover



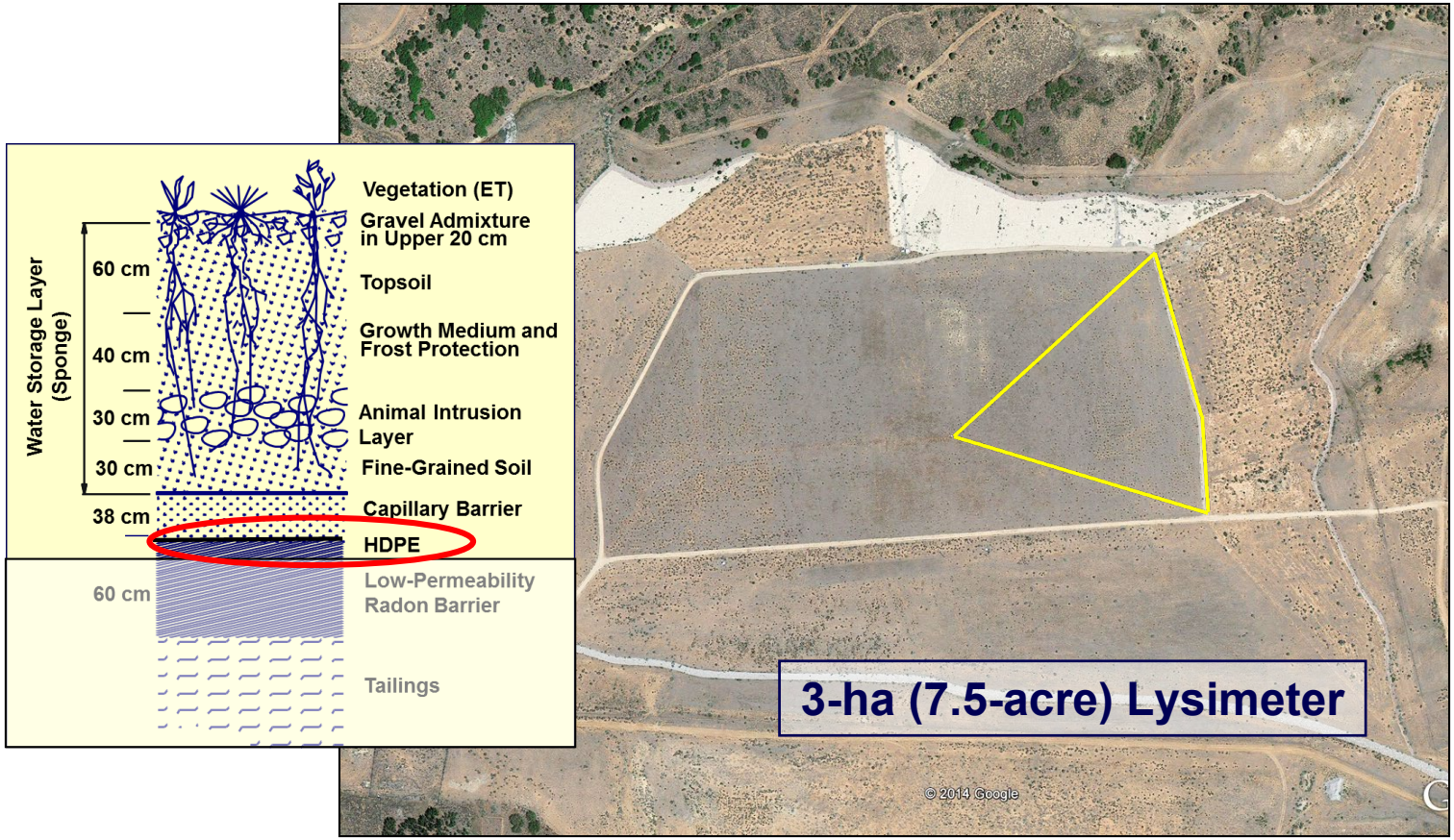
Evapotranspiration (ET) or
Water Balance Cover

