Groundwater in Anne Arundel County, Maryland

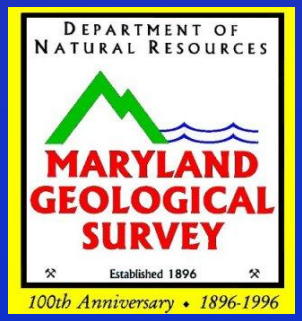
Presented to

Fort George G. Meade Restoration Advisory Board

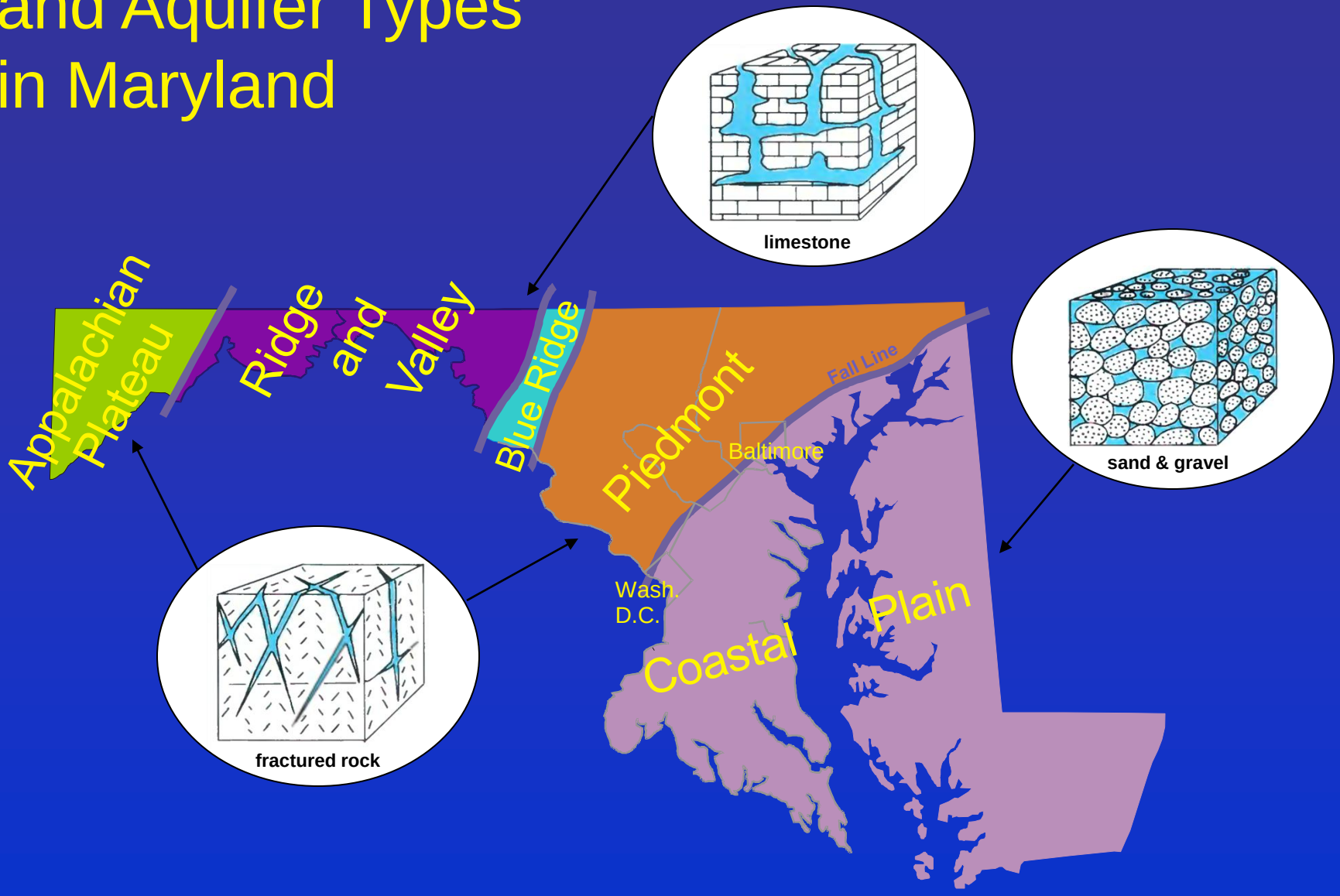
March 15, 2012

David W. Bolton

Maryland Geological Survey

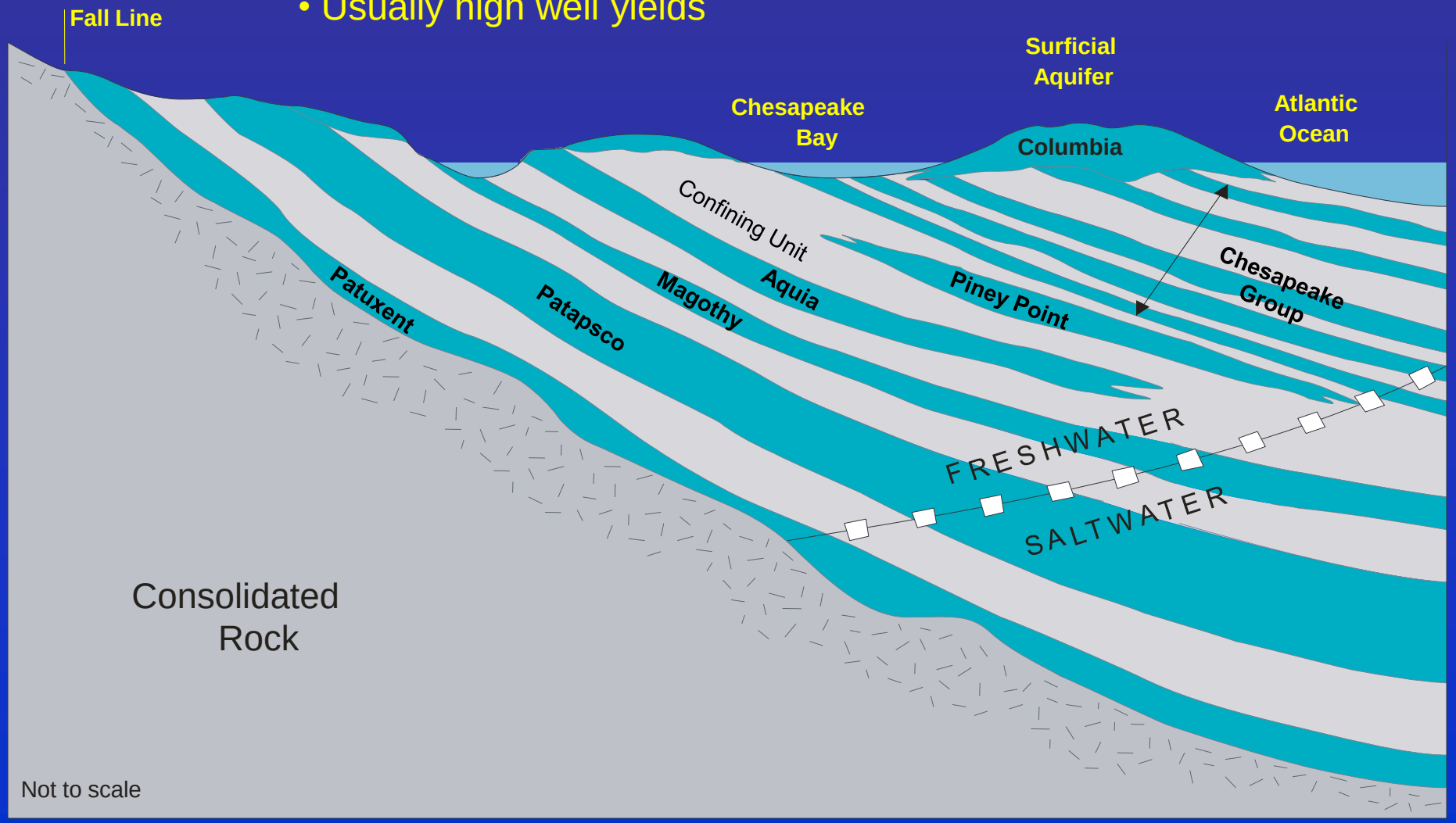


