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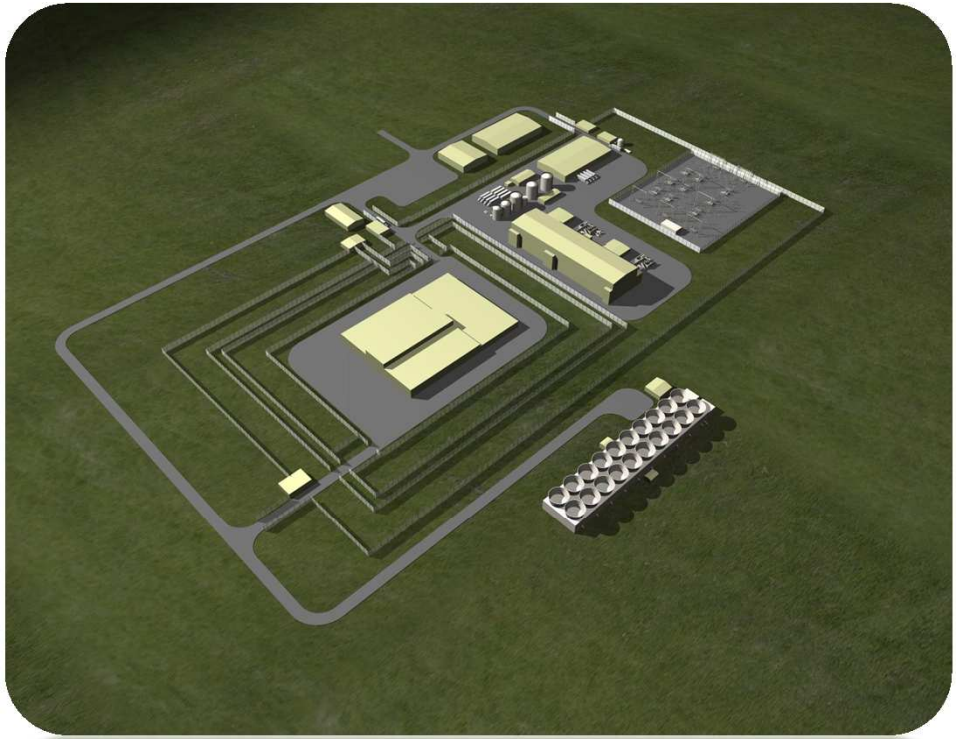
Clinch River SMR