Water Balance: The Role of Plants

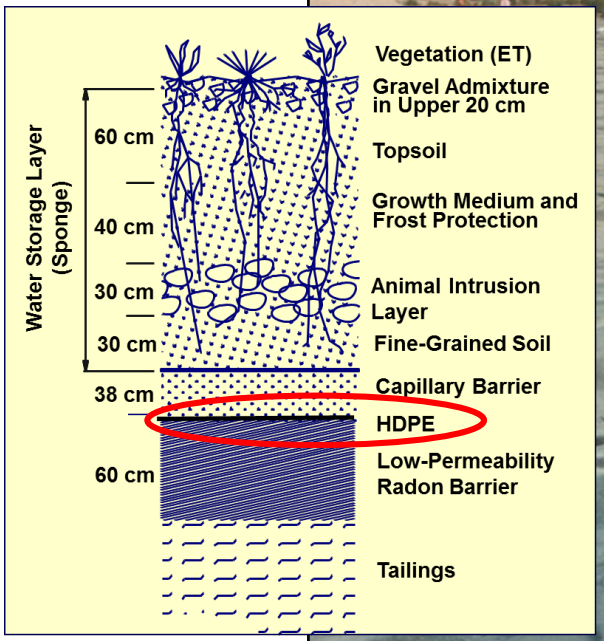


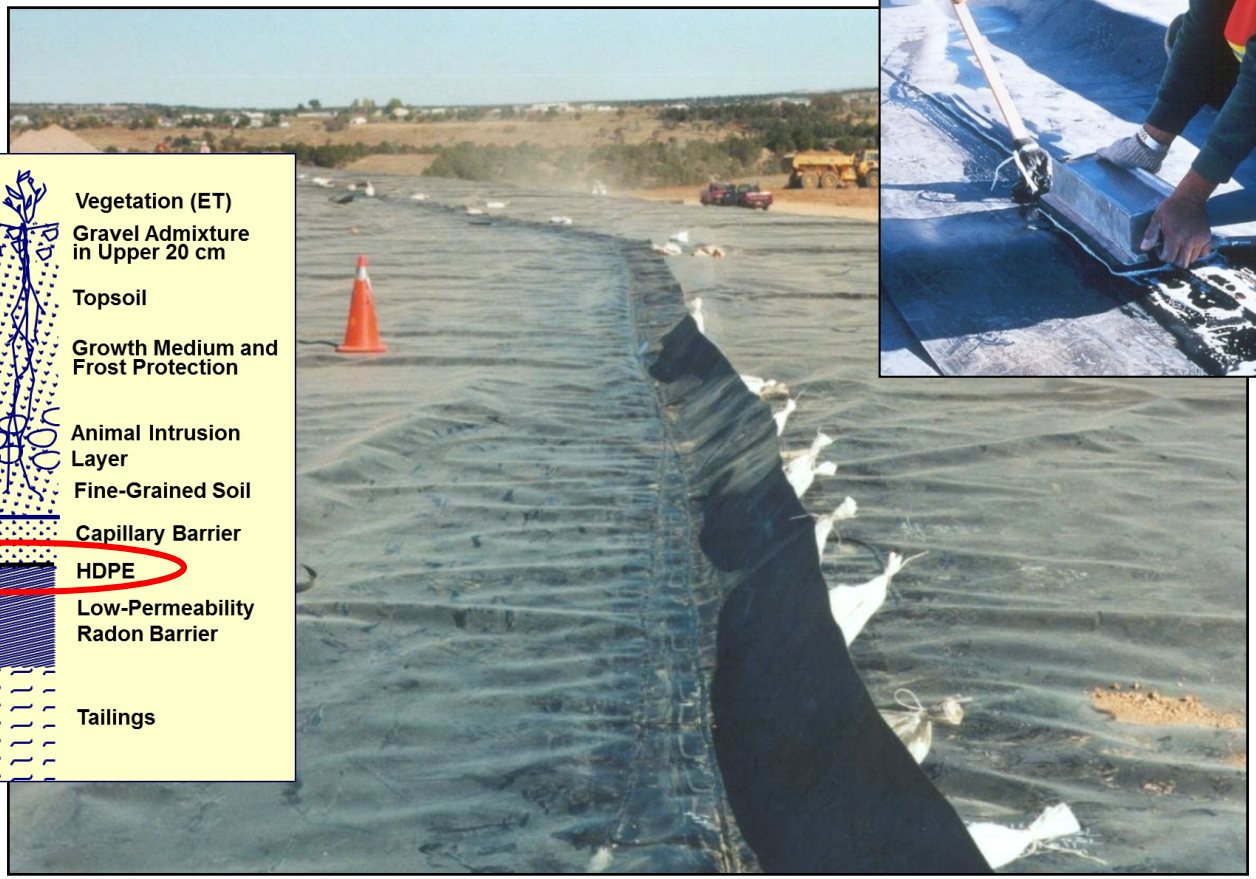
Estimated Ranges of Annual Recharge (mm/yr)

