Gathright Dam Case History – Constructing a Dam in Karst Geology

Virginia

H. Marcus Kim, P.E.

Geotechnical Engineer - USACE

F. Alex Rutledge, P.E., P.G.

Geotechnical Engineer – Schnabel Engineering

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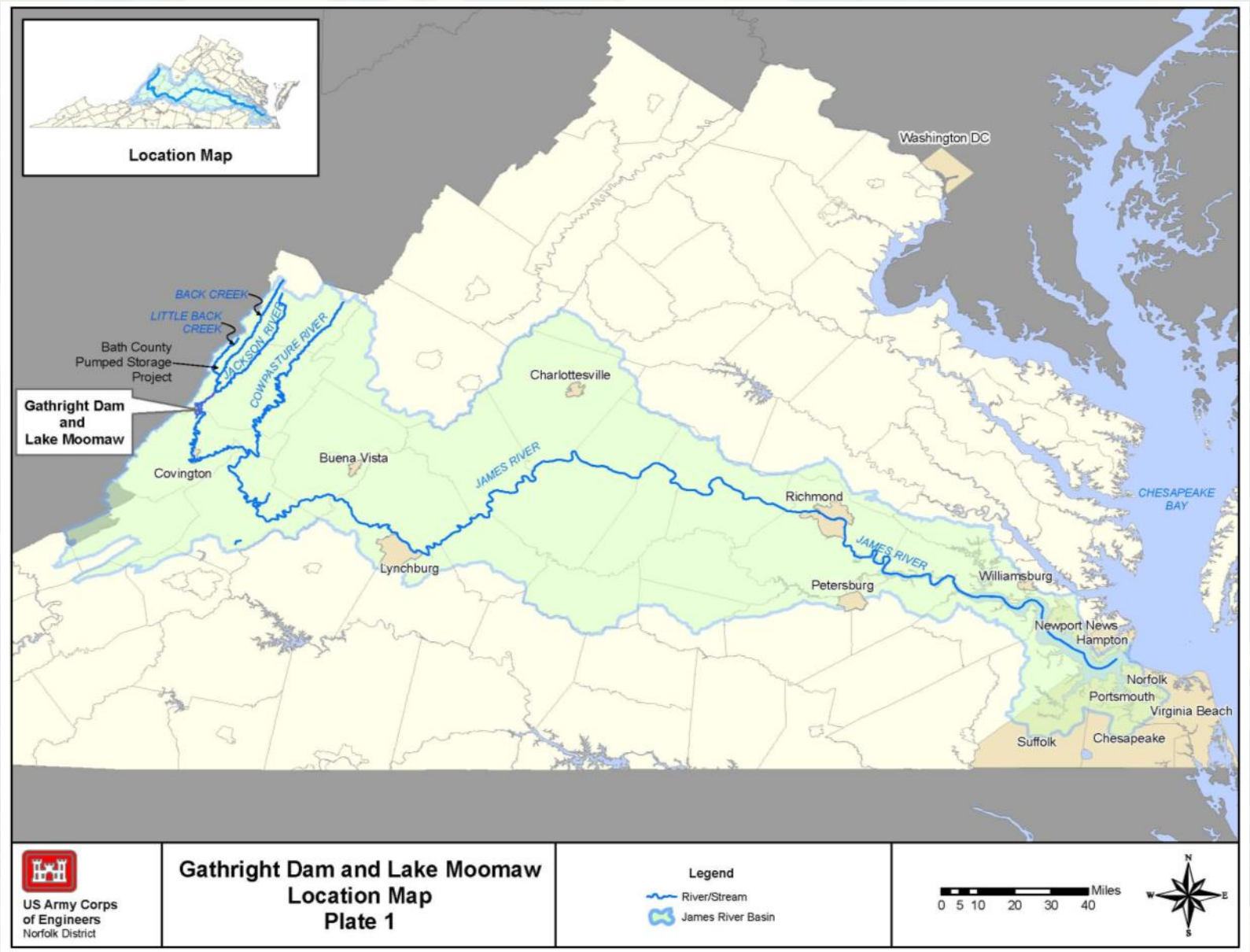
PRESENTATION OUTLINE

- Gathright Dam General Information
- Site Geology
- Challenges
- Solutions

General Information - Location



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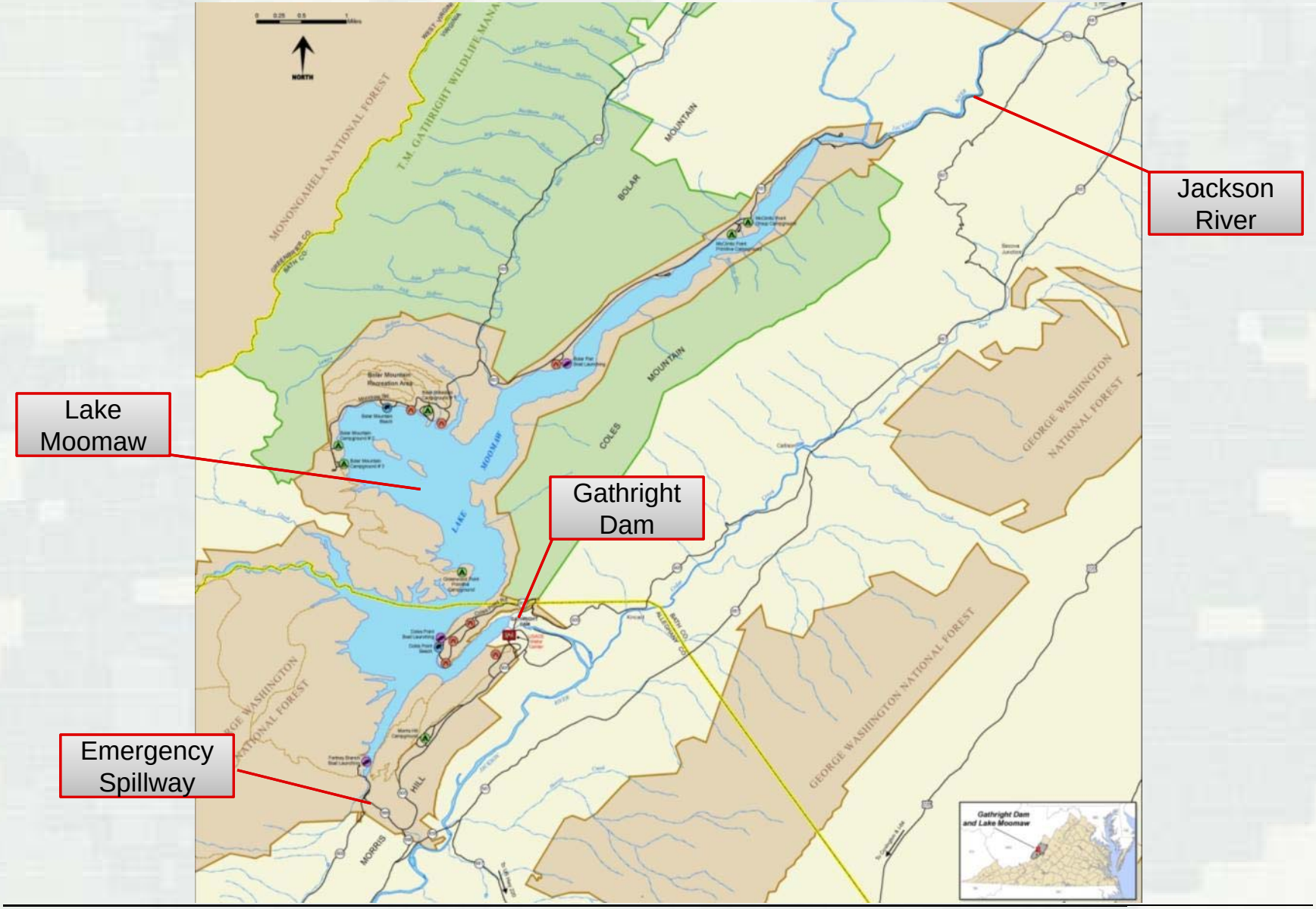
General Information – Site Map



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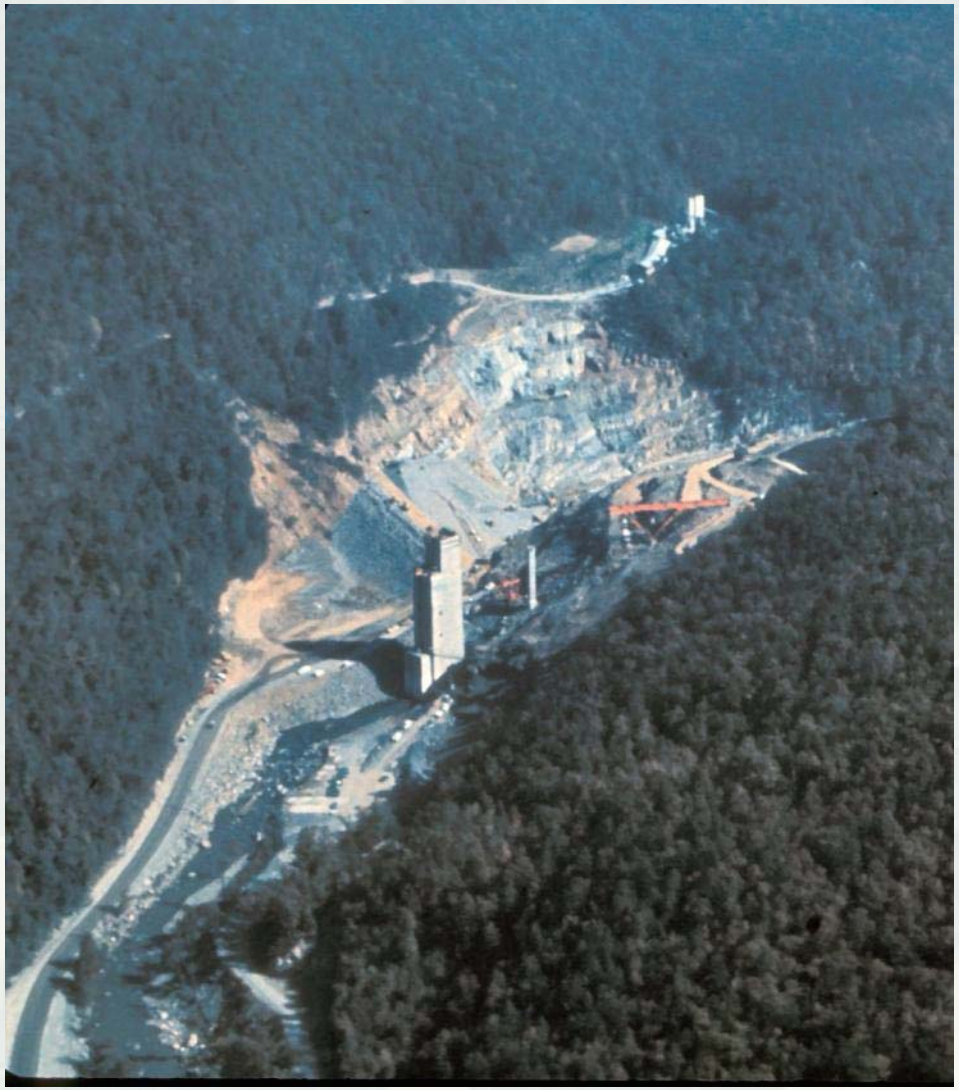
General Information – Project History