February 12, 2013

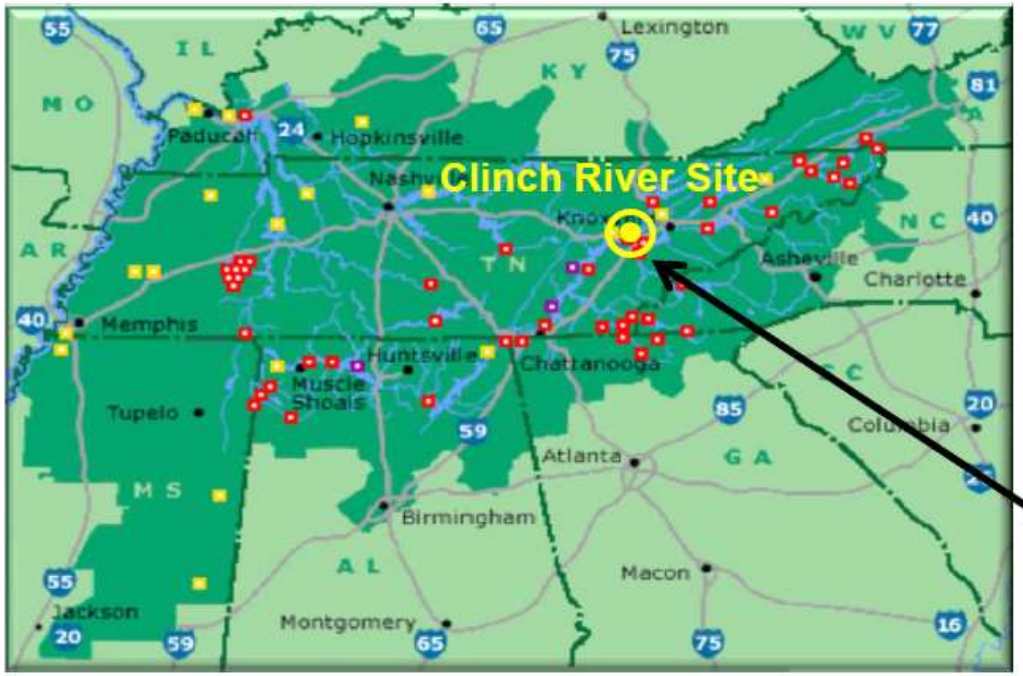


Subsurface Investigation Plan

Agenda

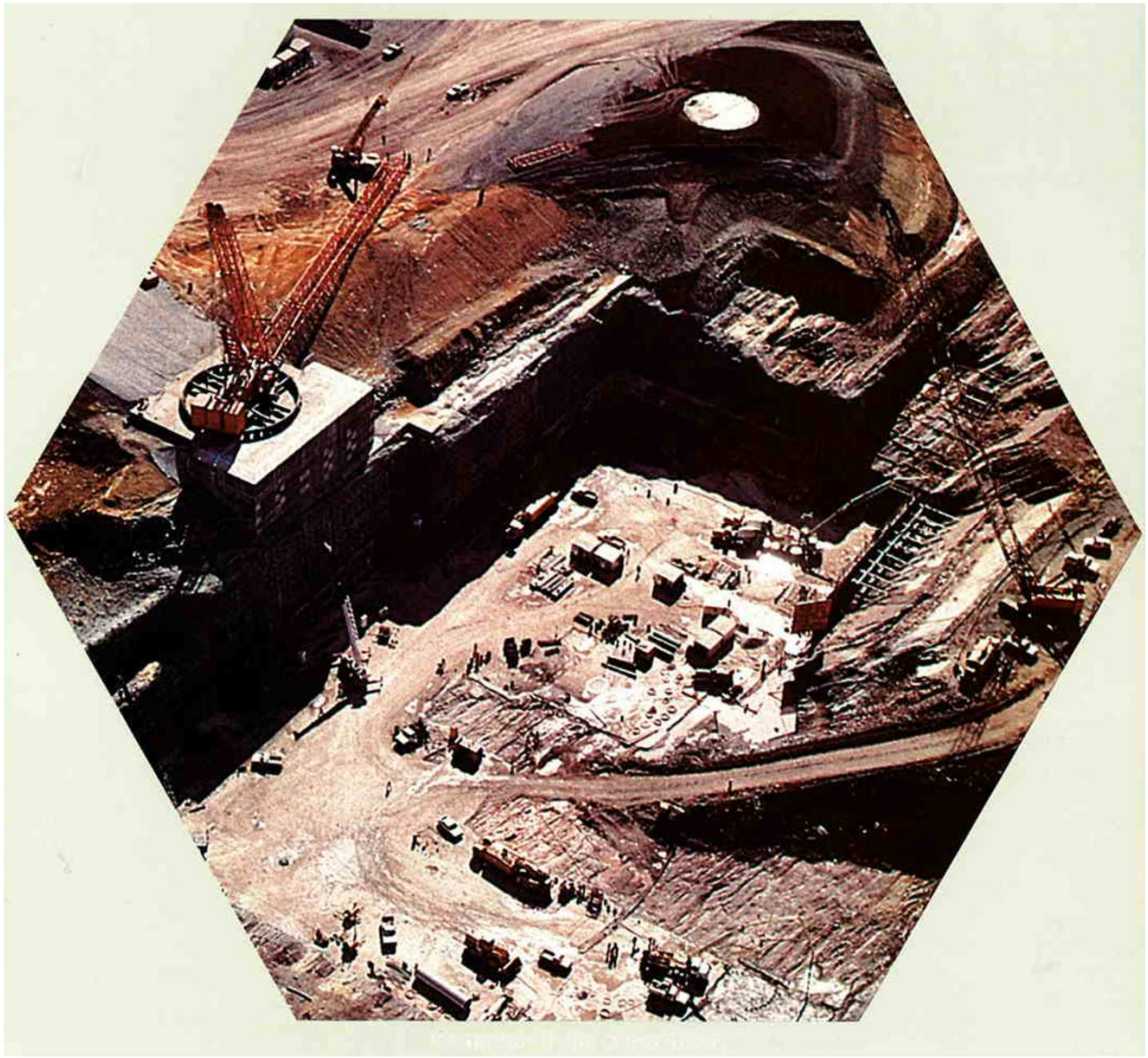
- Introduction
- Project Description
- Overview of Area Geology/Hydrogeology
- Description of Subsurface Investigation Program
- Laboratory Testing Program
- Schedule
- Questions

Clinch River Site (CRS) Location



Clinch River Site (CRS)