Monticello, Utah: Embedded Lysimeter

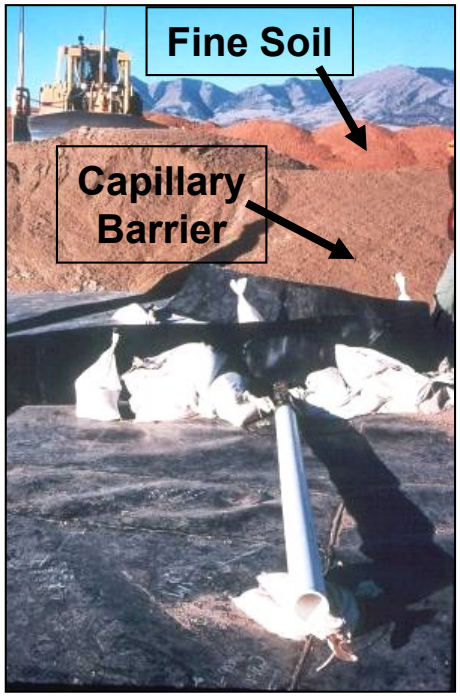


Lysimeter Construction

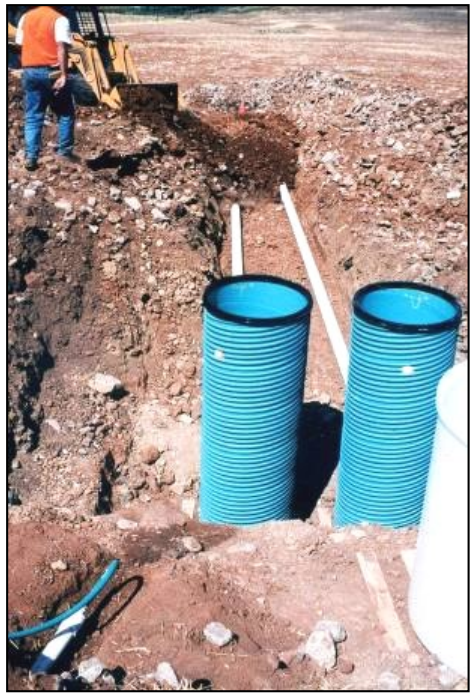




Soil Water Balance Monitoring (Lysimeter Instrumentation)