Physiographic Provinces and Aquifer Types in Maryland

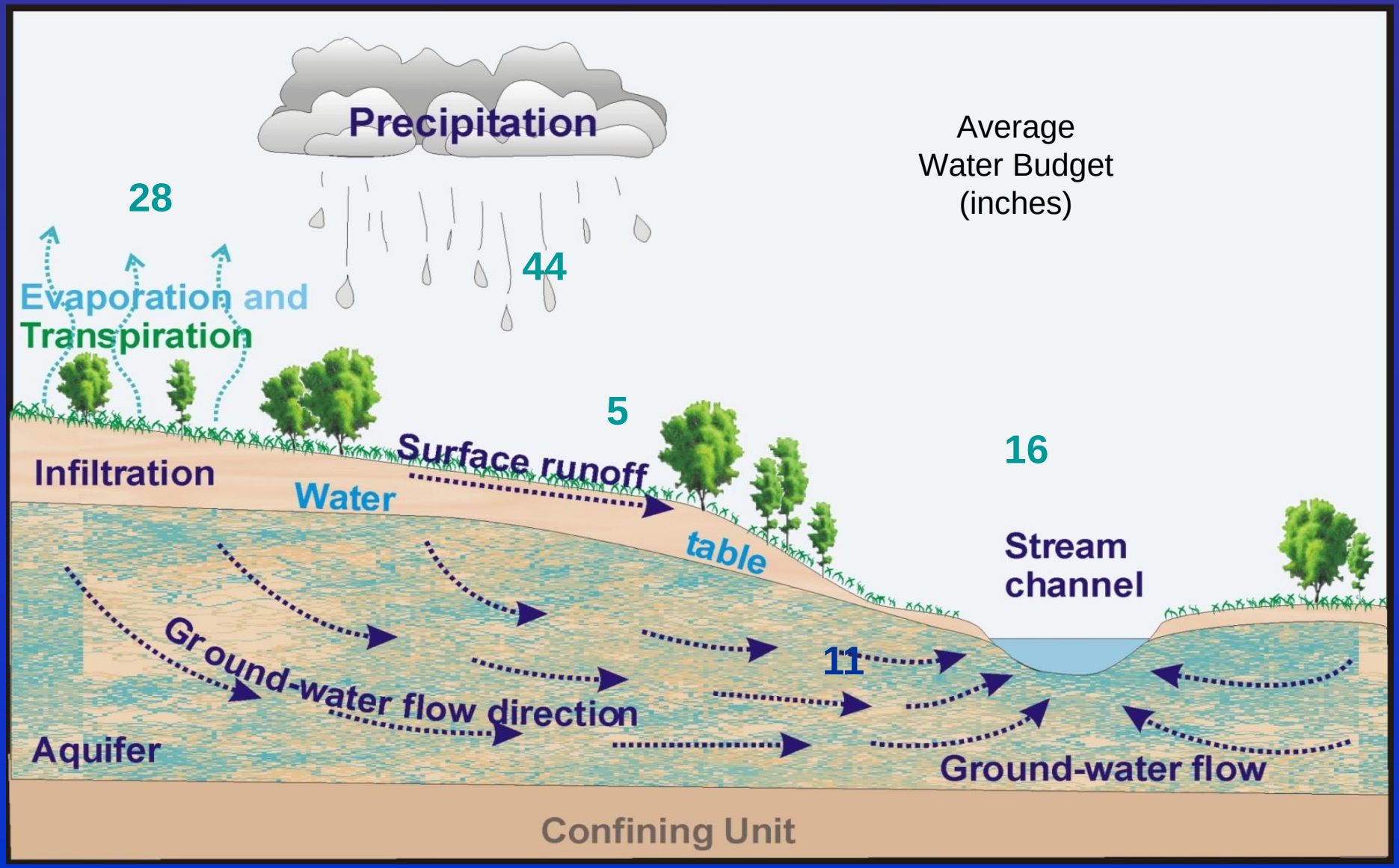


Coastal Plain Groundwater Characteristics

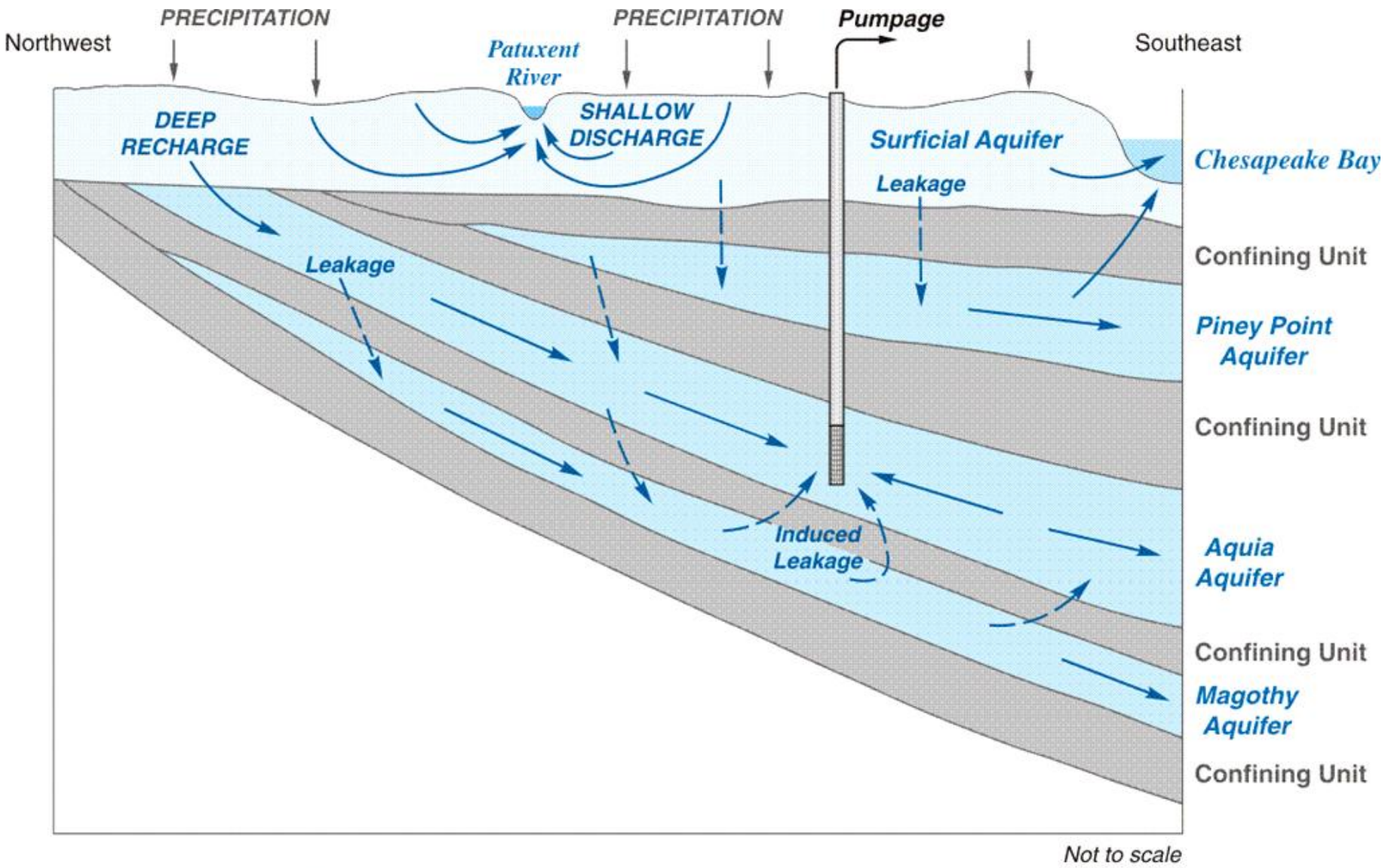
- Unconsolidated sediments
- Confined aquifers
- Usually high well yields



