Geosynthetics Applications and Performance Reviews
Select Case Histories

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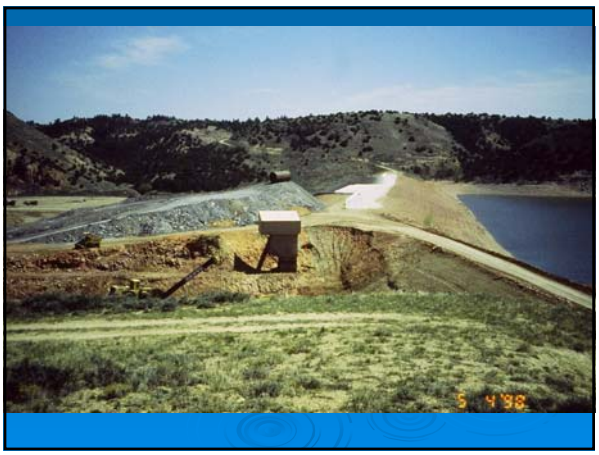
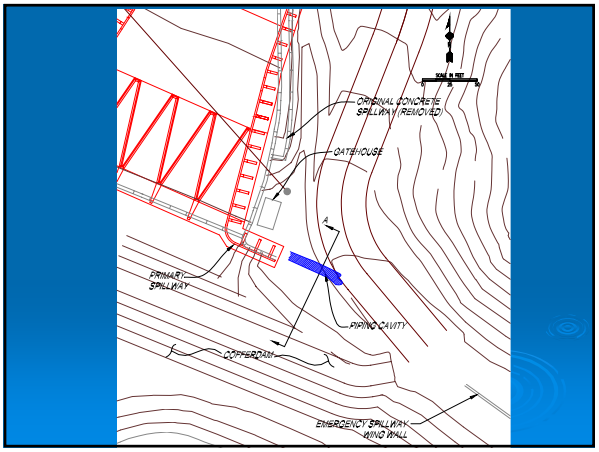
Five Case Histories

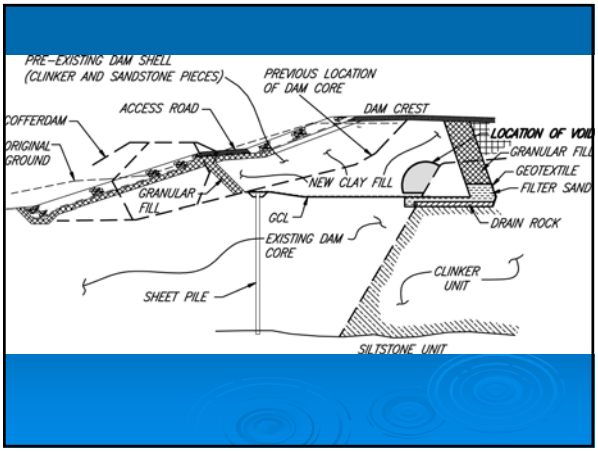
- Gardner Creek Dam, PA (downstream raise with geotextile-protected drain zone)
- Tailings Dam Raise, AK (upstream raise using a geocomposite underdrain)
- Lynchwood Lake Dam, PA (upstream geotextile seepage control)
- Tongue River Dam, MT (upstream geosynthetic seepage barriers)
- Nilan East Dam, MT (upstream sinkhole treatment using geosynthetics)

Tongue River Dam

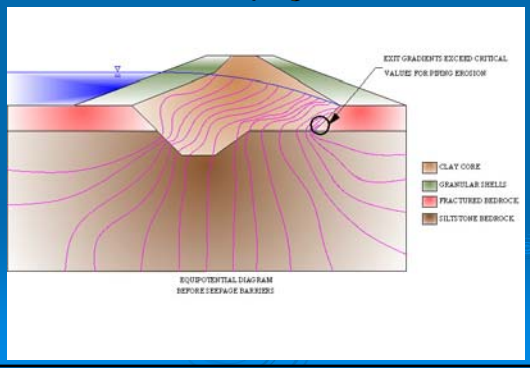
- Constructed 1937-1939
- 1,300 feet long
- 91 feet high
- 65,000 AF Storage