Drainage Collection System

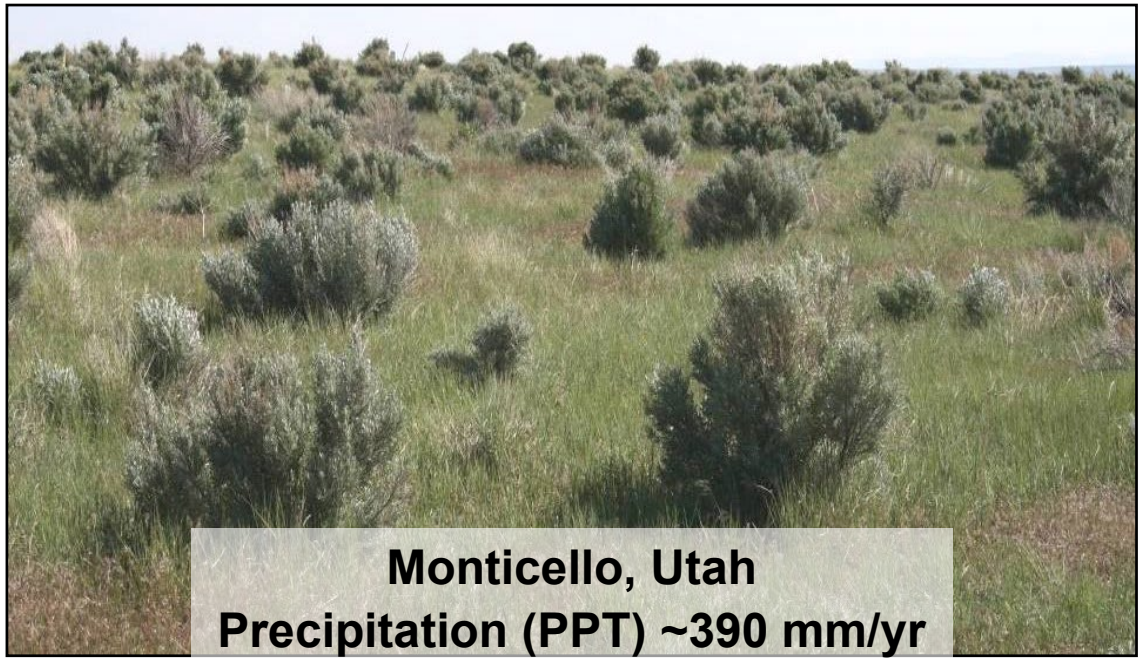


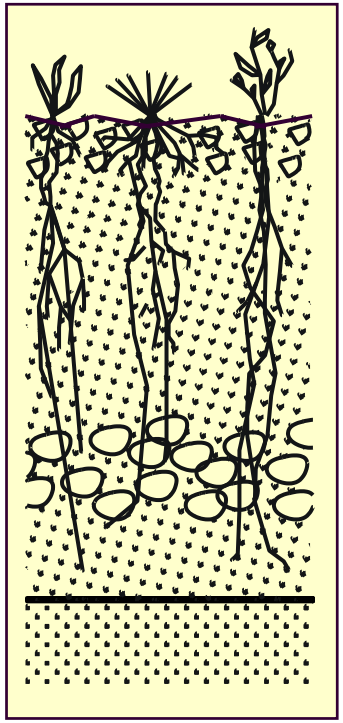
Percolation and Runoff
- Dosing Siphons

Soil Moisture Monitoring
- Water Content
- Water Potential

