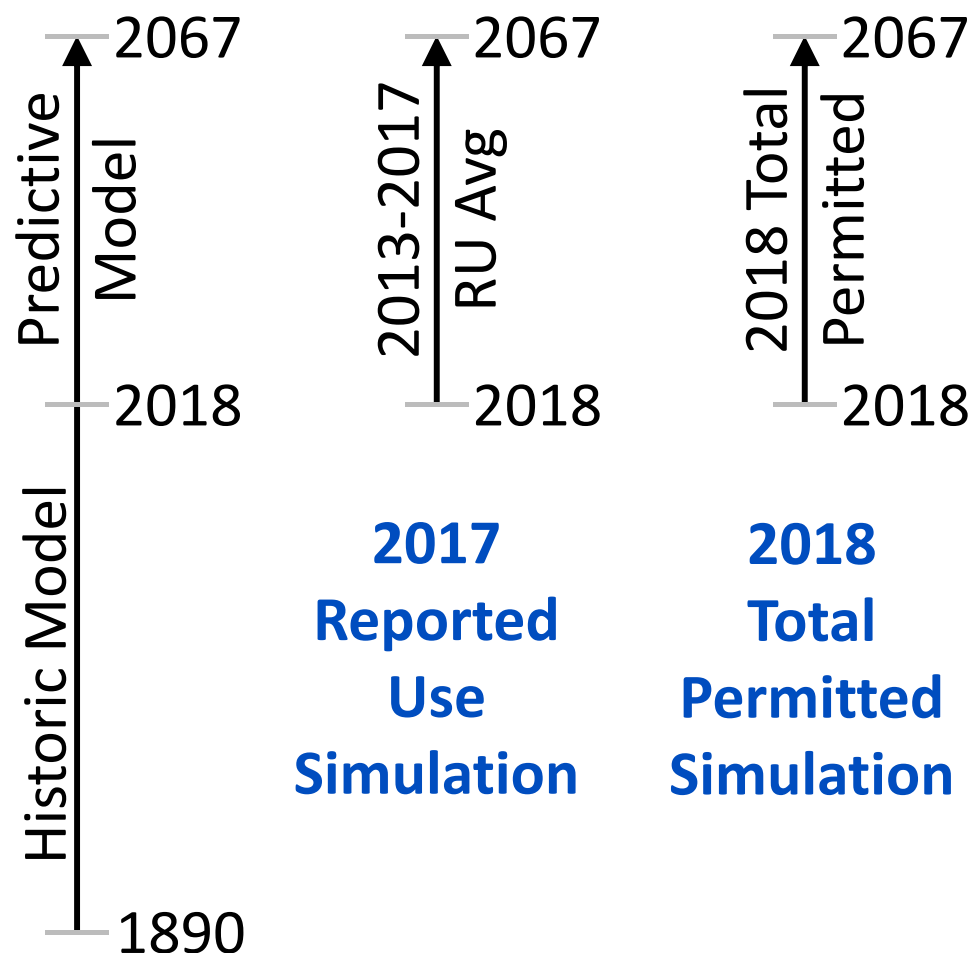


VAHYDRO-GW: MAINTENANCE



■ VCPM Adaptation

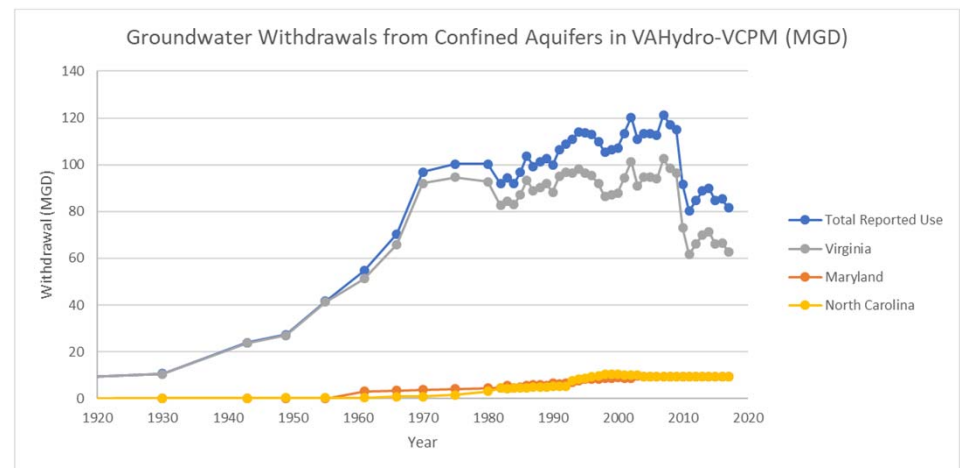
- 2013 Updated and adapted for DEQ use
 - 2003 -2012 data
 - RU and TP created
 - Critical surface
- 2015-16 RU and TP updated
- 2016 Addition of SUB package
- 2016-17 RU and TP updated
- 2017-18 RU and TP updated



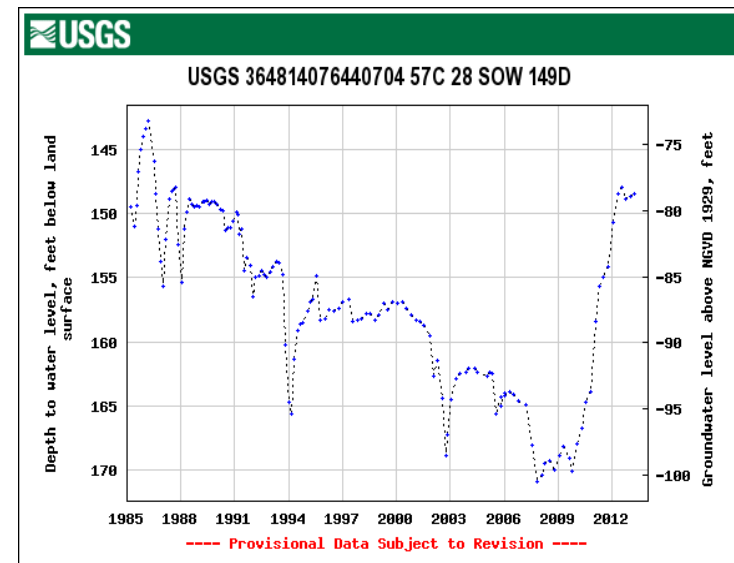
- 1-2 year occurrence:
 - Pumping values updated
 - Measured heads updated
 - Recharge values updated
- 2-10 year occurrence:
 - Boundary conditions updated
 - Hydraulic parameters recalibrated
 - Updated geologic framework
- 10+ occurrence :
 - Model overhaul



