COMMONWEALTH of VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

TECHNICAL EVALUATION FOR PROPOSED GROUNDWATER WITHDRAWAL

Date: January 9, 2024

Application /Permit Number: GW0049201

Owner / Applicant Name: Town of Onancock

Facility / System Name: Town of Onancock Water System

Facility Type: Public Water Supply – Municipal

Facility / System Location: Accomack County

The Commonwealth of Virginia's Groundwater Withdrawal Regulations (9VAC25-610) provide that, for a permit to be issued for a new withdrawal, to expand an existing withdrawal, or reapply for a current withdrawal, a technical evaluation shall be conducted. This report documents the results of the technical evaluation conducted to meet the requirements for the issuance of a permit to withdraw groundwater within a Designated Groundwater Management Area (9VAC25-600).

This evaluation determines the:

(1) The Area of Impact (AOI): The AOI for an aquifer is the areal extent of each aquifer where one foot or more of drawdown is predicted to occur as a result of the proposed withdrawal.
(2) Water Quality: The potential for the proposed withdrawal to cause salt water intrusion into any portion of any aquifers or the movement of waters of lower quality into areas where such movement would result in adverse impacts on existing groundwater users or the groundwater resource.
(3) The Eighty Percent Drawdown (80% Drawdown): The proposed withdrawal in combination with all existing lawful withdrawals will not lower water levels, in any confined aquifer that the withdrawal impacts, below a point that represents 80% of the distance between the land surface and the top of the aquifer at the points where the one-foot drawdown contour is predicted for the proposed withdrawal.

Requested withdrawal amount:

Requested Withdrawal Amount	
Annual Value	120,000,000 (328,767 average gpd)
Monthly Value	10,597,000 (341,838 average gpd)

Summary of Requested Withdrawal:

The Town of Onancock ("Town") water system supplies around 600 residential connections, 125 commercial connections within the Town limits, unmetered municipal connections, the wastewater treatment plant, and water to fire departments for firefighting and fire protection purposes. In addition, Riverside Shore Memorial Hospital was added to the system in 2017. Accomack County is installing a water line connection to the Town's system at a point near the new hospital with plans to supply new and existing users in the Four Corners commercial area with water from the Town. On September 8, 2023, the Town updated and revised the requested withdrawal amounts and justification due to four new development projects expected to be completed during the upcoming 15-year permit term and recently reported withdrawal data trends from 2023.

Requested Apportionment of Withdrawal:
The three wells are used alternately with Well #7 (DEQ Well #100-01015) often having the higher monthly withdrawal. The wells are located within 450 feet of each other. Given this configuration and the wells being constructed within the same aquifer, assigning equal apportionment is requested to represent the withdrawal and to allow operational flexibility.

DEQ Well #	Owner Well #	Aquifer	Percent of Withdrawal
100-01015	Well #7	Middle Yorktown-Eastover	33.3
100-01016	Well #8	Middle Yorktown-Eastover	33.3
100-01017	Well #9	Middle Yorktown-Eastover	33.4

Production Wells:

Identification	Location	Construction	Pump Intake	Source Aquifer
Owner Well Name: Hartman Ave Well #7 DEQ Well Number: 100-01015 MPID: 374225075441401 Hydro ID: 220	Lat: 37° 42' 24.9" Lon: -75° 44' 14.4" Datum: NAD27 Elevation: 19 feet (Datum: NAVD88)	Completion Date: December 5, 2004 Screens (ft/bls): 168.4-198.85 Total Depth (ft/bls): 208.85	153.2 ft. bls	Middle Yorktown-Eastover
Owner Well Name: Hartman Ave Well #8 DEQ Well Number: 100-01016 MPID: 374227075441901 Hydro ID: 221	Lat: 37° 42' 27.1" Lon: -75° 44' 19.1" Datum: NAD27 Elevation: 19 feet (Datum: NAVD88)	Completion Date: January 7, 2005 Screens (ft/bls): 170-200.45 Total Depth (ft/bls): 210.45	153.6 ft. bls	Middle Yorktown-Eastover
Owner Well Name: Hartman Ave Well #9 DEQ Well Number: 100-01017 MPID: 374229075441401 Hydro ID: 222	Lat: 37° 42' 29.3" Lon: -75° 44' 13.9" Datum: NAD27 Elevation: 19 feet (Datum: NAVD88)	Completion Date: January 24, 2005 Screens (ft/bls): 169.4-199.10 Total Depth (ft/bls): 210	153.2 ft. bls	Middle Yorktown-Eastover

Abandoned Well(s):

Identification	Location	Construction	Pump Intake	Source Aquifer
Owner Well Name: Justis Street Well #1 DEQ Well Number: 100-00002 MPID: 374233075443001 Hydro ID: 21	Lat: 37° 42' 33.2" Lon: -75° 44' 30.7" Datum: NAD27 Elevation: 5 feet (Datum: NAVD88)	Completion Date: May 30, 1968 (Abandoned April 11, 2008) Screens (ft/bls): 108-123, 130-145, 168-188 Total Depth (ft/bls): 282	NA	Middle & Upper Yorktown-Eastover
Owner Well Name: Justis Street Well #2 DEQ Well Number: 100-00036 MPID: 374234075443001 Hydro ID: 33	Lat: 37° 42' 34" Lon: -75° 44' 30" Datum: NAD27 Elevation: 22 feet (Datum: NAVD88)	Completion Date: January 7, 1953 (Abandoned April 13, 2008) Screens (ft/bls): 106-110, 110-119, 119-132, 132-138, 138-145, 145-156 Total Depth (ft/bls): 159	NA	Upper Yorktown-Eastover
Owner Well Name: Well #3 DEQ Well Number: 100-00004 MPID: 373735075400001 Hydro ID: 22	Lat: 37° 42' 33" Lon: -75° 44' 30" Datum: NAD27 Elevation: 22 feet (Datum: NAVD88)	Completion Date: January 7, 1953 (Abandoned April 14, 2008) Screens (ft/bls): 106-156 Total Depth (ft/bls): 159	NA	Not Determined
Owner Well Name: Well #4 DEQ Well Number: 100-00037 MPID: 374259075445301 Hydro ID: 34	Lat: 37° 42' 59" Lon: -75° 14' 53" Datum: NAD27 Elevation: 6 feet (Datum: NAVD88)	Completion Date: January 21, 1971 (Abandoned April 20, 2008) Screens (ft/bls): Unknown Total Depth (ft/bls): 177	NA	Not Determined

Owner Well Name: Well #5 DEQ Well Number: 100-00038 MPID: 374259075445302 Hydro ID: 35	Lat: 37° 42' 59" Lon: -75° 44' 54" Datum: NAD27 Elevation: 6 feet (Datum: NAVD88)	Completion Date: January 21, 1971 (Abandoned April 20, 2008) Screens (ft/bls): Unknown Total Depth (ft/bls): 183	NA	Not Determined

Observation Well(s):

Identification	Location	Construction	Pump Intake	Source Aquifer
Owner Well Name: Well #6 OW-1 DEQ Well Number: 100-01014 MPID: 374226075441599 Hydro ID: 219	Lat: 37° 42' 25.9" Lon: -75° 44' 15" Datum: NAD27 Elevation: 19 feet	Completion Date: November 4, 2004 Screens (ft/bls): 158-198 Total Depth (ft/bls): 230	NA	Middle Yorktown-Eastover

Geologic Setting:

The Town of Onancock Water System wells (applicant wells) are located in Accomack County. The production wells are screened in the Middle Yorktown-Eastover aquifer. The upper portion of the Yorktown-Eastover aquifer (described in the 2006 Virginia Coastal Plain Hydrologic Framework[1] (VCPHF) as a combination of the Upper, Middle, and Lower Yorktown-Eastover aquifers) is composed primarily of estuarine to marine quartz sands of the Yorktown Formation of Pliocene age. The nearest USGS geologic cross section found in the USGS Scientific Investigations Report 2019-5093 is cross-section A-A' (see attached figure at the end of the report) [2].

Virginia Eastern Shore Model data:

The following table lists the locations of the applicant production wells within the Virginia Eastern Shore Model[3] (VAHydroGW-ES).

