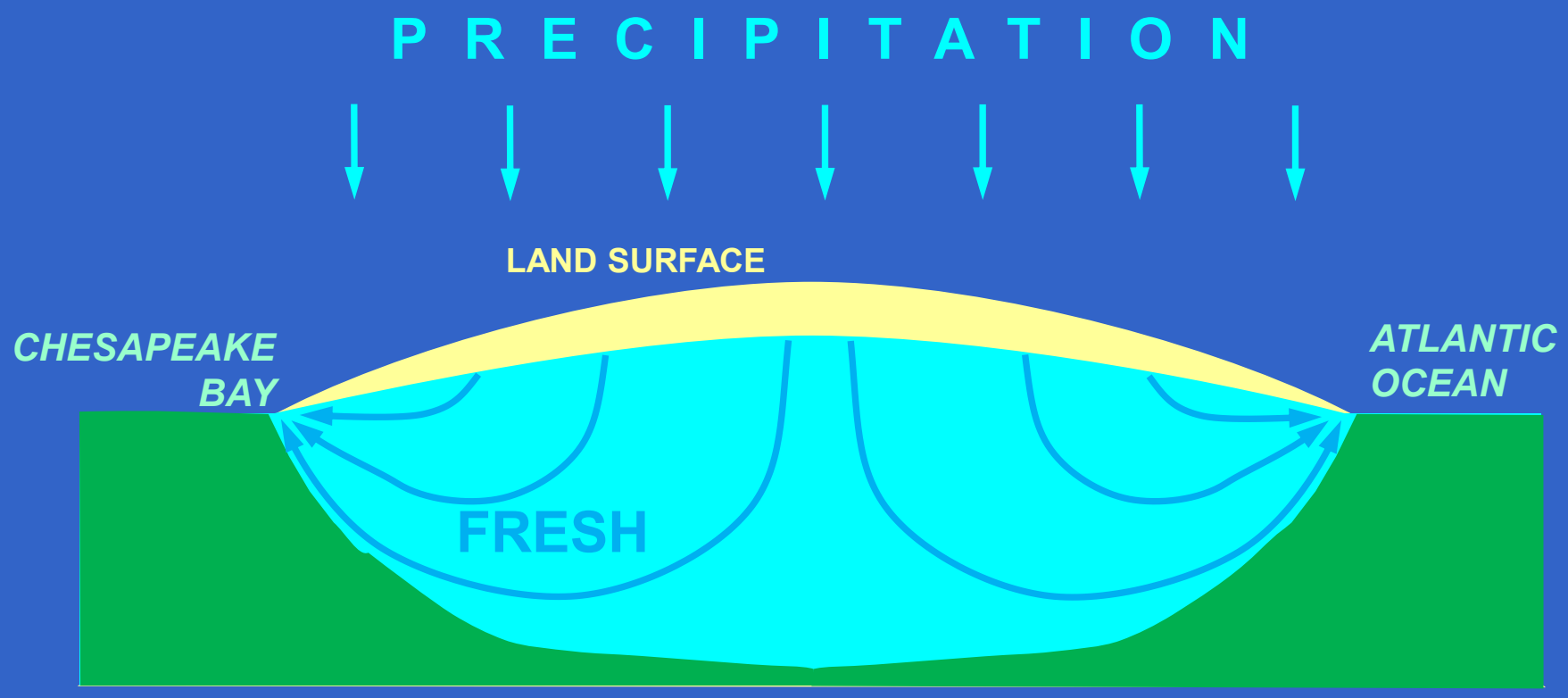
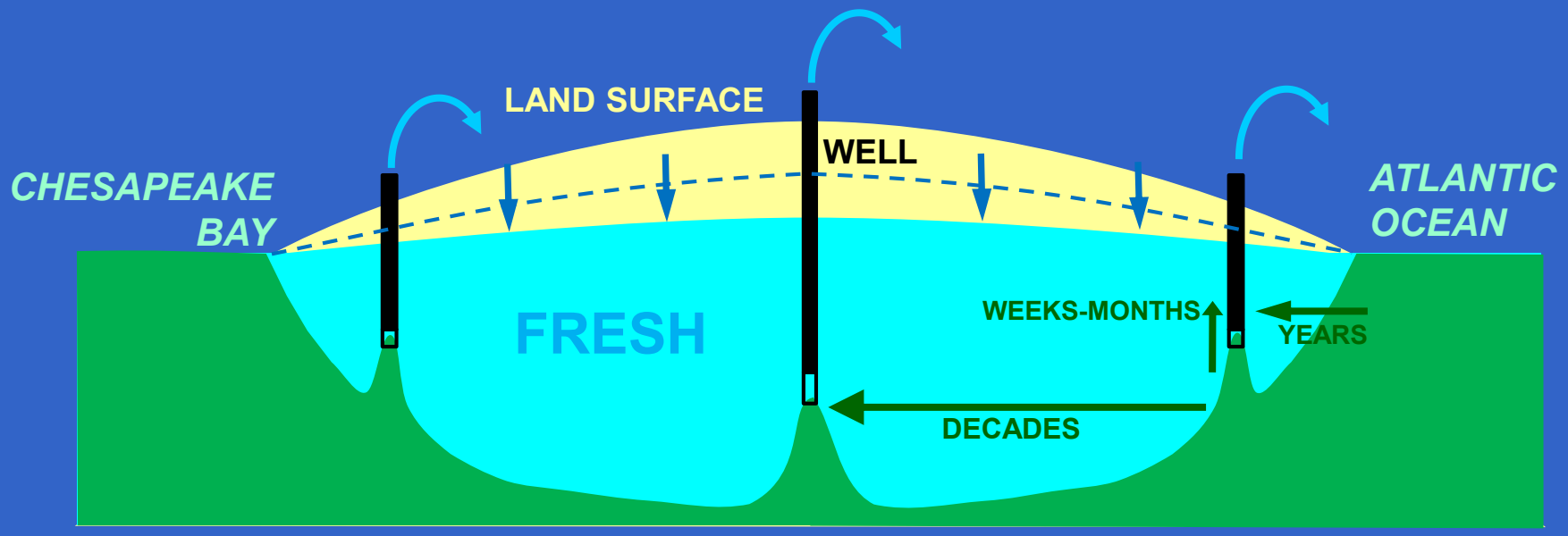
Virginia Eastern Shore