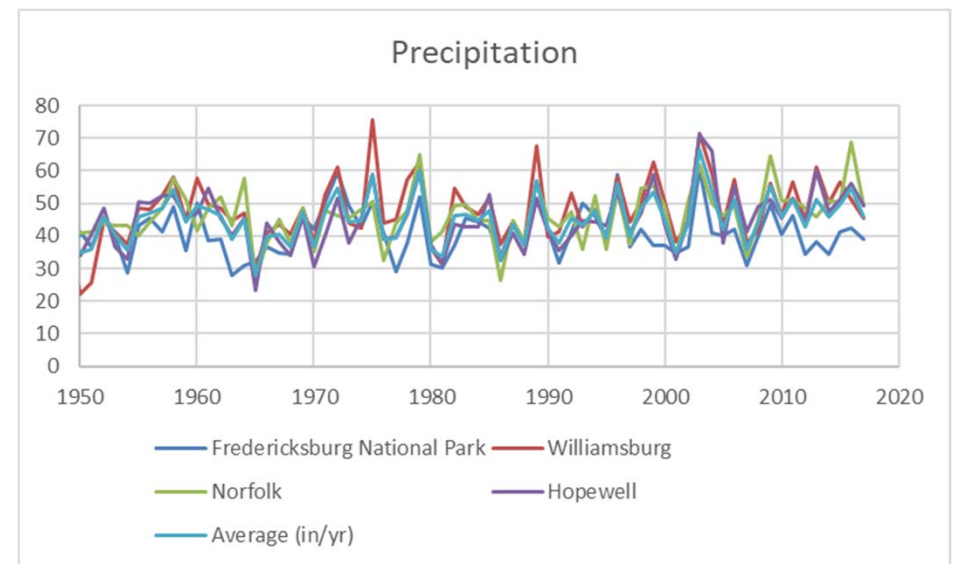
- 1-2 year occurrence:
 - Pumping values updated - **2018**
 - Measured heads updated
 - Recharge values updated
- 2-10 year occurrence:
 - Boundary conditions updated
 - Hydraulic parameters recalibrated
 - Updated geologic framework
- 10+ occurrence :
 - Model overhaul



- 1-2 year occurrence:
 - Pumping values updated - **2018**
 - Measured heads updated – **in progress**
 - Recharge values updated
- 2-10 year occurrence:
 - Boundary conditions updated
 - Hydraulic parameters recalibrated
 - Updated geologic framework
- 10+ occurrence :
 - Model overhaul



- 1-2 year occurrence:
 - Pumping values updated - **2018**
 - Measured heads updated – **in progress**
 - Recharge values updated – **2018**
- 2-10 year occurrence:
 - Boundary conditions updated
 - Hydraulic parameters recalibrated
 - Updated geologic framework
- 10+ occurrence :
 - Model overhaul



- 1-2 year occurrence:
 - Pumping values updated - **2018**
 - Measured heads updated – **in progress**
 - Recharge values updated – **2018**
- 2-10 year occurrence:
 - Boundary conditions updated – **upcoming**
 - Hydraulic parameters recalibrated
 - Updated geologic framework
- 10+ occurrence :
 - Model overhaul

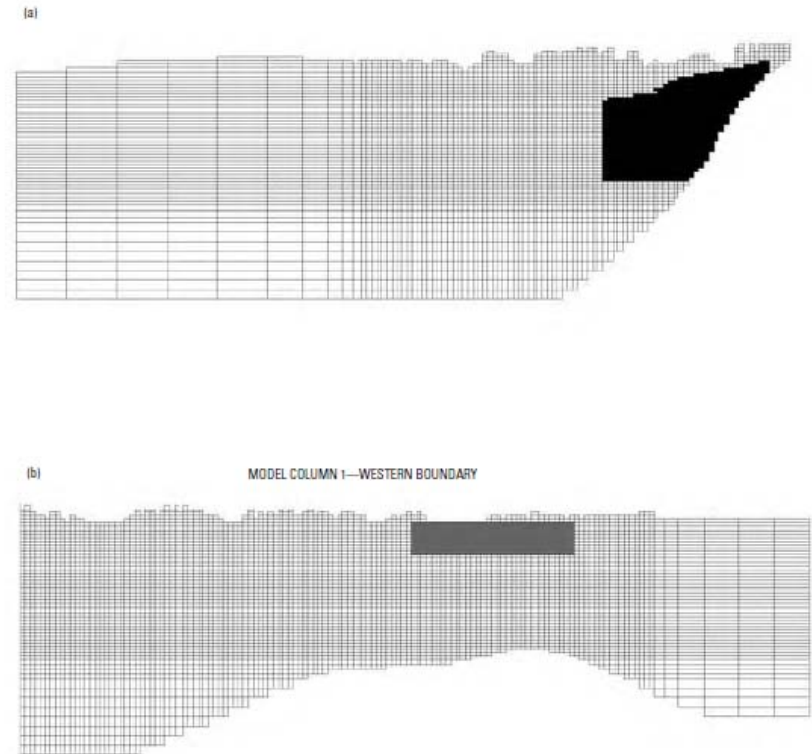


Figure 12. Finite-difference model grid showing cells designated for (a) time-varying specified flux to Maryland in row 1 and (b) constant specified flux from the Piedmont Province in columns 4-20.



- 1-2 year occurrence:
 - Pumping values updated - **2018**
 - Measured heads updated – **in progress**
 - Recharge values updated – **2018**
- 2-10 year occurrence:
 - Boundary conditions updated – **upcoming**
 - Hydraulic parameters recalibrated – **upcoming**
 - Updated geologic framework
- 10+ occurrence :
 - Model overhaul

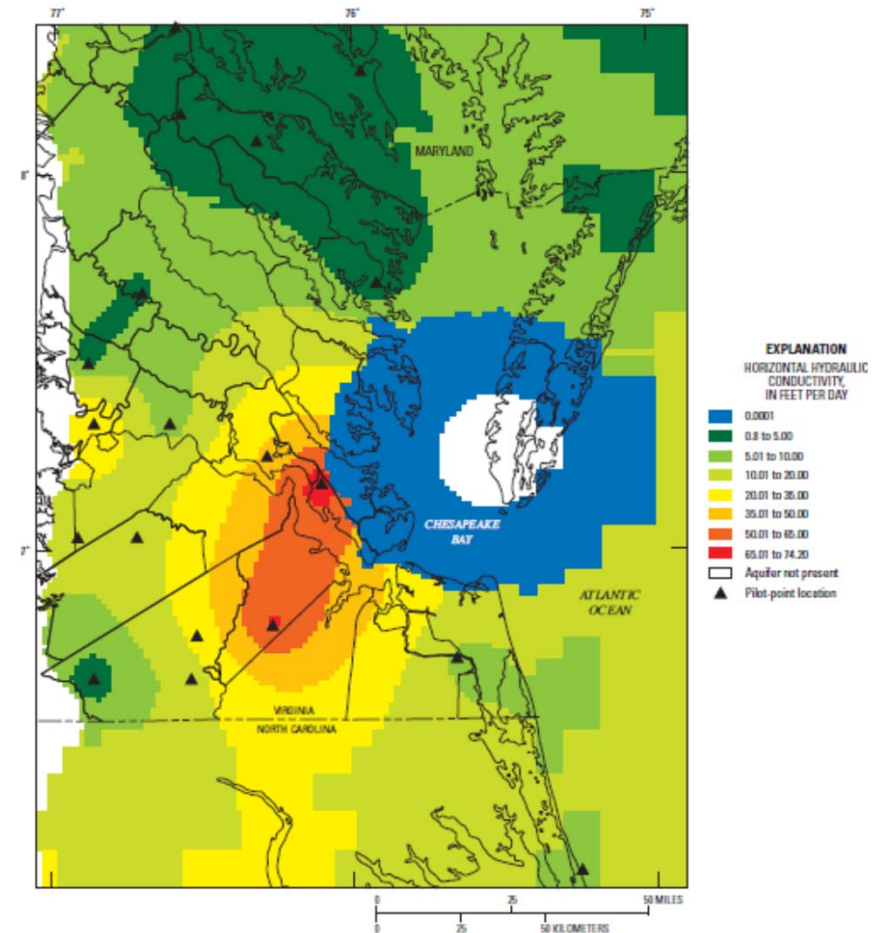
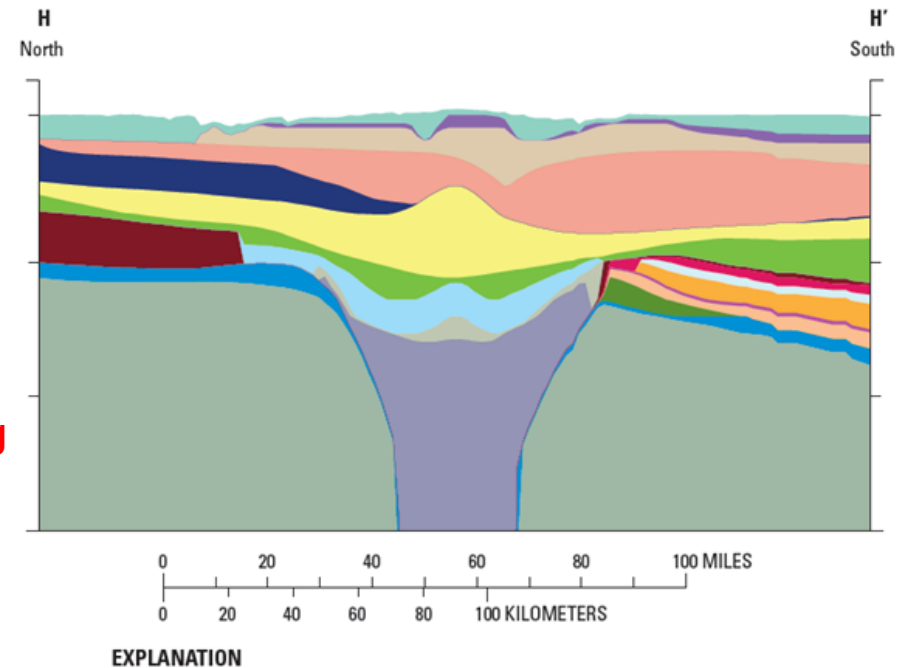