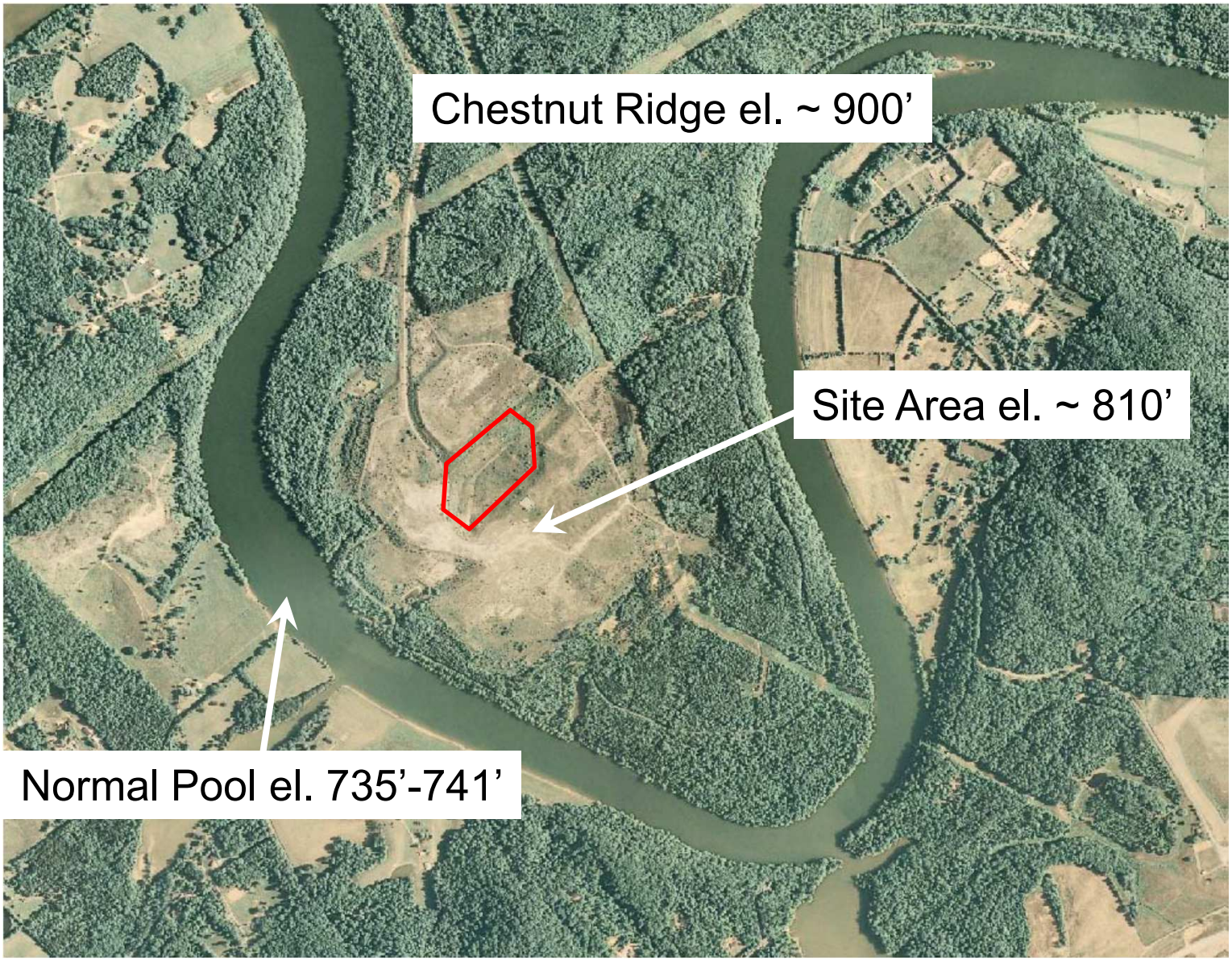
Clinch River Breeder Reactor Project Excavation (CRBRP)