Groundwater Flow



*** VERTICAL SCALE GREATLY EXAGGERATED ***

Pumping-Induced Effects

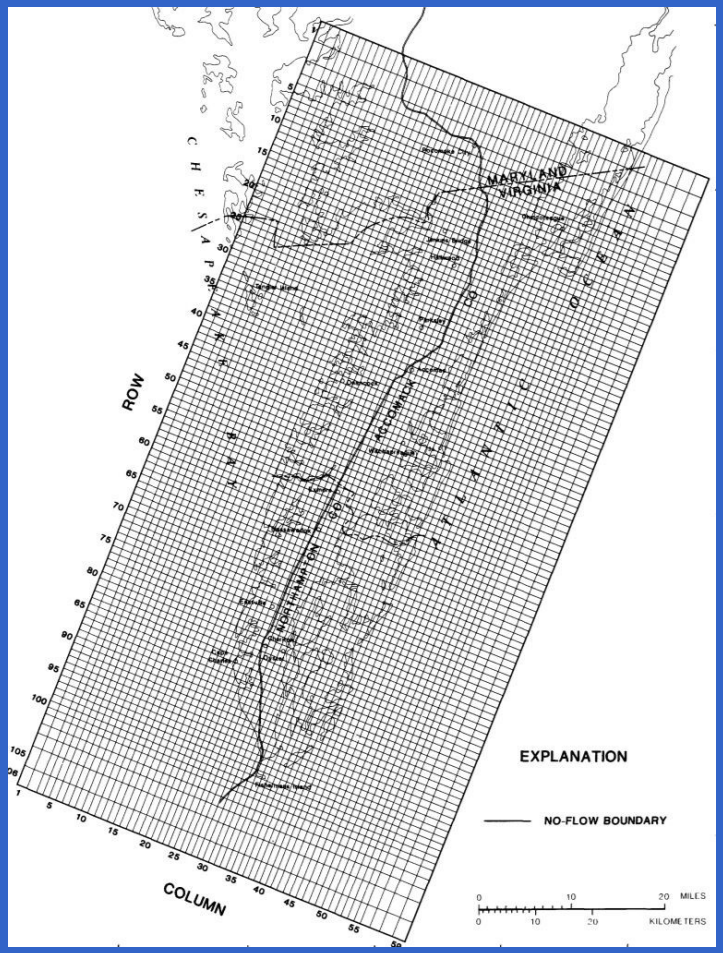


*** VERTICAL SCALE GREATLY EXAGGERATED ***

Previous Groundwater Studies

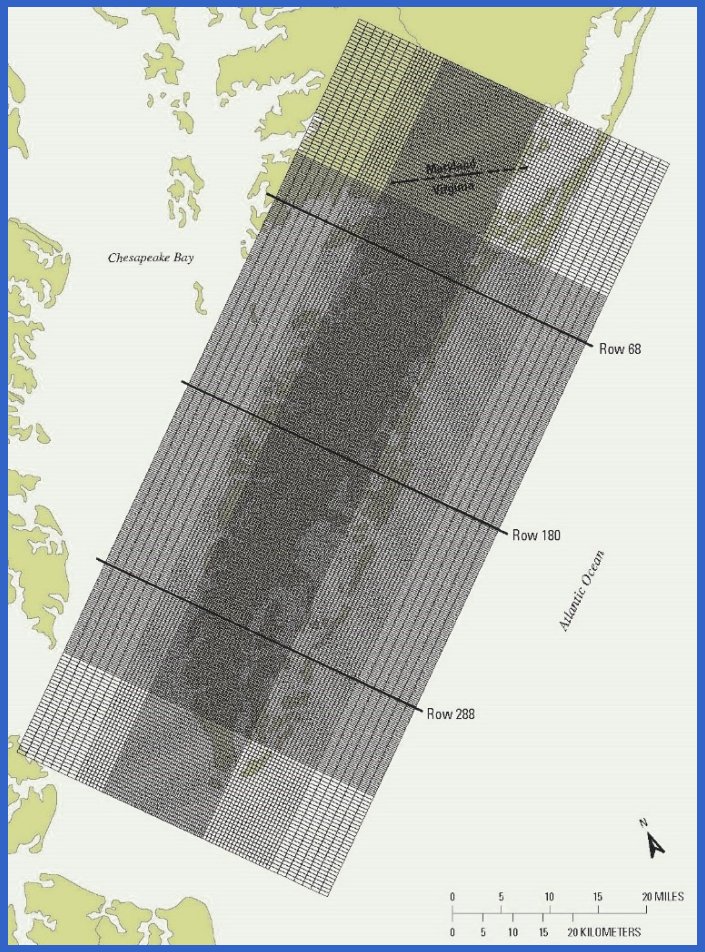
1994 USGS MODEL

- first numerical simulation
- 1982 SWCB framework



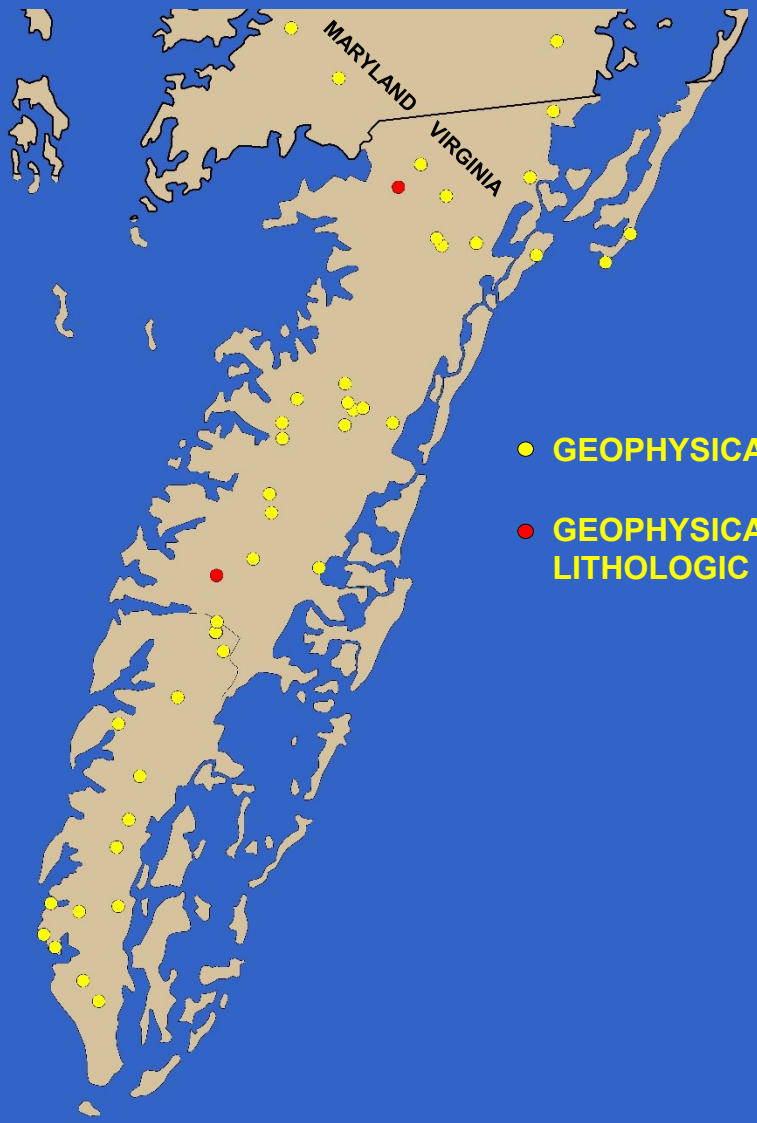
2009 USGS MODEL

- increased resolution
- 1982-94 framework

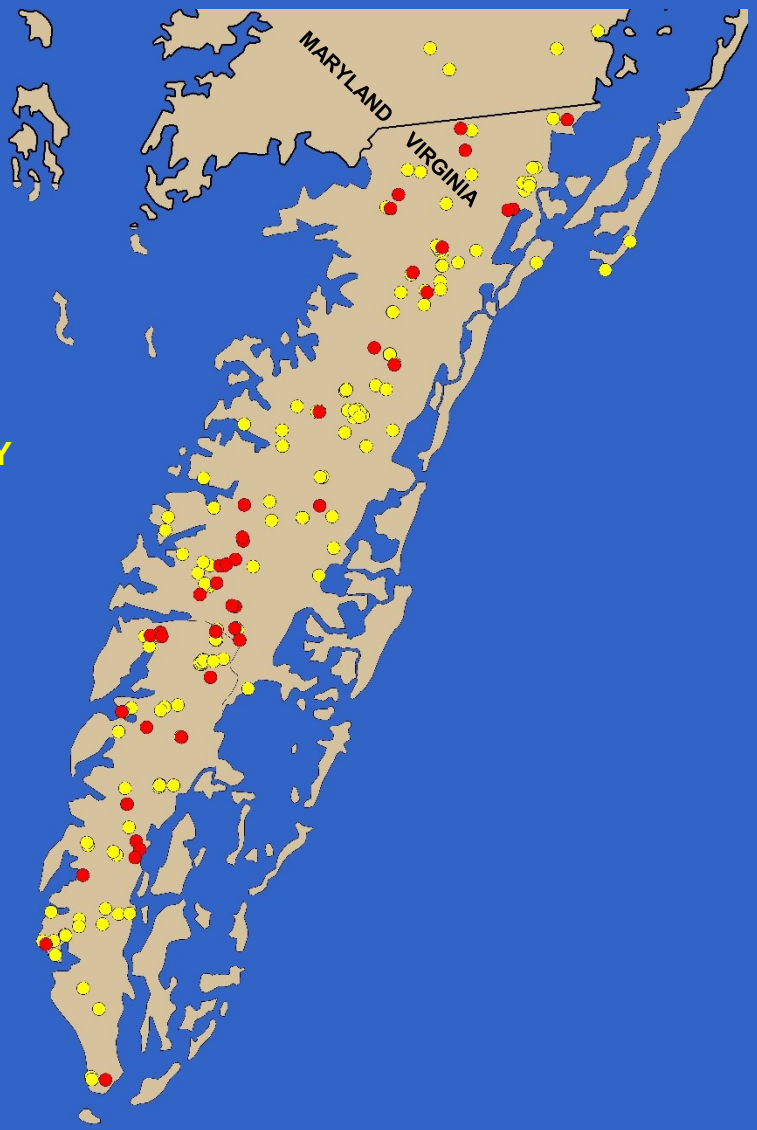


Framework Borehole Data

1994
47 BOREHOLES



2019
202 BOREHOLES



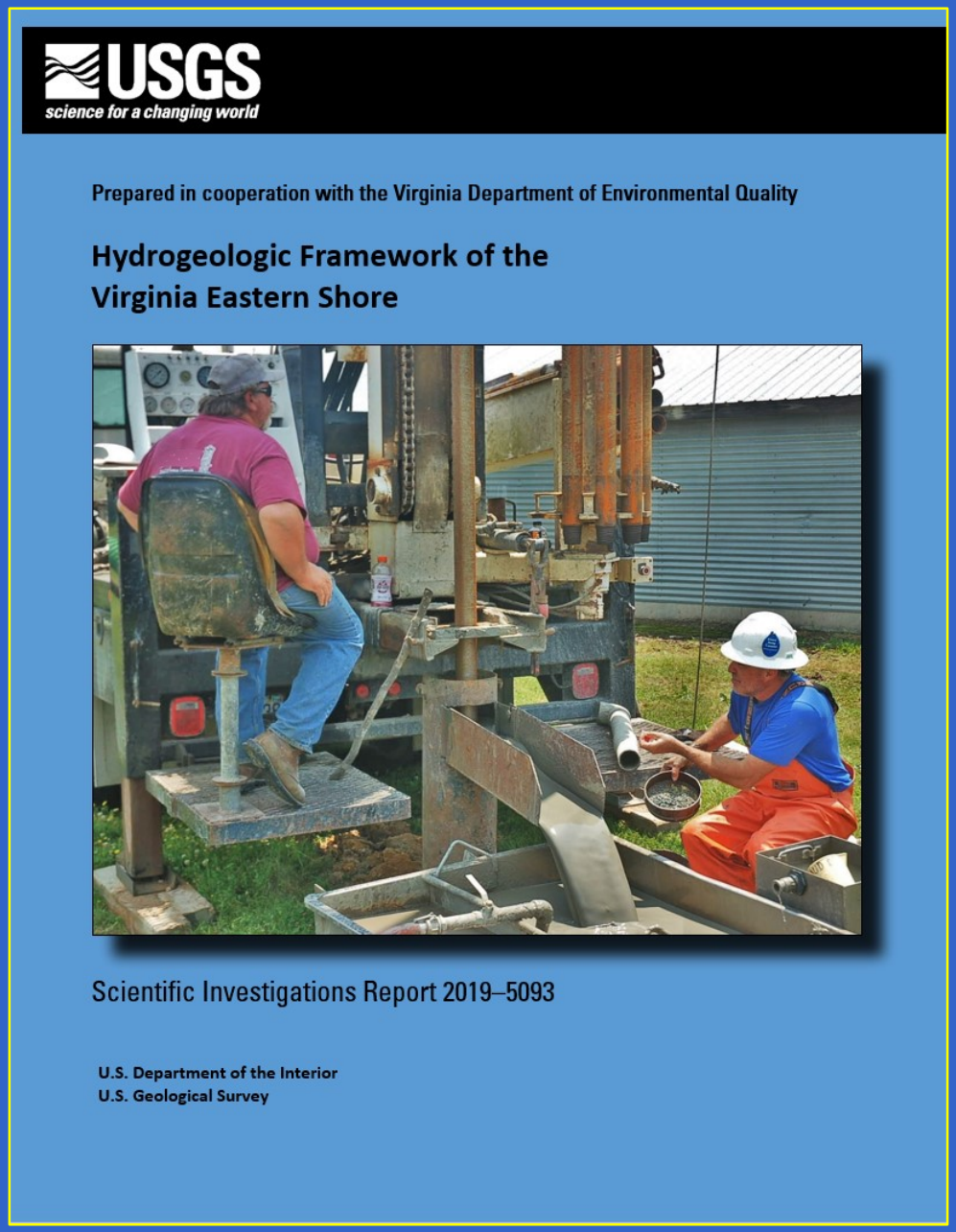
- GEOPHYSICAL LOG ONLY
- GEOPHYSICAL LOG AND LITHOLOGIC LOG

USGS-DEQ Eastern Shore Study

- ***2017 "scoping effort"***
  1. ***compile/summarize existing data***
  2. ***evaluate technical issues***
  3. ***identify future needs***
- ***2018 revision of hydrogeologic framework***
  1. ***update aquifer-system configuration***
  2. ***characterize paleochannels***
  3. ***update configuration of saltwater boundary***
- ***2019 - 2020 publication***