The Hydrologic Cycle and Water Budget

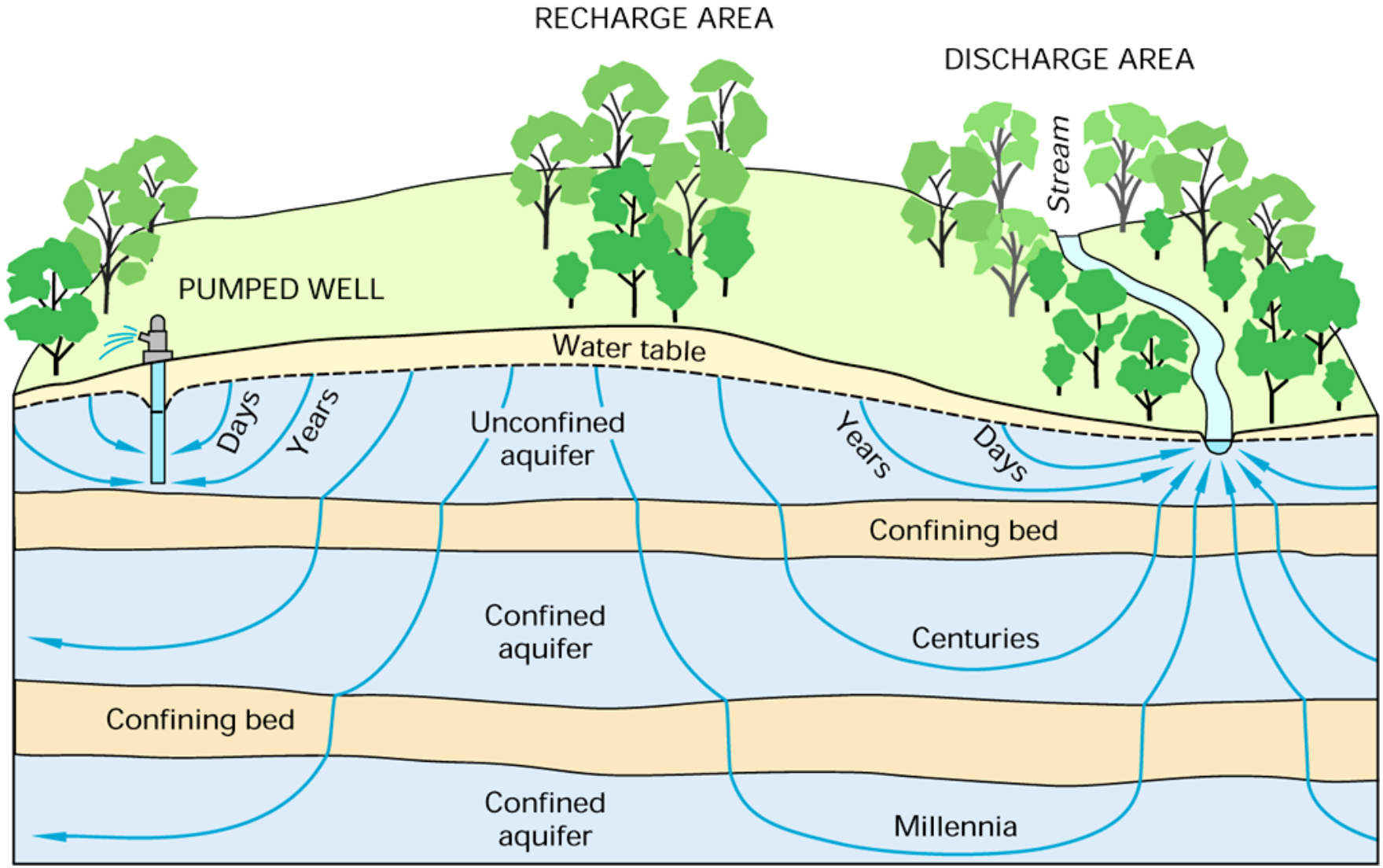


Groundwater Flow System

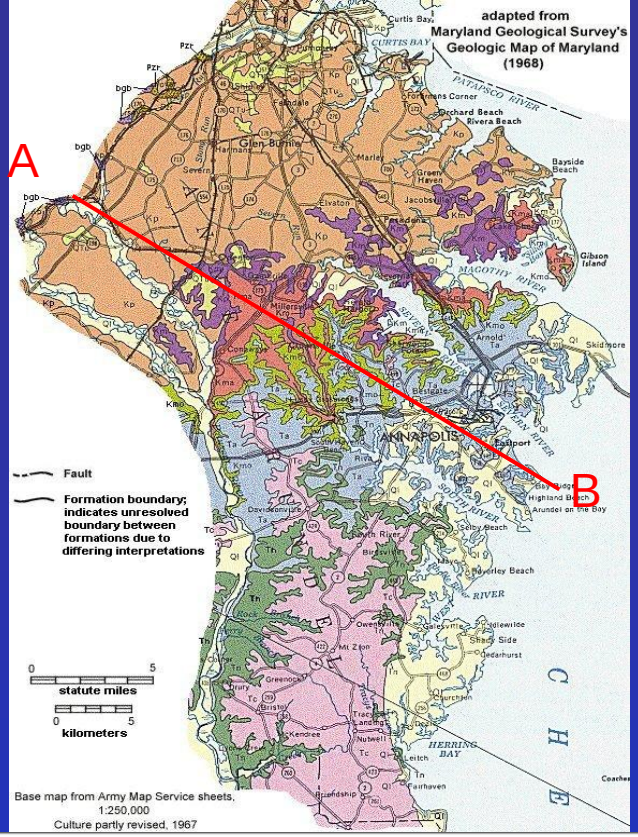


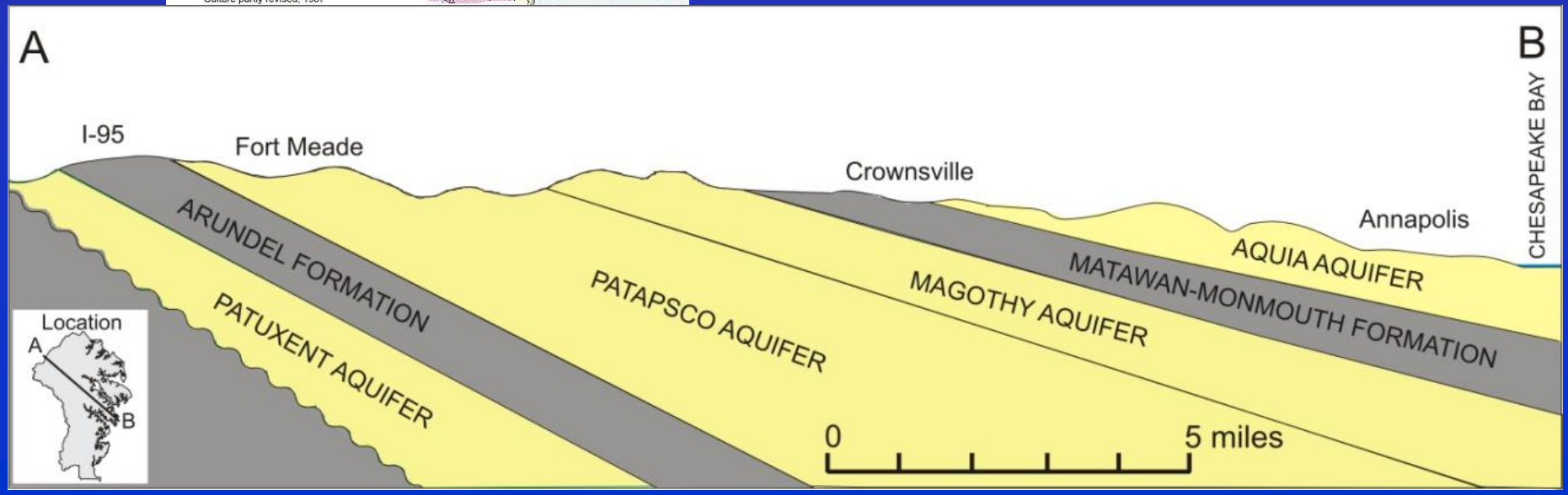
Diagrammatic cross section showing water sources and losses.

Groundwater System



Geology of Anne Arundel County





Characteristics of Major Aquifers in Anne Arundel County

Aquifer	Description	Depositional Environment	Water Quality	Reported withdrawals in 2010
Aquia	Quartz sand, shells, glauconite	Marine	Iron, Manganese (some local issues)	0.2 mgd
Magothy	White/gray/clear quartz, interbedded with black and gray clay, lignite	Fluvial/ marine	Low pH Iron Manganese Radium	1.6 mgd
Upper and Lower Patapsco	White/gray/brown quartz sand interbedded with red, gray, brown clays	Fluvial		28.7 mgd
Patuxent	White/gray/orange brown sands and quartz gravels; clay and silt beds			6.8 mgd

Aquia aquifer

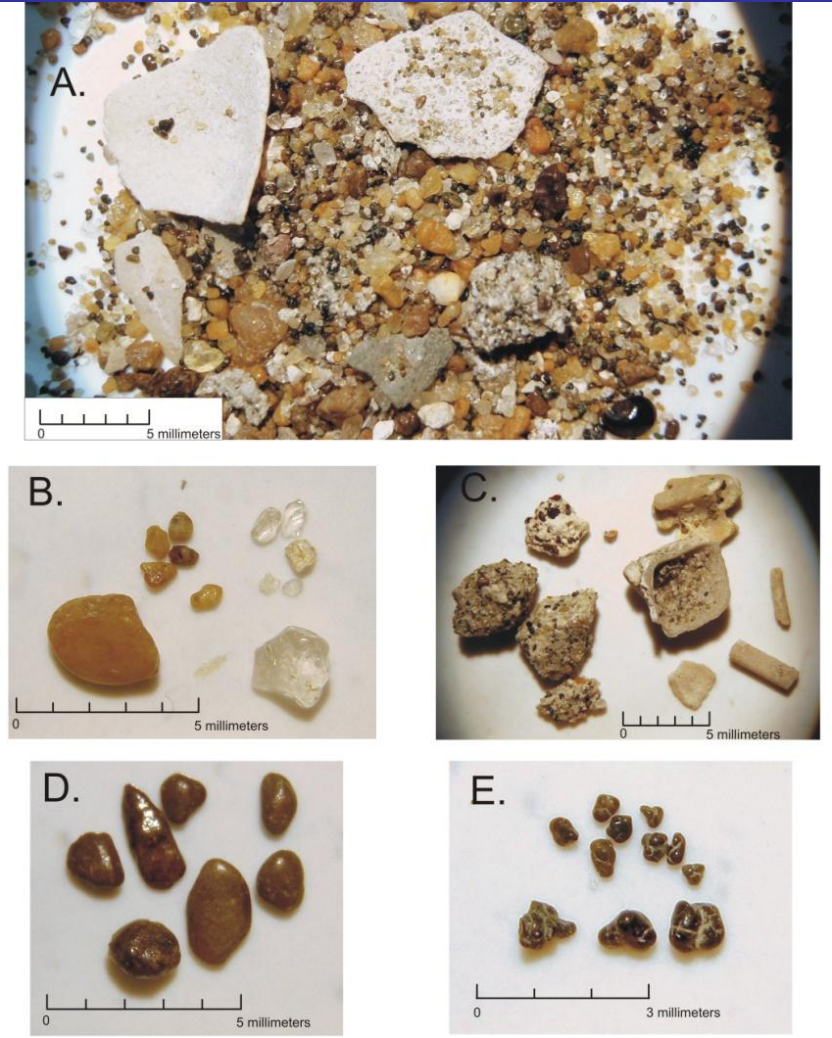
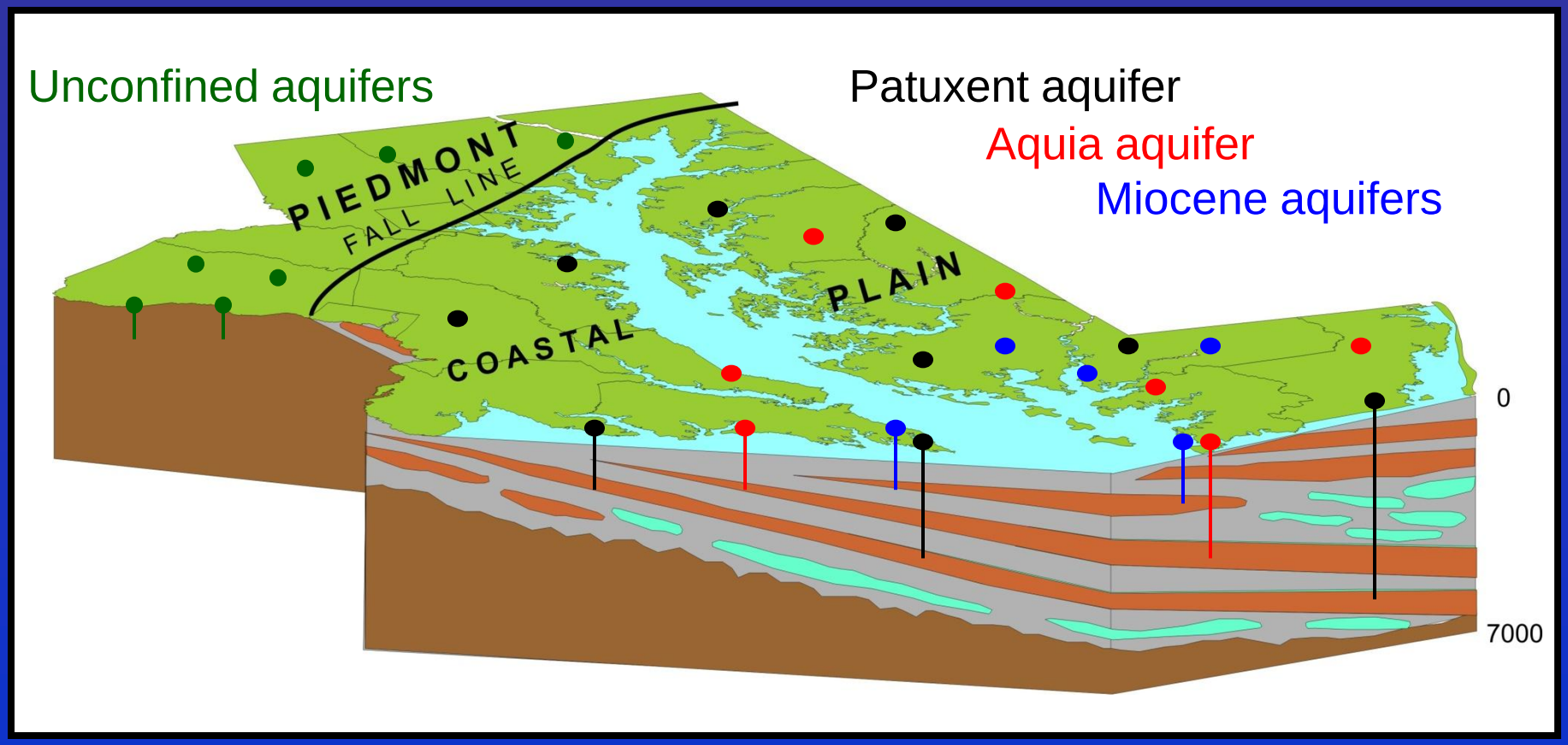