VAHydroGW-ES Model Grid					
Well	**Hydro ID**	**Well Number**	**MPID**	**Row**	**Column**
Well #7	220	100-01015	374225075441401	143	35
Well #8	221	100-01016	374227075441901	143	35
Well #9	222	100-01017	374229075441401	142	35

[1] McFarland, E.R., and Bruce, T.S., 2006, The Virginia Coastal Plain Hydrogeologic Framework: U.S. Geological Survey Professional Paper 1731, 118 p., 25 pls.

[2] McFarland, E.R., and Beach, T.A., 2019, Hydrogeologic framework of the Virginia Eastern Shore: U.S. Geological Survey Scientific Investigations Report 2019-5093, 26 p., 13 pl., https://doi.org/10.3133/sir20195093.

[3] Sanford, W.E., Pope, J.P., and Nelms, D.L., 2009, Simulation of groundwater-level and salinity changes in the Eastern Shore, Virginia: U.S. Geological Survey Scientific Investigations Report 2009–5066, 125 p.

Hydrologic Framework:
Data from the VCPHF is reported in this technical report to illustrate the hydrogeologic characteristics of the aquifers in the Virginia Eastern Shore near the applicant wells and identify major discrepancies between regional hydrogeology and site logs interpreted by the DEQ.

The following average aquifer elevations were estimated from the VAHydroGW-ES at the model cells containing the applicant production wells.

VAHydroGW-ES Average Hydrologic Unit Information		
Aquifer	**Elevation (feet msl)**	**Depth (feet bls)**
Surface	19.3	0
Columbia aquifer (bottom)	-19	38
Upper Yorktown-Eastover aquifer (top)	-83	102
Upper Yorktown-Eastover aquifer (bottom)	-130	149
Middle Yorktown-Eastover aquifer (top)	-144	164
Middle Yorktown-Eastover aquifer (bottom)	-188	207
Lower Yorktown-Eastover aquifer (top)	-224	243
Lower Yorktown-Eastover aquifer (bottom)	-275	295

Groundwater Characterization Program Recommendations:
DEQ staff reviewed available information and made the following determinations regarding the location of the aquifer tops for the following wells. Information reviewed in this process included geophysical logs, GW-2 forms, and the Eastern Shore: Hydrogeologic Framework of the Virginia Eastern Shore (USGS Scientific Investigations Report 2019-5093).

Unit	Well #7 (ft/bls)	Well #8 (ft/bls)	Well #9 (ft/bls)
Middle Yorktown-Eastover Top	160	170	165
Middle Yorktown-Eastover Bottom	200	210	200

Comparison of the Hydrogeologic Framework and Groundwater Characterization Program Recommendations:
The average top elevation of the Middle Yorktown-Eastover aquifer obtained from the VAHydroGW-ES framework of 102 ft-bls is 63 feet higher than, but in general agreement with, the average value provided by the DEQ of 165 ft-bls. The average bottom elevation of the Middle Yorktown-Eastover aquifer obtained from the VAHydroGW-ES framework of 207 ft-bls is 3.6 feet higher than, but also in general agreement with, the average value provided by the DEQ of 203.3 ft-bls.

Water Level Comparison:
Below water levels retrieved from the USGS regional observation network wells are compared to the simulated water levels reported in the *Virginia Eastern Shore Model (VAHydroGW-ES) 2022-2023 Simulation of Potentiometric Groundwater Surface Elevations of Reported and Total Permitted Use* report (the 2022-2023 report) and simulation files.[4] This comparison is made in order to evaluate the

[4] See *Virginia Eastern Shore Model 2022-2023 Simulation of Potentiometric Groundwater Surface Elevations of Reported and Total Permitted Use* report and simulation files on file with the VA DEQ.

performance of the regional model in the vicinity of the applicant wells and assess historical groundwater trends.

The 2022-2023 report provides two sets of simulated potentiometric water surface elevations. The VAHydroGW-ES model is divided into three parts. The first portion of the model simulates water levels within the Eastern Shore aquifers from 1900 through 2022 based upon historically reported pumping amounts (the "*Historic Use Simulation*"). This portion of the model has been calibrated to match water levels observed in USGS regional observation network wells situated throughout the peninsula. The water levels reported in the 2022-2023 report are based upon two separate simulations, each simulation running from 2021 through 2072. The simulated pumping amount in these two simulations are based upon, 1) the average 2018-2022 reported withdrawal amount of wells in the VAHydroGW-ES model (the "R*eported Use Simulation*") and, 2) the current (2023) maximum withdrawal amount allowed under their current permit for wells in the VAHydroGW-ES model (the "*Total Permitted Simulation*"). Both these simulations are an extension of the *Historic Use Simulation* and the water levels reported in the 2022-2023 report are the final water levels simulated at the end of the simulations (2072).

The "VAHydroGW-ES 2072 Reported Use Water Level," reported in the tables below, is the simulated water level – 50 years from present – if all permitted pumping continued at the average 2018-2022 reported withdrawal amount for the next 50 years. The "VAHydroGW-ES 2072 Total Permitted Water Level," reported in the tables below, is the simulated water level – 50 years from present – if all Eastern Shore permitted wells were to pump at the maximum permitted amount allowed under their current permit for the next 50 years. Finally, the "VAHydroGW-ES 2022 Historic Use Water Level," reported in the tables below, is the water level simulated for the year 2022 in the *Historic Use Simulation*.

The nearest USGS regional observation network wells to the applicant wells completed in the Middle Yorktown-Eastover aquifer are listed in the following tables and shown in Figure 1. For the USGS regional observation network wells, average 2022 reported water levels are shown in the following tables. Simulated water levels for the Middle Yorktown-Eastover aquifer for the VAHydroGW-ES cells containing the USGS regional observation network wells are also shown in the following tables.

Comparing the VAHydroGW-ES 2022 Historic Use Water Level with the USGS Network Well 2022 Water Level provides a method for judging the accuracy of the VAHydroGW-ES. Figures 2 and 3 show graphs of the recorded water levels from the USGS observation wells listed in the following tables. These figures also show the simulated VAHydroGW-ES *Historic Use Simulation* water levels for the model cell containing each USGS well. Observing the simulated and observed water elevations together provides a second method for assessing the accuracy of the VAHydroGW-ES in the vicinity of the applicant wells.

The VAHydroGW-ES Reported Use simulated water level elevations are in general agreement with the water levels observed in the USGS regional observation network Well 66K 3 SOW 101B screened in the Middle Yorktown-Eastover aquifer.

The VAHydroGW-ES Reported Use water levels are within a few feet of the USGS regional observation network Well 64K 12 SOW 108C (also screened in the Middle Yorktown-Eastover aquifer) until around 2000 when the USGS observed water levels decrease steadily while the Reported Use water levels remain steady. By 2022 the Reported Use water levels are about 20 feet higher than the USGS Well 64K 12 SOW 108C observed water levels.

Both of the USGS regional observation wells exhibit yearly fluctuations in water levels of approximately 2 to 10 feet. Water levels simulated by the VAHydroGW-ES do not fluctuate in the same manner because the pumping and recharge simulated in the model for any given year are averaged over the year and entered in

the model as the average value for the year. Water levels for both wells are in general agreement with the water level simulated by the VAHydroGW-ES.