USGS SIR 2019-5093

- **composed & reviewed 2019**
- **approved August 2019**
- **pending final layout, printing, and distribution**



USGS
science for a changing world

Prepared in cooperation with the Virginia Department of Environmental Quality

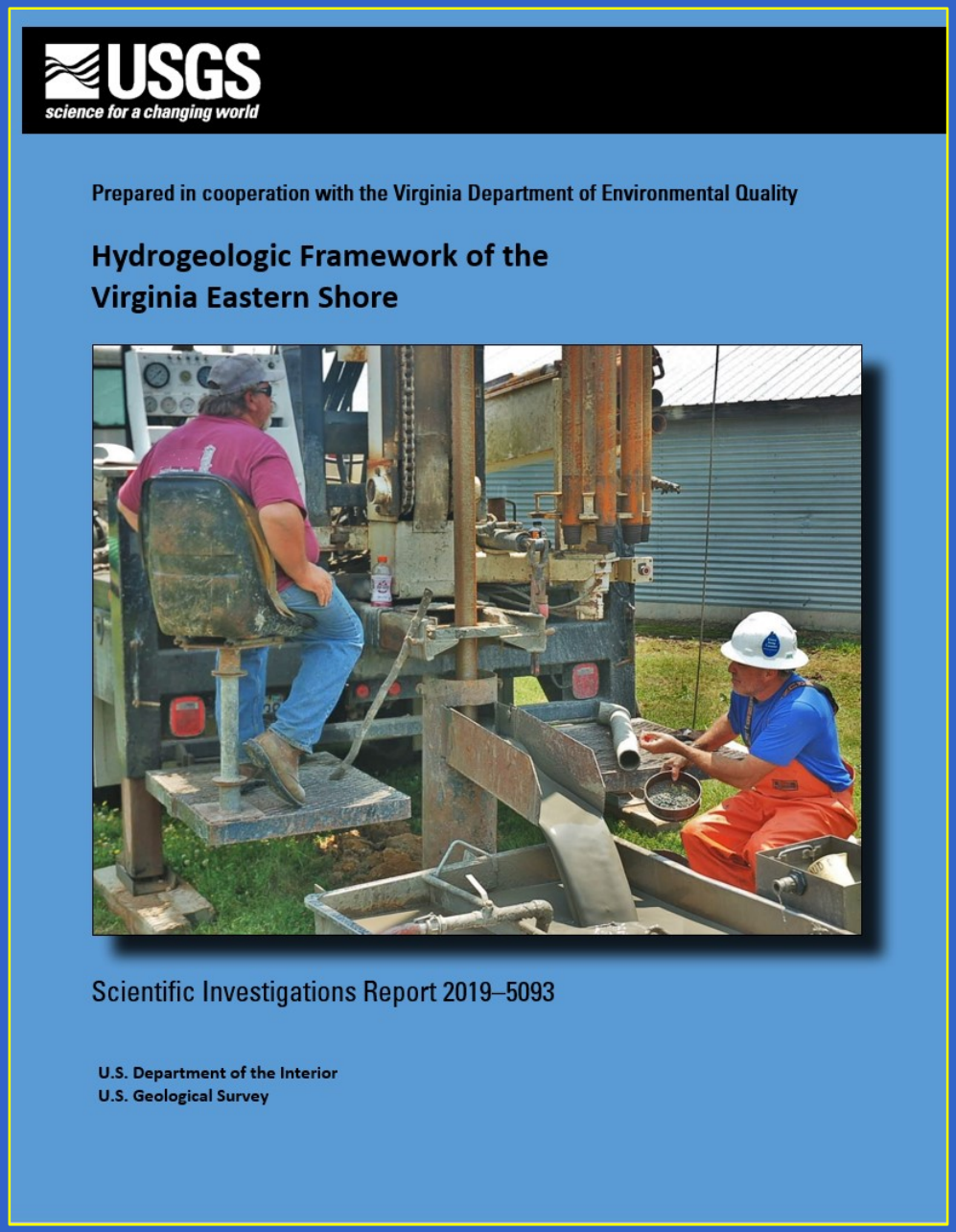
Hydrogeologic Framework of the Virginia Eastern Shore

Scientific Investigations Report 2019–5093

U.S. Department of the Interior
U.S. Geological Survey

USGS SIR 2019-5093

- body (text, figures, tables)
- 3 data appendixes
  - hydrogeologic-unit top surface altitudes at boreholes
  - aquifer hydraulic properties
  - groundwater-sample chloride concentrations
- 13 plates
  - borehole-location map
  - hydrogeologic section
  - hydrogeologic-unit top structural contour maps
  - 250 mg/L chloride surface contour map



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  - Saltwater-Transition Zone
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    - Digital Model Improvement
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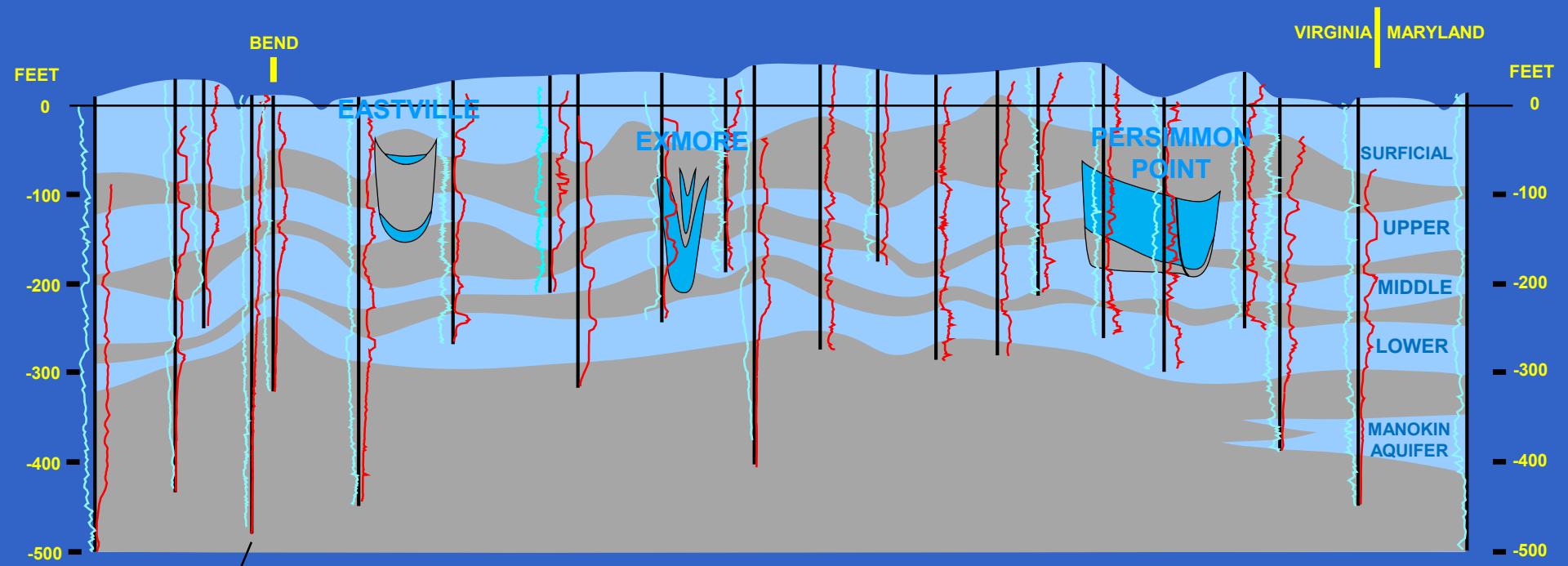
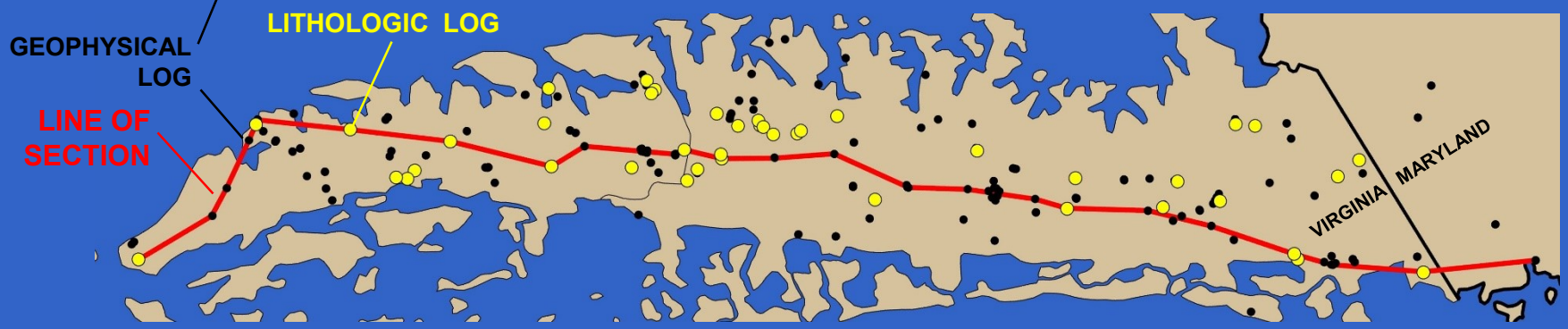
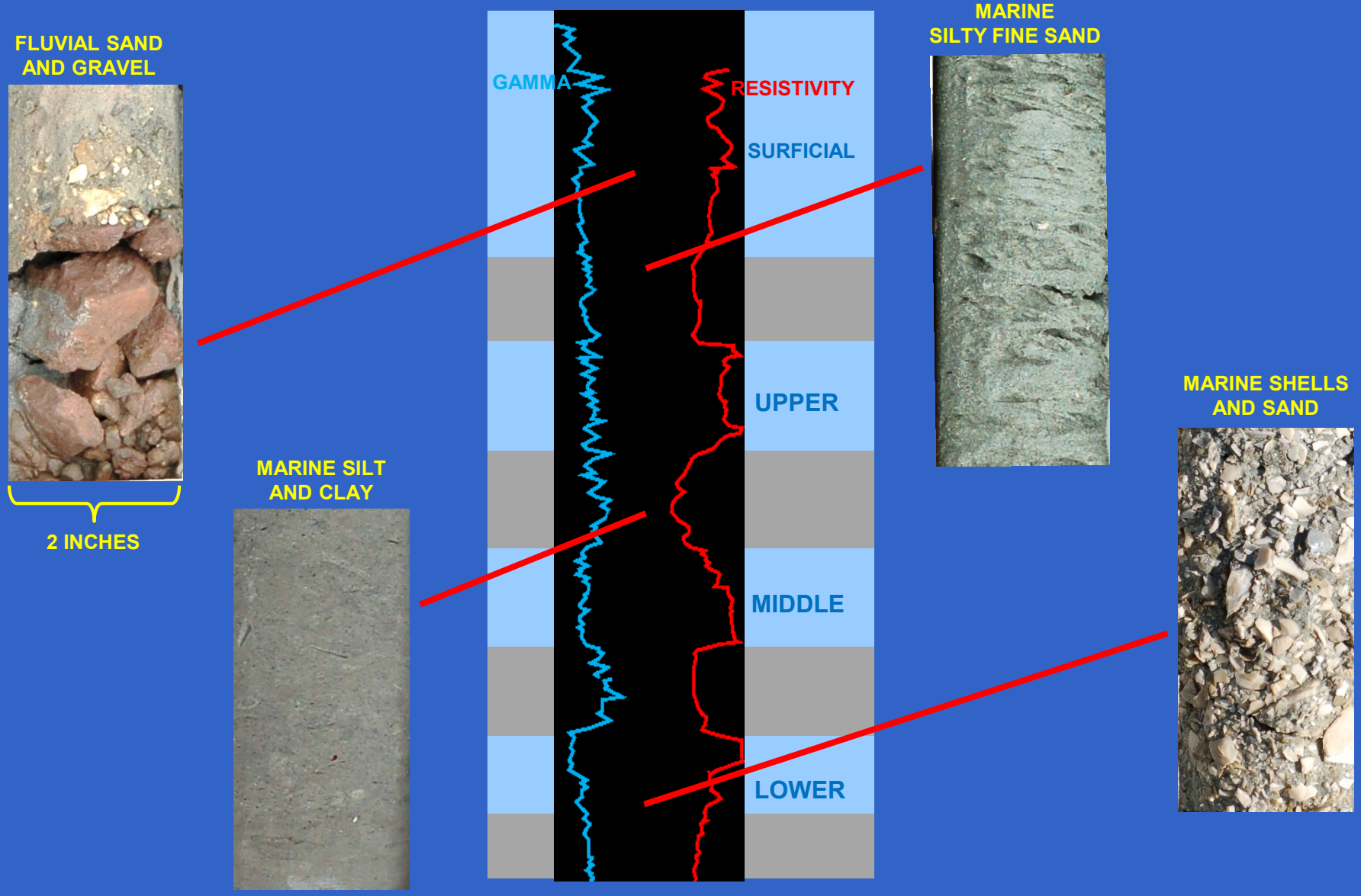
Hydrogeologic Section