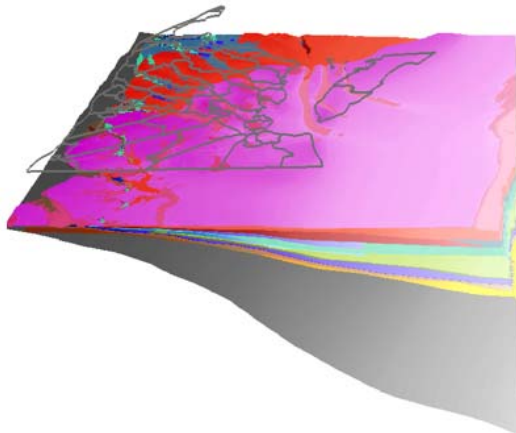
Figure 13. Pilot-point locations and simulated horizontal hydraulic conductivity at the top of the Potomac aquifer of the Virginia Coastal Plain.



- 1-2 year occurrence:
 - Pumping values updated - **2018**
 - Measured heads updated – **in progress**
 - Recharge values updated – **2018**
- 2-10 year occurrence:
 - Boundary conditions updated – **upcoming**
 - Hydraulic parameters recalibrated – **upcoming**
 - **Updated geologic framework – in progress**
- 10+ occurrence :
 - Model overhaul

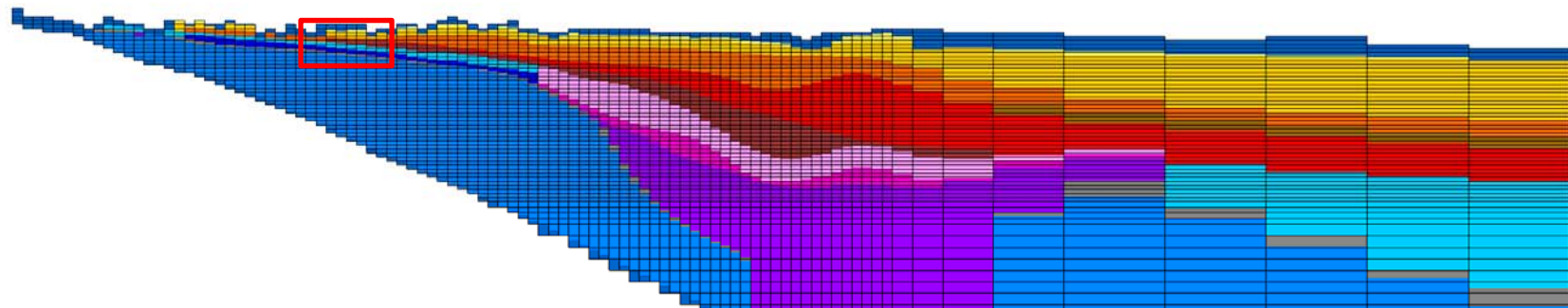
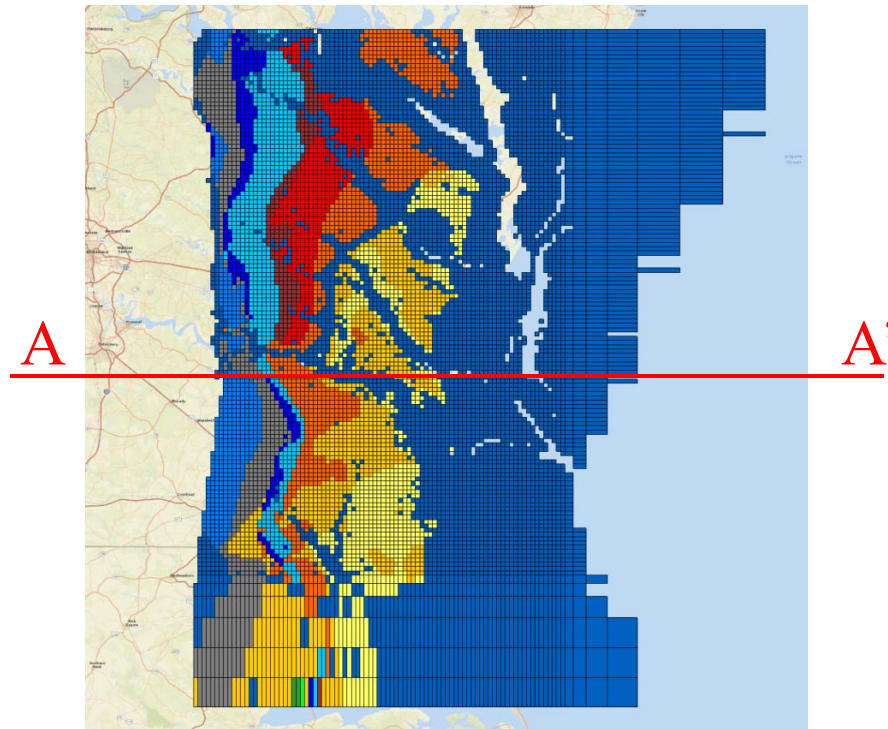


- Model\Framework
 - 60-layer constant elevation.
 - 19 hydrogeologic units
 - HUF Package
 - 38 grid independent arrays