- Flood Control Act of 1946
- Study Completed in 1964
- Construction 1974 – 1979
- Filling of Reservoir

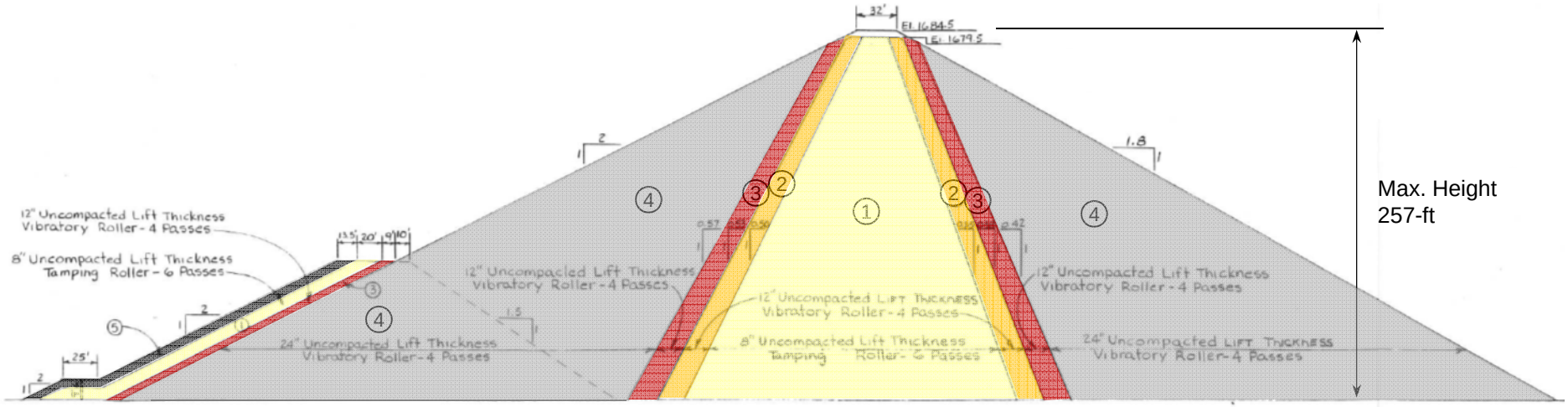
  1979 - 1982



General Information – Typical Dam Cross Section

UPSTREAM

DOWNSTREAM



EMBANKMENT MATERIALS

ZONE	①	Impervious Core : *clayey silts and silty clays*
ZONE	②	Transition Material No. 1: *sand-gravel size material*
ZONE	③	Transition Material No. 2: *quarry spall material(2"-6" size)*
ZONE	④	Rock Shell: *up to 16"*
ZONE	⑤	Dumped Rock

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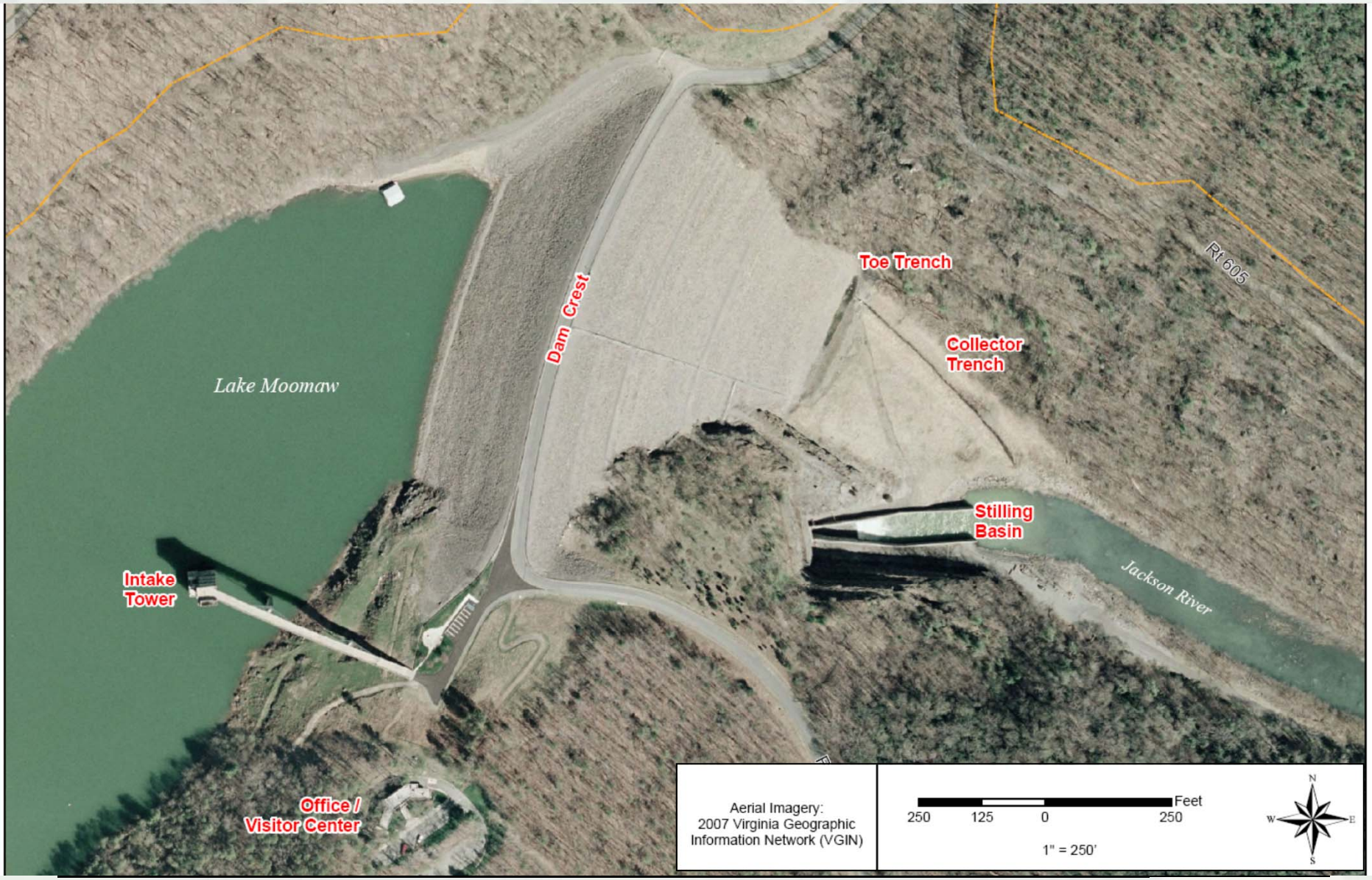
General Information – Features



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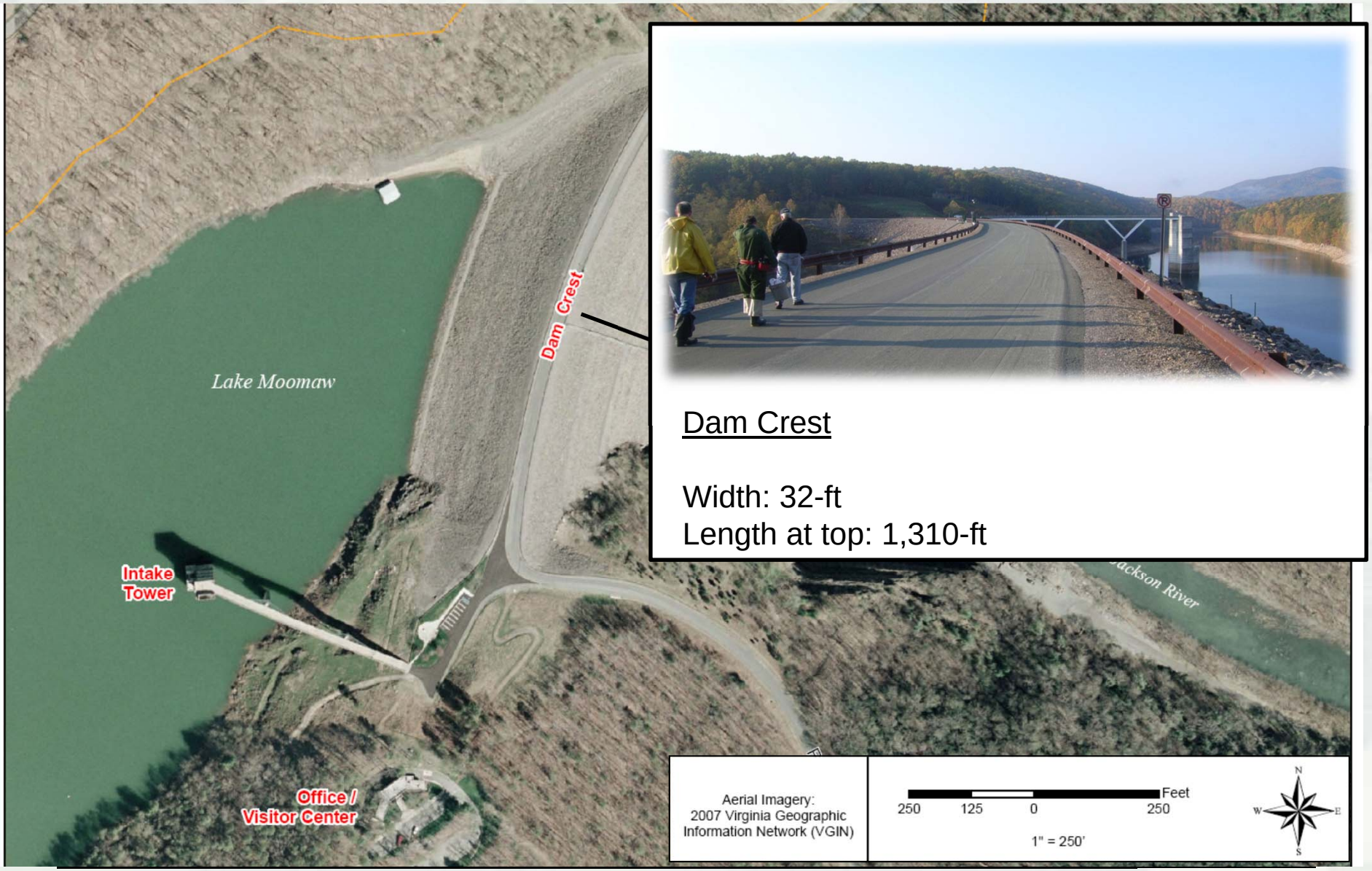
General Information – Features