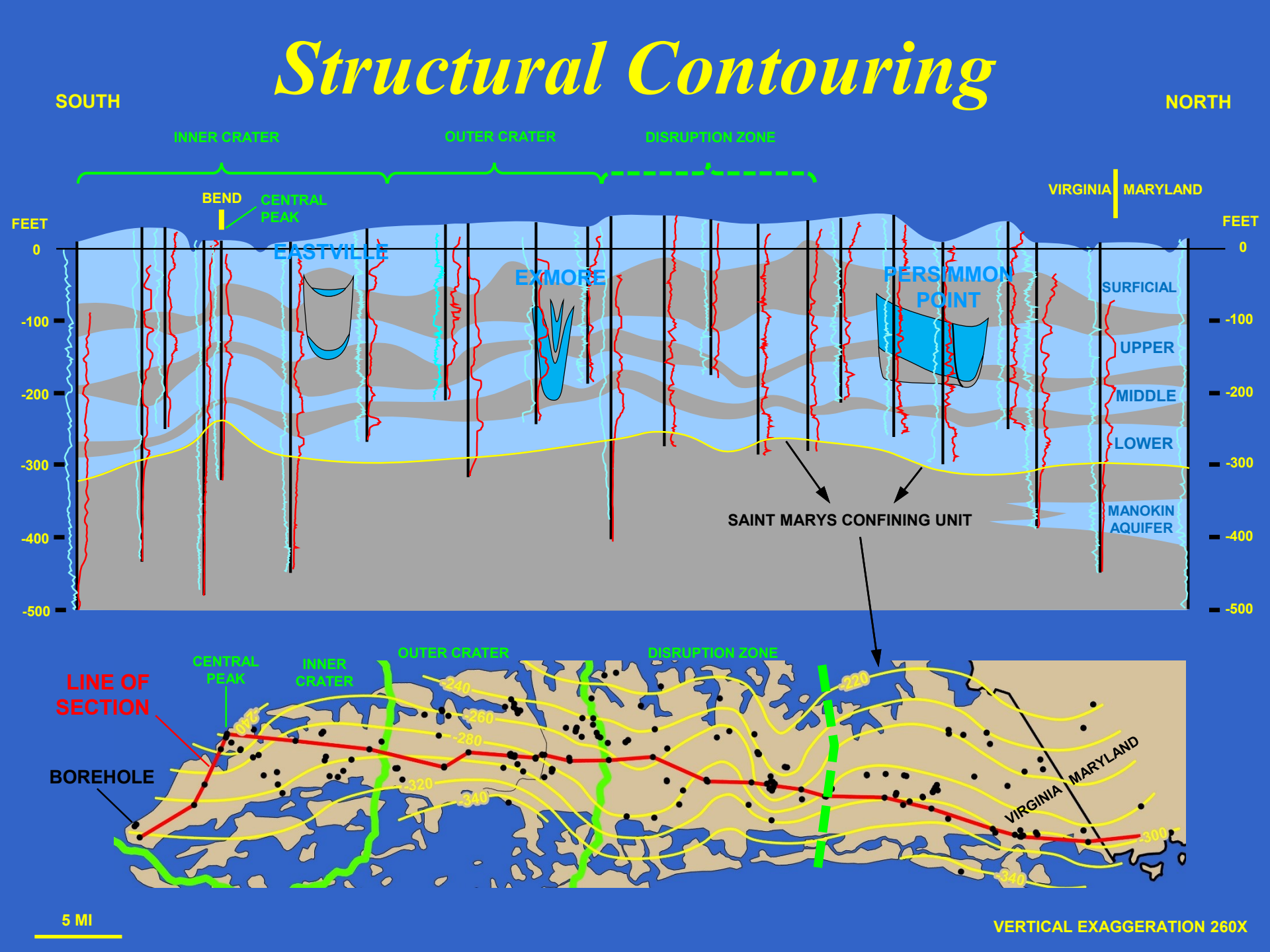


VERTICAL EXAGGERATION 260X

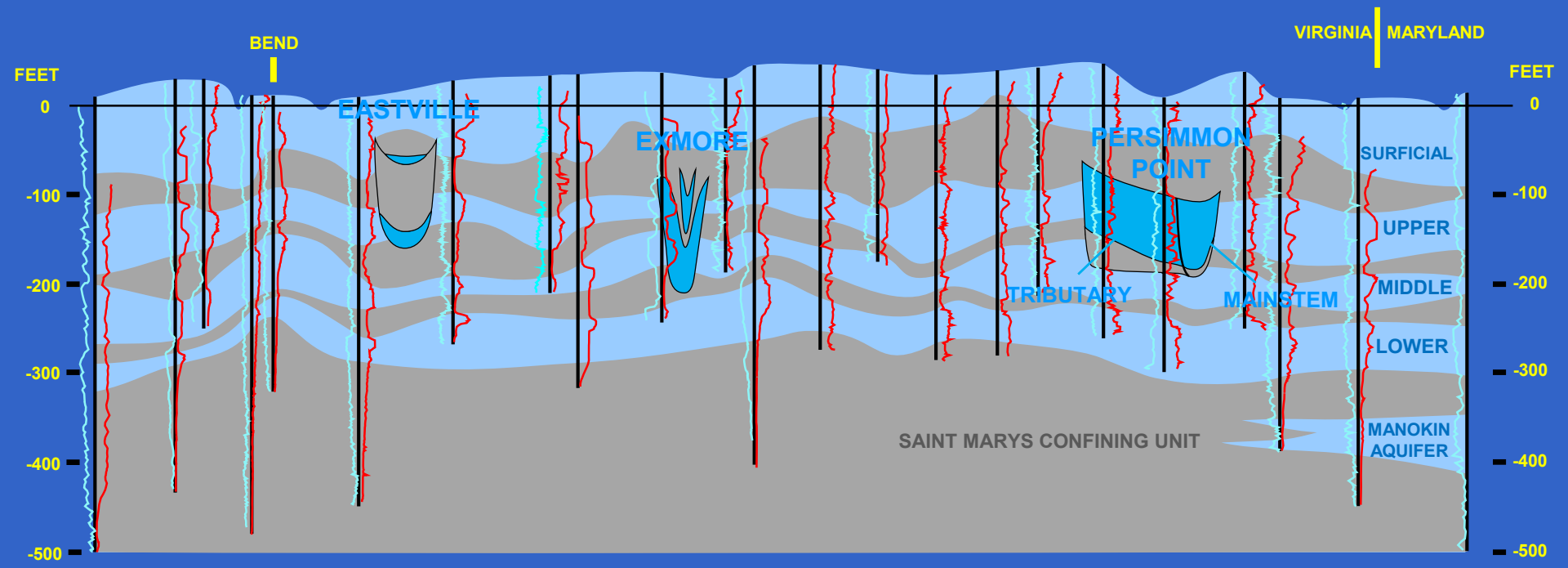
Borehole Geophysical Log and Lithology

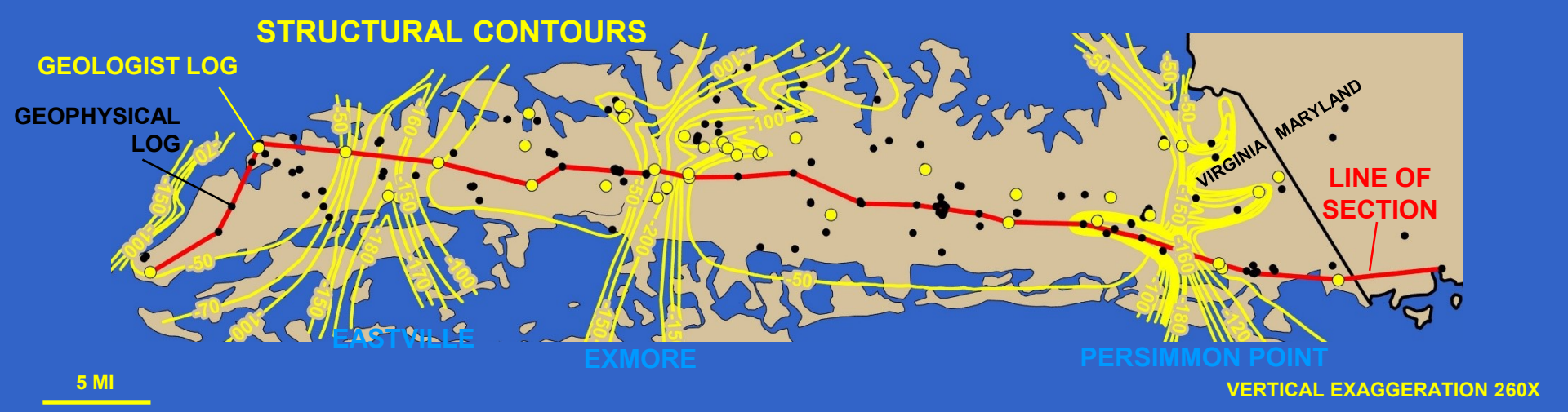


Structural Contouring