Preliminary Site Layout

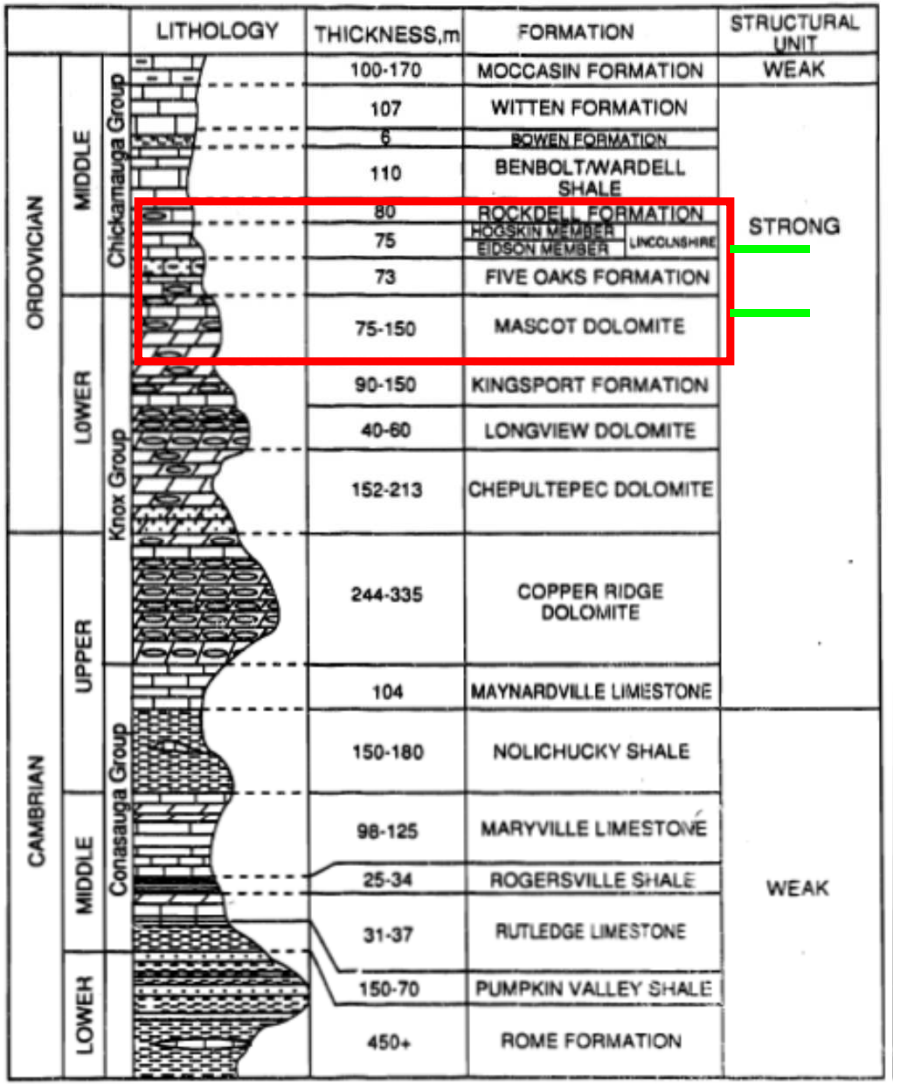
Reactor Service Building Locations

CRS Physiography



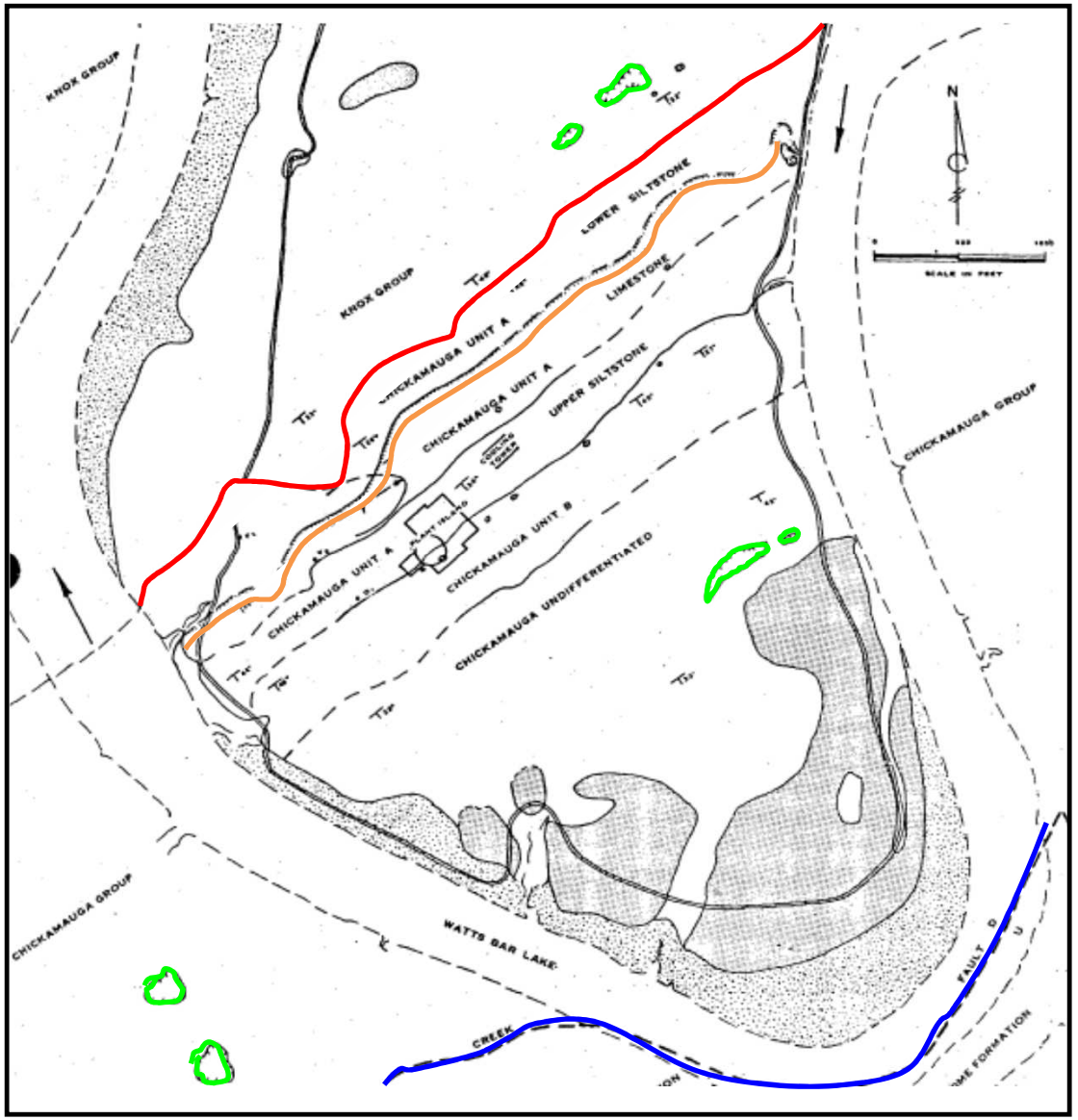
CRS Stratigraphic Column

Approximate Stratigraphic Interval to be Investigated for Site Stratigraphy, Geologic Structure, Groundwater Flow Regime, and Foundation Strength