Dam Crest

Width: 32-ft
Length at top: 1,310-ft

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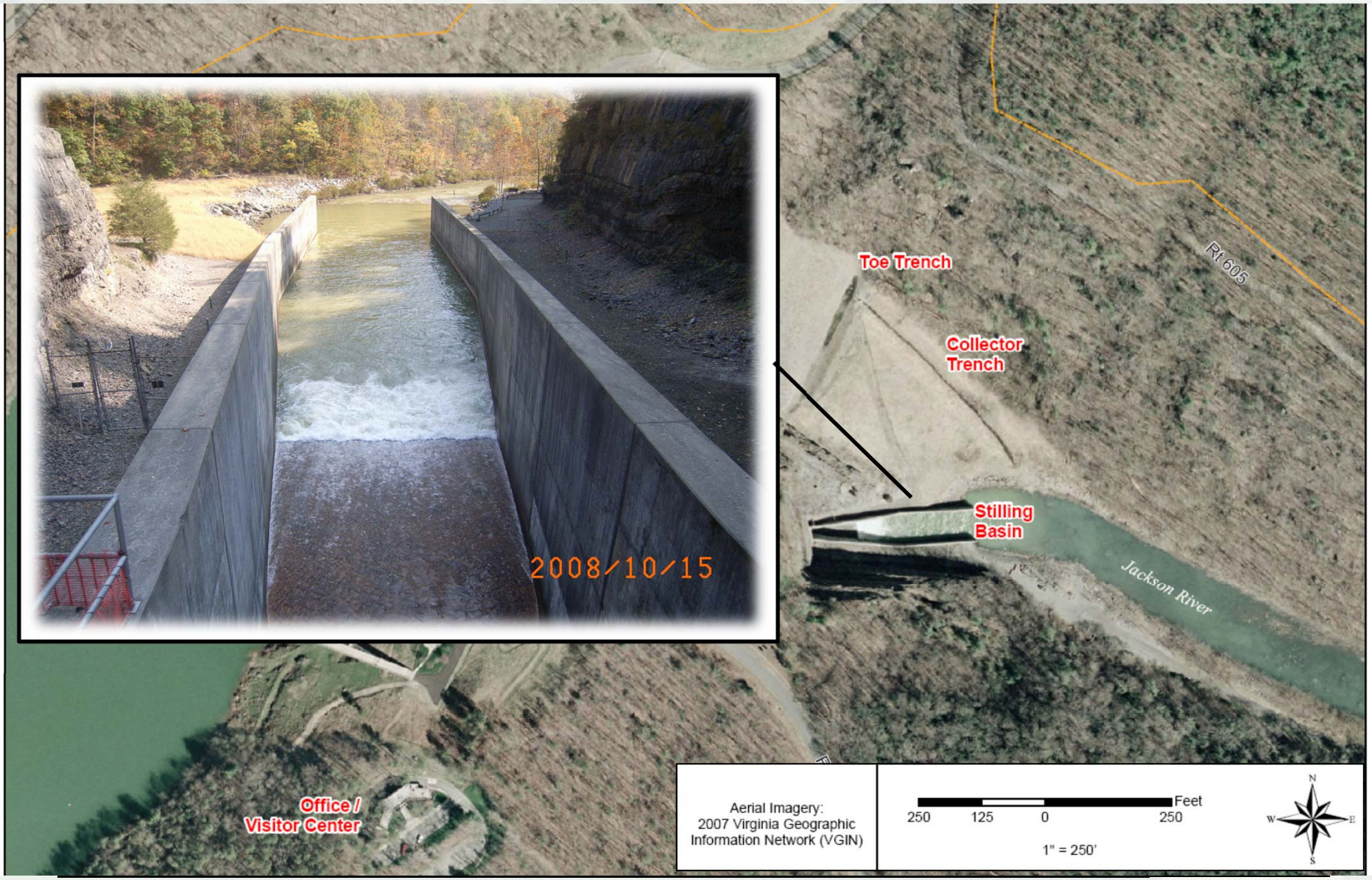
General Information – Features



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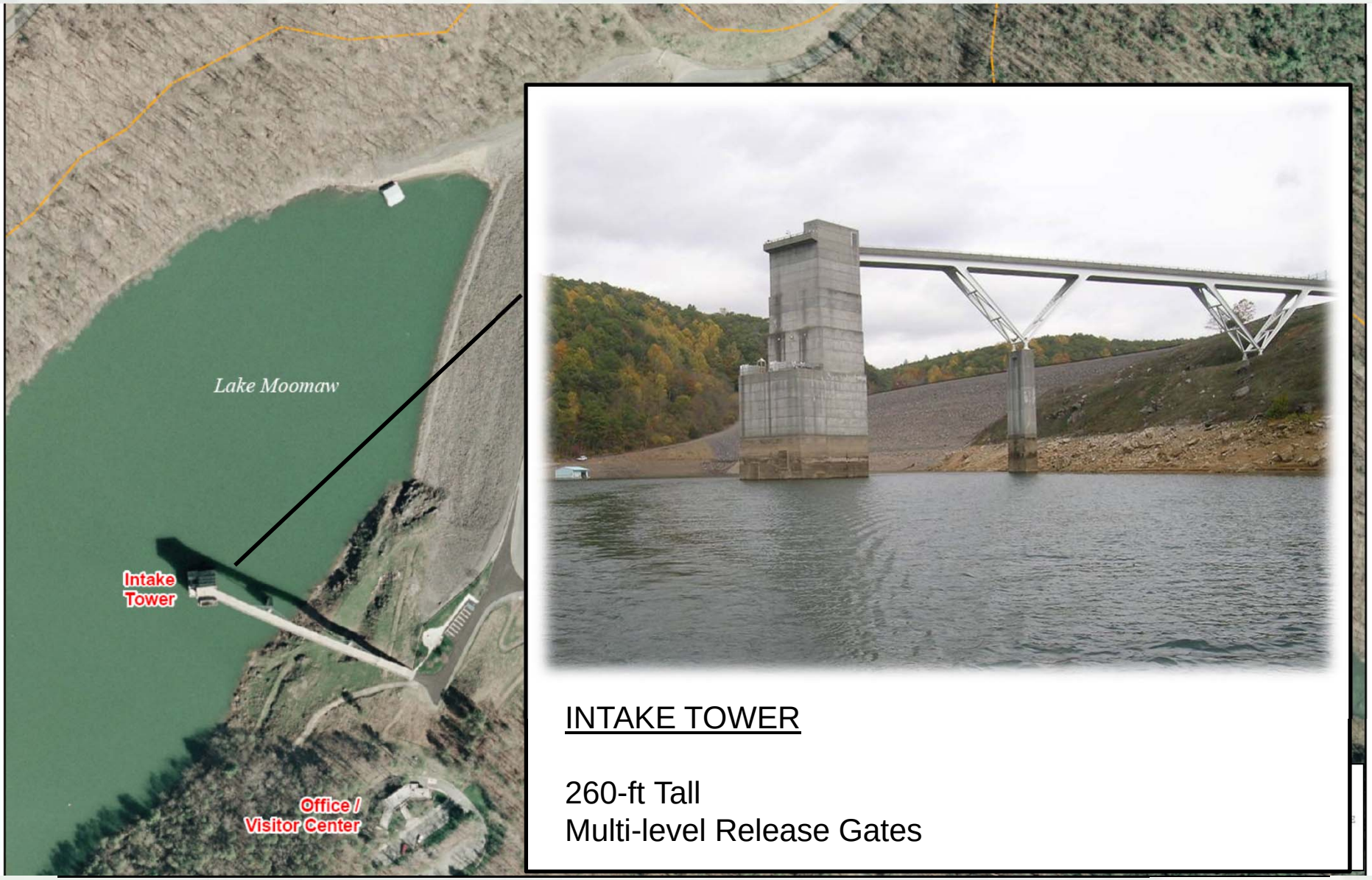
General Information – Features



INTAKE TOWER

260-ft Tall
Multi-level Release Gates

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General Information – Features

LAKE MOOMAW

Length: 12-miles
Shoreline: 43.5-miles
Depth: 80-ft (Avg) & 150-ft (Intake Tower)
Surface Area: 2,530-acres