Middle Yorktown-Eastover Aquifer Measurements	66K 3 SOW 101B	64K 12 SOW 108C
Distance from applicant wells (miles)	6.7	3.8
VAHydroGW-ES Row	122	161
VAHydroGW-ES Column	65	38
VAHydroGW-ES Land Surface Elevation (ft-msl)	10	44
USGS Well Land Surface Elevation (ft-msl)	8	47
USGS Network 2022 Water Level (ft-msl)	-0.4	9.2
VAHydroGW-ES 2022 Reported Use Water Level (ft-msl)	0.6	22.5
VAHydroGW-ES 2072 Reported Use Water Level (ft-msl)	0.6	22.4
VAHydroGW-ES 2072 Total Permitted Water Level (ft-msl)	0.0	19.2

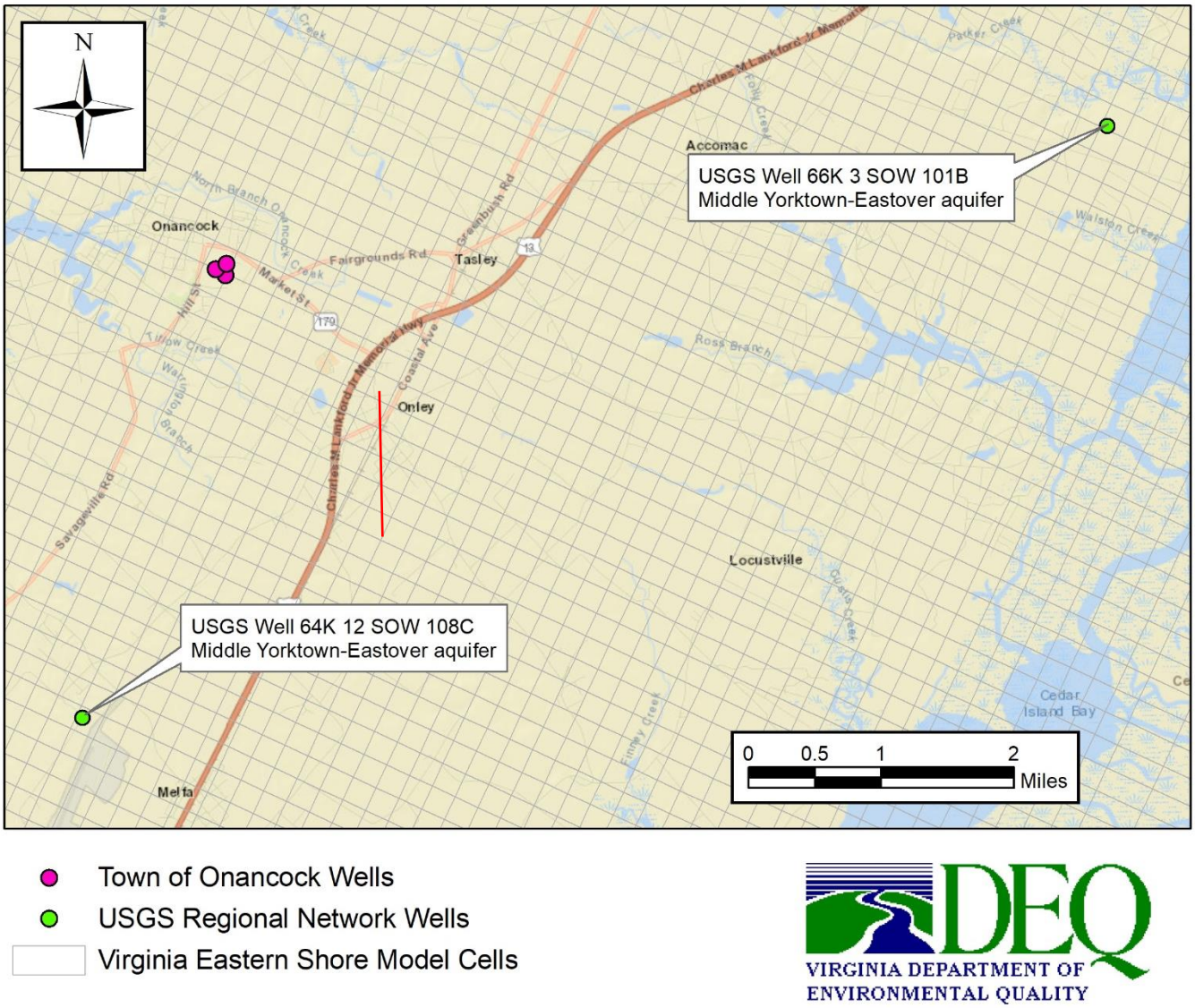


Figure 1. Nearest USGS regional observation network wells.

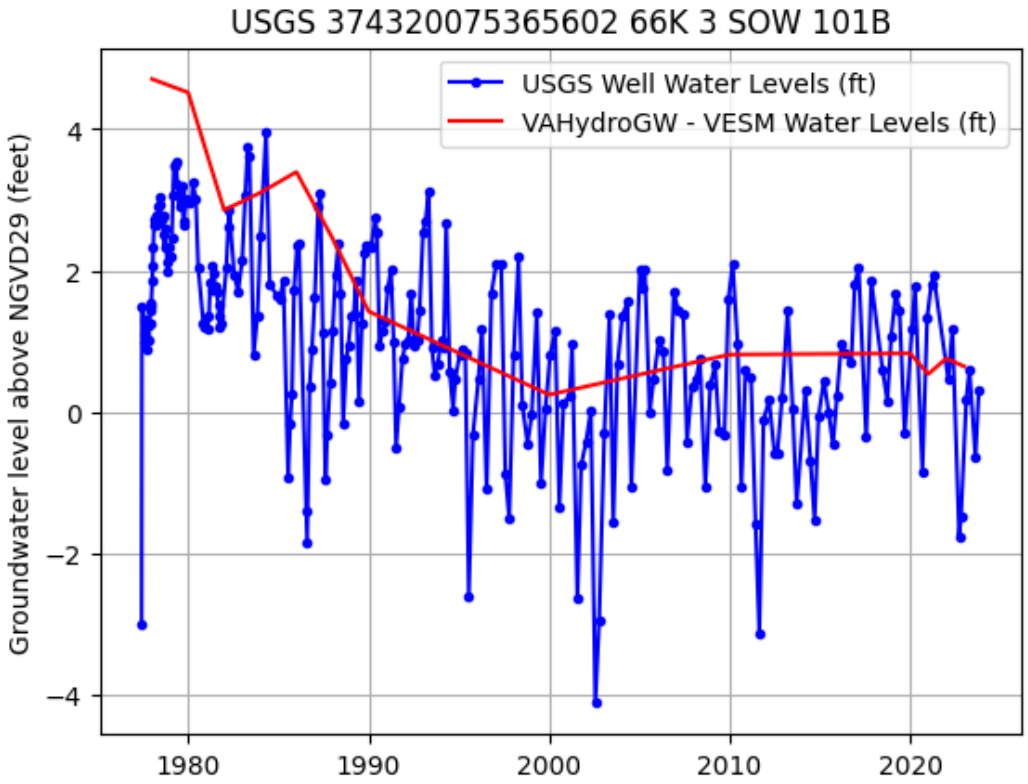


Figure 2. USGS Regional Observation Well 66K 3 SOW 101B, Middle Yorktown-Eastover aquifer water level recorded from 1977 to present (well depth 222 ft bls, land surface 8 ft msl).

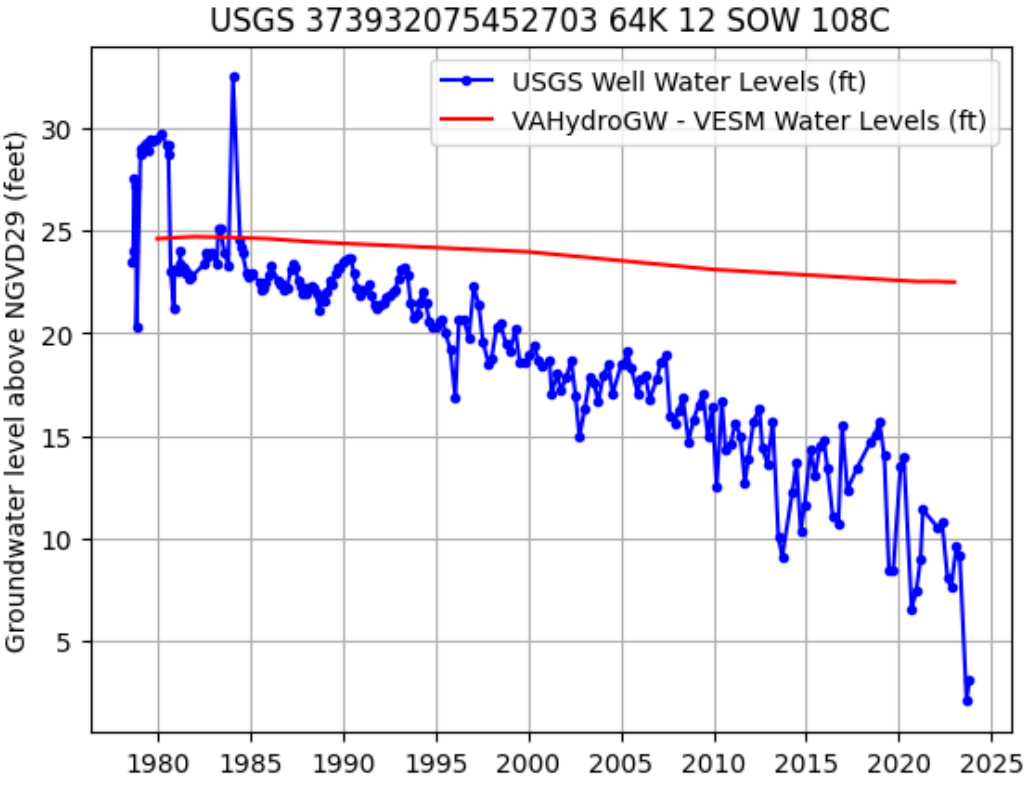


Figure 3. USGS Regional Observation Well 64K 12 SOW 108C, Middle Yorktown-Eastover aquifer water level recorded from 1978 to present (well depth 284 ft bls, land surface 47 ft msl).