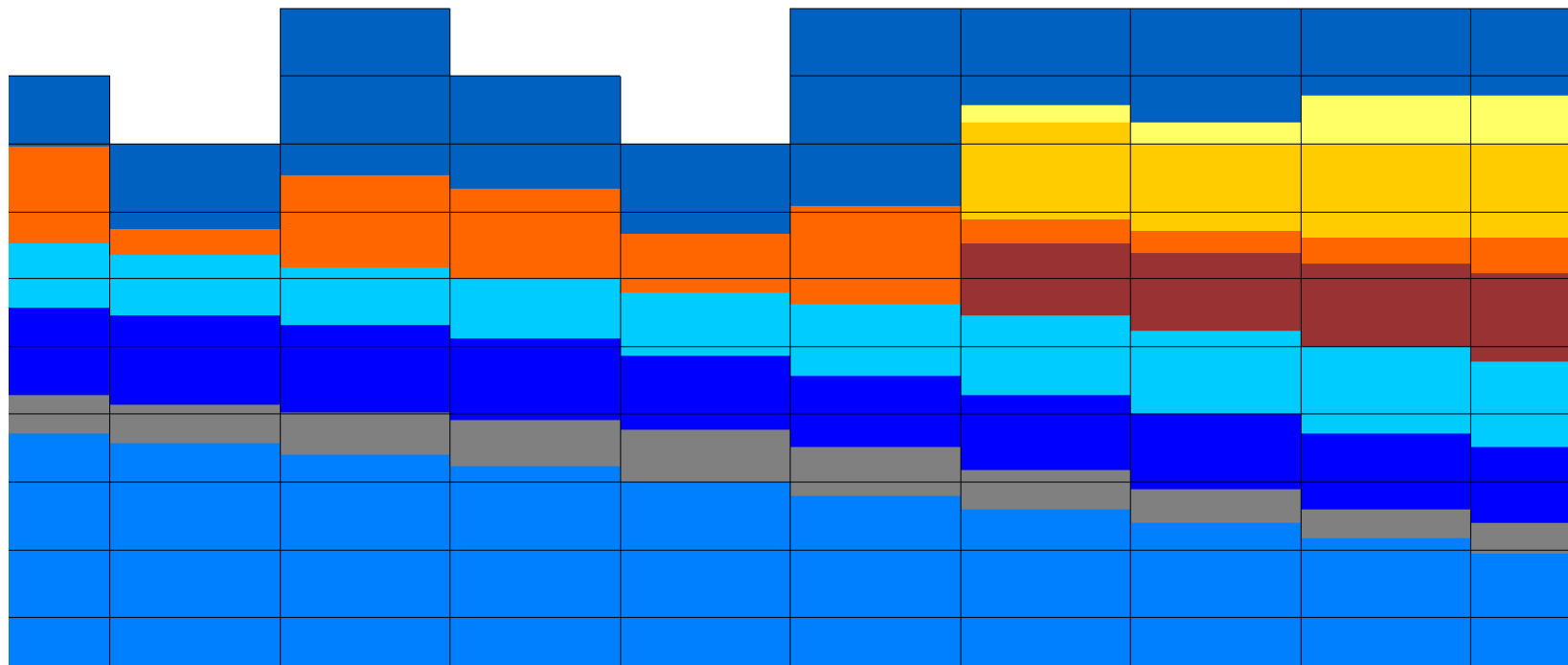


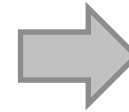
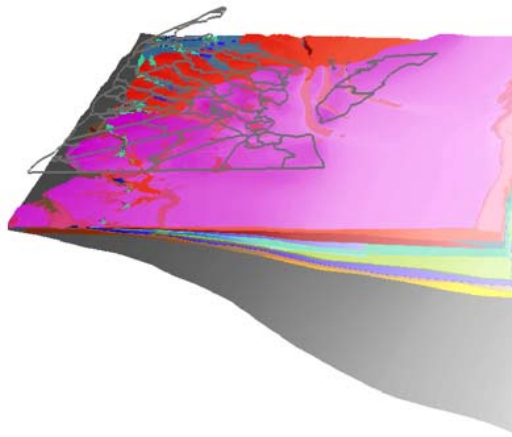
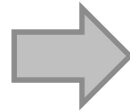
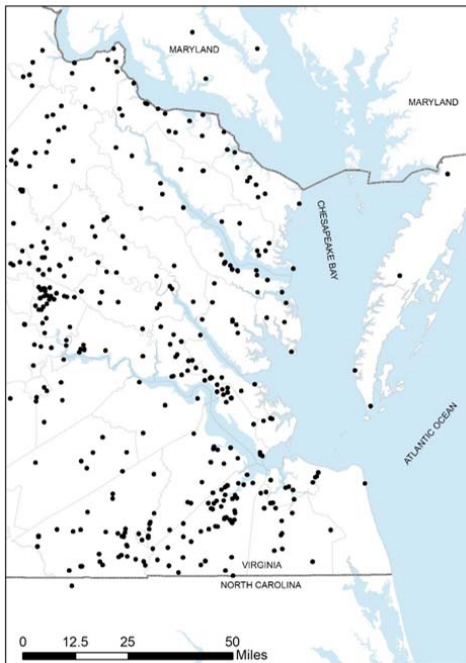
	Hydrogeologic Unit Name	Raster Name	HUF Array
1	Surficial Aquifer	m01_surf	SURF
2	Yorktown-Eastover Confining Unit	yorktown_cu	YTCZ
3	Yorktown-Eastover Aquifer	yorktown_aq	YEAQ
4	Saint Marys Confining Unit	saintmary_cu	SMCU
5	Saint Marys Aquifer	saintmary_aq	SMAQ
6	Calvert Confining Unit	calvert_cu	CACU
7	Piney Point Aquifer	pineypoint_aq	PPAQ
8	Chickahominy Confining Unit	chickah_cu	CHCU
9	Exmore Matrix Confining Unit	exmoremat_cu	XMCU
10	Exmore Clast Confining Unit	exmorecla_cu	XCAQ
11	Nanjemoy-Marlboro Confining Un.	nan_marb_cu	NMCU
12	Aquia Aquifer	aquia_aq	AQAQ
13	Peedee Confining Unit	peedee_cu	PDCU
14	Peedee Aquifer	peedee_aq	PDAQ
15	Virginia Beach Confining Zone	virgbeach_cu	VBCU
16	Virginia Beach Aquifer	virgbeach_aq	VBAQ
17	Upper Cenomanian Confining Unit	upperceno_cu	UCCU
18	Potomac Confining Zone	potomac_cz	POCZ
19	Potomac Aquifer	potomac_aq	POAQ
20	Basement Bedrock	basement	-





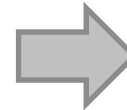
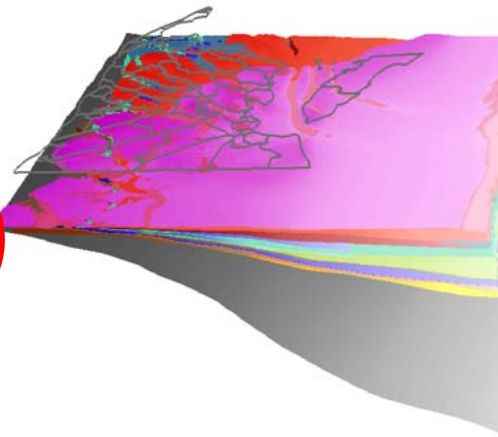
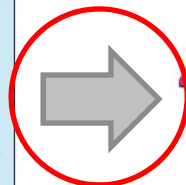
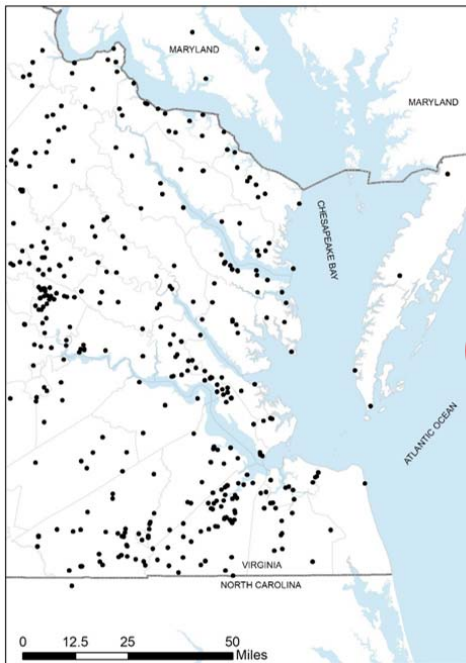
- Multiple hydrogeologic units in one cell.