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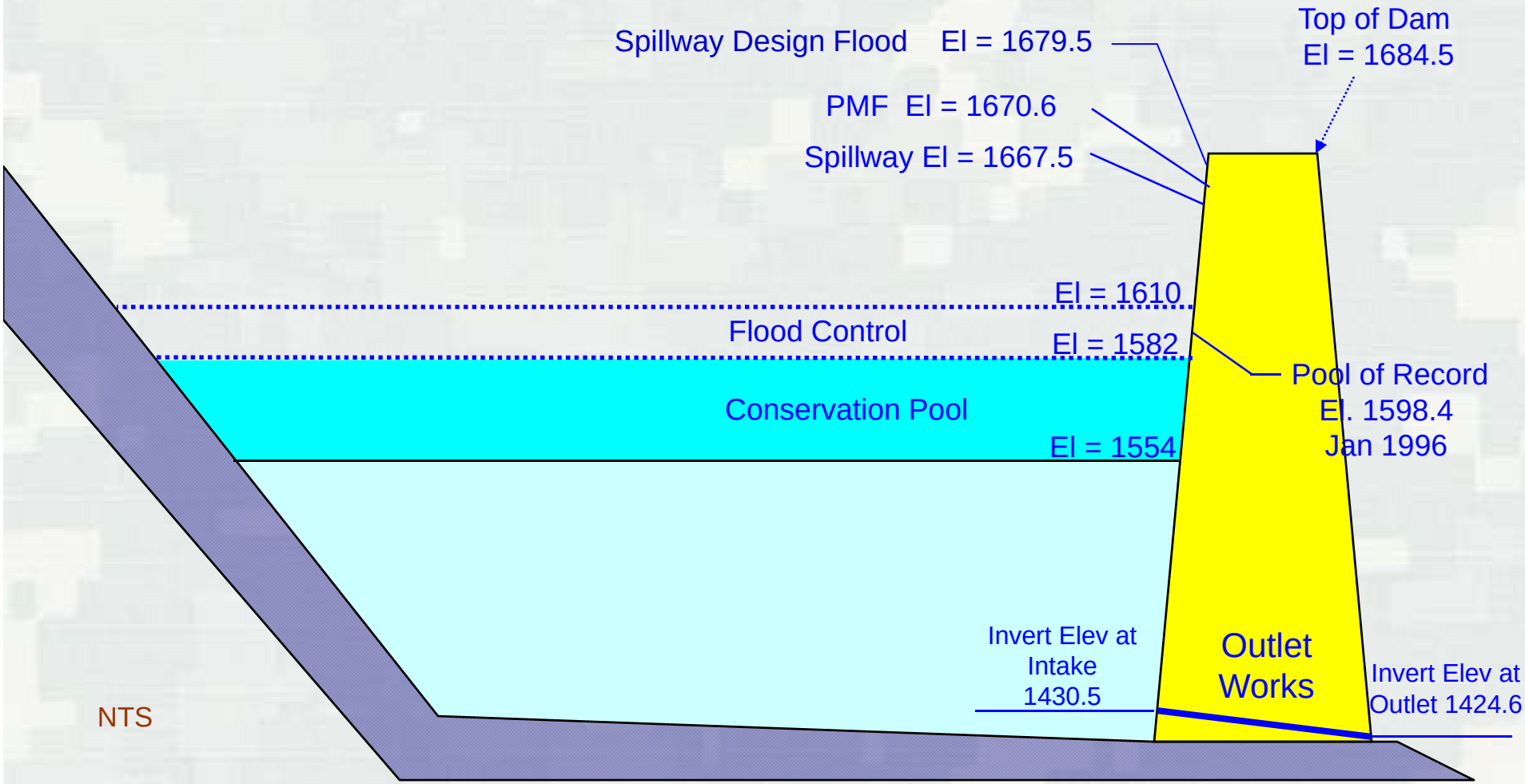
General Information – Elevations

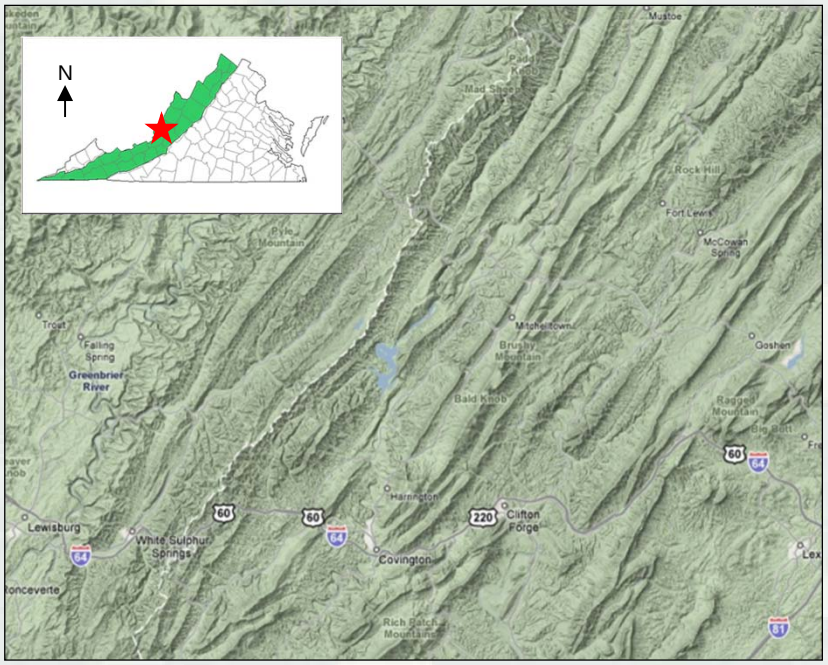


General Information

- Built and Operated by USACE Norfolk District
- Provides:
  - Flood Control – Protection of properties along the Jackson and James Rivers (immediate protection of Covington, VA)
  - Water Quality Augmentation – Regulation of the Jackson River minimum flow rate, temperature, and DO levels.
  - Recreation – Lake Moomaw and its surrounding areas (camp sites, trails, etc.). Operated and maintained by US Forest Service.

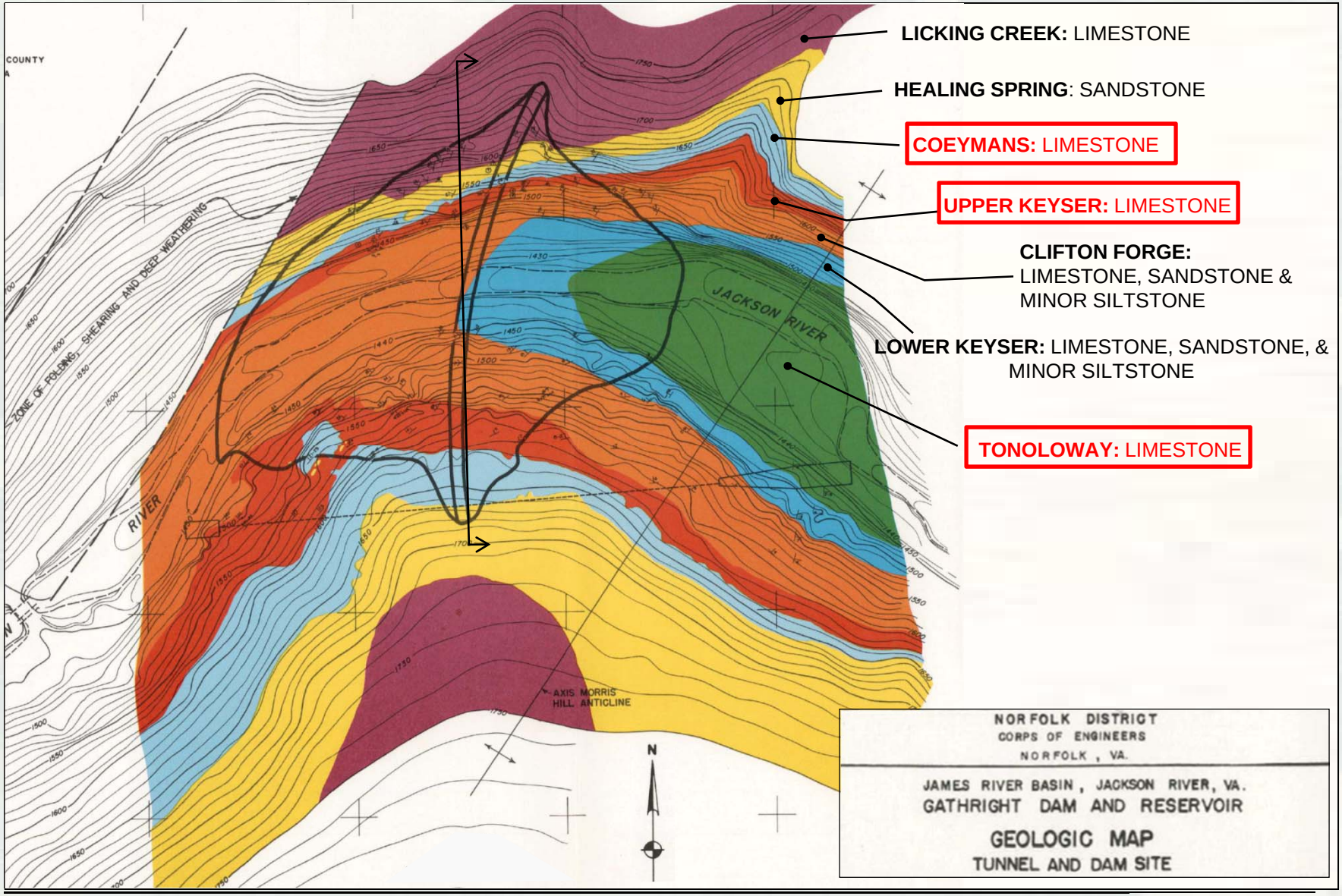
Geology

- Located in the Appalachian Valley and Ridge Province of Virginia
- Nearly parallel synclinal valleys and anticlinal ridges from intensely folded sedimentary rocks
- Dam located on the Jackson River (Eroded anticlinal ridge)