Figure 3. Photomicrographs of Aquia aquifer sediments: A. Washed sand. B. Quartz grains: iron-stained (left), clear (right). C. Calcite: cement (left), shell fragments (right). D. Goethite grains. E. Glauconite grains. Sample from well CA Db 96, 580 to 600 feet.

Potomac Group aquifers (Patapsco, Patuxent)

Water-level monitoring in Anne Arundel County:

- Organized into “sub-networks”



USGS/MGS Monitoring wells in Anne Arundel County:

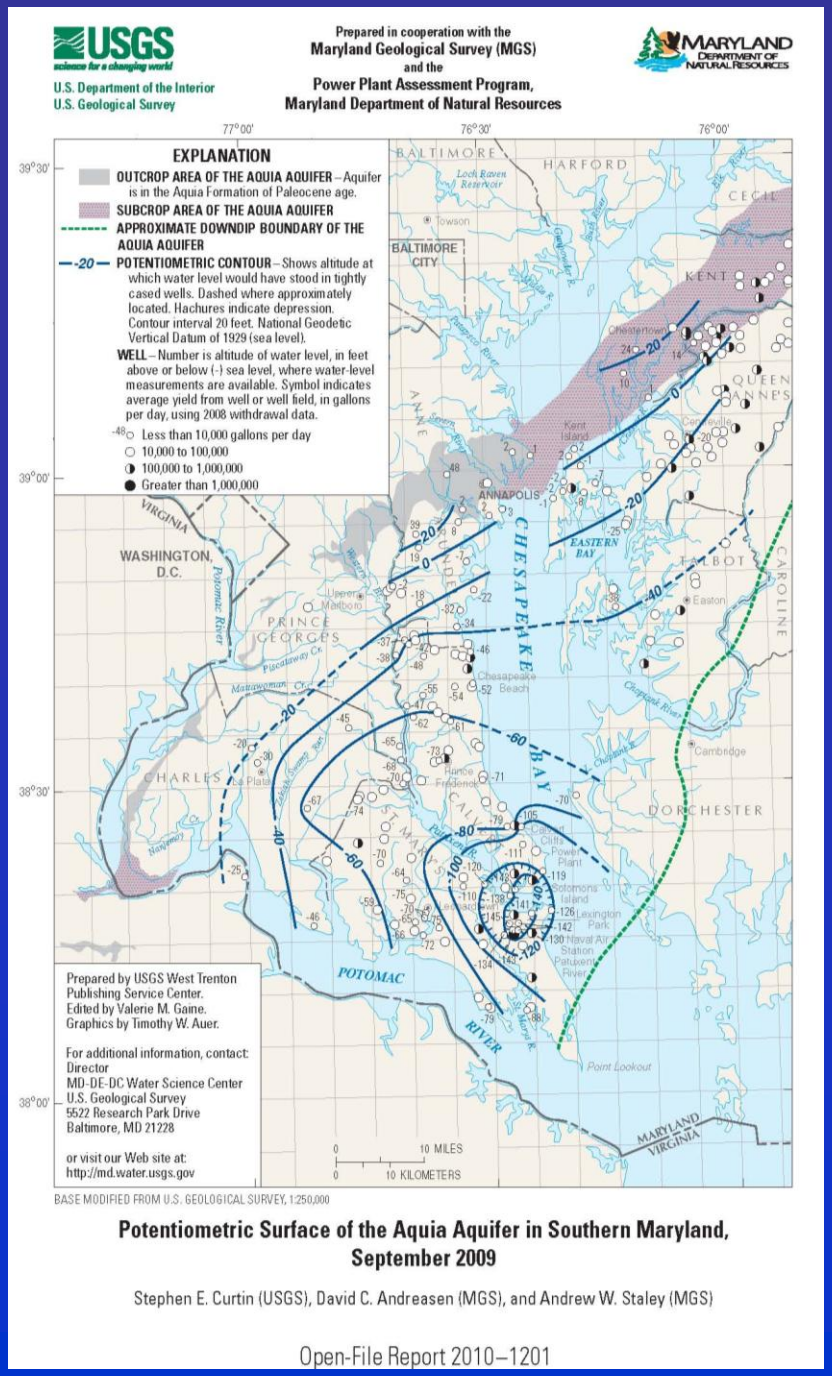
- Aquia (32 wells)
- Magothy (36)
- Upper Patapsco (25)
- Lower Patapsco (27)
- Patuxent (16)

Water-level (Potentiometric-surface) maps:

- Prepared every other year by MGS and USGS
- Seven major aquifers in Southern Maryland
- Illustrate:
  - -- Potentiometric surface
  - -- change in water level (20-30 yrs)
- Available online
- Water-level maps for all Coastal Plain aquifers planned for 2014

Aquia aquifer

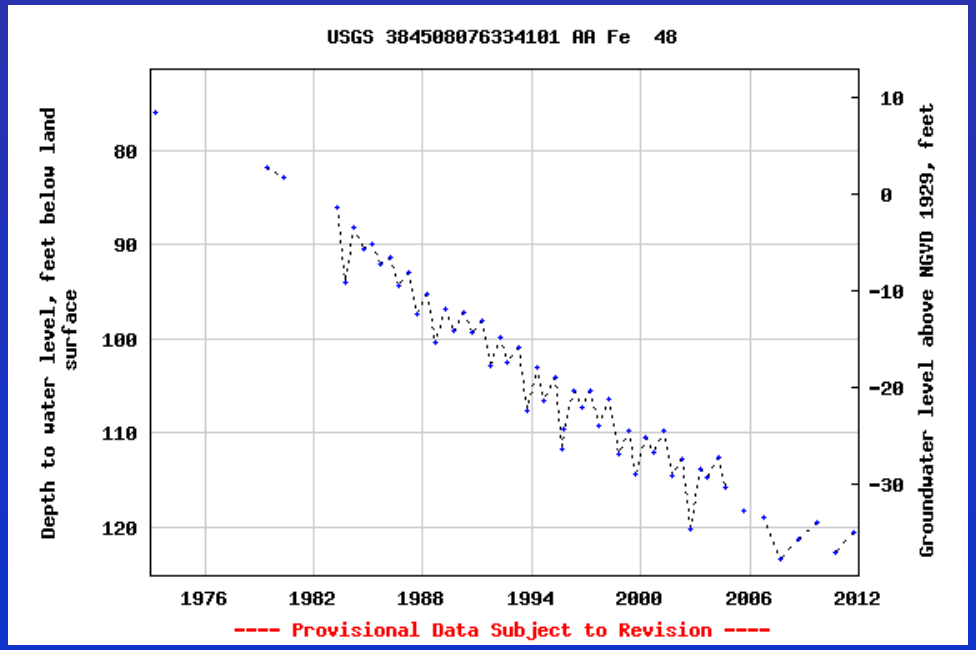
- Water level declines 0.2-1.4 ft/yr
- Affected by cone of depression in Calvert and St. Mary's Counties
- Water age: modern to >30,000 years (AA County)