Aquifer Test(s):
An aquifer test was conducted at this site after the installation of Hartman Avenue wells (100-01015, 100-01016, and 100-01017). An observation well (100-01014) was constructed 50.25 feet from the production well (100-01015) in the source aquifer. Drawdown during 24-hours of continuous pumping, at a rate of 150 gpm, was monitored in the production well, observation well, and the other two remaining Hartman Avenue wells. Recovery was also measured in the same wells for 8 hours after pumping had ceased. Unfortunately, the existing production wells were pumping during the test causing background interference that was not addressed during the test and a transducer error occurred for the observation well. DEQ staff made a number of efforts to correct the data but could not obtain values that fit the observed drawdown or appeared to be realistic.

The following table provides the average hydrogeologic properties assigned to the VAHydroGW-ES cells containing the applicant wells.

Virginia Eastern Shore Model Hydrogeologic Properties							
Aquifer	**Top Elevation (feet msl)**	**Top Elevation (feet bls)**	**Aquifer Thickness (feet)**	**Horizontal Conductivity (feet/day)**	**Vertical Conductivity (feet/day)**	**Specific Storage (1/feet)**	**Specific Yield**
Columbia	19	0	38	60	0.5	0.00001	0.15
Upper Yorktown-Eastover	-83	102	47	2	1.5	0.000004	N/A
Middle Yorktown-Eastover	-144	164	43	12	14.3	0.000004	N/A
Lower Yorktown-Eastover	-224	243	51	5	3.9	0.000004	N/A

Model Results

Evaluation of Withdrawal Impacts:
The VAHydroGW-ES model was used to simulate the effects resulting from the proposed withdrawal due to the multi-aquifer impacts. The stabilized effects resulting from the proposed withdrawal were simulated using an annual withdrawal rate of 120,000,000 gallons per year (328,767 average gpd). The stabilized effects were simulated by replacing the reported use amounts in the 2022 VAHydroGW-ES Reported Use Simulation with the current maximum annual withdrawal limit allowed under the terms of their permit for all Ground Water Management Area (GWMA) permit holders. That same simulation was executed twice, once with the proposed withdrawal removed (the *baseline simulation*), and once with the proposed withdrawal added (the *proposed withdrawal simulation*). The stabilized effects of the proposed withdrawal were considered by simulating both simulations for 50 years and observing the difference in water potentiometric levels at the end of the simulations.

Area of Impact:
The area of impact (AOI) for an aquifer is the area where the additional drawdown due to the proposed withdrawal exceeds one foot. The results of the VAHydroGW-ES simulations, outlined in the preceding section, predict areas of impact in the Upper, Middle, and Lower Yorktown-Eastover aquifers. The AOI areas extend a maximum distance of approximately 3.1, 3.2, and 3.2 miles from the production center for Upper, Middle, and Lower Yorktown-Eastover aquifers, respectively. These areas are shown in the accompanying maps at the end of this report. The existing permitted wells located within the applicant's AOIs are listed in the accompanying tables.

80 % Drawdown:
The 80% drawdown criterion was evaluated for all impacted, confined aquifers in the Virginia Eastern Shore using the VAHydroGW-ES *proposed withdrawal simulation*. The elevations of the top of the Upper, Middle, and Lower Yorktown-Eastover aquifers at the VAHydroGW-ES cell simulating the greatest

drawdown (row 143, column 35) are -83, -144, and -224 feet msl, respectively. Based on the results of the *proposed withdrawal simulation* the predicted potentiometric water levels at the same VAHydroGW-ES cell are 4.6, -14.7, and 3.4 feet msl for the Upper, Middle, and Lower Yorktown-Eastover aquifers, respectively. The 80% drawdown criterion allows the potentiometric water level (based on the critical surface elevation calculated from the VAHydroGW-ES data) to be reduced to -62.6, -111.4, and -175.4 feet msl in the Upper, Middle, and Lower Yorktown-Eastover aquifers, respectively. Therefore, the water levels in the VAHydroGW-ES cells containing the applicant wells for each confined aquifer are not simulated to fall below the critical surface. Additionally, the AOIs for the Upper, Middle, and Lower Yorktown-Eastover aquifers do not intersect or contain any existing critical cells and no new VAHydroGW-ES cells are simulated to have water levels fall below the critical surface. Therefore, this withdrawal is within the limits set by the 80% drawdown criterion.

Water Quality:

The EPA has established the National Secondary Drinking Water Regulations (NSDWRs) which are non-enforceable guidelines regulating contaminants that may cause cosmetic or aesthetic (such as taste, odor, or color) effects in drinking water. The EPA recommends the secondary standards to water systems – states may choose to adopt them as enforceable standards. The EPA NSDWRs specify the limit on chloride as 250 mg/L.

The VAHydroGW-ES was created "to help the Commonwealth and local water managers better plan water use and estimate future changes in water and salinity levels in response to changes in water use."[5] Use of the model to predict future chloride concentrations results in a "general useful understanding of system behavior, but water-resource managers must be careful in trusting the accuracy of predictions at individual wells from a regional model."[6] Further, chloride concentrations at individual wells, predicted using the regional model, should not be relied upon to predict actual concentrations at those locations.

The potential for adverse changes to water quality due to the requested withdrawal was evaluated using transient, density-dependent, SEAWAT simulations using the VAHydroGW-ES. Two simulations were executed – one simulation without the proposed withdrawal included and a second with the proposed withdrawal included. Both simulations were executed for 50 years. Both used the 2023 total permitted stresses, concentrations, and heads as starting conditions. In an effort to simulate the long-term effects on water quality due to the proposed withdrawal, the total annual amount of 120,000,000 gallons per year (328,767 average gallons per day) was used for the duration of the second simulation. The two simulations were compared to evaluate the potential for adverse changes to water quality. The results indicated that one model cell representing the Upper Yorktown-Eastover confining unit simulates an increase in chloride concentrations greater than 250 mg/L due to the proposed withdrawal. Additionally, 15 model cells representing the Upper Yorktown-Eastover confining unit, 2 model cells representing the Middle Yorktown-Eastover confining unit, and 6 model cells representing the Middle Yorktown-Eastover aquifer simulate an increase in chloride concentrations greater than 100 mg/L due to the proposed withdrawal. Additionally, many cells in the Upper Yorktown-Eastover confining unit, Upper Yorktown-Eastover aquifer, Middle Yorktown-Eastover confining unit, and Middle Yorktown-Eastover aquifer simulate an increase in chloride concentrations greater than 50 mg/L due to the proposed withdrawal (see figures at the end of this report). As a result, the VAHydroGW-ES model results establish a potential for adverse changes to water quality as a result of the proposed withdrawal.

[5] Sanford, W.E., Pope, J.P., and Nelms, D.L., 2009, Simulation of groundwater-level and salinity changes in the Eastern Shore, Virginia: U.S. Geological Survey Scientific Investigations Report 2009–5066, 125 p.

[6] Sanford, W.E. and Pope, J.P., 2009, Current challenges using models to forecast seawater intrusion: lessons from the Eastern Shore of Virginia, USA. Hydrogeology Journal (2009), Volume: 18, Issue: 1, p: 73-93

The first year when simulated chloride concentration increase is 50 mg/L or more within each AOI is shown in the following table.