Typical physiography of Valley and Ridge Province

Geology – Site Geologic Map



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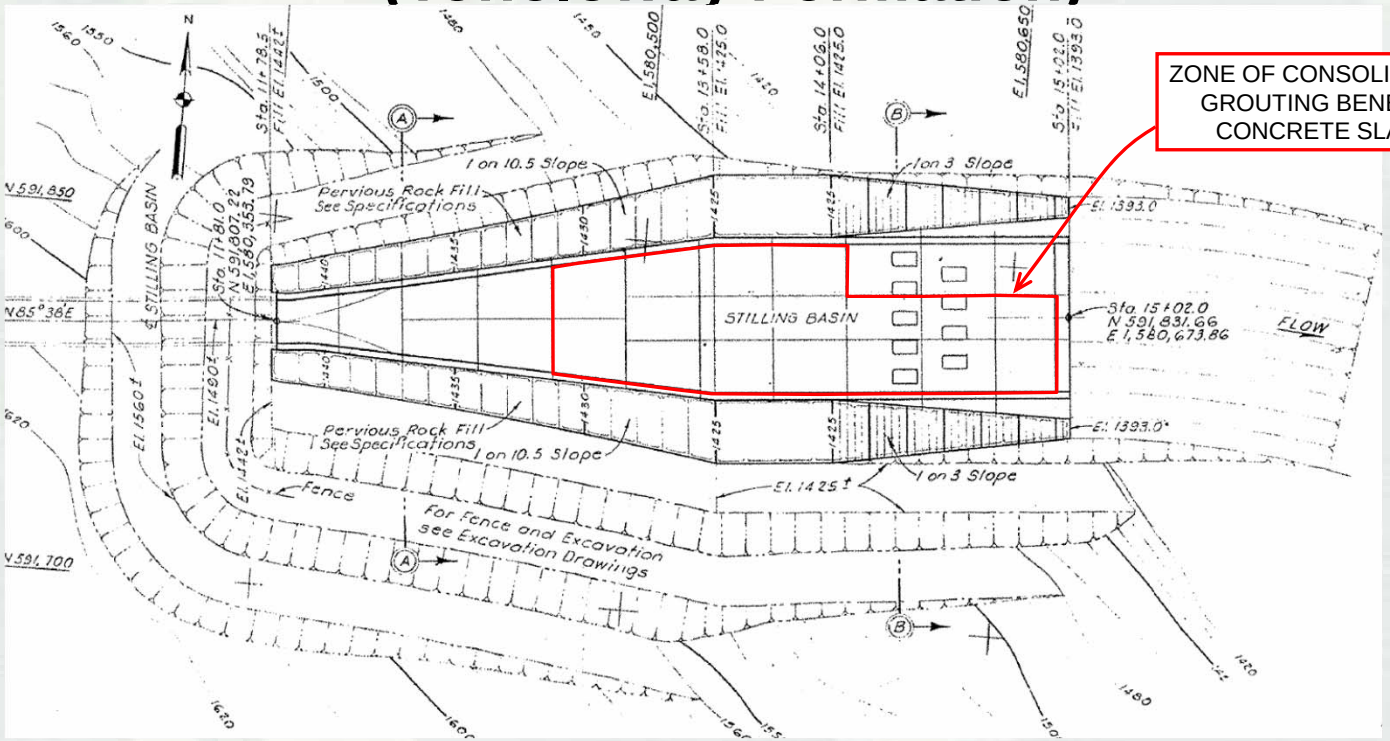
Stilling Basin Mitigation (Tonoloway Formation)



- Artesian flow encountered – 1,000+ gpm
- Consolidation Grouting Program
  - Depths 20’ to 40’, total of 7,370-linear feet drilled & grouted
  - Cavities (avg. 2.5’ vertically) encountered in 98 of the 206 holes.
  - Total of 9,803 ft^3 of solids (cement & sand) injected

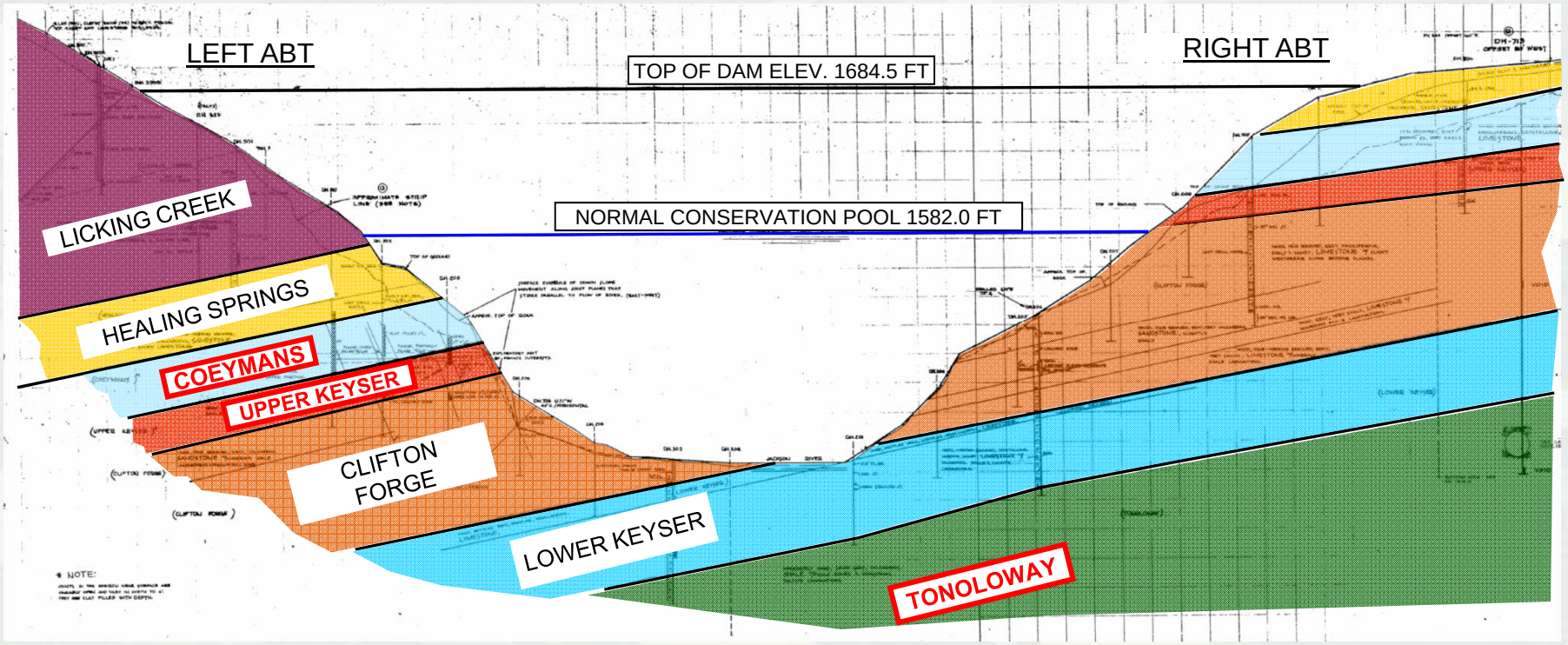
Solutions – Stilling Basin Construction Pictures

Concrete slab construction

Tunnel lining frame at Outlet

Nearly completed

Geology – Geologic Cross Section



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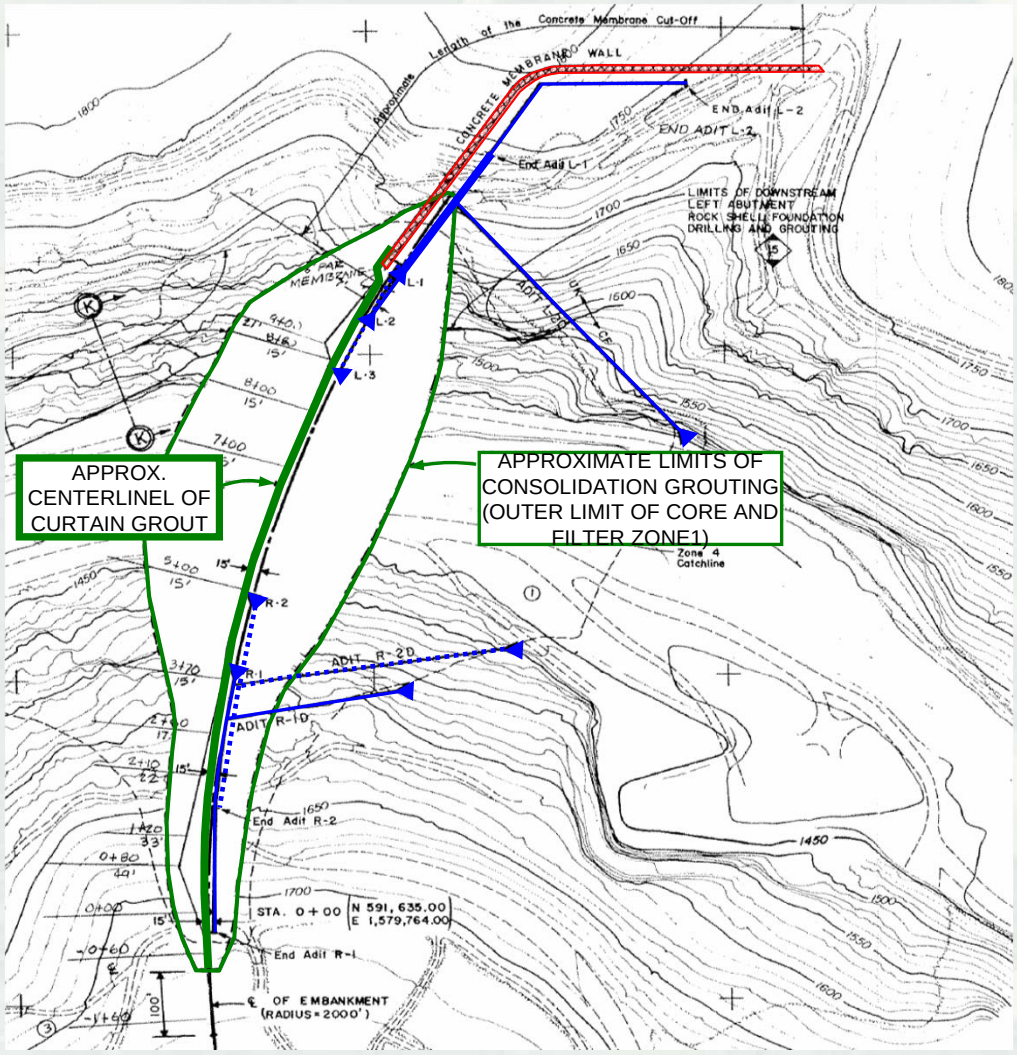
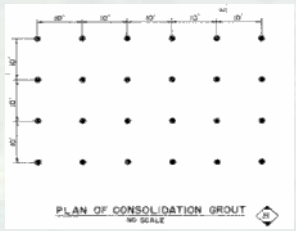
Foundation & Abutments Mitigation
(Upper Keyser & Coeymans Formations)