Potentiometric Surface of the Aquia Aquifer in Southern Maryland, September 2009

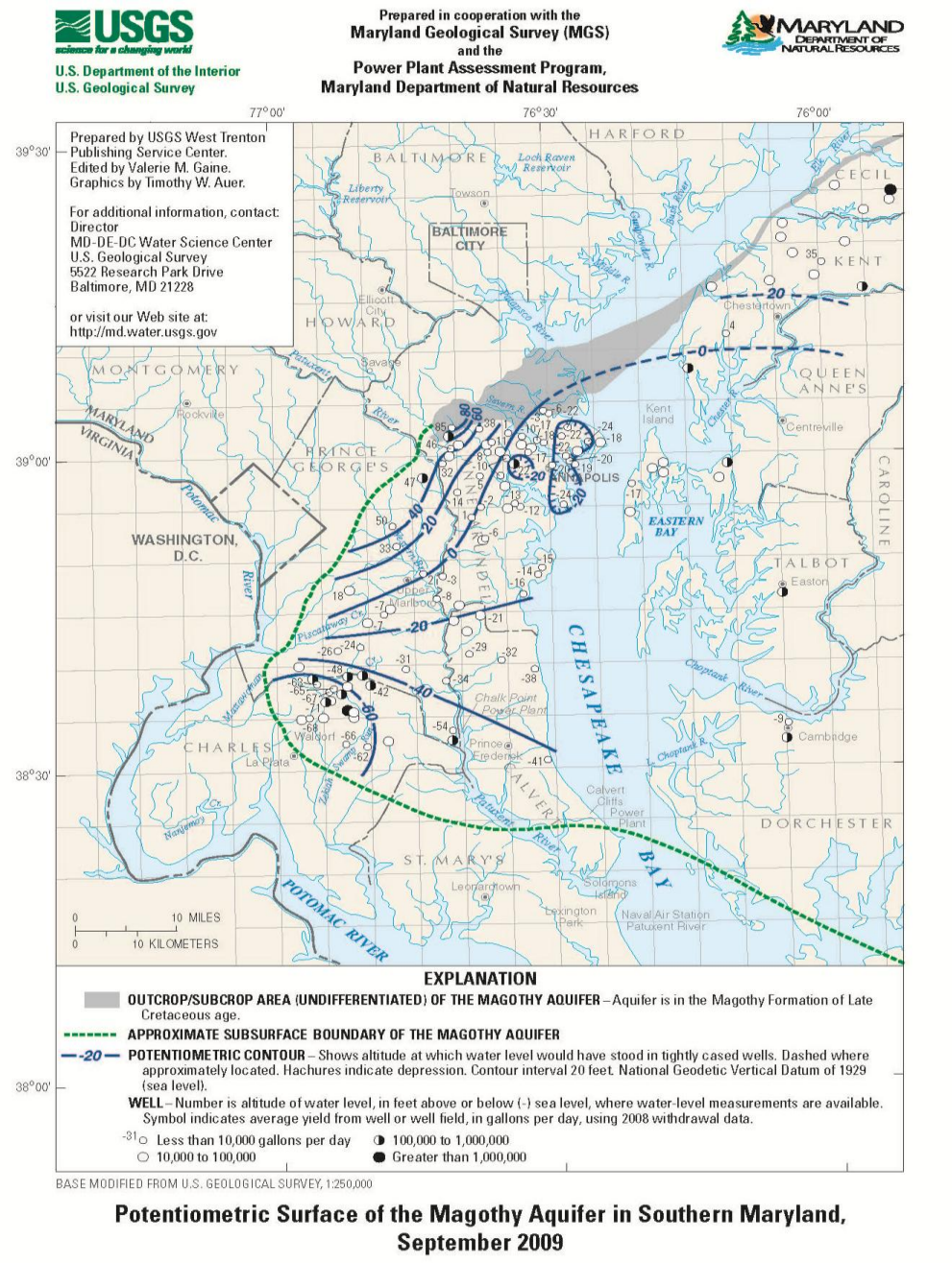
Stephen E. Curtin (USGS), David C. Andreasen (MGS), and Andrew W. Staley (MGS)

Open-File Report 2010–1201

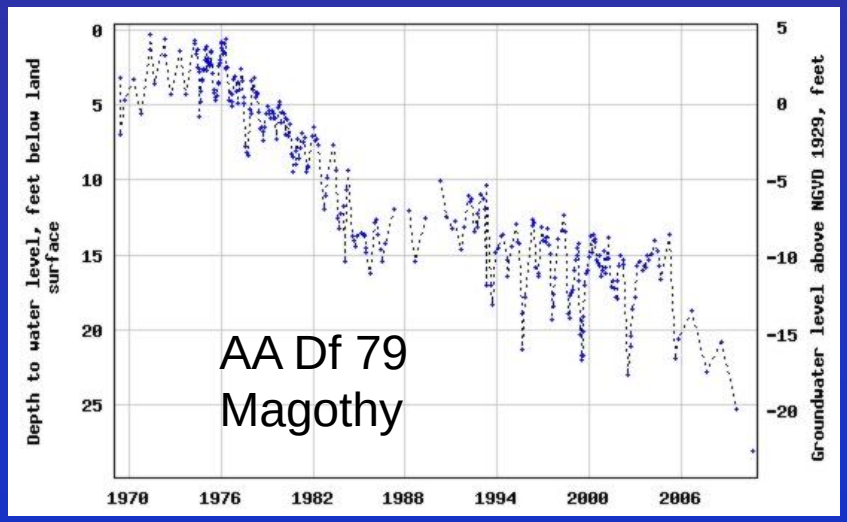


Magothy aquifer

- Water level declines 0.7-0.9 ft/yr
- Annapolis, Waldorf cones of depression

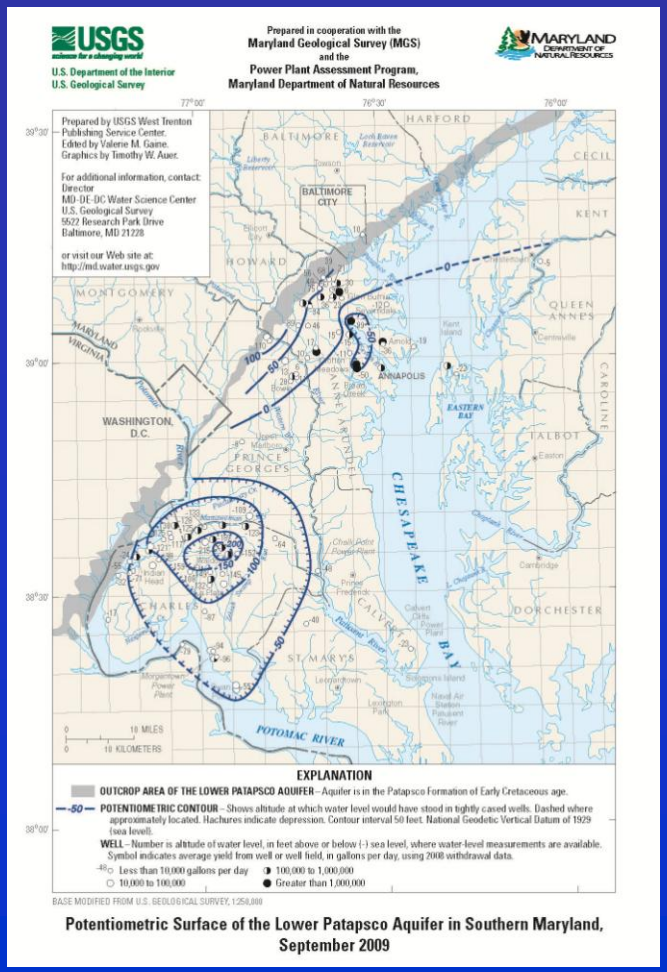


Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 2009

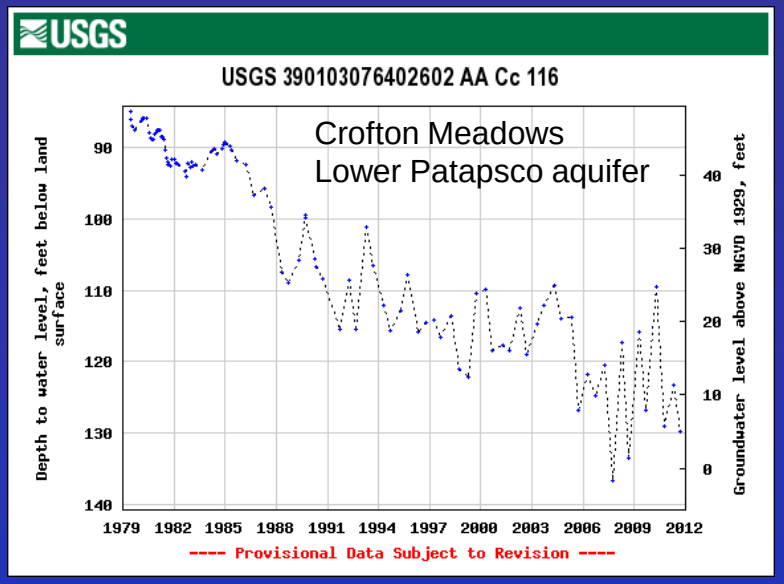


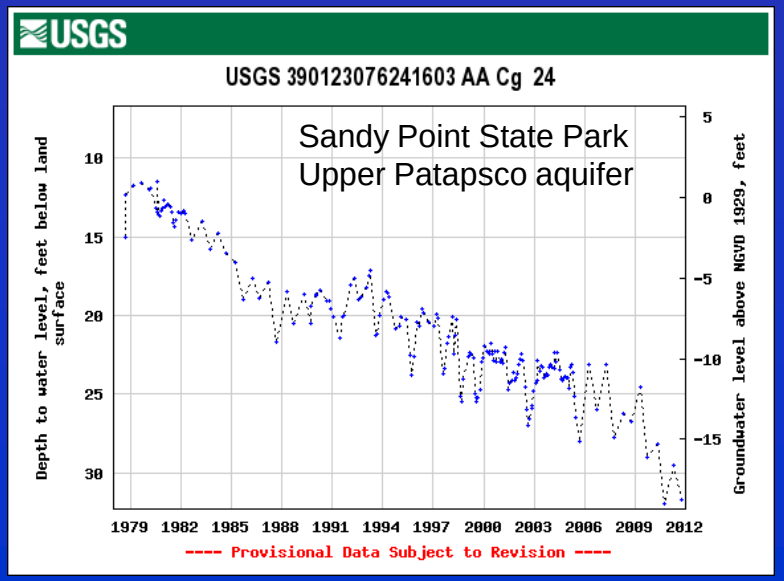
Upper, Lower Patapsco aquifers

- Annapolis, Waldorf/La Plata cones of depression
- Water age: modern to 50,000 years (AA County)