Aquifer	First year when simulated concentration increase is 50 mg/L or greater within AOI
Upper Yorktown-Eastover Aquifer	2049
Middle Yorktown-Eastover Aquifer	2045
Lower Yorktown-Eastover Aquifer	N/A

Upconing:
The reversal of vertical flow between two confined aquifers so that the underlying aquifer begins to flow upward into the layer above is called upconing. Upconing is predicted when the modeled head in the upper layer drops below the head in the lower layer directly beneath the referenced head. Upconing has the potential to degrade water quality when the contributing area of the lower aquifer is of a poorer quality than that in the receiving aquifer. The predicted water level in the Middle Yorktown-Eastover aquifer for the VAHydroGW-ES cells containing the applicant wells is simulated to fall below the simulated water level for the Lower Yorktown-Eastover aquifer. This indicates, based upon VAHydroGW-ES results, the potential for upconing of the potentially more brackish Lower Yorktown-Eastover waters into the overlying Middle Yorktown-Eastover source aquifer. Consequently, the model results do establish a potential for adverse changes to water quality due to an influx of more saline waters in the general vicinity of the withdrawal as a result of the proposed pumping.

Conclusion:
The withdrawal requested by Town of Onancock for Town of Onancock Water System satisfies the technical evaluation criteria for permit issuance. The AOIs for the Upper, Middle, and Lower Yorktown-Eastover aquifers are shown in the following maps. Modeling results do establish a potential for adverse changes to water quality due to simulated chloride concentration increases as a result of the proposed pumping. Additionally, the VAHydroGW-ES model results establish potential for upconing of the potentially more saline waters of the Lower Yorktown-Eastover aquifer into the Middle Yorktown-Eastover source aquifer.

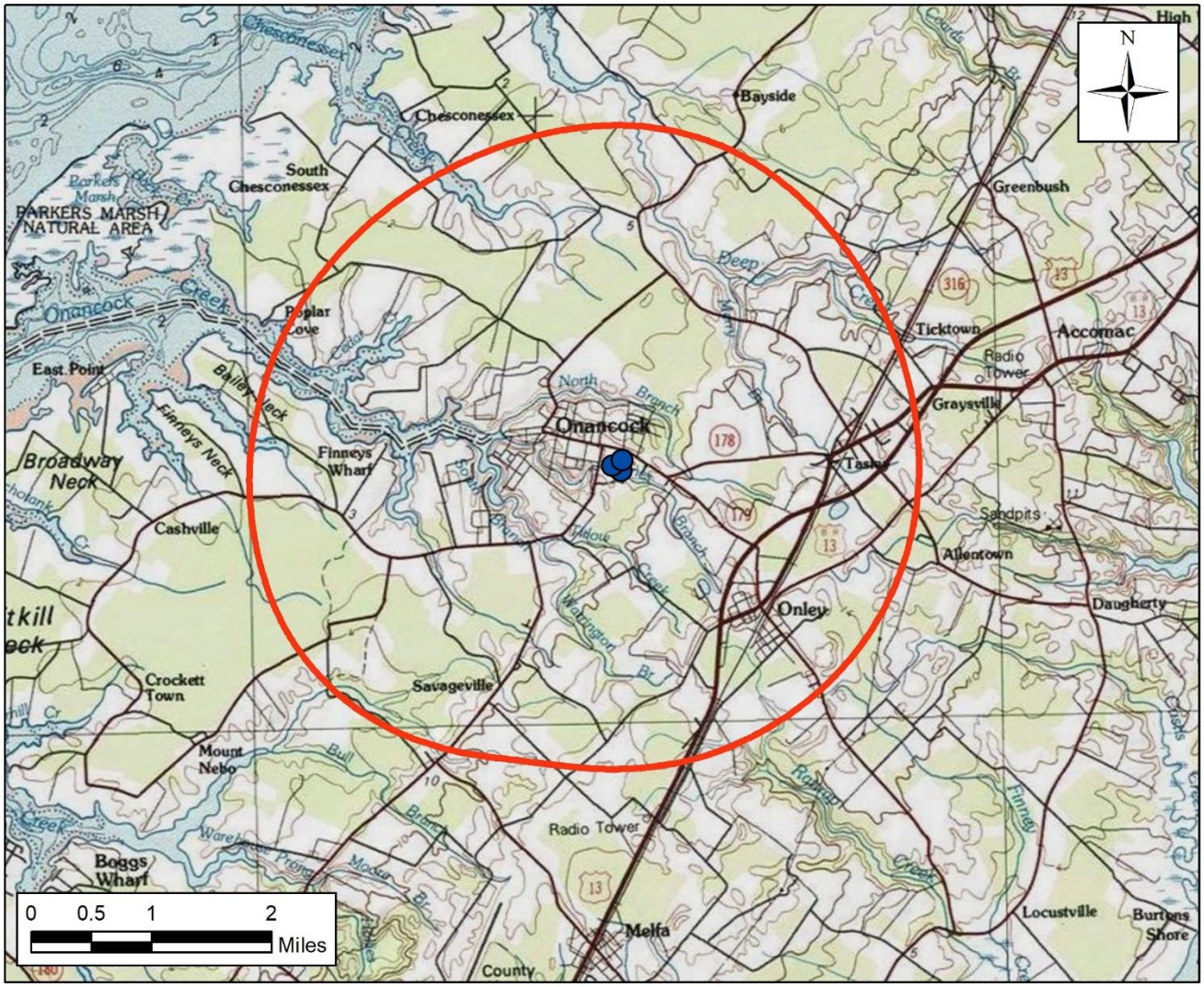
Upper Yorktown-Eastover Aquifer - Existing Permittees within the Town of Onancock AOI

Permittee	Permit	Well	Latitude	Longitude
Richard F Hall III	GW0063100	100-00960	37.688625	-75.738056
	GW0063100	100-00961	37.691114	-75.729747
	GW0063100	100-00962	37.688628	-75.751394

Middle Yorktown-Eastover Aquifer - Existing Permittees within the Town of Onancock AOI

Permittee	Permit	Well	Latitude	Longitude
Del Monte Fresh Production Inc	GW0063800	100-00984	37.682239	-75.700847

Town of Onancock
Area of Impact - Upper Yorktown-Eastover Aquifer



Town of Onancock Wells

Upper Yorktown-Eastover Area of Impact

Simulated drawdown at or exceeding one foot in the Upper Yorktown-Eastover aquifer resulting from a 120,000,000 gallons per year (328,767 average gpd), 50 year withdrawal from the Middle Yorktown-Eastover aquifer using the VAHydroGW-ES.

Maximum radius of one foot drawdown (Area of Impact) extends approximately 3.1 miles from the pumping center.

Technical evaluation performed by Aquaveo, LLC for the Virginia DEQ, Office of Water Supply
January 9, 2024