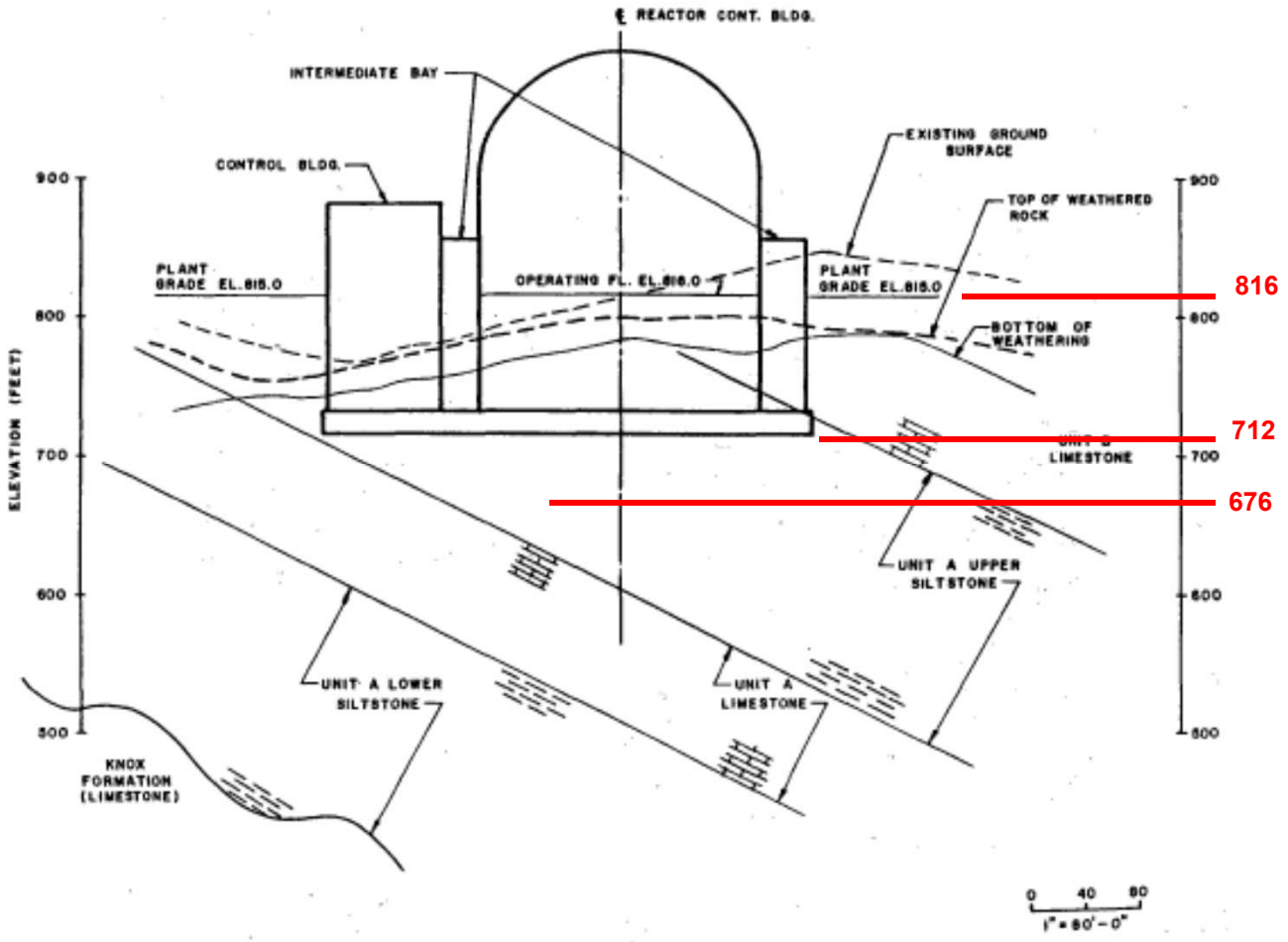


Stratigraphic Intervals Potentially Subject to Dissolution

CRS Geologic Map



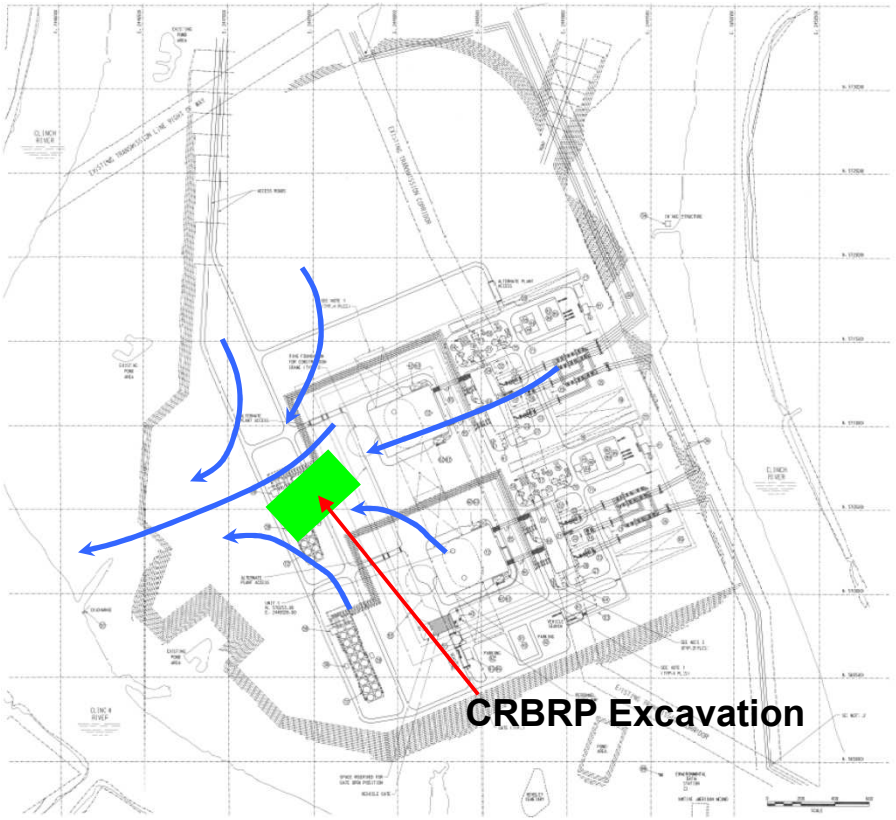
Geologic Cross Section CRBRP



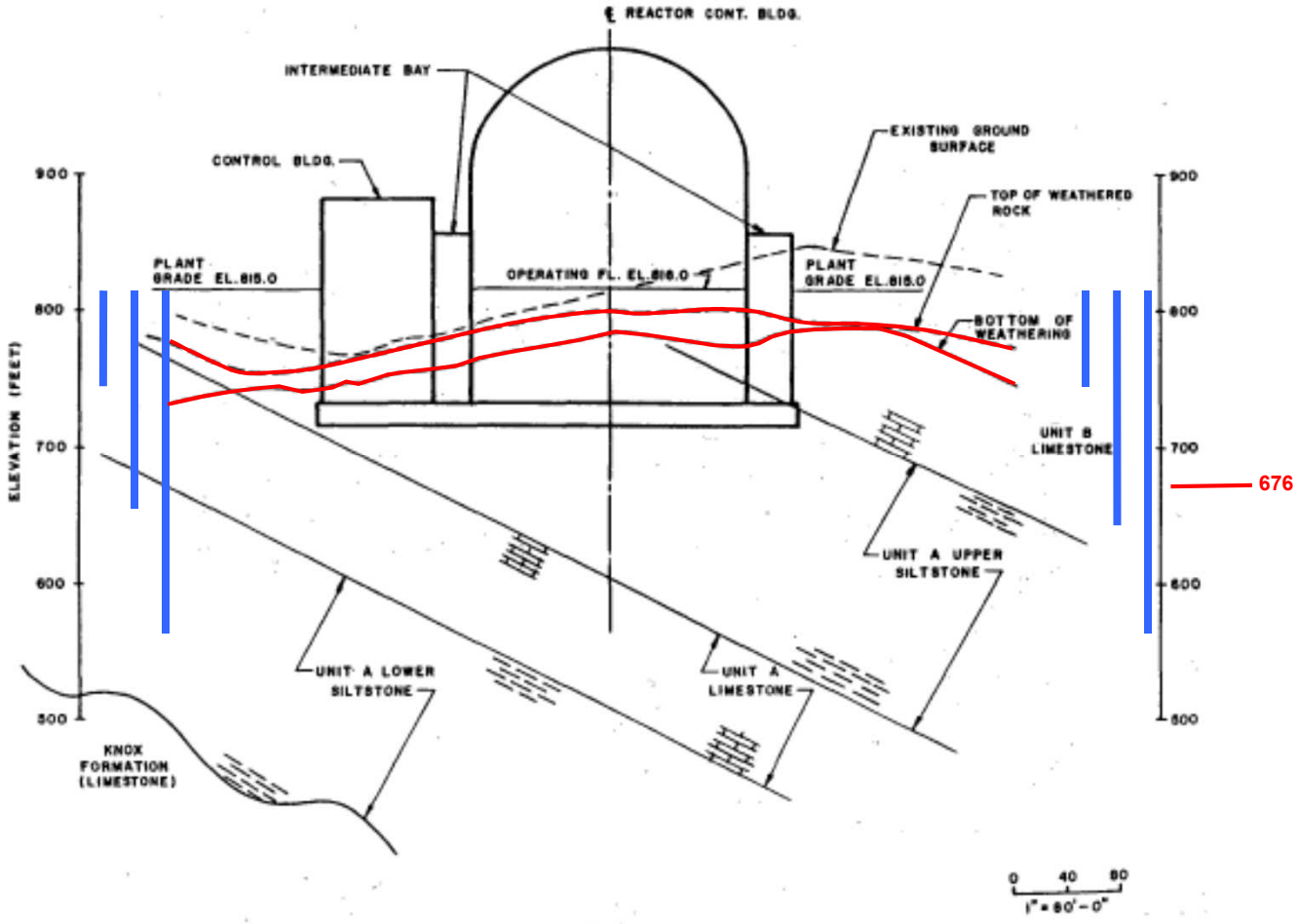
CRS Hydrogeology

- Dipping strata creates complex groundwater flow regime
- Bulk of flow is in the weathered bedrock and upper portion of solid rock
- Hydraulic conductivity decreases with depth (fracture flow)
- Limited data regarding flow direction – changes since CRBRP PSAR

Groundwater investigation and numeric model will support dewatering, rock stability, and post-construction radionuclide transport evaluations



Hydrogeologic Cross Section CRBRP



Subsurface Investigation Program

- RG 1.206 - SAR Standard Content & Format
- RG 1.208 – Site-Specific Ground Motion
- NUREG-0800 – NRC's Standard Review Plan

- Prescriptive program in RG 1.132 – Site Investigations for Foundations of Nuclear Power Plants (Rev 2, October 2003)
  - Guidance on investigation methods, density of data points, depth of explorations
  - Emphasis on a flexible field program that can be adjusted based on conditions encountered
  - Program tailored to the site and geologic setting

Subsurface Investigation Program

- Focus
  - Geologic conditions and hazards
  - Characterize extent and sizes of dissolution features
  - Fractures and other planes of weakness
  - Shear wave velocity profile(s)
  - Hydrogeologic conditions
  - Engineering properties of soil and rock
  - Foundation conditions across strike