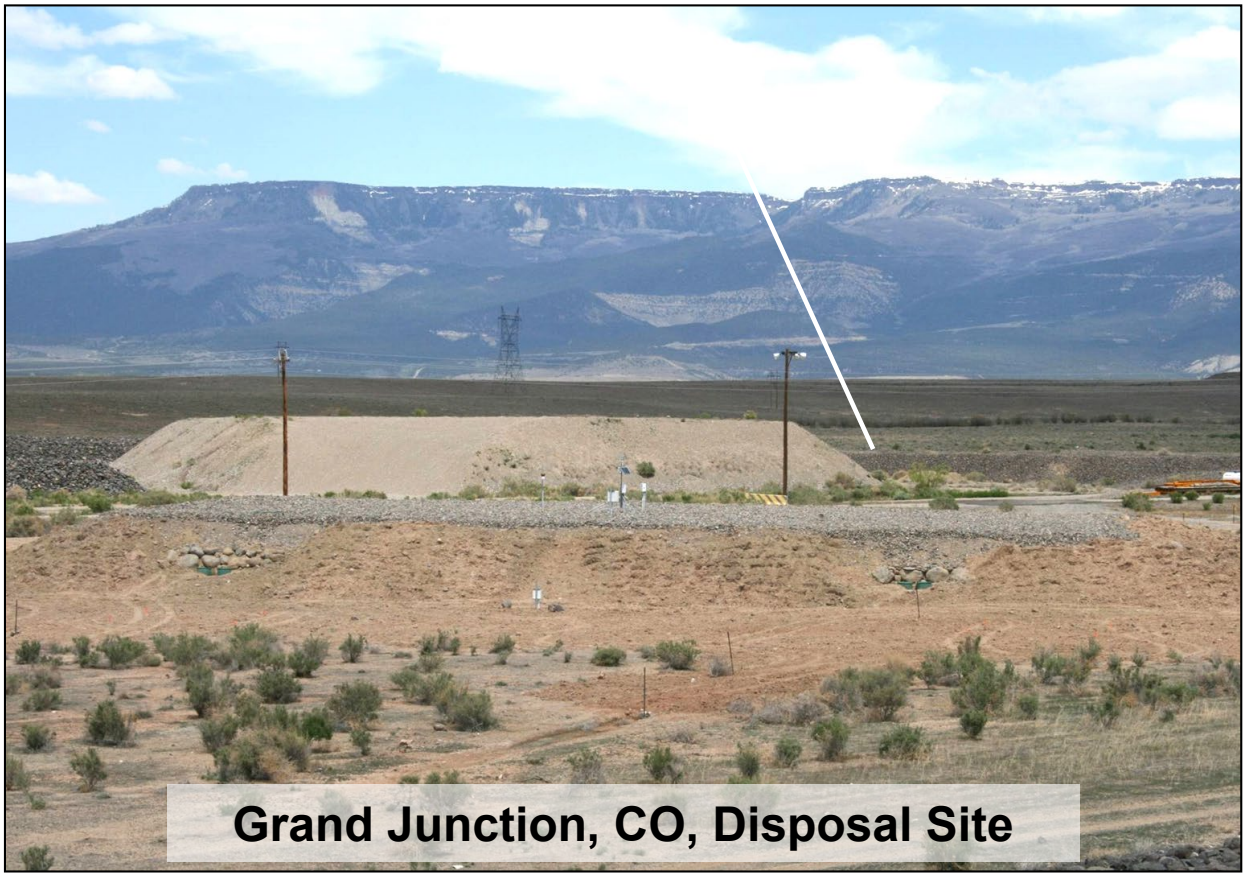
ET Cover Lysimeter

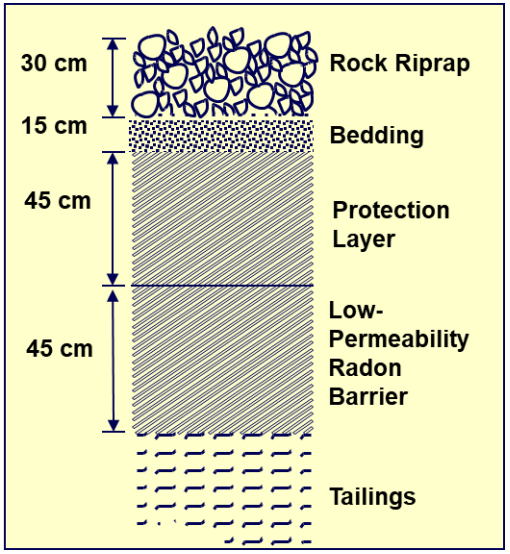
- Native sagebrush savannah vegetation
- ET cover designs accommodate ecological succession and soil formation processes