AQAQ.array	SMCU.array
AQAQ_THK.array	SMCU_THK.array
CACU.array	SURF.array
CACU_THK.array	SURF_THK.array
CHCU.array	UCCU.array
CHCU_THK.array	UCCU_THK.array
NMCU.array	VBAQ.array
NMCU_THK.array	VBAQ_THK.array
PDAQ.array	VBCU.array
PDAQ_THK.array	VBCU_THK.array
PDCU.array	XCAQ.array
PDCU_THK.array	XCAQ_THK.array
POAQ.array	XMCU.array
POAQ_THK.array	XMCU_THK.array
POCZ.array	YEAQ.array
POCZ_THK.array	YEAQ_THK.array
PPAQ.array	YTCZ.array
PPAQ_THK.array	YTCZ_THK.array
SMAQ.array	
SMAQ_THK.array	

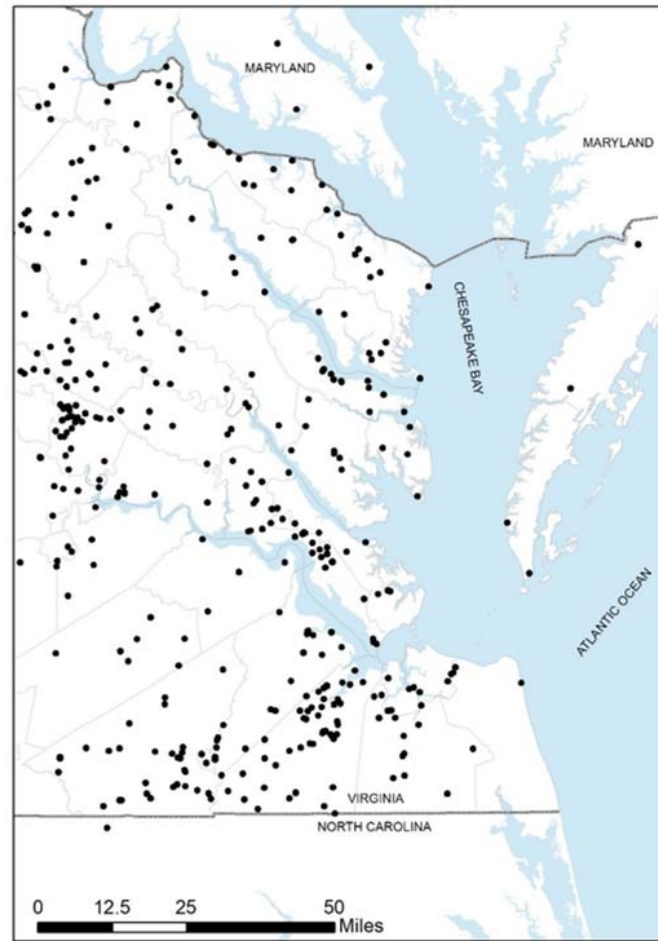




AQAQ.array	SMCU.array
AQAQ_THK.array	SMCU_THK.array
CACU.array	SURF.array
CACU_THK.array	SURF_THK.array
CHCU.array	UCCU.array
CHCU_THK.array	UCCU_THK.array
NMCU.array	VBAQ.array
NMCU_THK.array	VBAQ_THK.array
PDAQ.array	VBCU.array
PDAQ_THK.array	VBCU_THK.array
PDCU.array	XCAQ.array
PDCU_THK.array	XCAQ_THK.array
POAQ.array	XMCU.array
POAQ_THK.array	XMCU_THK.array
POCZ.array	YEAQ.array
POCZ_THK.array	YEAQ_THK.array
PPAQ.array	YTCZ.array
PPAQ_THK.array	YTCZ_THK.array
SMAQ.array	
SMAQ_THK.array	



- Reproduce original rasters
 - **Borehole data**
 - Digitized contours
 - Surface/Bathymetry

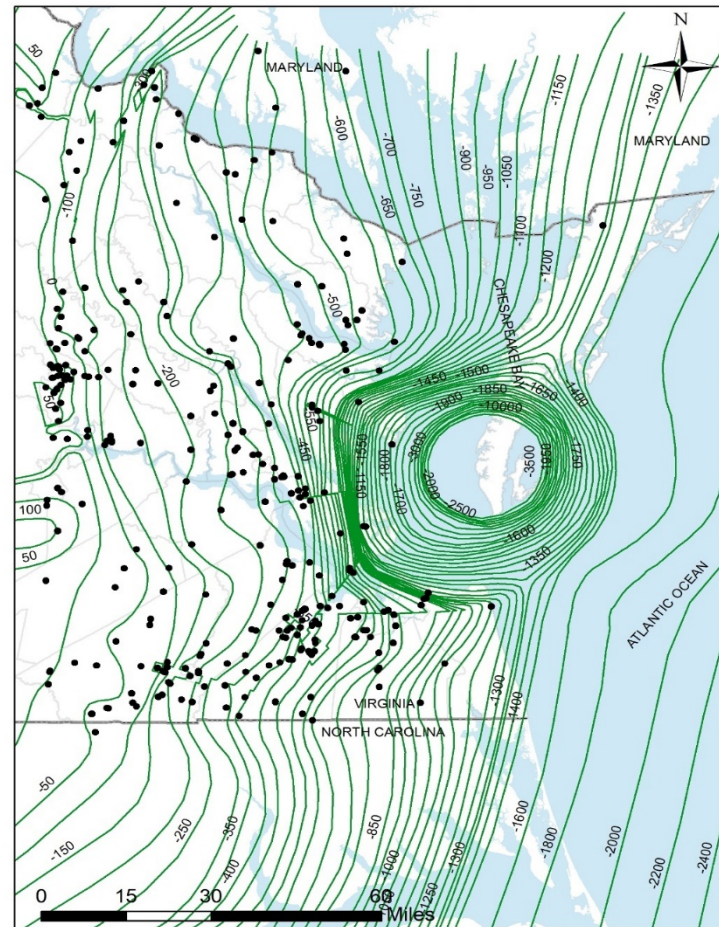


Legend

- YorktownCU - 125 Points
- YorktownAQ - 180 Points
- StMarysCU - 283 Points
- StMarysAQ - 39 Points
- CalvertCU - 260 Points
- PinePointAQ - 254 Points
- ChickahominyCU - 44 Points
- ExmoreMatrixCU - 30 Points
- ExmoreClastCU - 18 Points
- NanjemoyCU - 270 Points
- AquiaAQ - 261 Points
- PeedeeCU - 4 Points
- PeedeeAQ - 4 Points
- VirginiaBeachCU - 33 Points
- VirginiaBeachAQ - 33 Points
- UpperCenoCU - 97 Points
- PotomacCU - 307 Points
- PotomacAQ - 309 Points
- Basement - 76 Points



- Reproduce original rasters
 - Borehole data
 - **Digitized contours**
 - Surface/Bathymetry