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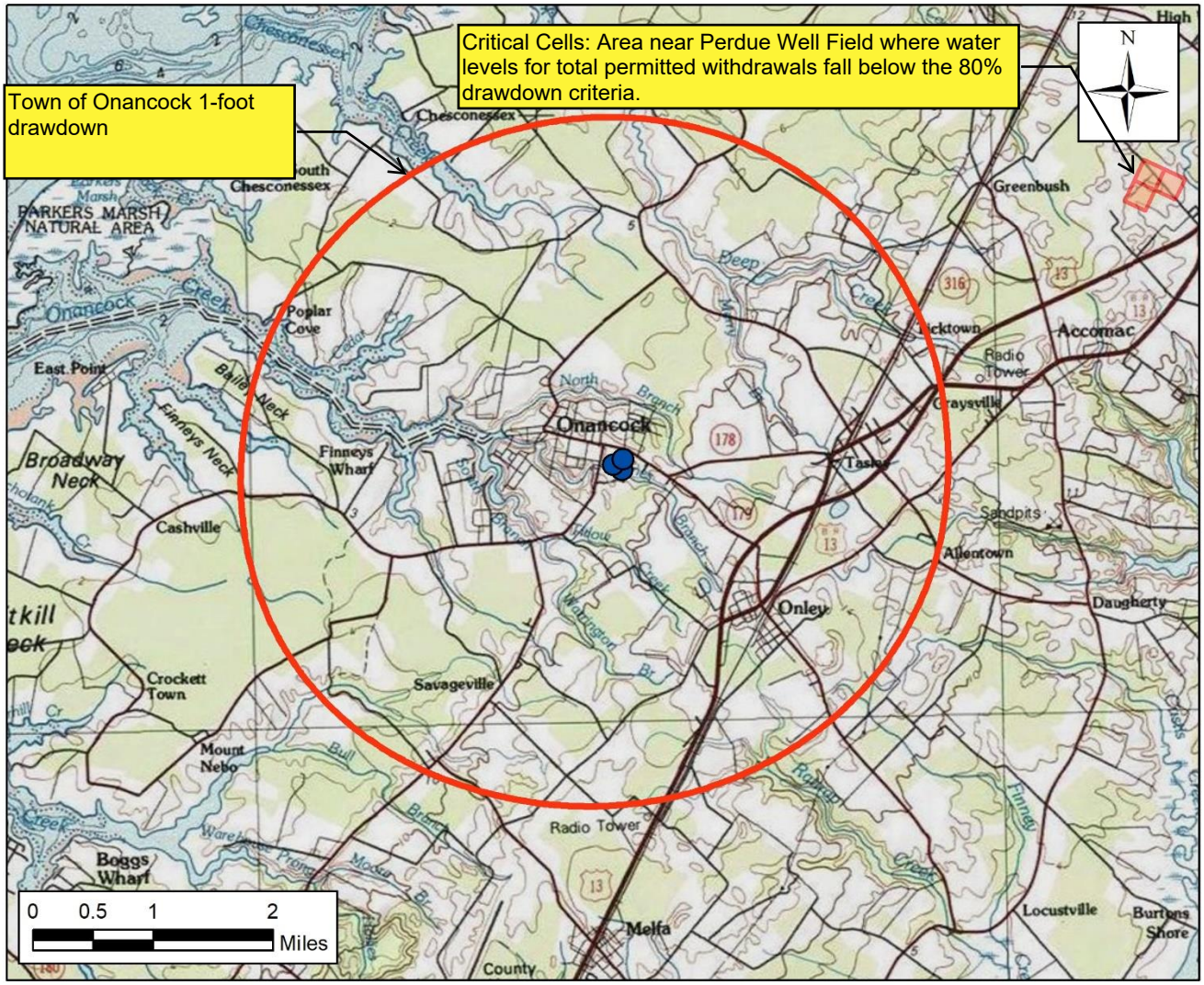
Town of Onancock
Area of Impact - Middle Yorktown-Eastover Aquifer



Town of Onancock Wells

Middle Yorktown-Eastover Area of Impact

MYE Aquifer Critical Cells

Simulated drawdown at or exceeding one foot in the Middle Yorktown-Eastover aquifer resulting from a 120,000,000 gallons per year (328,767 average gpd), 50 year withdrawal from the Middle Yorktown-Eastover aquifer using the VAHydroGW-ES.

Maximum radius of one foot drawdown (Area of Impact) extends approximately 3.2 miles from the pumping center.

Technical evaluation performed by Aquaveo, LLC for the Virginia DEQ, Office of Water Supply
January 9, 2024

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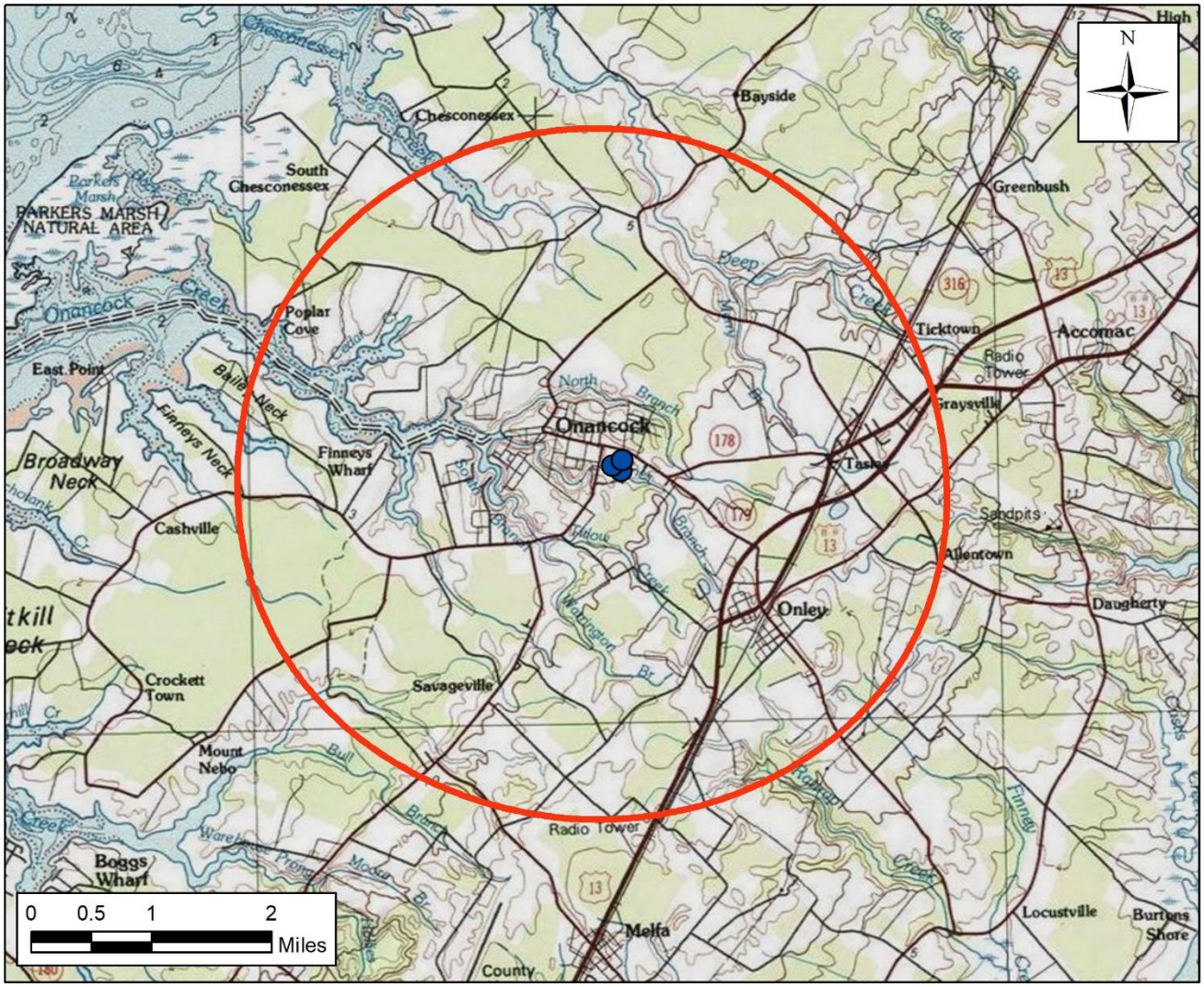
Town of Onancock
Area of Impact - Lower Yorktown-Eastover Aquifer



Town of Onancock Wells

Lower Yorktown-Eastover Area of Impact

Simulated drawdown at or exceeding one foot in the Lower Yorktown-Eastover aquifer resulting from a 120,000,000 gallons per year (328,767 average gpd), 50 year withdrawal from the Middle Yorktown-Eastover aquifer using the VAHydroGW-ES.

Maximum radius of one foot drawdown (Area of Impact) extends approximately 3.2 miles from the pumping center.