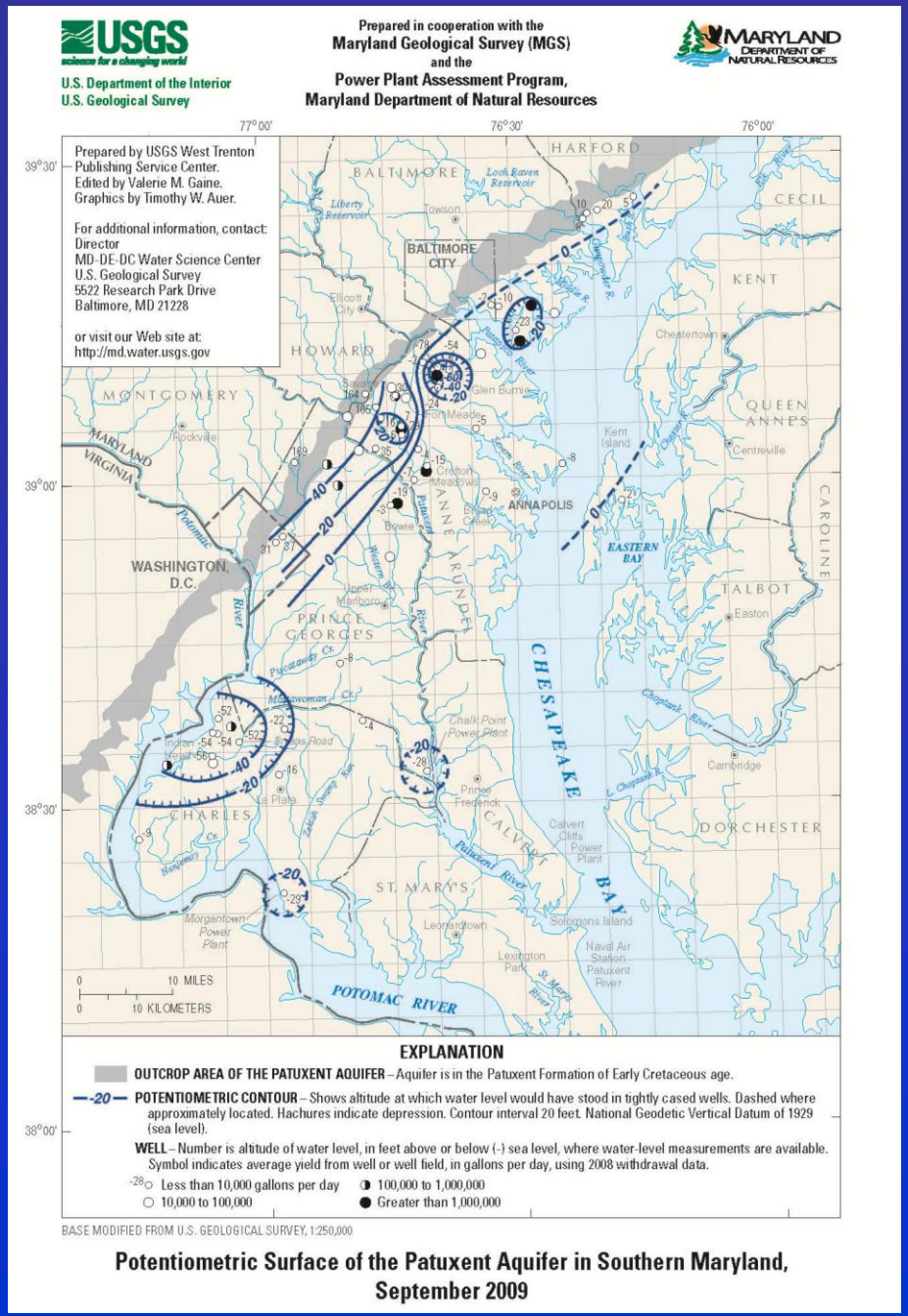
Potentiometric Surface of the Lower Patapsco Aquifer in Southern Maryland, September 2009



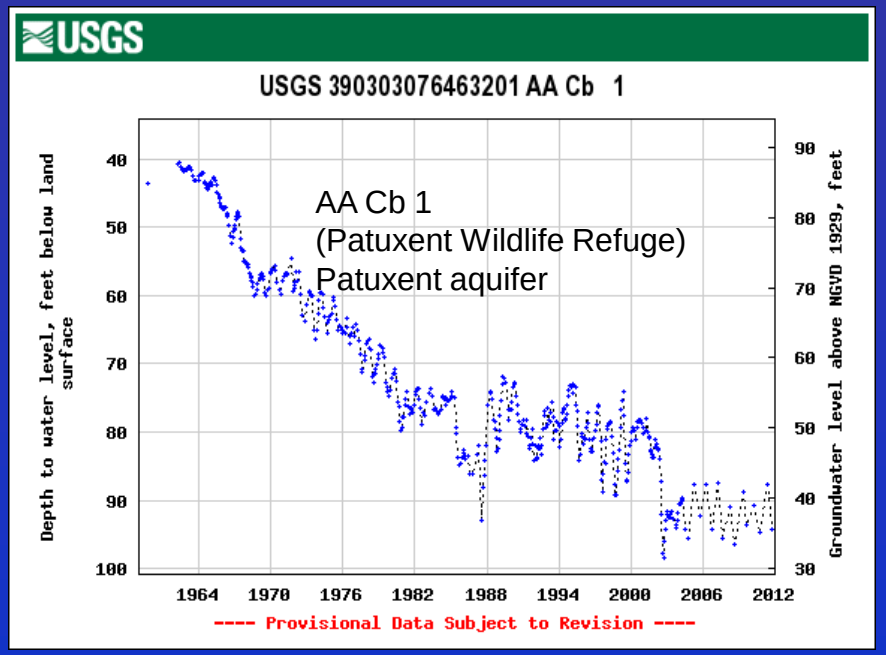


Patuxent aquifer

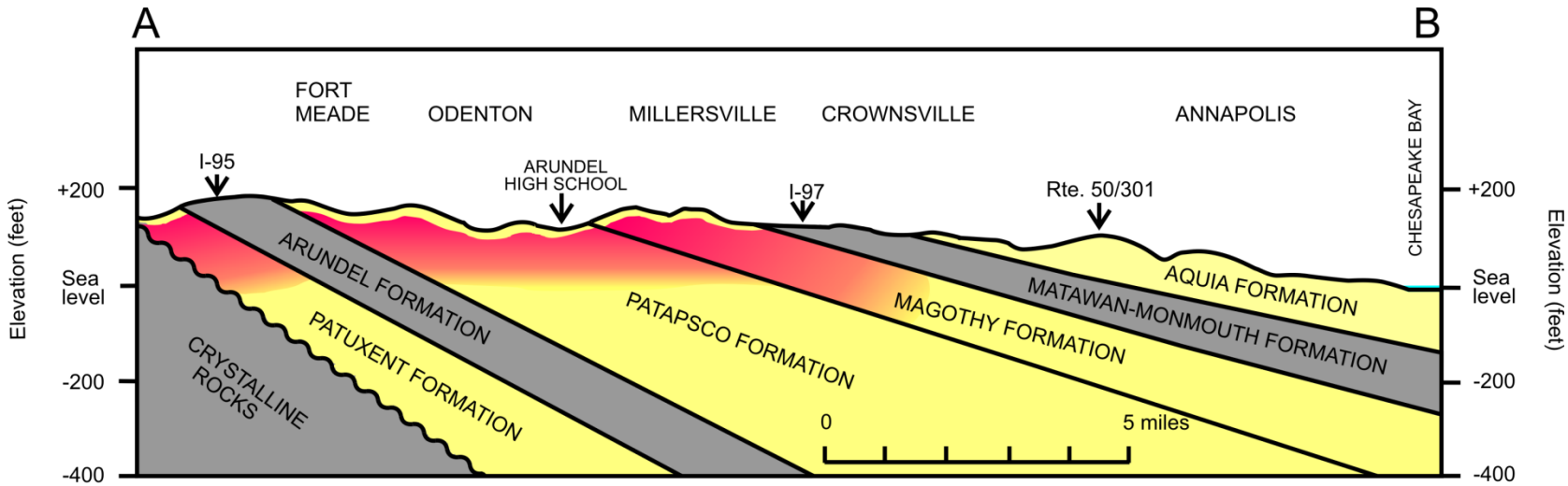
- Largest impacts in Charles County, Chalk Point
- Smaller cones of depression at Dorsey Road, Crofton Meadows

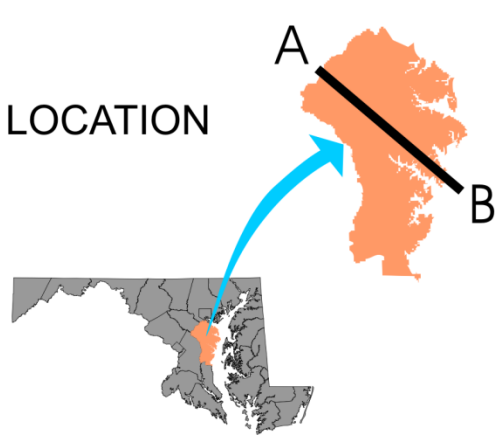


Potentiometric Surface of the Patuxent Aquifer in Southern Maryland, September 2009