- Seepage control & foundation improvement measures included:
  - Concrete Membrane in left abutment bedrock
  - Consolidation grouting on abutments/foundation
  - Curtain grouting along foundation alignment

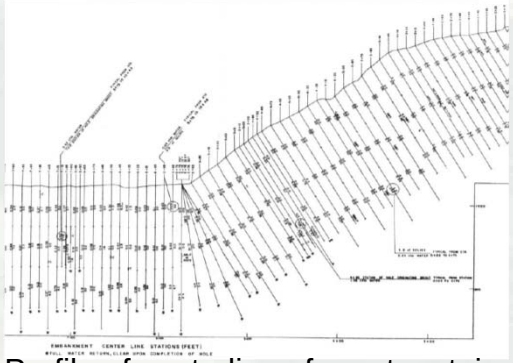
Solutions – Foundation & Abutment Schematic

Grouting and Concrete Membrane





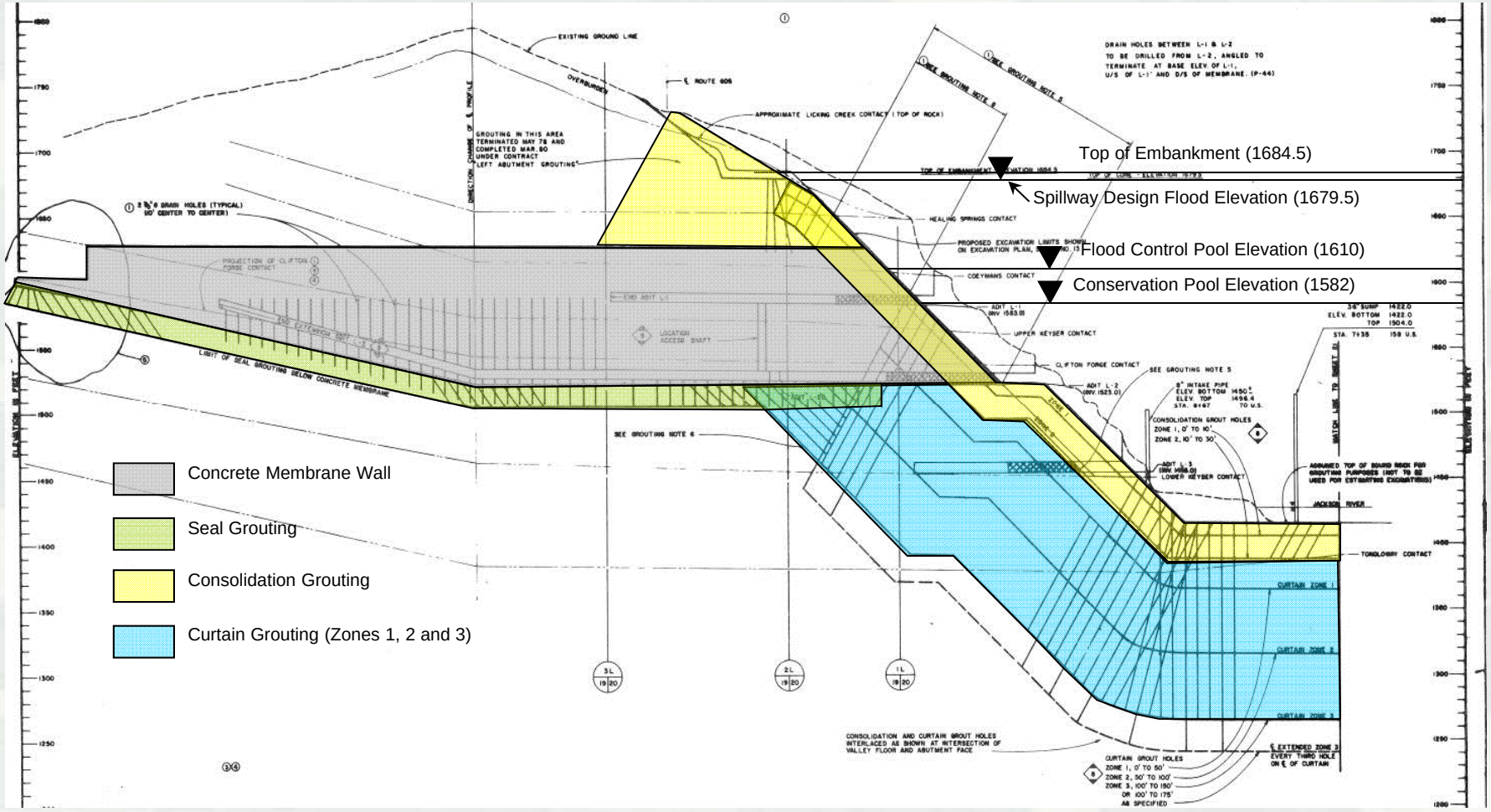
Spacing for consolidation grouting (top) and grout curtain (bottom)



Profile of centerline of grout curtain along portion of river channel and right abutment

Solutions – Foundation & Abutment Schematic

Left Abutment



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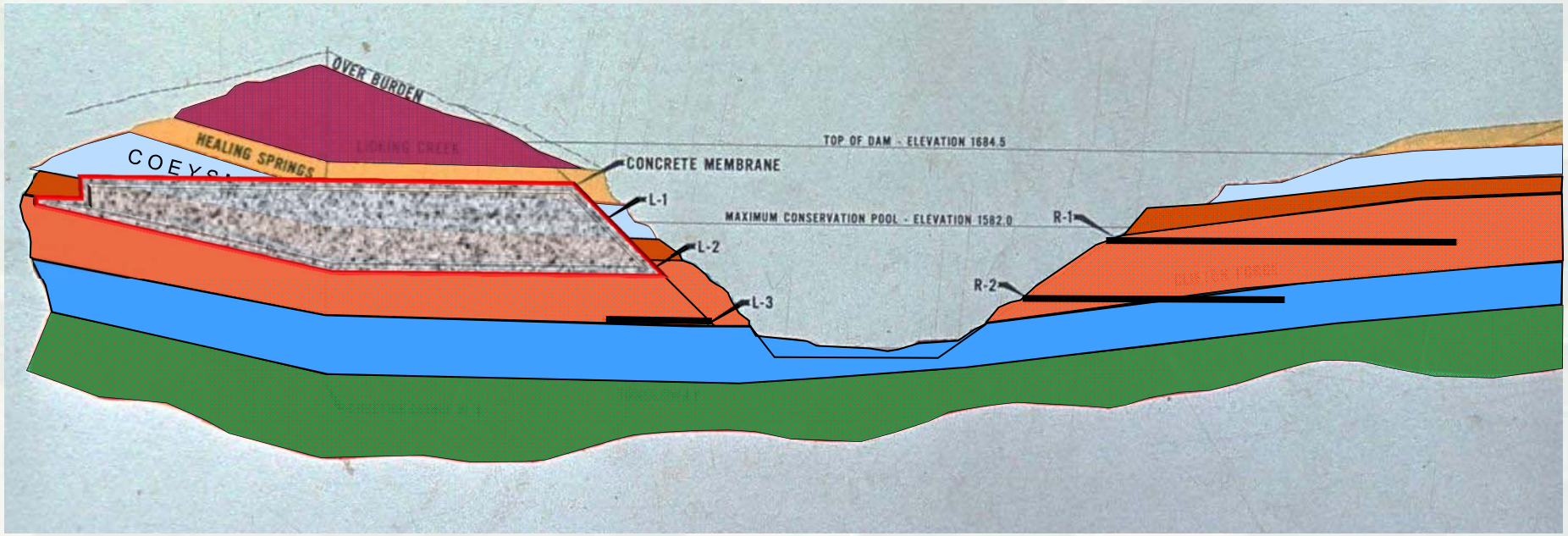
Solutions – Foundation & Abutment Schematic