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January 9, 2024

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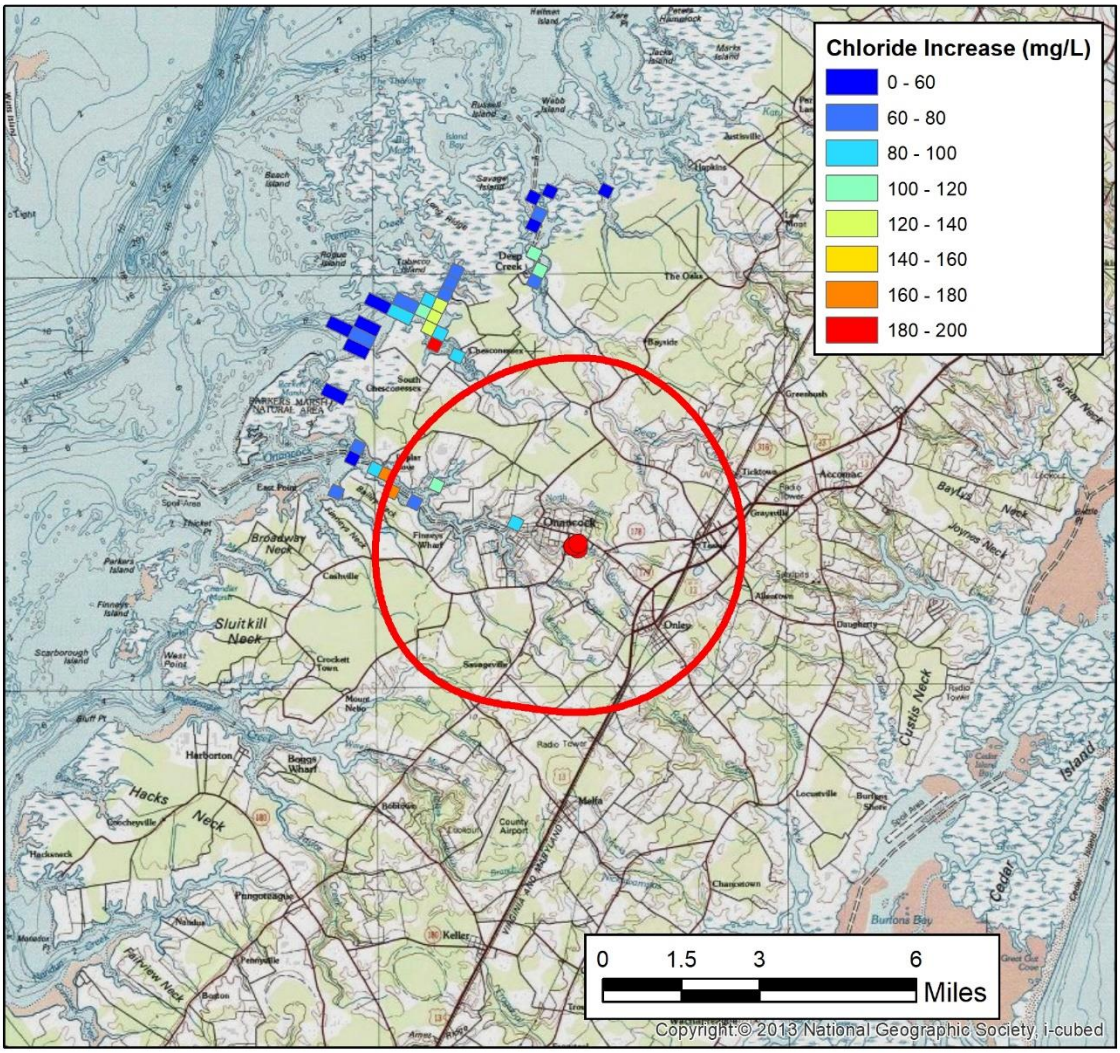
Town of Onancock-
Upper Yorktown-Eastover Confining Unit - Simulated VESM Chloride Concentration Increase



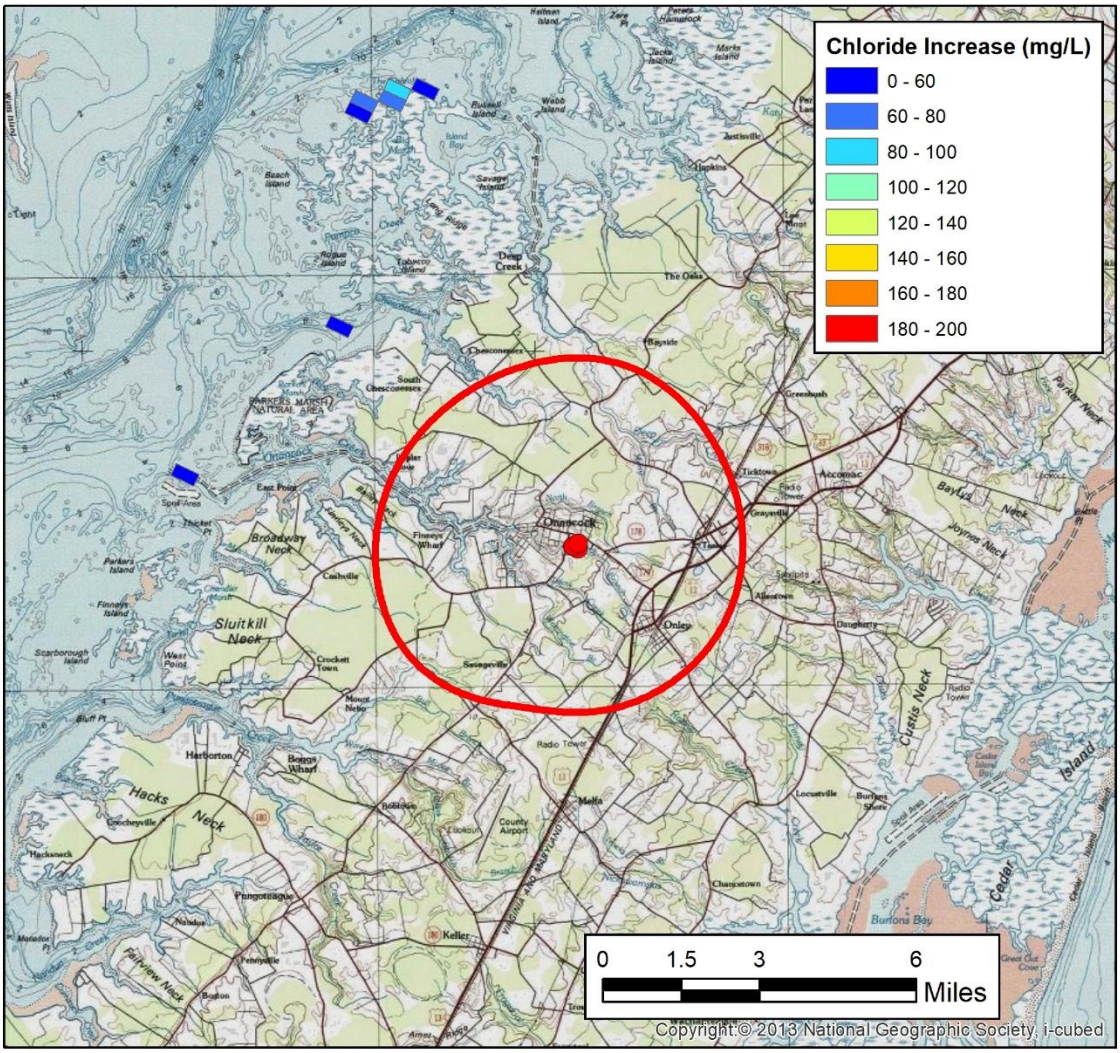
- Town of Onancock Wells
- Upper Yorktown-Eastover Aquifer AOI

Simulated chloride concentration increase in the Upper Yorktown-Eastover confining unit resulting from a 50 year simulation of 120,000,000 gallons per year from the Middle Yorktown-Eastover aquifer.