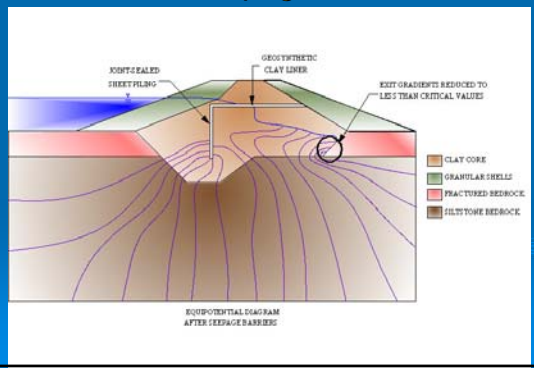




Seepage Model – Without Seepage Barriers



Seepage Model – With Seepage Barrier



Steel Sheet Pile Installation

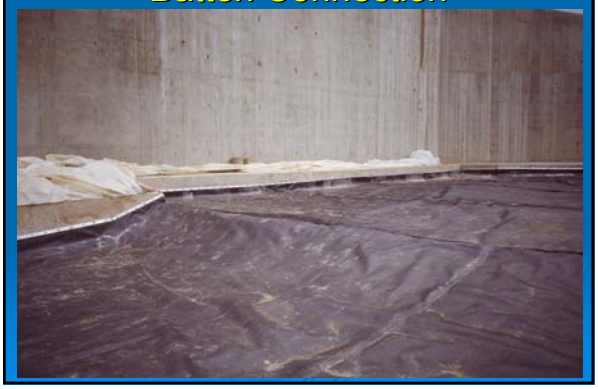
GCL Layer

Geomembrane Layer

Seam Testing

Batten Connection

Batten Connection

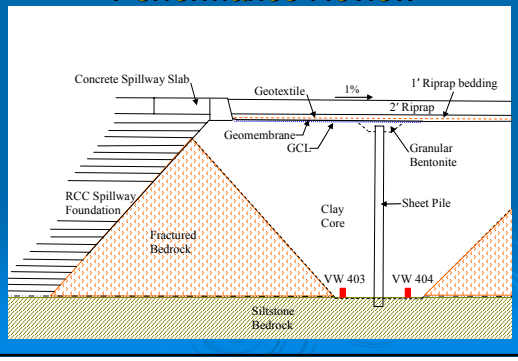


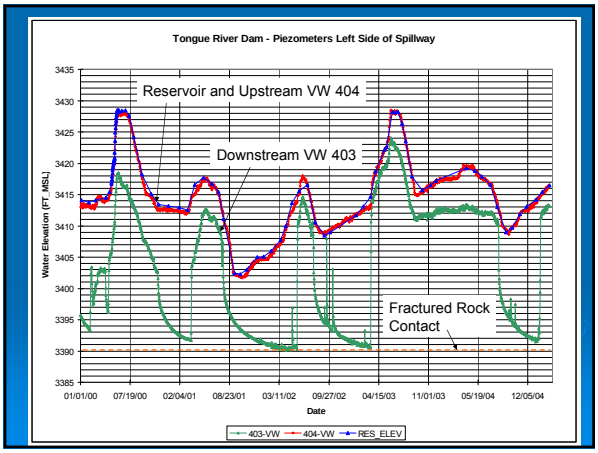
Geotextile and Riprap Bedding

Riprap

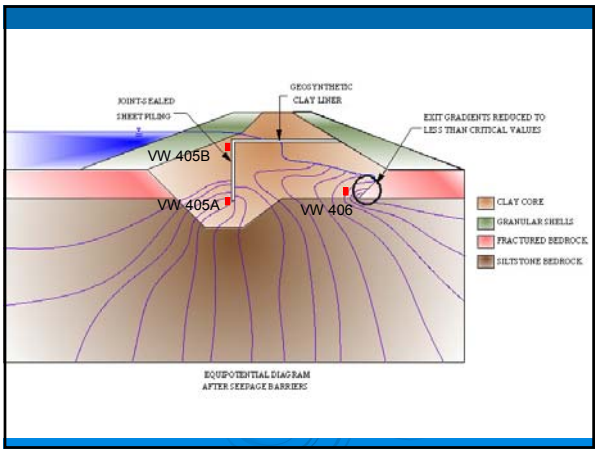
Tongue River Seepage Barriers
Performance Review