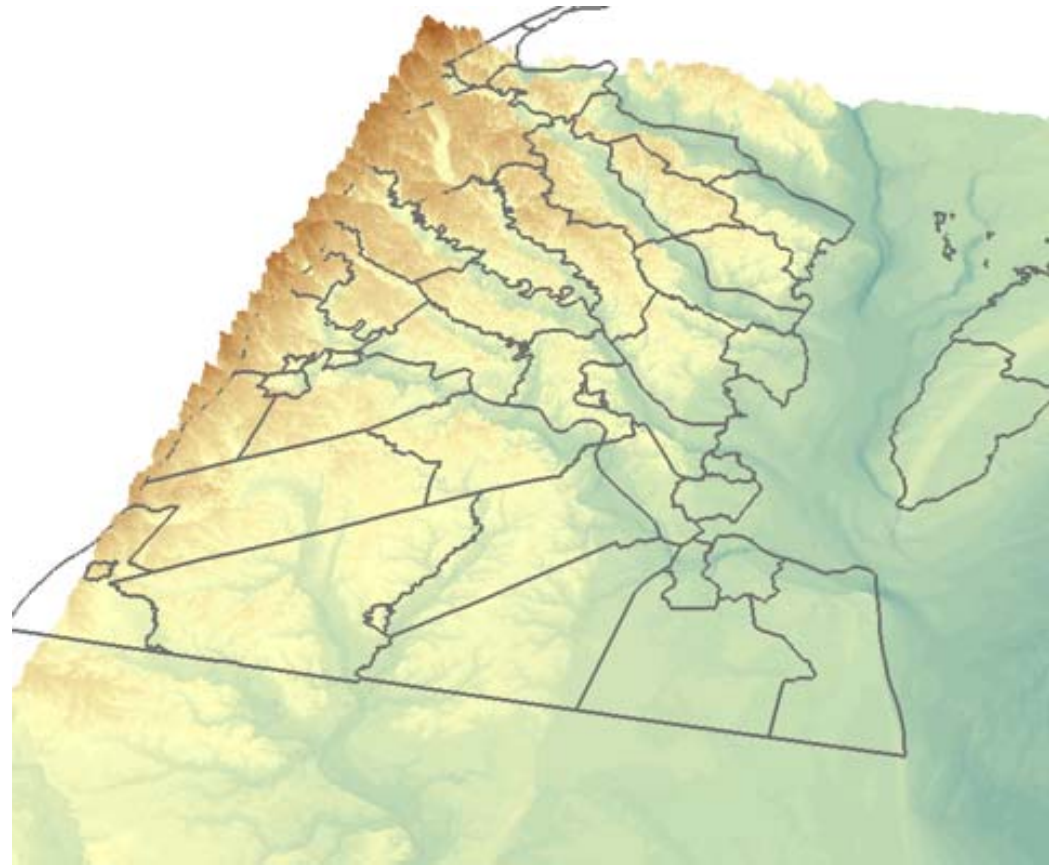


Legend

- PotomacAQ - 309 Points
- Potomac Aquifer Top Hand Digitized Contours



- Reproduce original rasters
 - Borehole data
 - Digitized contours
 - **Surface/Bathymetry**



- Reproduce original rasters
 - Borehole data
 - Digitized contours
 - Surface/Bathymetry
 - Documentation

DATA COMPILATION

Point elevations for the hydrogeologic units are contained in the ARC point feature "logpicks_04", and were interpreted from borehole geophysical, lithologic, and ancillary data. The point feature was generated from a dbase table "picks_table_04" that includes all boreholes within the Virginia Coastal Plain for which geophysical logs exist in established site files as of through most of 2004. The following status codes appear for each site in the table and point feature:

- 0 - ESTABLISHED SITES UNINTERPRETED
- 1 - INTERPRETATIONS OF ESTABLISHED SITES MADE DURING 2003 OF SITES IN SOUTHEASTERN VIRGINIA
- 2 - INTERPRETATIONS MADE INITIALLY OF ESTABLISHED SITES IN THE NORTHERN NECK AND MIDDLE PENINSULA (FY 2001) AND FALL ZONE (FY 2002), AND MODIFIED DURING FY 2003 WHILE BEING COMBINED WITH ESTABLISHED SITES IN SOUTHEASTERN VIRGINIA
- 3 - WAS PREVIOUSLY DESIGNATED FOR INTERPRETATION REQUIRING RE-EVALUATION, HAS SINCE FALLEN UNDER 4 OR 6 BELOW AND NO LONGER APPEARS IN TABLE OR POINT FEATURE)
- 4 - ESTABLISHED SITES INTERPRETION CHANGED OR ADDED DURING FY 2004
- 5 - SITES NEWLY ESTABLISHED AND INTERPRETED DURING FY 2004
- 6 - EARLIER INTERPRETATION DISCARDED DURING FY 2004 OR SITE OMITTED BECAUSE OF POOR DATA QUALITY
- 7 - BASEMENT CONTROL ONLY

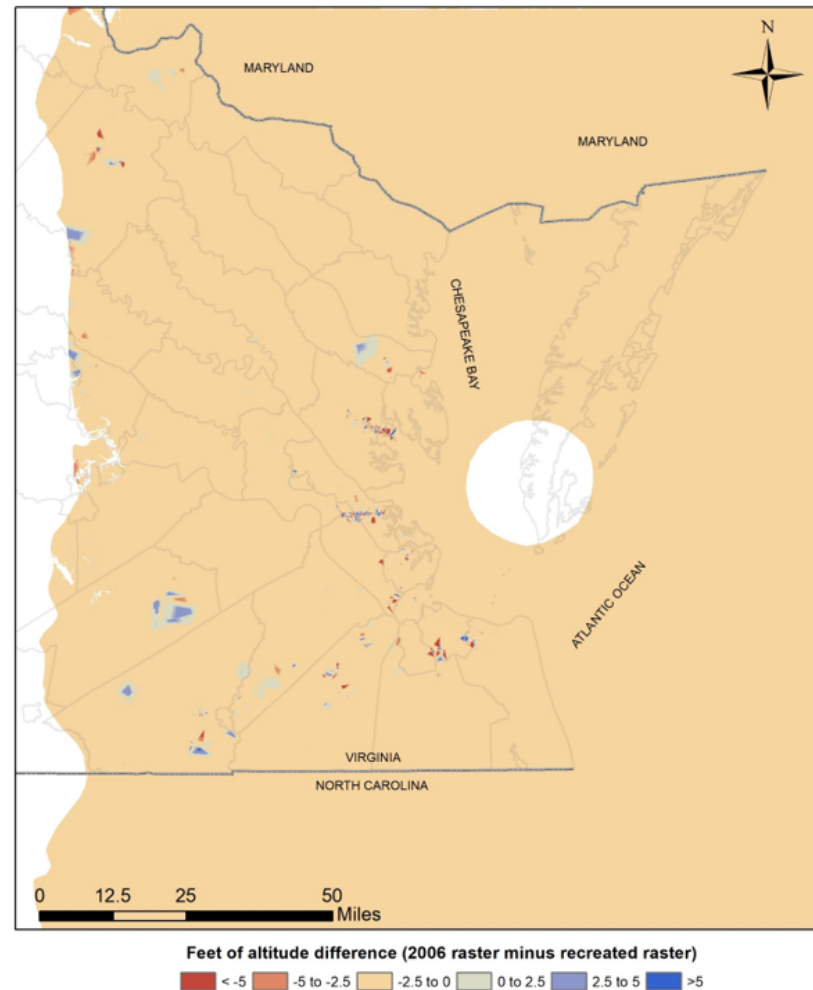
All points with a value of other than 0 or 6 were included in subsequent analyses. The majority of points with a value of 0 are shallow wells solely in the Yorktown-Eastover aquifer in far southeastern Virginia. Among all wells deep enough to reach the Potomac aquifer approximately 30 remain not included because of time constraints, with the majority in Southampton and Isle of Wight Counties.