Radium





Radium concentrations potentially greater than Federal Drinking Water standard

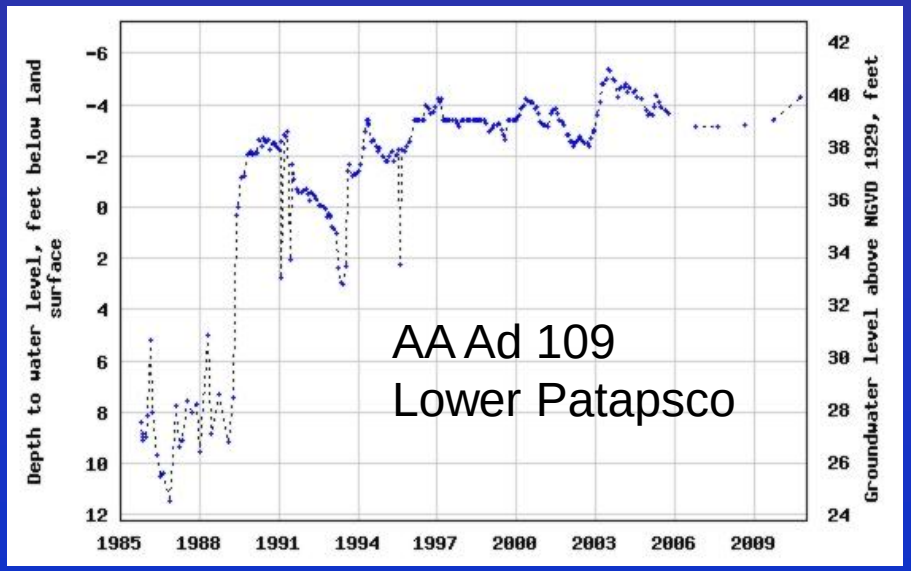
Major aquifers in Anne Arundel County

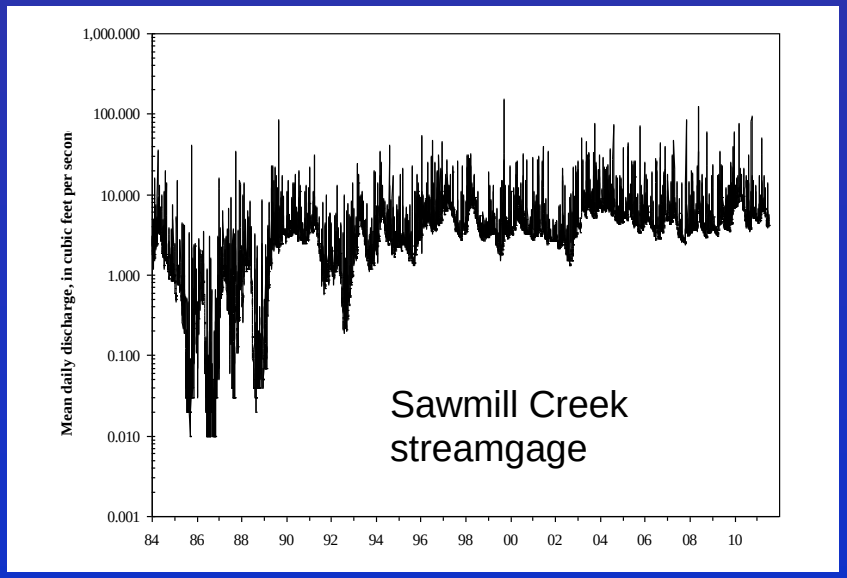
Minor aquifers and non-water-bearing zones

Groundwater-surface water interaction

Example: Sawmill Creek

- Increased pumpage from Lower Patapsco associated with decreased flow in Sawmill Creek
- Pumping ceased at Sawmill Well Field in late 1980s; Sawmill Creek baseflow has increased





Aquifers in Ft. Meade area

Patuxent aquifer:

- Unconfined northwest of base; confined beneath base
- Base production wells screened in Patuxent
- Arundel Clay provides hydraulic separation from overlying Lower Patapsco

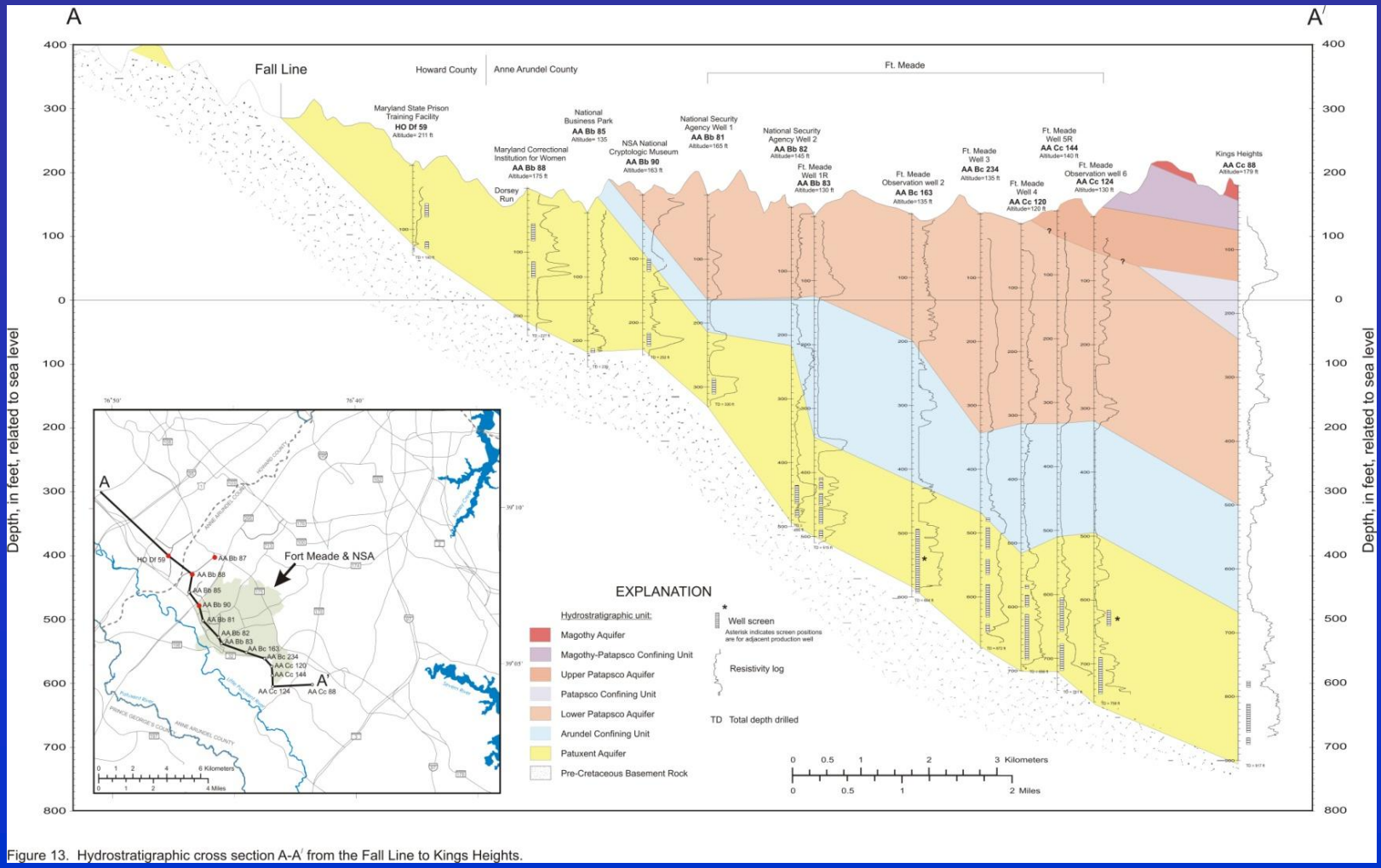
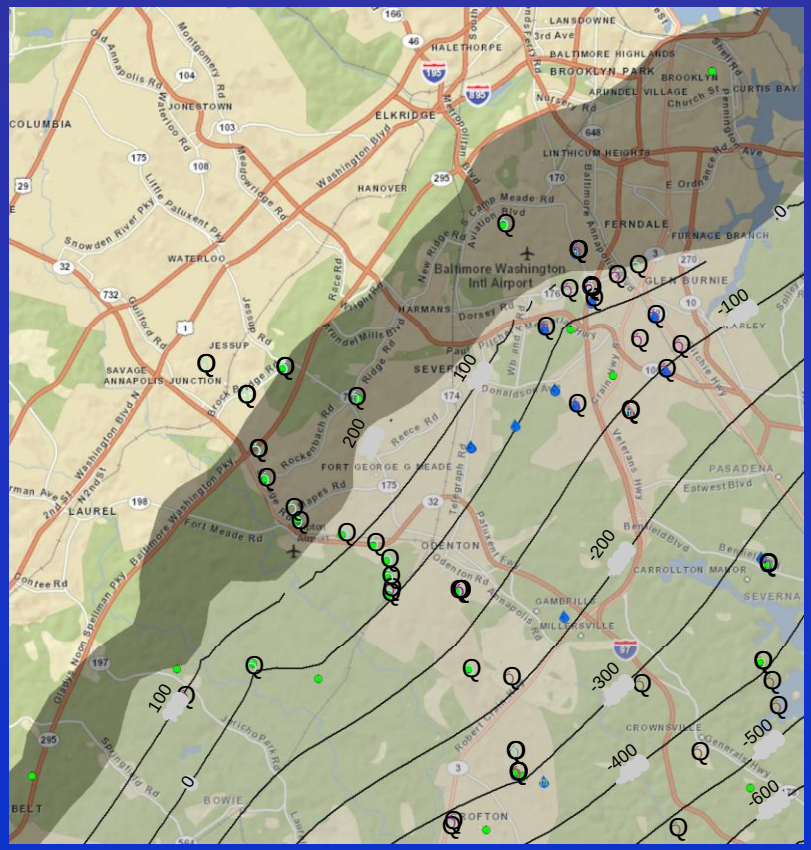


Figure 13. Hydrostratigraphic cross section A-A′ from the Fall Line to Kings Heights.