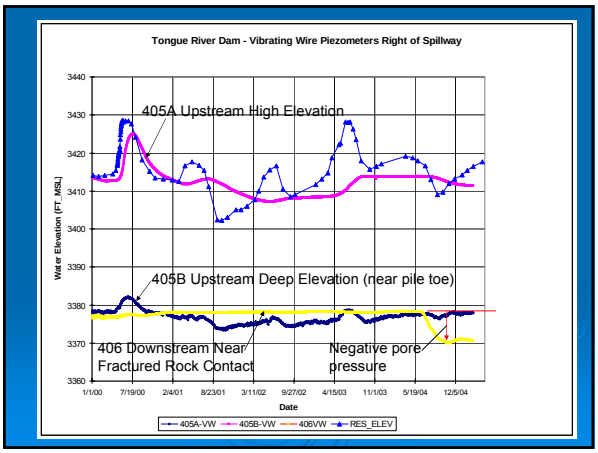
Tongue River Seepage Barriers
Performance Review





Tongue River Seepage Barriers
Performance Review





Tongue River Seepage Barriers
Performance Review

- Piezometric data are inconclusive with regard to barrier performance
  - "End-around" seepage into the fractured rock unit from west causes rapid rise and fall in water levels as the wedge clinker unit in front of spillway foundation "fills up" then empties. This is being tracked by Piezo 403, and indicates a direct hydraulic connection with the fractured rock unit.
  - One VW instrument downgradient from the barrier east of spillway (406) may be malfunctioning and needs to be replaced

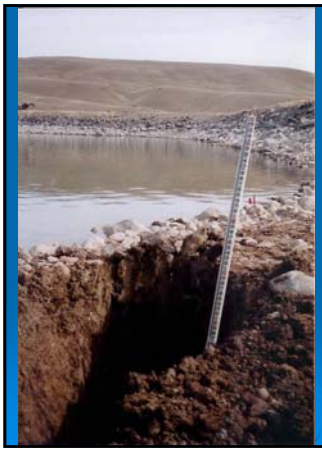
Nilan East Dam, MT

Nilan Project
- Constructed 1951
- 10,100 AF reservoir
- 2 dams: North and East
- Homogeneous embankments
- 50-55 ft high

Nilan East Dam, MT

Partially Excavated "Pipe"

Pipe Feature



The natural reservoir "lining" is very effective!

Nilan East Dam, MT

Interpretation from field investigations:

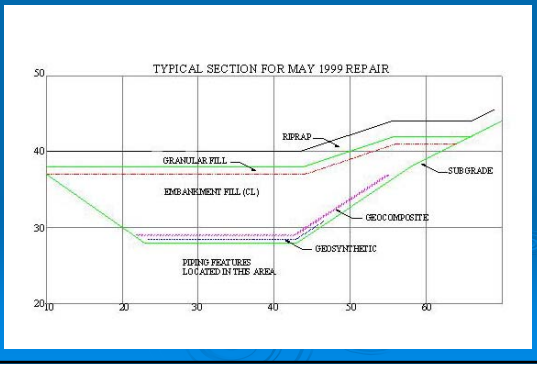
- Glacial materials in dam and reservoir area consist of low-permeability clayey sands and gravels near ground surface
- Surficial soils are underlain to depths up to 60 to 70 feet by intermixed gravels, cobbles, and boulders
- Underlying the mixed surficial materials in the dam foundation at depth is a very permeable 20-30 ft thick zone of clean sand and gravels (fluvial outwash deposit).