Paleochannels

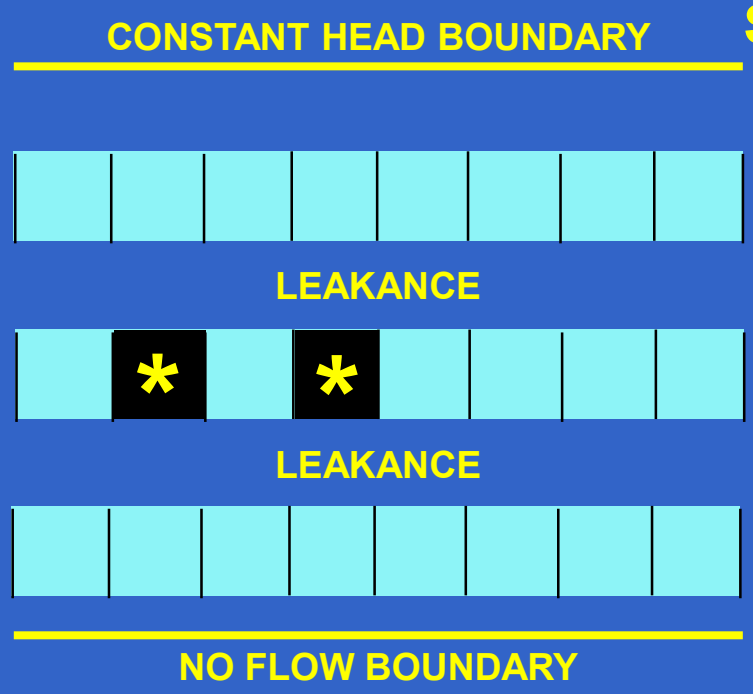




Paleochannel Modeling

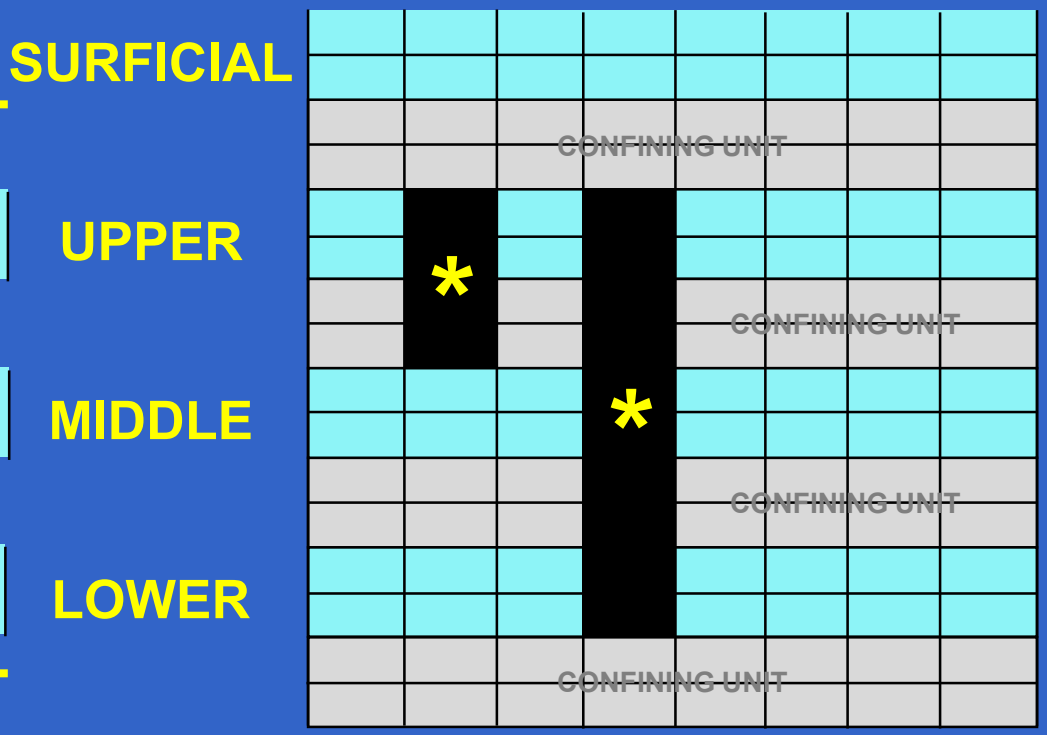
NORTH →

1994 MODEL



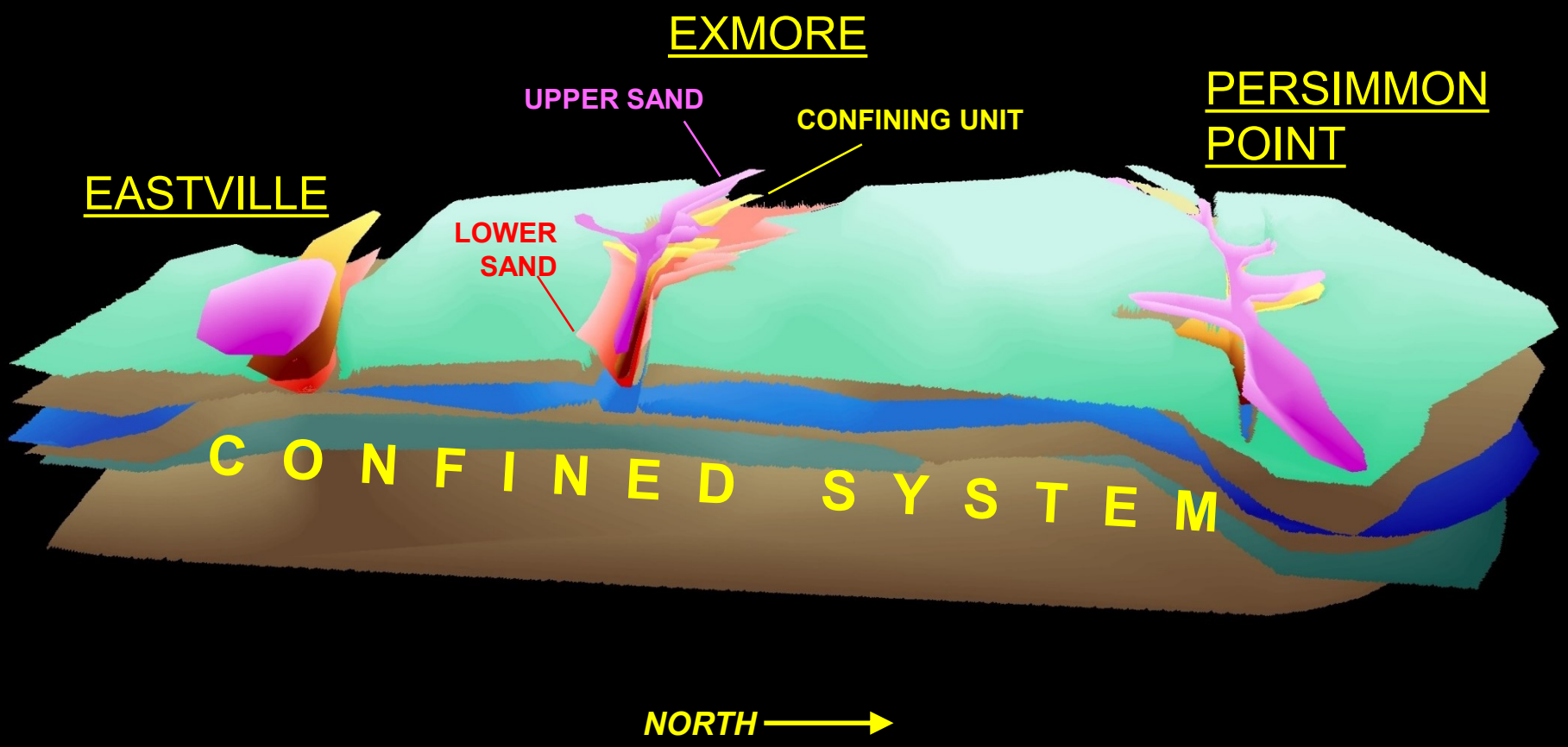
* PALEOCHANNEL K
= 1/10 CONFINED-AQUIFER K