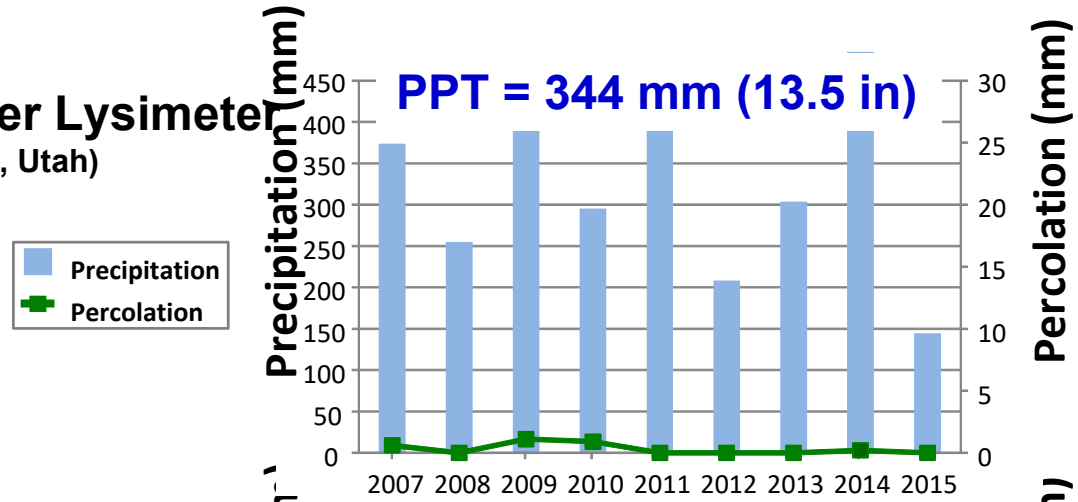
Rock Cover Lysimeter



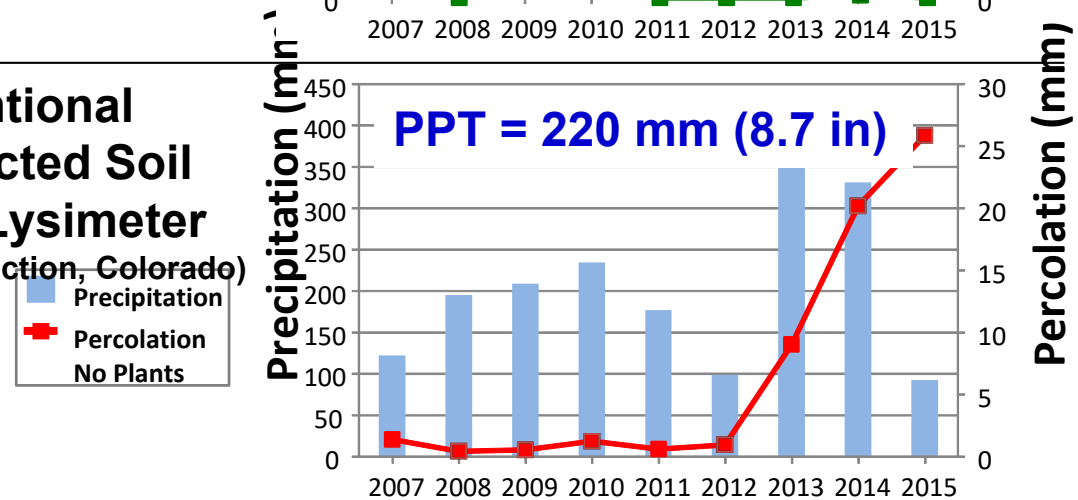


Comparison of ET and Compacted Soil Covers

ET Cover Lysimeter
(Monticello, Utah)



Conventional Compacted Soil Cover Lysimeter
(Grand Junction, Colorado)



Cover Percolation Comparison

Cover Type	Site EPA ACAP* LM	Average Precipitation (mm)	Average Percolation (mm)	Percolation as % of Precipitation
Low-Permeability Cover	Albany, GA	849	265.0	26.0
	Apple Valley, CA	61	2.5	4.1
	Cedar Rapids, IA	449	39.5	8.8
	Lakeview, OR	319	30.1	9.4
Water Balance Cover	Apple Valley, CA	167	0.5	0.3
	Boardman, OR	181	0	0.0
	Polson, MT	349	0.2	0.1
	Monticello, UT	387	0.5	0.1

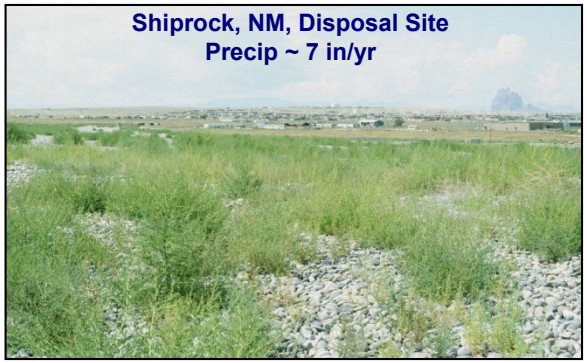
Collaboration Between LM and EM

ET or Water Balance Cover

Disposal Cell in Crescent Junction, Utah

Broader Implications

- Deposition of windblown dust in conventional rock covers enhances soil development and “volunteer” plant habitat
- Natural environment will eventually reclaim engineered systems
- 40-year track record versus 200-1,000-year design life
- DOE no longer treats annual plants and grasses
- Basis for future “ecological engineering” design



Comments and Discussion