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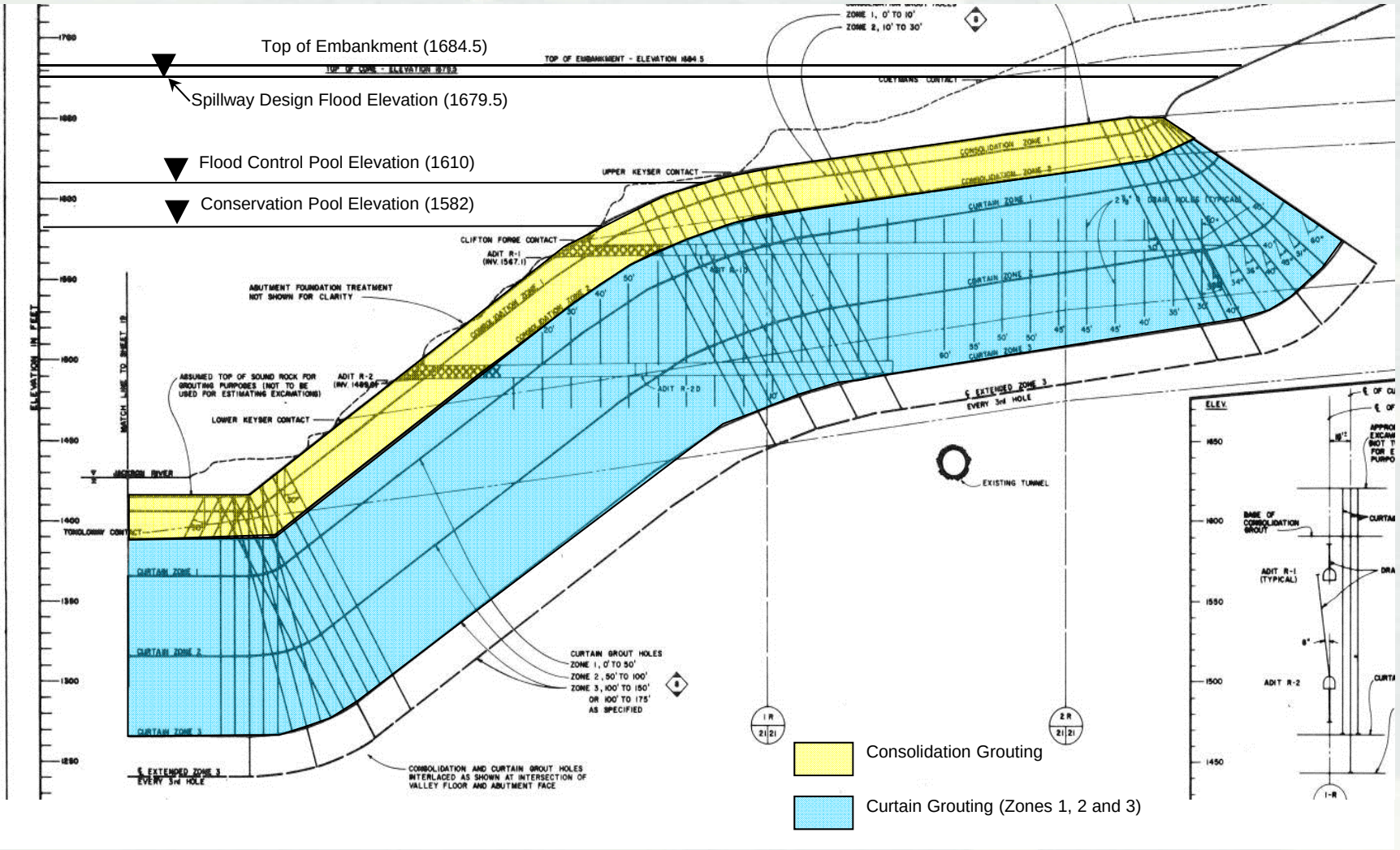
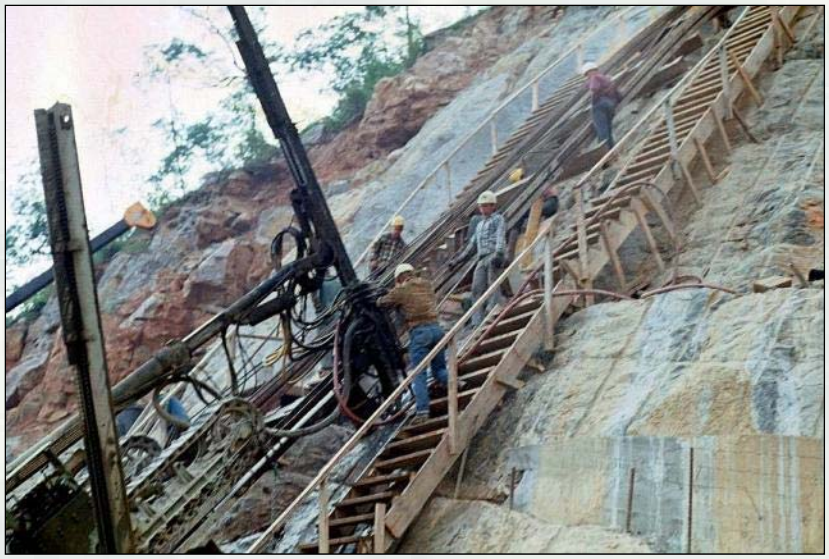
Solutions – Foundation & Abutment Schematic

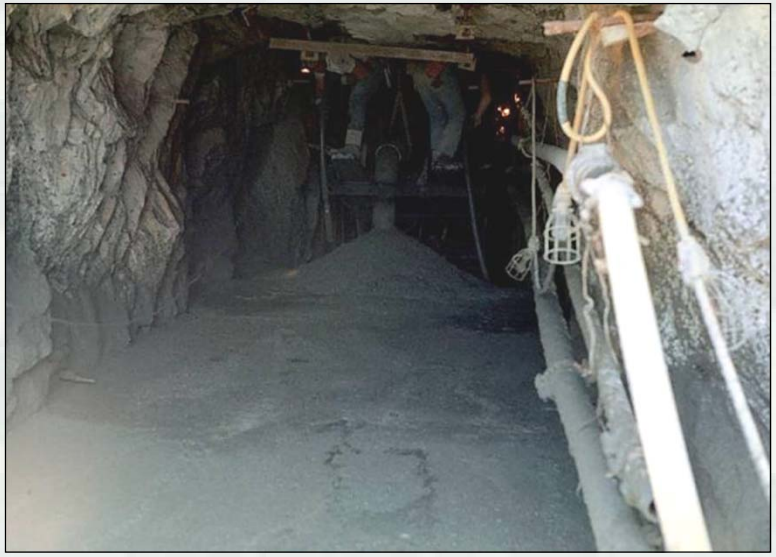
Right Abutment





Drilling of foundation grout holes

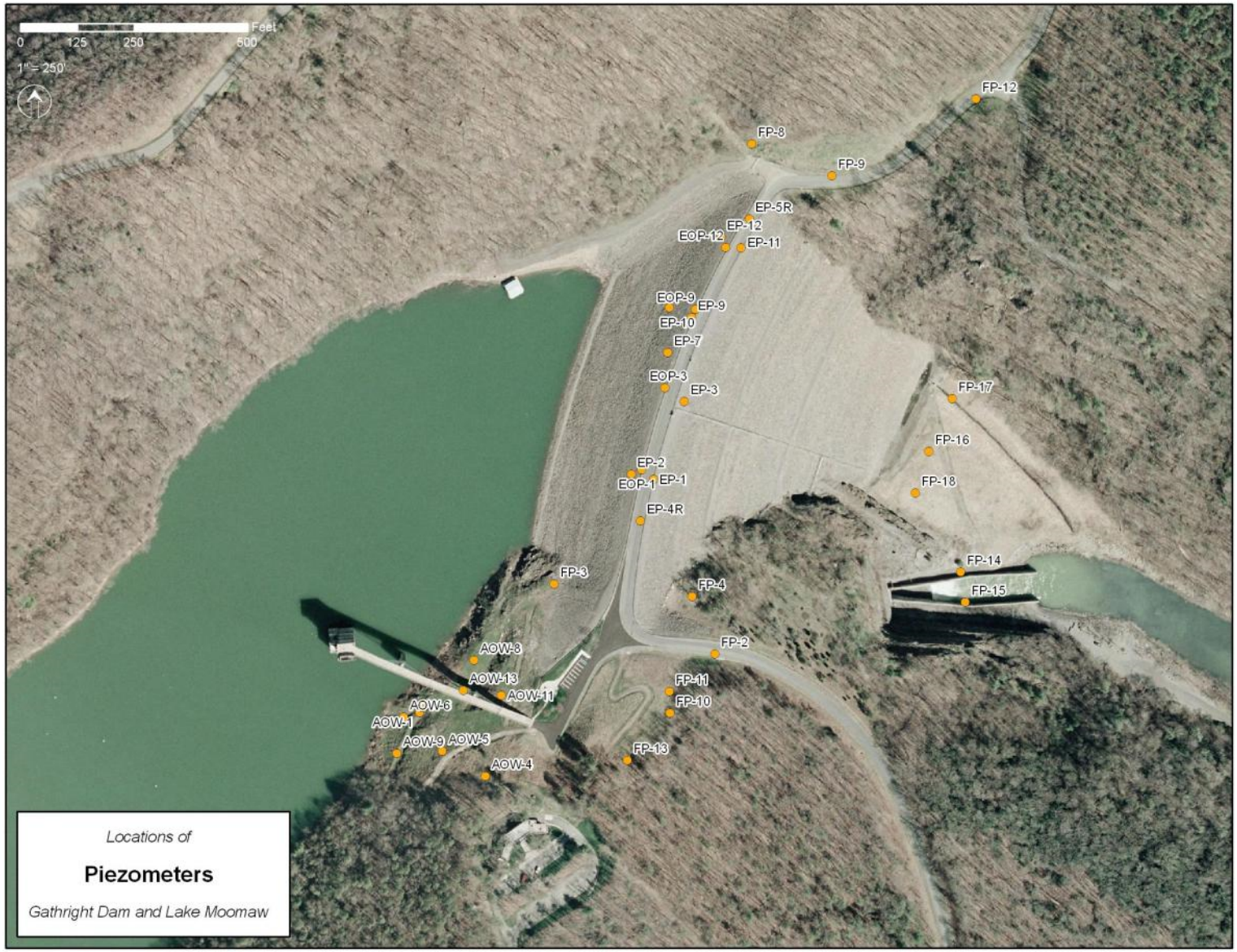
Grout pump



Concrete placement in Membrane

Concrete membrane exposed along the slope of the left abutment, note shotcreteing to the left of the membrane