2009 MODEL

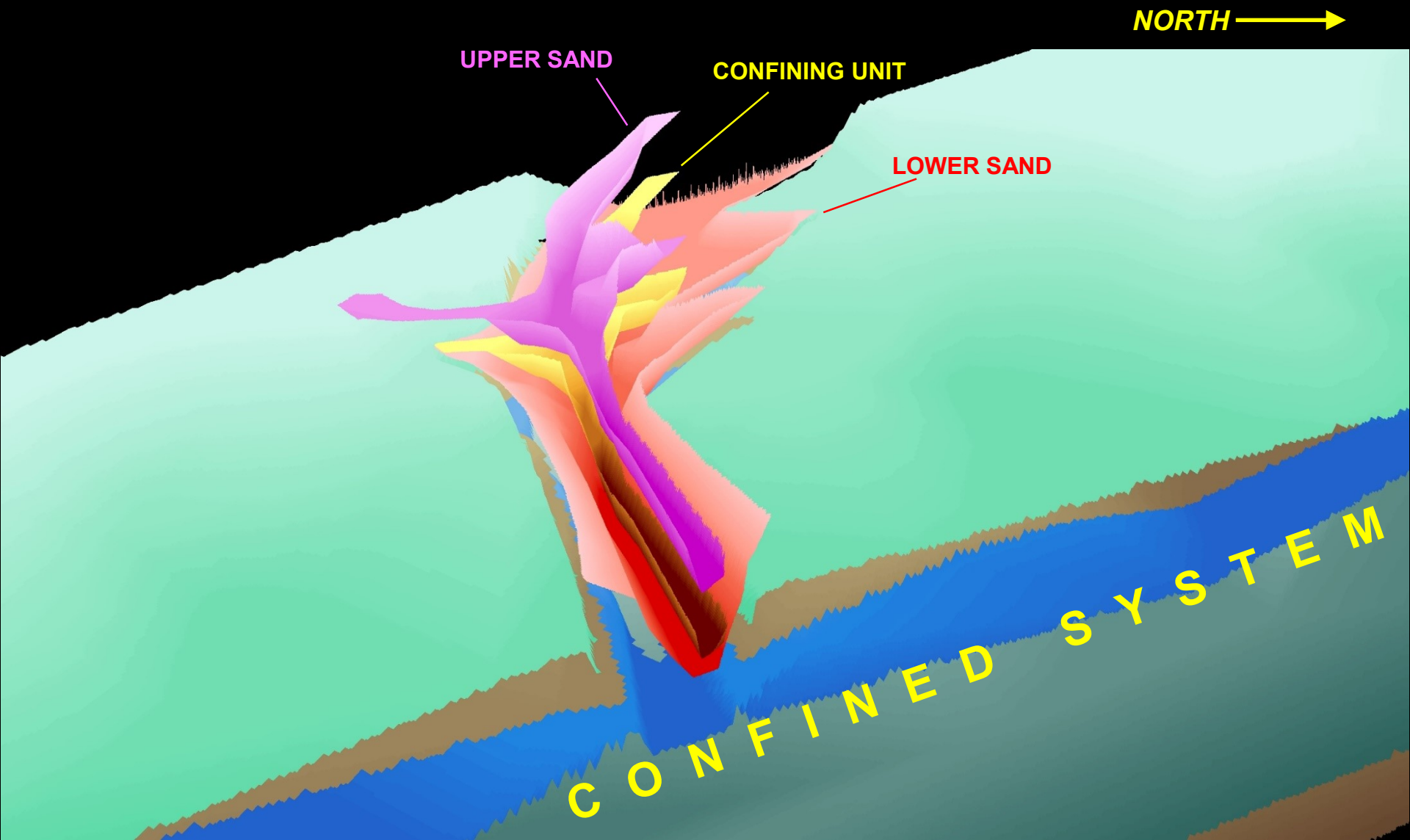


* PALEOCHANNEL K
5 FT/D EASTVILLE
100 FT/D EXMORE

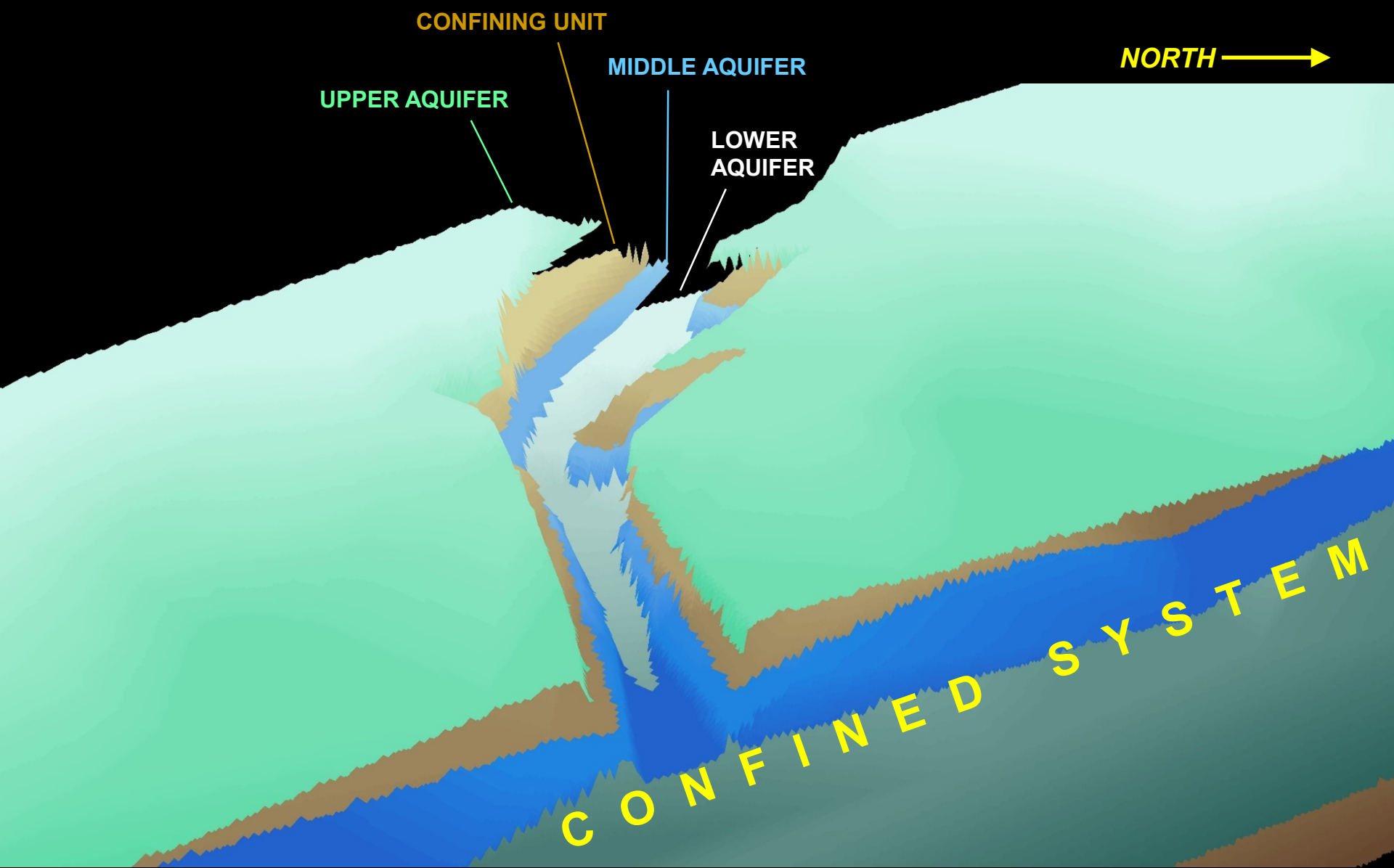
Paleochannel Configurations



Exmore Paleochannel



Confined System Incision



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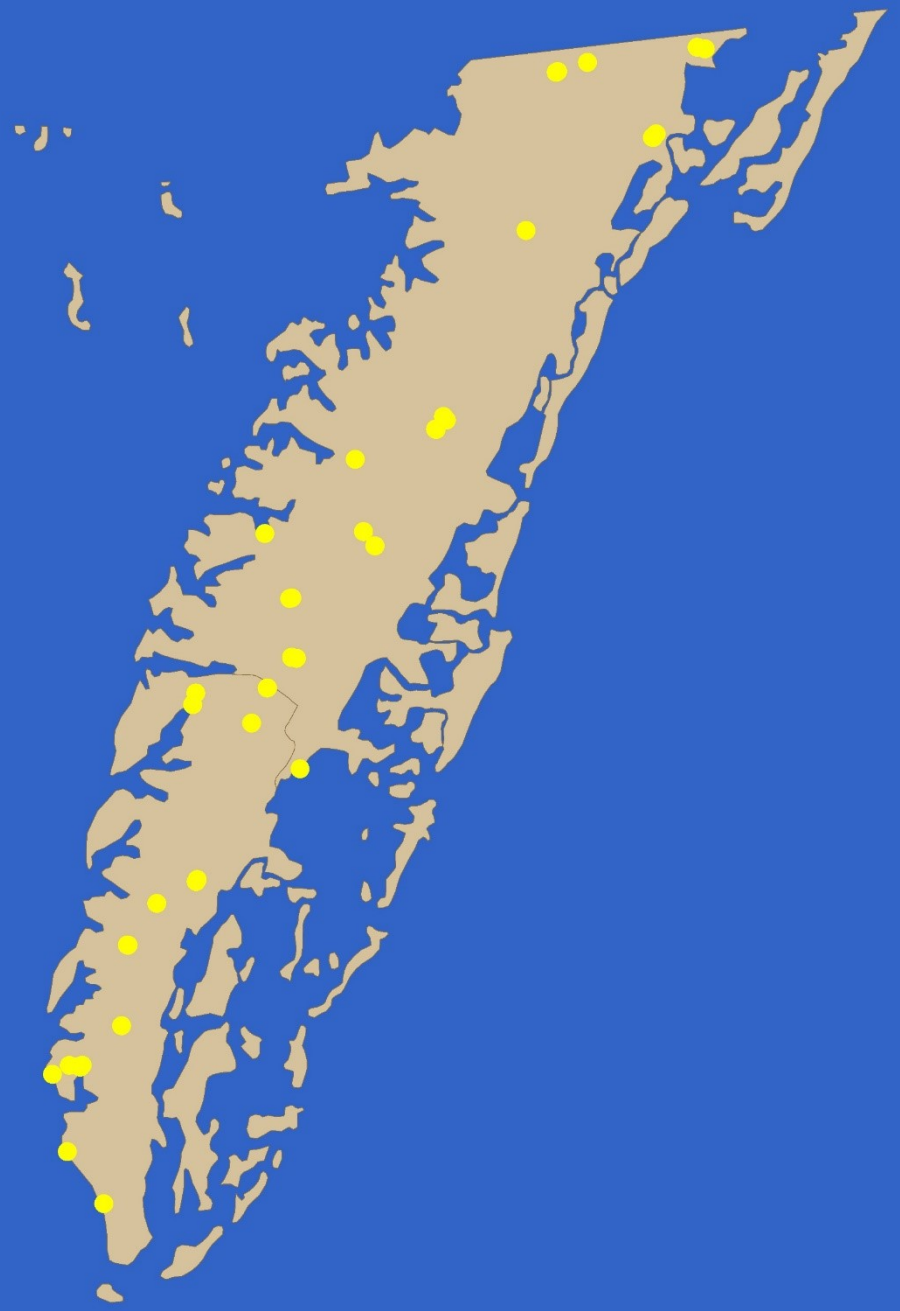
Aquifer Tests