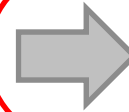
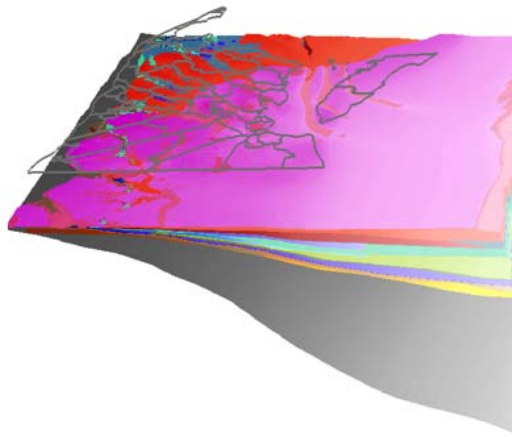
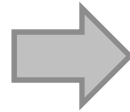
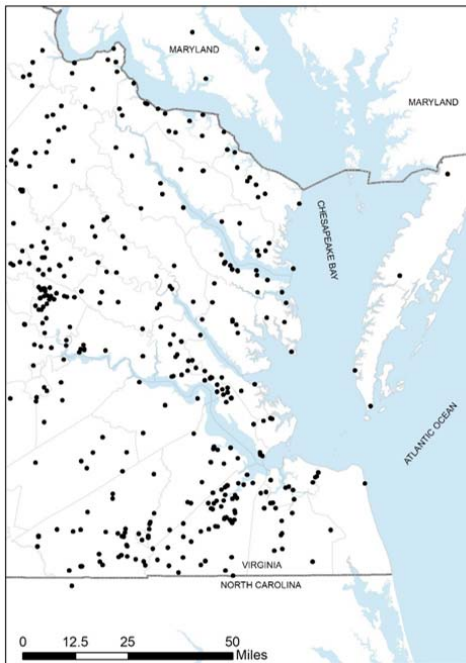
Based on the point elevations, ARC line features were hand digitized to initially delineate top-surface configurations of each hydrogeologic unit along with the basement bedrock. Separate polygon features depicting the estimated extents of the units also were hand digitized. The point, line, and polygon features were developed sequentially during distinct, geographically based phases of investigation including the Northern Neck and Middle Peninsula (2001), Fall Zone (2002), and southeastern Virginia and the York-James Peninsula (2003). A separate interim effort also was undertaken during 2002 to extrapolate the line features into northeastern North Carolina, across the Delmarva Peninsula, and offshore beneath the continental slope, based generally on published information for those areas. During the summer of 2003, features produced during the earlier separate phases were combined to represent the entire Virginia Coastal Plain along with adjacent areas in adjoining states and offshore. The structural-contour line features were augmented with artificial "extender" contours purposefully placed beyond the margins of the hydrogeologic units, so that further refinement of the top surfaces of the units during subsequent analyses could be generated up to the margins.

Subsequent analyses were undertaken during the summer of 2003 to quantitatively depict aerially continuous surfaces representing the top surfaces of the hydrogeologic units and basement bedrock (see following section). Numerical operations performed on each unit were organized and analyzed in ARC Map. During 2004, point data were



- Automated reproduction of original rasters
 - Points & contours -> TIN
 - TIN - > raster
 - Clip raster to originals
 - Adjust using incision surface
 - Adjust for interpolation below lower units
 - Add control points

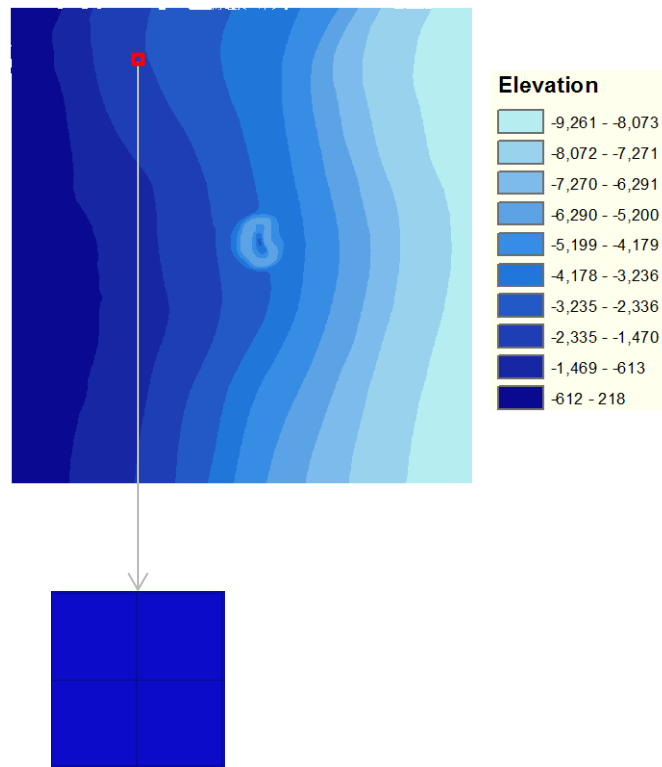




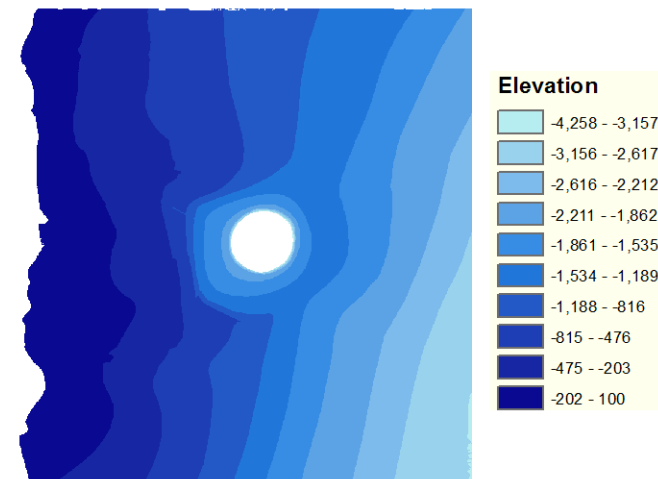
 AQAQ.array	 SMCU.array
 AQAQ_THK.array	 SMCU_THK.array
 CACU.array	 SURF.array
 CACU_THK.array	 SURF_THK.array
 CHCU.array	 UCCU.array
 CHCU_THK.array	 UCCU_THK.array
 NMCU.array	 VBAQ.array
 NMCU_THK.array	 VBAQ_THK.array
 PDAQ.array	 VBCU.array
 PDAQ_THK.array	 VBCU_THK.array
 PDCU.array	 XCAQ.array
 PDCU_THK.array	 XCAQ_THK.array
 POAQ.array	 XMCU.array
 POAQ_THK.array	 XMCU_THK.array
 POCZ.array	 YEAQ.array
 POCZ_THK.array	 YEAQ_THK.array
 PPAQ.array	 YTCZ.array
 PPAQ_THK.array	 YTCZ_THK.array
 SMAQ.array	
 SMAQ_THK.array	