Dam Monitoring Instrumentation



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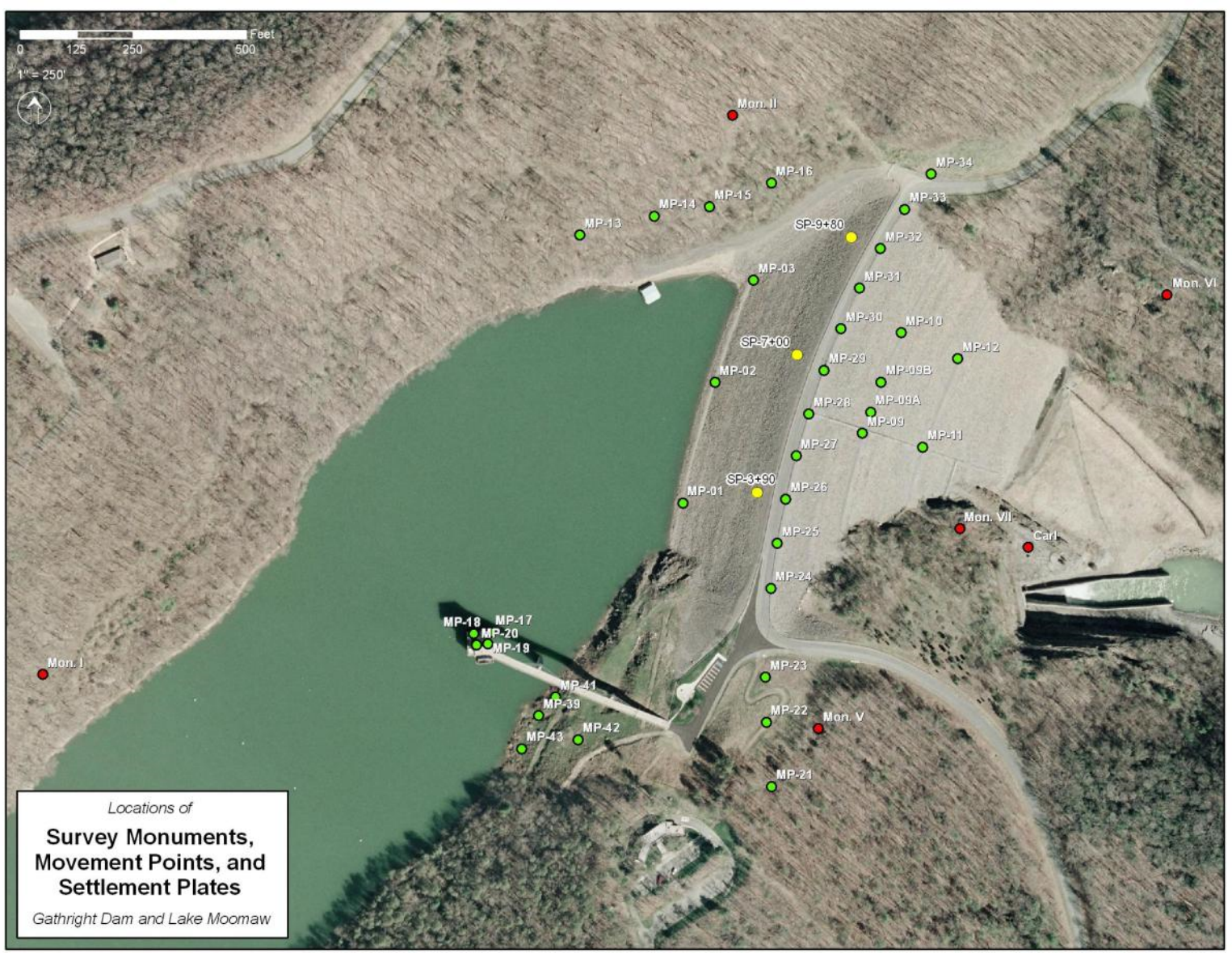

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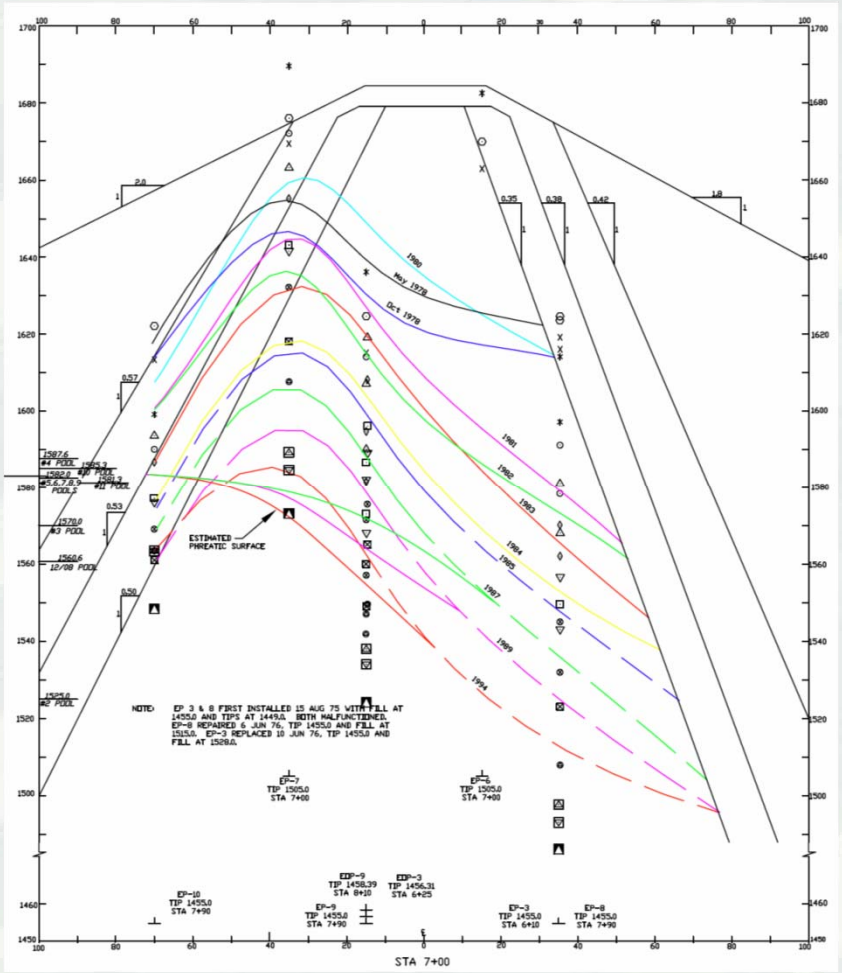

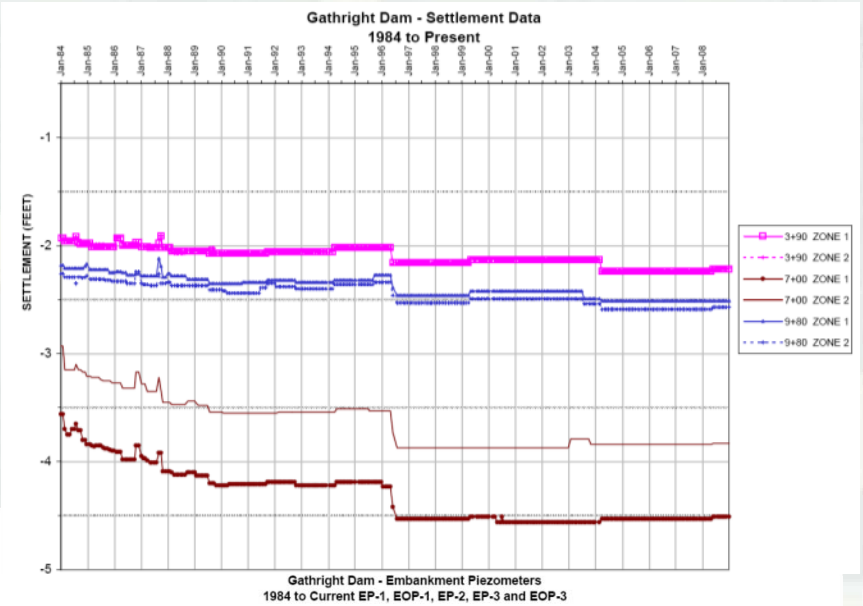

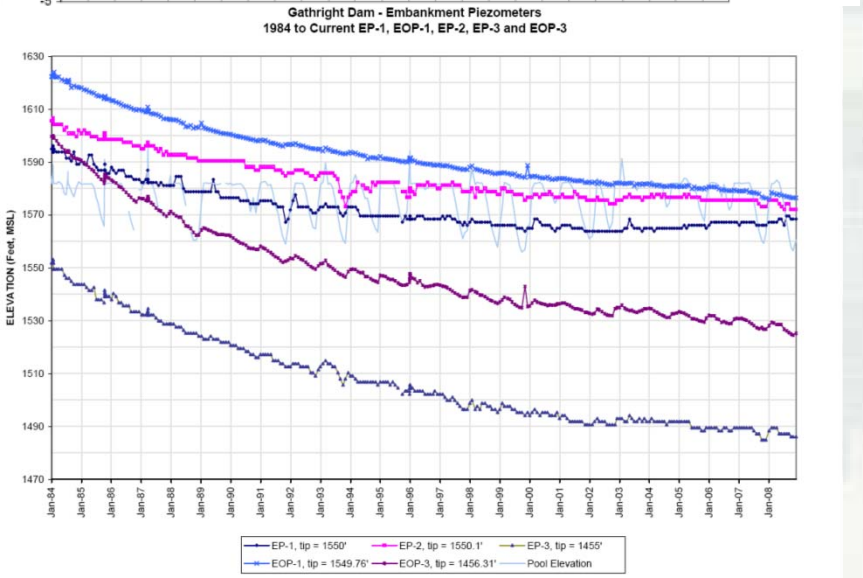

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SUMMARY

- Geologic Formations Highly Prone to Develop Solution Features Exist at the Project Site.
- Karst Features Identified and Dam was Designed & Constructed Accordingly
- Extensive Instrumentation Monitoring Program
- Seepage Control & Foundation Improvement Features Working

SUMMARY

QUESTIONS?