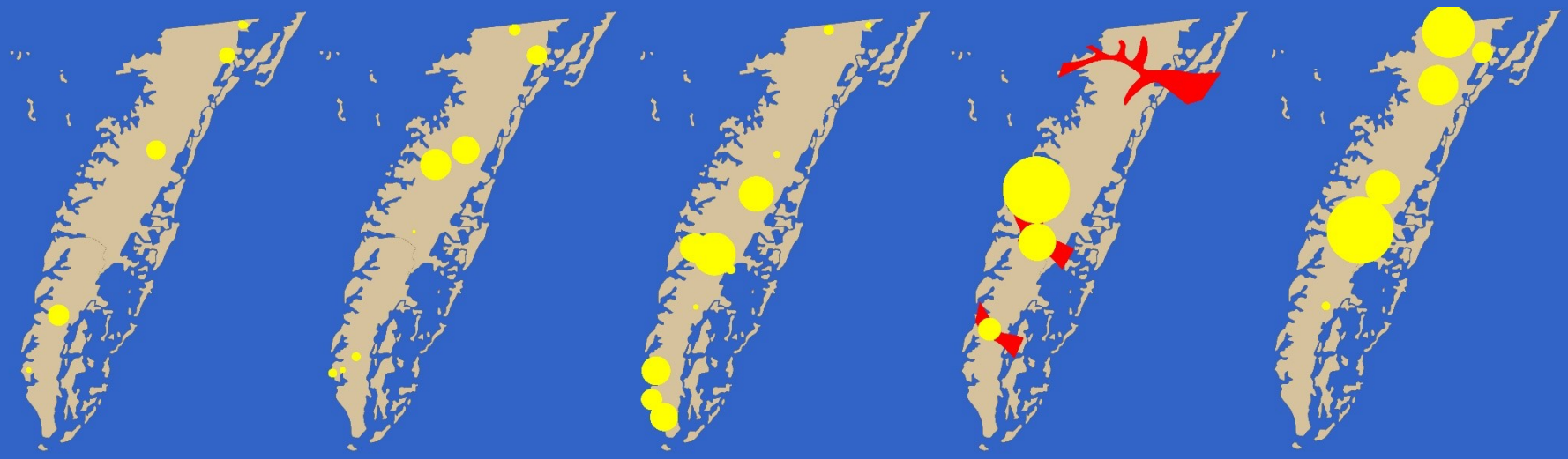
- **VA DEQ permit files**
- **36 tests**
- **58 wells**
- **133 analyses**



Transmissivity

MEAN FT^2/D

LOWER	MIDDLE	UPPER	PALEO-CHANNELS	SURFICIAL



RANGES

LOWER	MIDDLE	UPPER	PALEO-CHANNELS	SURFICIAL	FT^2/D
133	30	143	1820	214	MIN
2080	4360	8270	20340	20290	MAX

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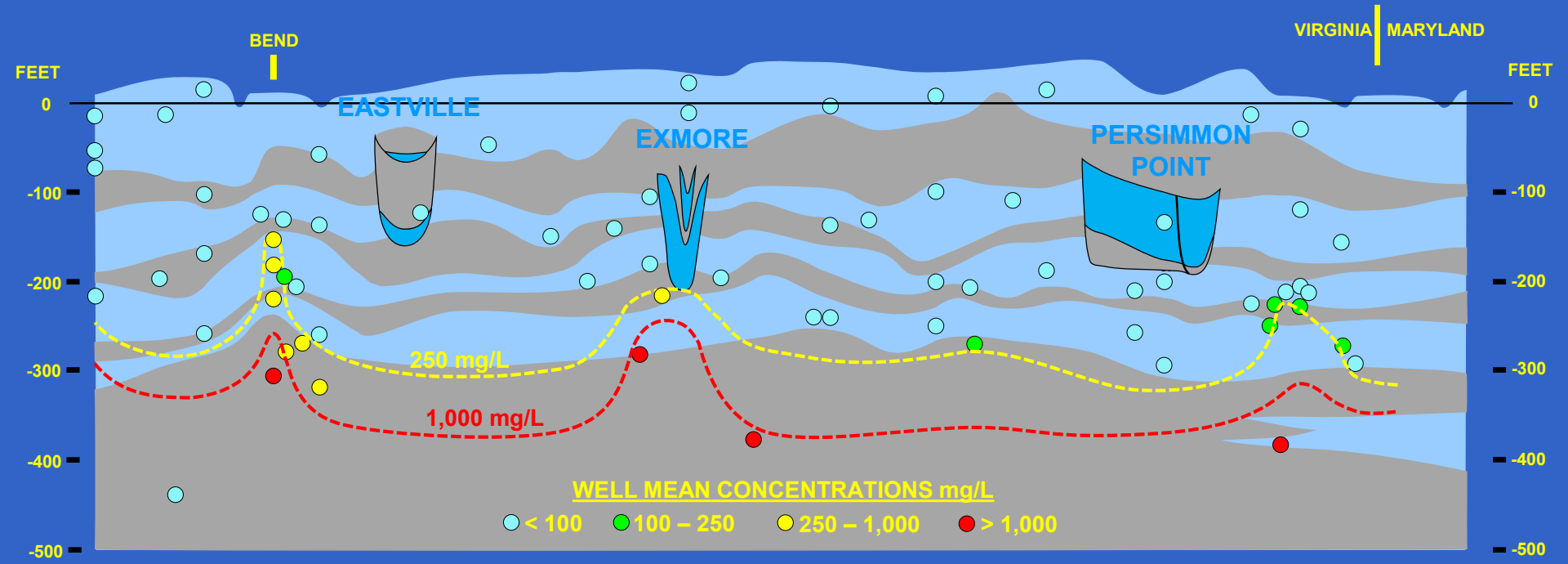
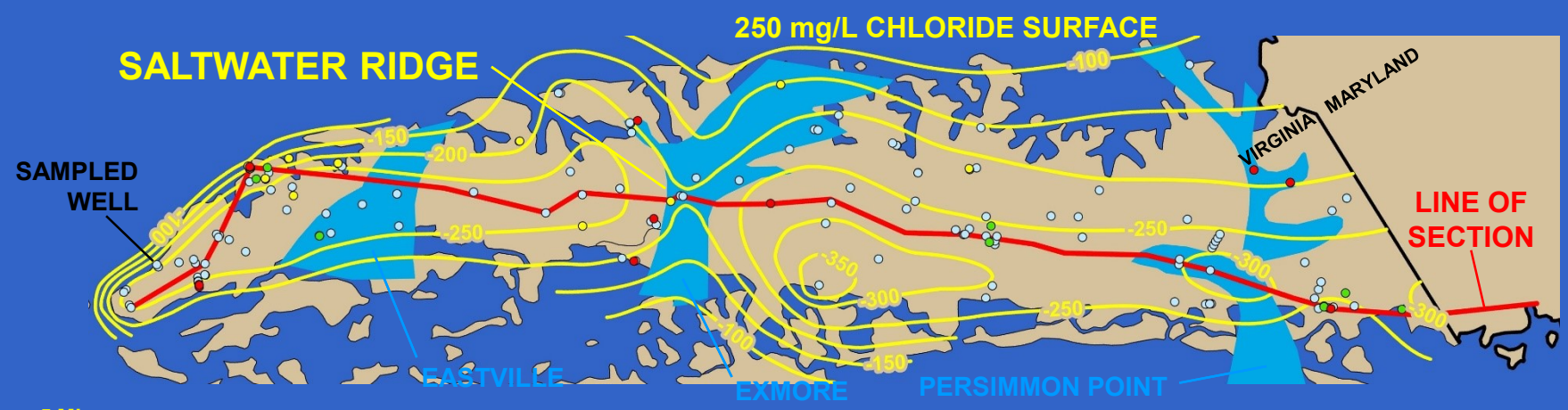
Groundwater Chloride