Subsurface Investigation Program

- Methods
  - Soil borings with SPT in soils
  - Rock coring
  - Downhole geophysics
  - Seismic refraction survey
  - In situ testing
  - Test pits
  - Groundwater observation wells
  - Packer testing
  - Aquifer pumping test
  - Pre-Construction field geophysical surveys on foundation for karst investigation

Subsurface Investigation Program

- Oversight and Documentation
  - Qualified specialty contractors with approved QA plans
  - Experienced oversight for each drill rig
  - Adjustments to field operations as needed
  - Complex geology, detailed rock logs correlated with geophysical logs
  - Job specific training for borehole logging
  - Well installation and hydrogeologic activity oversight by hydrogeologists
  - Coordination amongst geologists

Geologic/Hydrogeologic Investigation Summary

- Dipping strata creates complex geologic and groundwater flow conditions. These conditions will likely differ below the individual units.
- Prevalence of carbonate rocks at the site will require an evaluation of the potential for dissolution features.
- Geologic/Geotechnical investigation will support the evaluations for:
  - Excavation rock slope stability (PSAR 2.5.5)
  - Vibratory ground motion (PSAR 2.5.2) and stability of subsurface materials (PSAR 2.5.4)
- Groundwater investigation will support the evaluations for:
  - Construction and permanent dewatering requirements (PSAR 2.4.12)
  - Determination of design bases for maximum post-construction groundwater elevation
  - Accidental release evaluation (PSAR 2.4.13)

Laboratory Testing Program

- RG 1.138 – Laboratory Investigations of Soils and Rocks for Engineering Analysis and Design of Nuclear Power Plants (Rev 2, December 2003)
  - Calibrations, NIST traceable
  - Testing standards: ASTM and USACOE
  - Specialized methods: RCTS
- Ongoing review of logs and samples
- Assignments early, review results to adjust program if necessary
- Soil classification testing to verify field classifications
  - Atterberg limits (Plasticity),
  - Grain size,
  - Moisture content,
  - Carbonate content

Laboratory Testing Program

- Laboratory testing for site characterization
  - Strength undrained, drained, triaxial, unconfined comp.
  - Consolidation
  - Compaction (Proctor)
  - Permeability
  - Unit weight
  - Water content
  - Specific gravity
  - Chemical (corrosivity)
  - Resonant column torsional shear (RCTS)
  - Slake durability
  - Specific gravity
  - Unconfined compression

Laboratory Testing Program

- Results used to verify/correct field boring logs
- Characterize various materials on site
- Input to calculations and models to support PSAR:
  - Engineering properties calculation
  - Bearing capacity and settlement calculation
  - Liquefaction calculation
  - Lateral earth pressure calculation
  - Site response calculation
  - Soil structure interaction model
  - Aquifer properties calculation
  - Groundwater model

Subsurface Investigation Schedule

- Scheduled to complete investigation in approximately 12 - two week shifts
- Shift 1
  - Mobilize Geotechnical Drill Rigs (Staged)
  - Equipment Calibration and Acceptance
  - Training
  - Readiness Review
  - Seismic Refraction Testing
  - SPT Energy Testing
  - Begin Drilling – Concentrating on borings at well locations

Subsurface Investigation Schedule

- Shift 2
  - Geotechnical Drilling – Concentrating on borings at well locations
  - Geophysical Testing
  - Packer Testing
- Shift 3
  - Geotechnical Drilling – Concentrating on borings at well locations and downhole geophysical testing locations
  - Geophysical Testing
  - Packer Testing
  - Well Installation
  - Intact Sampling
  - Rock Pressuremeter

Subsurface Investigation Schedule

- Shift 4
  - Geotechnical Drilling
  - Geophysical Testing
  - Packer Testing
  - Well Installation
  - Slug Testing
- Shift 5
  - Geotechnical Drilling
  - Well Installation
  - Slug Testing
- Shift 6
  - Geotechnical Drilling
  - Well Installation
  - Slug Testing
  - Water Quality Sampling

Subsurface Investigation Schedule

- Shifts 7, 8, 9 & 10
  - Geotechnical Drilling
- Shift 11
  - Complete Geotechnical Drilling
  - Install Wells for Pump Test
  - Begin As Built Survey
- Shift 12
  - Conduct Pumping Test
  - Seismic Reflection Survey
  - Complete As Built Survey
  - Sample Turnover
  - Demobilization

Subsurface Investigation

- Questions?