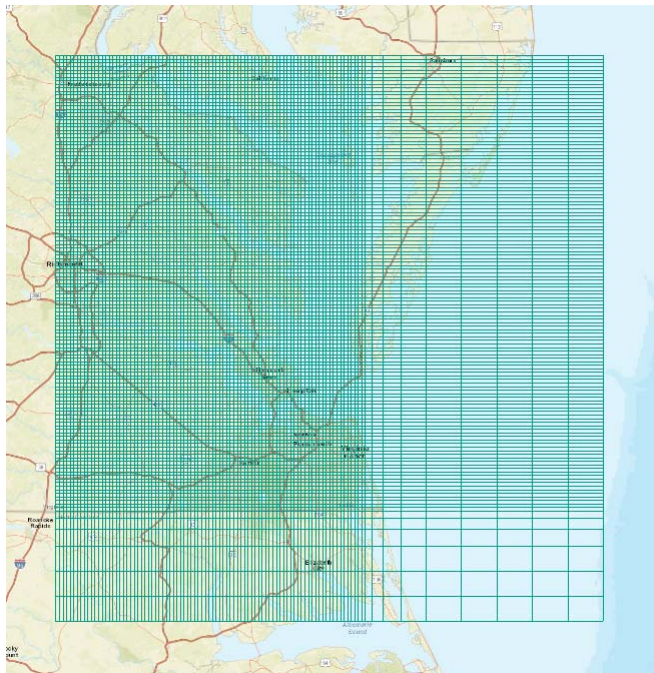
- Basement Raster



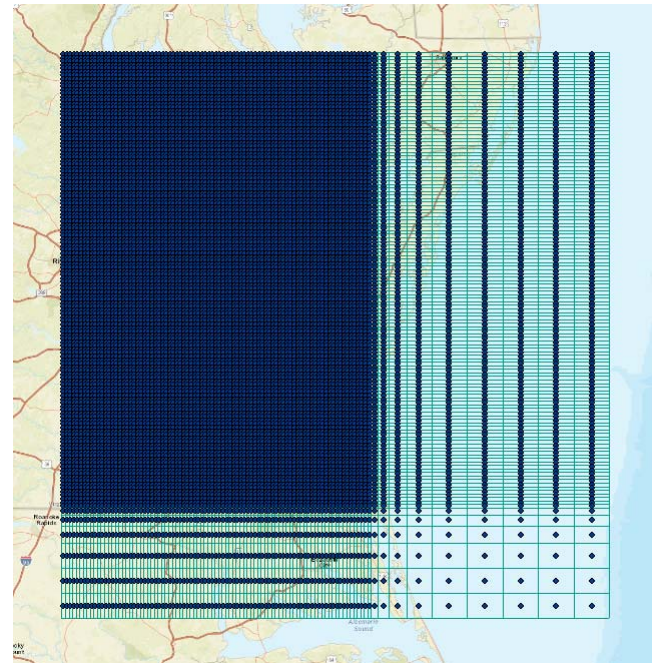
- Potomac Aquifer Raster



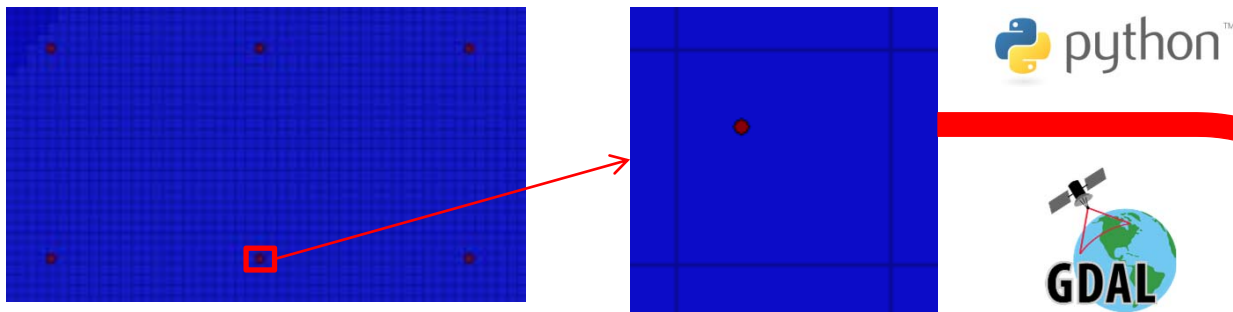
- MODFLOW GRID



- Cell-Center Locations



- Use Python with GDAL (Geospatial Data Abstraction Library) to extract values from raster at Cell-Center Locations to MODFLOW HUF input files.



HUF POAQ Input
File

1	56.	36.	13.	-17.	65.	55.	43.	127.	103.	90.	78.	-26.	-25.	-35.	-40.
2	0.	0.	0.	0.	0.	0.	-1.	-29.	-45.	-55.	-50.	-14.	-30.	-106.	-34.
3	-42.	-50.	-55.	-60.	-64.	-68.	-72.	-76.	-19.	-26.	-32.	-39.	-47.	-57.	-65.
4	-74.	-83.	-91.	-100.	-109.	-118.	-127.	-139.	-150.	-161.	-172.	-182.	-191.	-201.	-210.
5	-218.	-225.	-232.	-240.	-247.	-255.	-263.	-270.	-278.	-286.	-294.	-302.	-313.	-324.	-334.
6	-344.	-355.	-365.	-375.	-385.	-395.	-407.	-421.	-434.	-448.	-462.	-475.	-496.	-553.	-616.
7	-706.	-982.	-1078.	-1174.	-1228.	-1267.									
8	41.	19.	-4.	-50.	70.	60.	150.	131.	-1.	101.	84.	9.	-25.	-35.	-35.
9	-11.	-5.	-13.	0.	-11.	-25.	-50.	-41.	-35.	-28.	-21.	-13.	-21.	-35.	-116.
10	-45.	-52.	-57.	-62.	-67.	-71.	-75.	-15.	-21.	-29.	-35.	-42.	-49.	-56.	-64.
11	-71.	-79.	-88.	-96.	-105.	-116.	-127.	-139.	-150.	-161.	-172.	-183.	-193.	-204.	-213.
12	-221.	-228.	-235.	-242.	-249.	-257.	-265.	-273.	-281.	-289.	-297.	-306.	-317.	-327.	-337.
13	-348.	-358.	-368.	-378.	-388.	-398.	-412.	-426.	-439.	-453.	-467.	-482.	-507.	-558.	-621.
14	-710.	-988.	-1081.	-1177.	-1229.	-1268.									

HUF POAQ
Thickness Input
File

1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	0.	0.	0.	0.	0.	0.	0.	0.	0.	61.	58.	55.	52.	48.	42.
4	56.	68.	82.	93.	97.	98.	100.	98.	98.	98.	98.	98.	100.	101.	102.
5	102.	103.	103.	101.	100.	99.	99.	99.	98.	97.	96.	95.	93.	92.	91.
6	91.	90.	89.	88.	87.	85.	82.	77.	82.	87.	91.	96.	102.	98.	115.
7	133.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
9	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
10	0.	0.	0.	0.	0.	0.	0.	63.	61.	58.	55.	52.	49.	52.	60.
11	69.	80.	90.	102.	104.	103.	102.	100.	99.	99.	98.	98.	99.	99.	101.
12	102.	101.	100.	99.	98.	97.	97.	97.	97.	96.	95.	93.	91.	90.	90.
13	88.	88.	87.	86.	85.	84.	79.	74.	80.	84.	89.	92.	94.	97.	114.
14	134.	0.	0.	0.	0.	0.									



- Framework update progress
 - DEQ evaluations
 - 55 Evaluations - approximately 130 wells w/ >300 contacts
 - USGS Potomac/Piney Point Aquifer Reports
- Recalibration progress
 - Pumping and precipitation updated
 - USGS Piney Point Report – zonation
 - Observation data
 - Recalibration -Boundary condition/hydraulic parameters