SOUTH

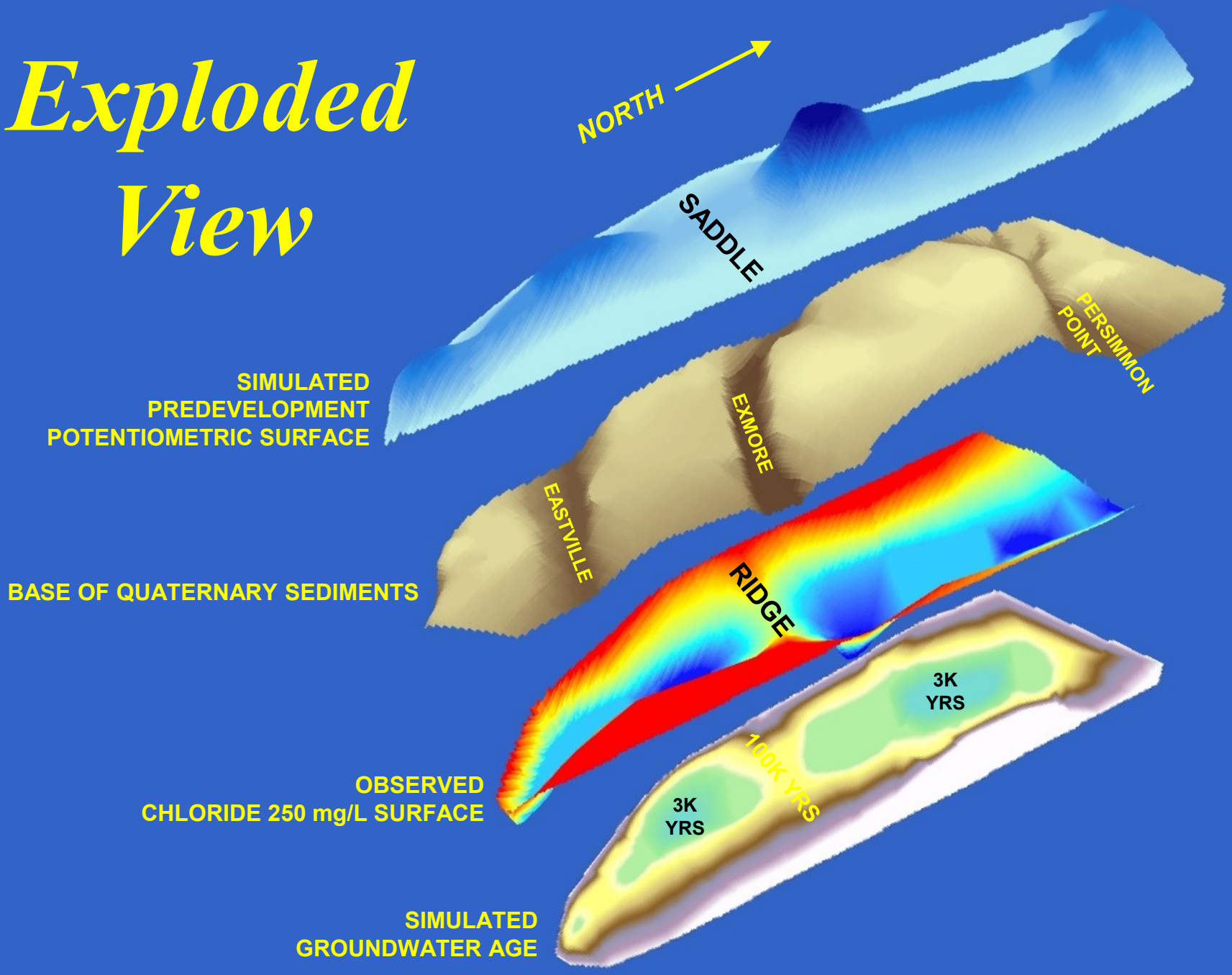
NORTH



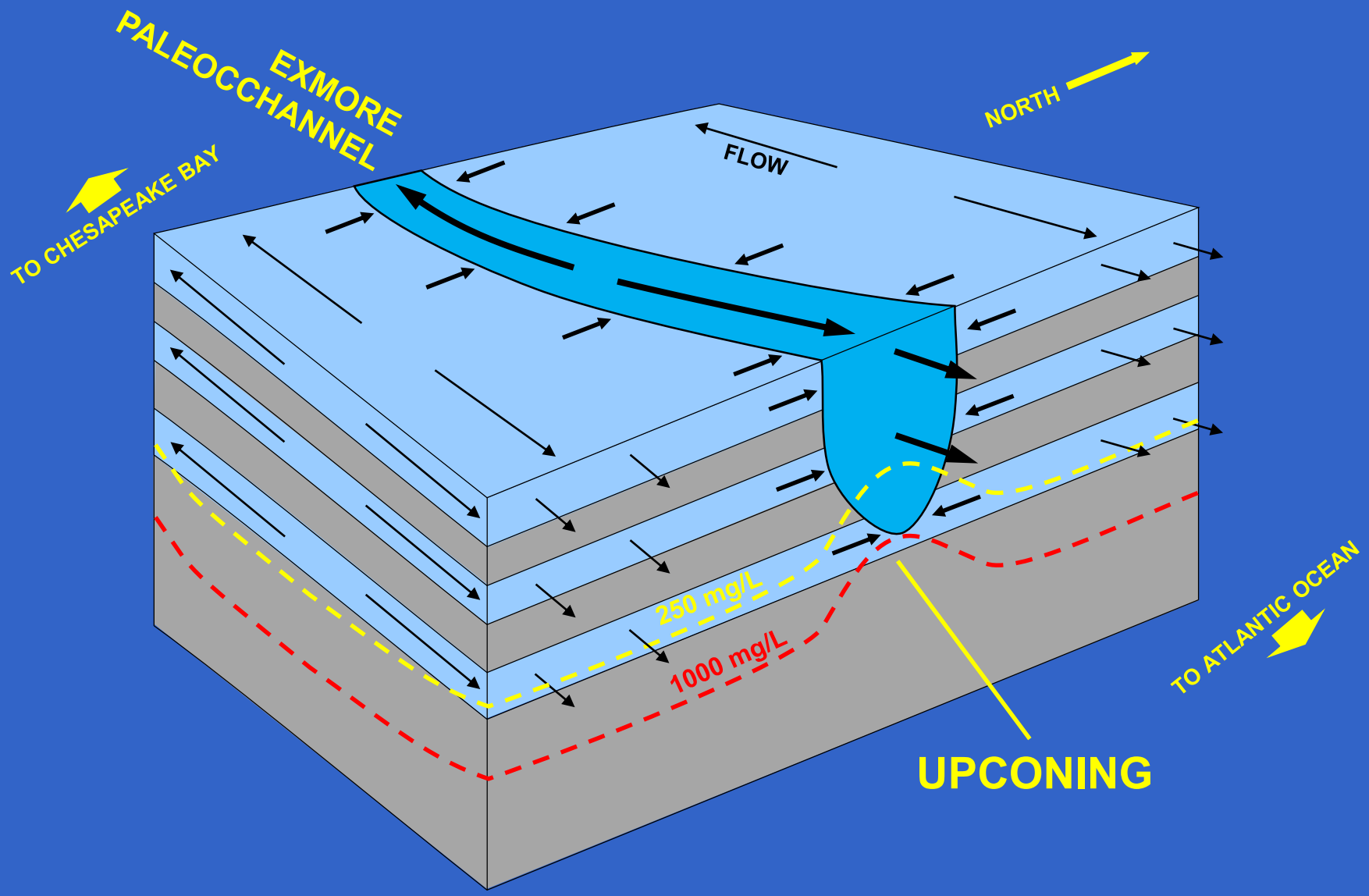


VERTICAL EXAGGERATION 260X

Exploded View



Saltwater-Ridge Formation

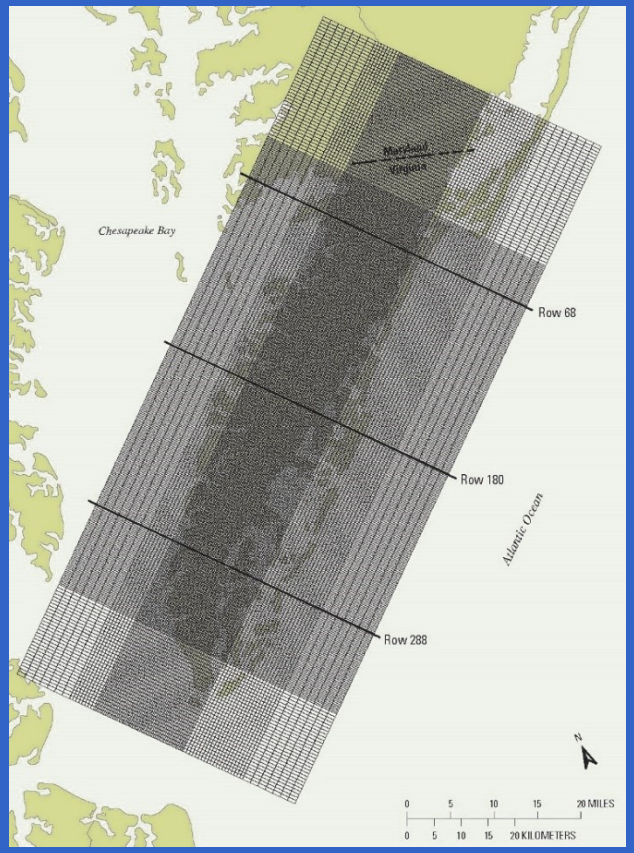


Buried Channels

Shallow Saltwater

Future Direction

2009 MODEL



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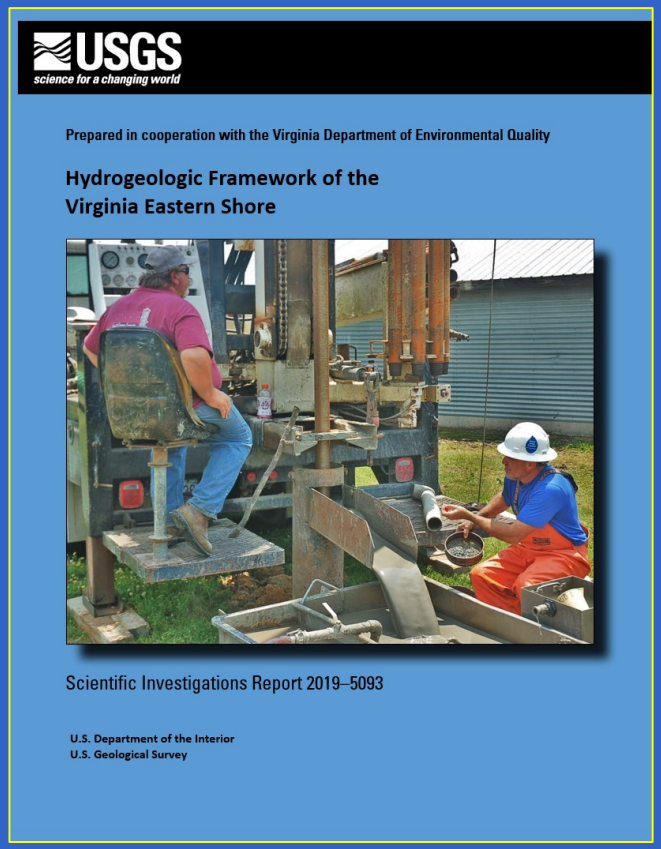
2019 FRAMEWORK



= REVISED MODEL

Questions?

VIRGINIA MAINLAND
MARYLAND
CHESAPEAKE BAY
ATLANTIC OCEAN
VA