Nilan East Dam, MT

Interpretation from field investigations:

- Depression and piping features were caused by downward erosion of fines from glacial soil matrix into a pocket of openwork boulders and cobbles
- Surfical soils had provided an effective impervious blanket over the area until progressive wave action eroded the natural clay "lining".
- The shallow boulder pocket in the right abutment appeared to be limited in extent, based on the drilling information.

Selected Remedy,

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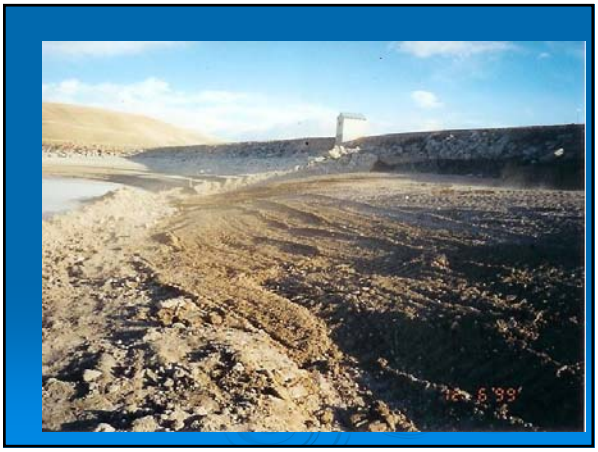

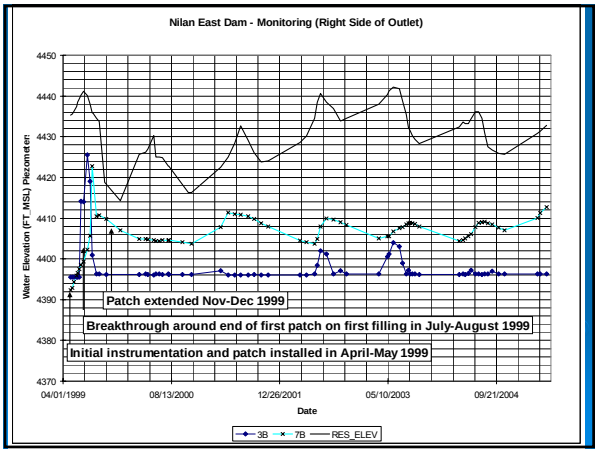

Nilan East Dam, MT
Performance Review

- Rapid rise in piezometric levels in summer 1999 following initial repair indicated that the piping features had broken through around the edge of the patch and connected to the gravelly zone at depth
- After patch was extended in Nov-Dec 1999, piezo monitoring indicates repair seems to be functioning well for past 6 years

Summary and Conclusions

- 3 examples of geosynthetics applications upstream to control seepage:
  - Nilan East & Tongue River projects have been in service for about 6 years
  - Lynchwood Lake (upstream geotextile designed to clog to reduce seepage) is about 15 years old
  - All 3 applications appear to be functioning adequately, although piezo data at Tongue River is somewhat inconclusive, and additional or replacement instruments may be needed

Summary and Conclusions

- 2 examples of geosynthetics for downstream filter and drainage functions:
  - Gardner Creek Dam in Pennsylvania - geotextile used as the downstream filter layer beneath a rockfill zone that was added to construct a downstream raise of the embankment, and filter fabric was also used to encase backfill drain zones behind the spillway walls.
  - Geocomposite drain used to as a critical blanket drainage system to construct an upstream raise of a tailings dam in Arkansas

Summary and Conclusions

Downstream Filter/Drain Applications

- Filter fabric at Gardner Creek Dam has been in service since 1983, and appears to be functioning well in the toe berm application. There have been some problems noted in the backfill areas behind the spillway walls, but these may be due to settlement of the backfill and not failure of the filter fabric.
- The geocomposite drain system at the tailings dam continues to operate well, although the pipe outlet components have required periodic cleanout maintenance.

Summary and Conclusions

- These examples illustrate the variety of geosynthetics and their potential applications for remediating dam problems.
- These examples also underscore the importance of adequate monitoring following installation to allow evaluation of their performance.