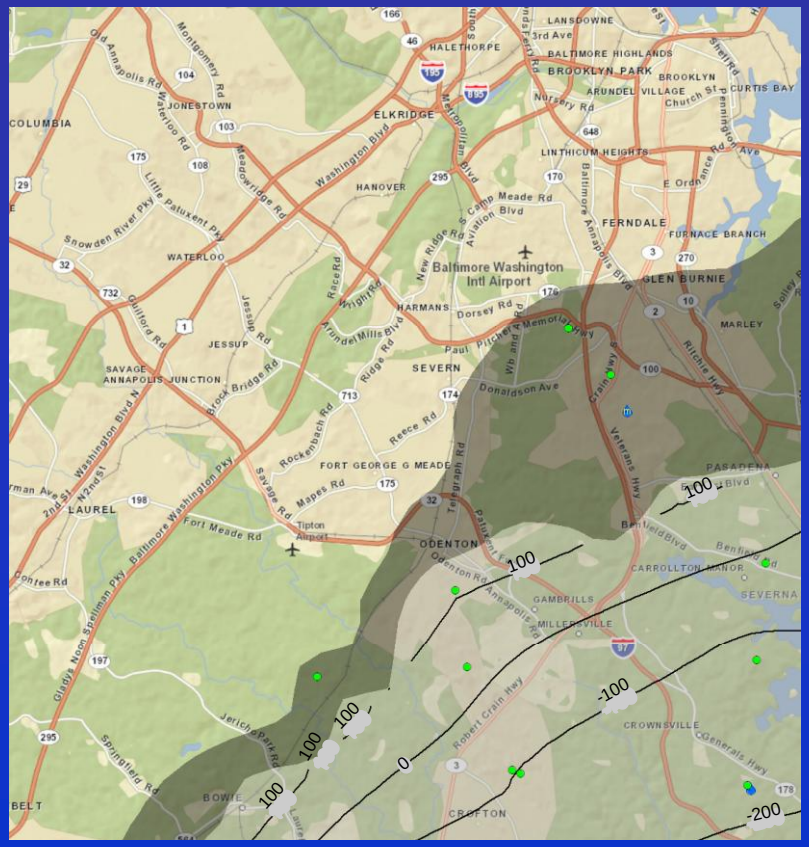
Aquifers in Ft. Meade area

Lower, upper Patapsco aquifer:

- Unconfined in vicinity of base; confined to southeast of base
- Regional flow to southeast
- Confining unit separating Lower and Upper Patapsco probably “leaky”



Lower Patapsco outcrop/contours



Upper Patapsco outcrop/contours

Aquifers in Ft. Meade area

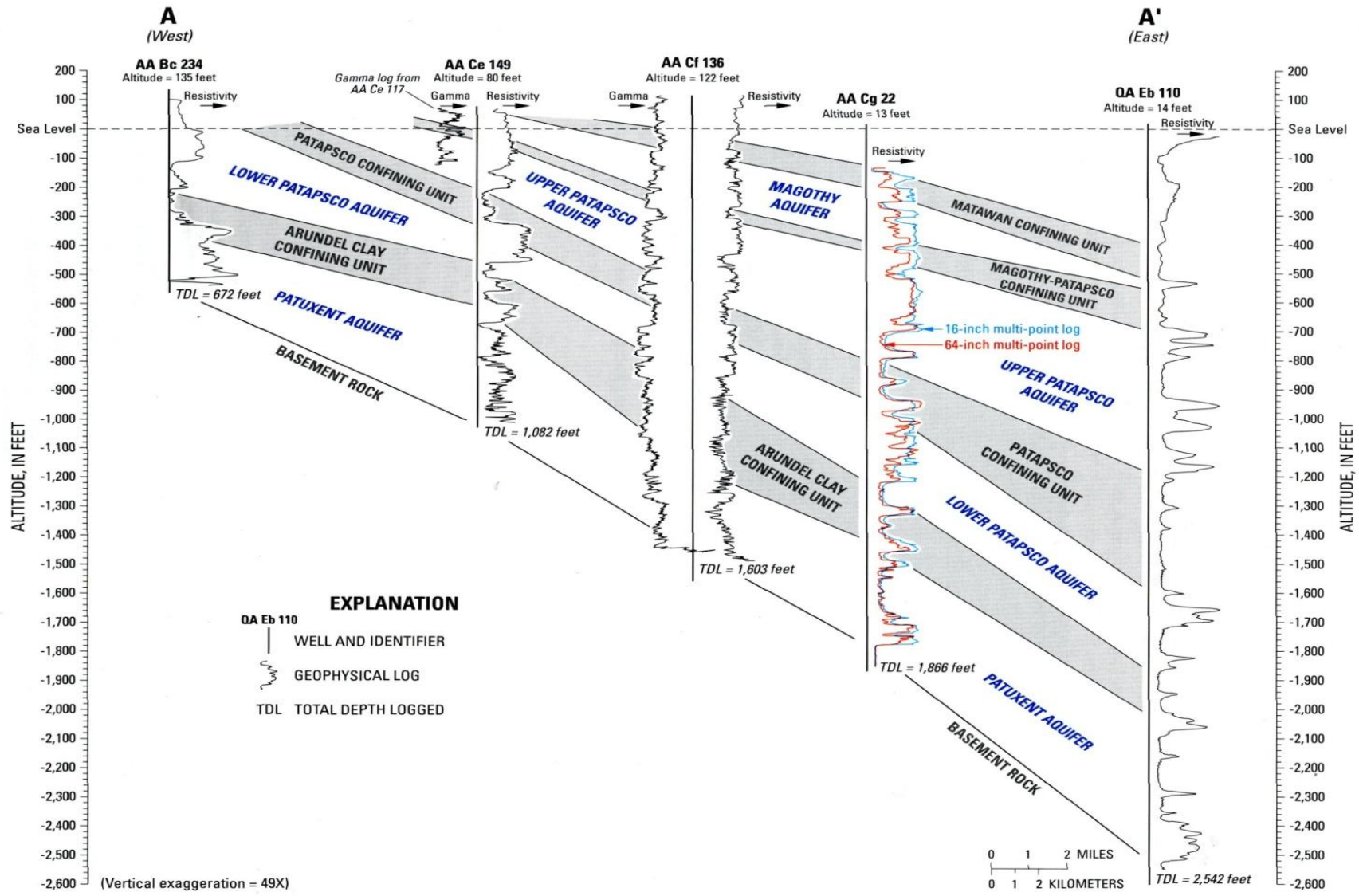


Figure 2. Hydrogeologic section A-A' from Fort Meade, Anne Arundel County, to Kent Island, Queen Anne's County, Maryland (modified from Andreasen, 2007).

Recent work:

Groundwater flow modeling:

- BRAC model (USGS)
  - -- Update based on of MGS 2007 model
  - -- estimate effects of pumpage on stream baseflow and water level near outcrop area
  - -- “child” model of regional model

Hydrogeology:

- Monitor wells in Patuxent aquifer (MGS)
  - -- study influence of confined-aquifer pumping in outcrop area
  - -- MGS Administrative Report

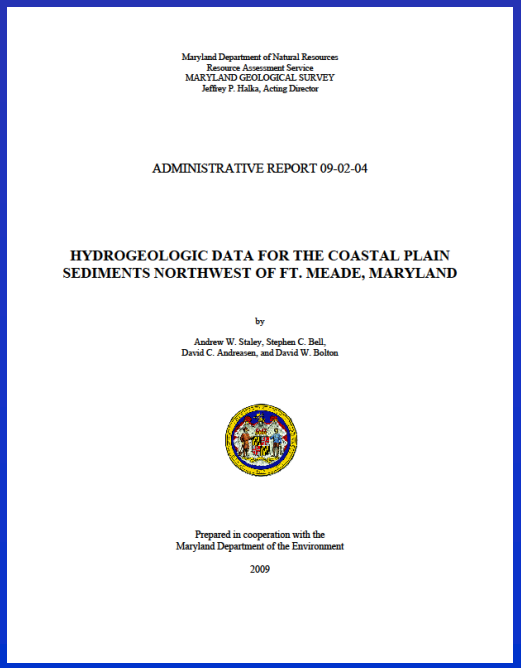

USGS
science for a changing world

Prepared in cooperation with the
Maryland Department of the Environment

Simulation of Groundwater Flow to Assess Future Withdrawals Associated with Base Realignment and Closure (BRAC) at Fort George G. Meade, Maryland

Scientific Investigations Report 2010–5186

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


Maryland Department of Natural Resources
Resource Assessment Service
MARYLAND GEOLOGICAL SURVEY
Jeffrey P. Halka, Acting Director

ADMINISTRATIVE REPORT 09-02-04

HYDROGEOLOGIC DATA FOR THE COASTAL PLAIN SEDIMENTS NORTHWEST OF FT. MEADE, MARYLAND

by

Andrew W. Staley, Stephen C. Bell,
David C. Andreasen, and David W. Bolton

Prepared in cooperation with the
Maryland Department of the Environment

2009

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