Technical Evaluation performed by Aquaveo, LLC for the Virginia DEQ, Office of Water Supply
January 9, 2024

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Town of Onancock- Upper Yorktown-Eastover Aquifer - Simulated VESM Chloride Concentration Increase



Town of Onancock Wells

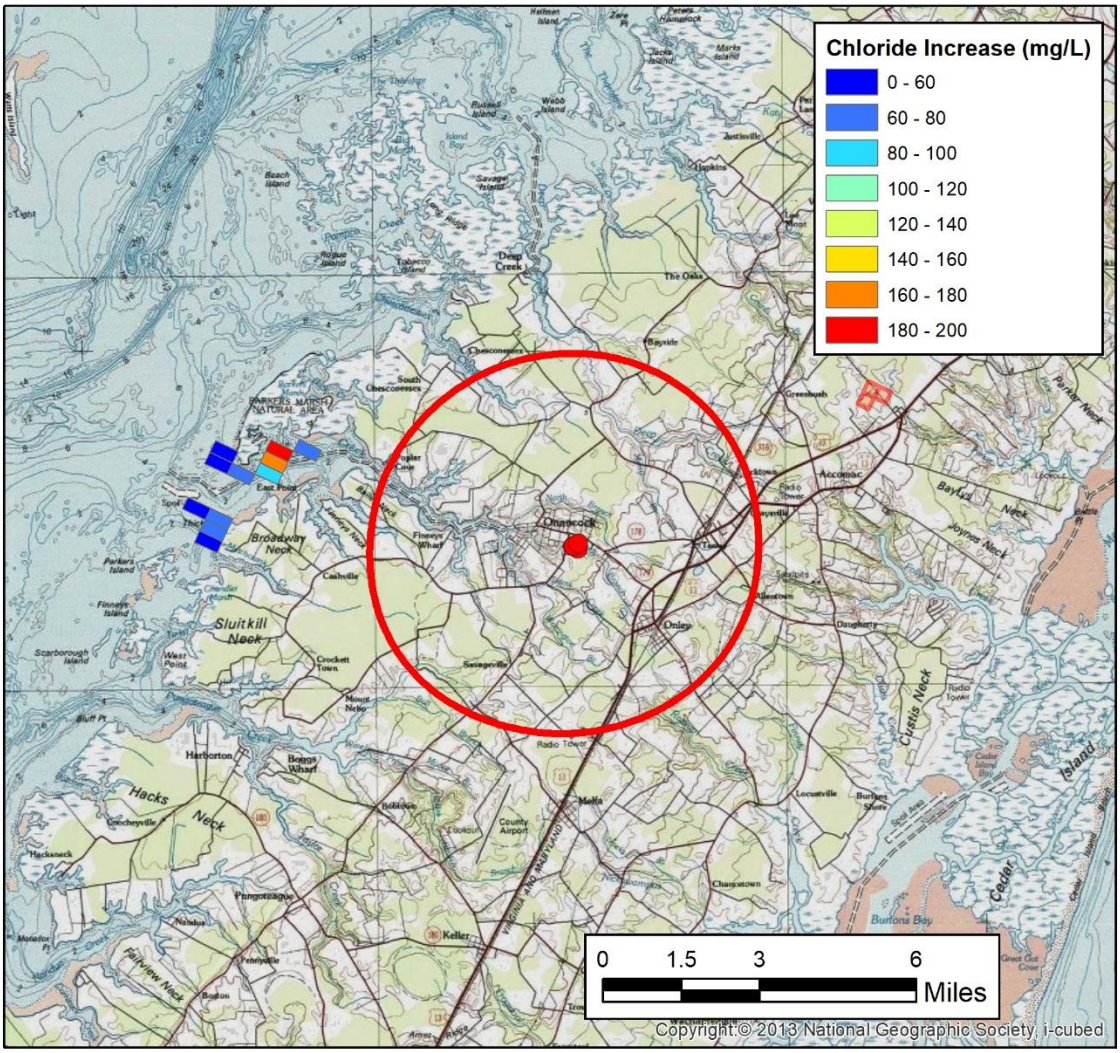
Upper Yorktown-Eastover Aquifer AOI

Simulated chloride concentration increase in the Upper Yorktown-Eastover aquifer resulting from a 50 year simulation of 120,000,000 gallons per year from the Middle Yorktown-Eastover aquifer.

Technical Evaluation performed by Aquaveo, LLC for the Virginia DEQ, Office of Water Supply
January 9, 2024

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Town of Onancock-
Middle Yorktown-Eastover Confining Unit-
Simulated VESM Chloride
Concentration Increase



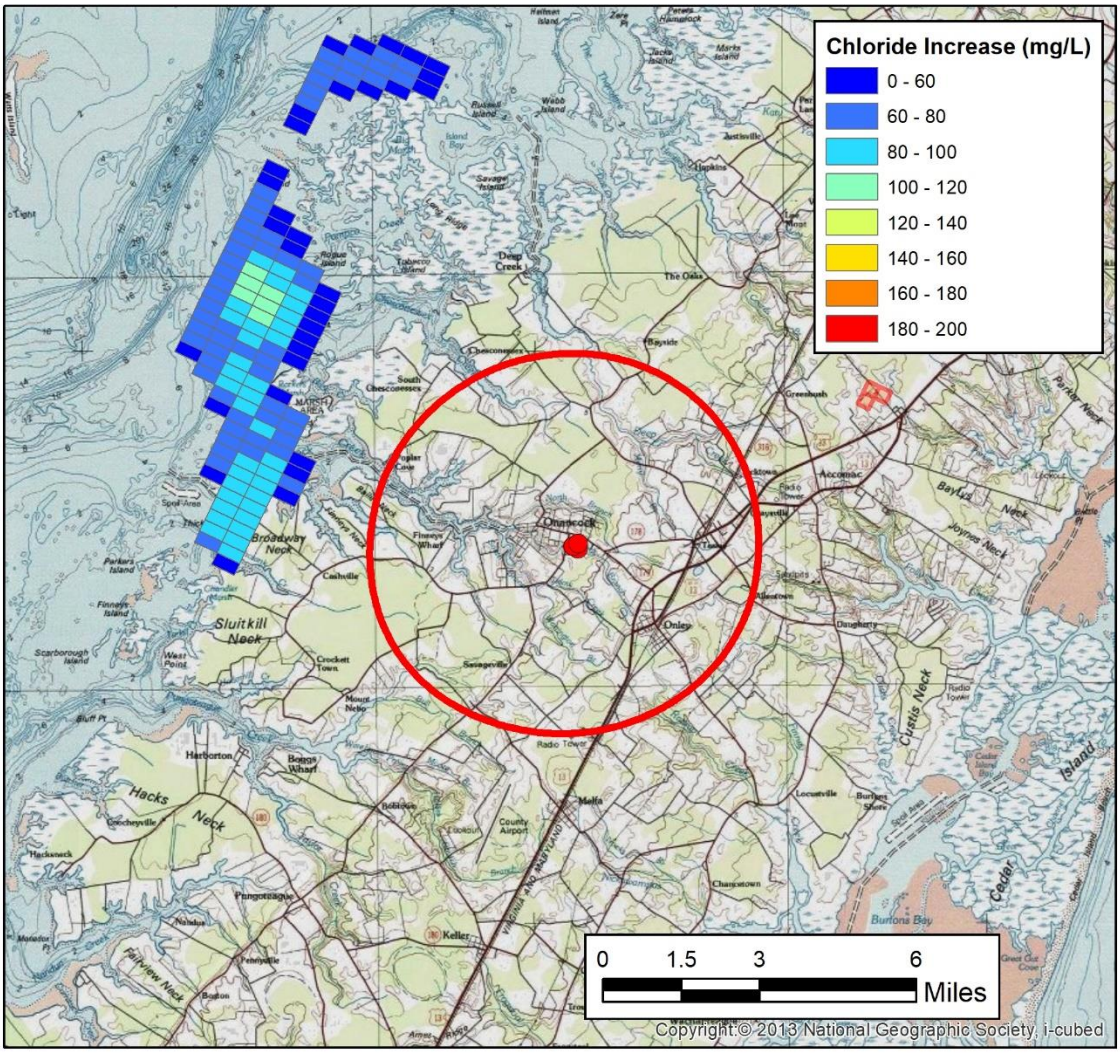
- Town of Onancock Wells
- Middle Yorktown-Eastover Aquifer AOI
- MYE Aquifer Critical Cells

Simulated chloride concentration increase in the Middle Yorktown-Eastover confining unit resulting from a 50 year simulation of 120,000,000 gallons per year from the Middle Yorktown-Eastover aquifer.

Technical Evaluation performed by Aquaveo, LLC for the Virginia DEQ, Office of Water Supply
January 9, 2024

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Town of Onancock-
Middle Yorktown-Eastover Aquifer-
Simulated VESM Chloride Concentration Increase



- Town of Onancock Wells
- Middle Yorktown-Eastover Aquifer AOI
- MYE Aquifer Critical Cells

Simulated chloride concentration increase in the Middle Yorktown-Eastover aquifer resulting from a 50 year simulation of 120,000,000 gallons per year from the Middle Yorktown-Eastover aquifer.

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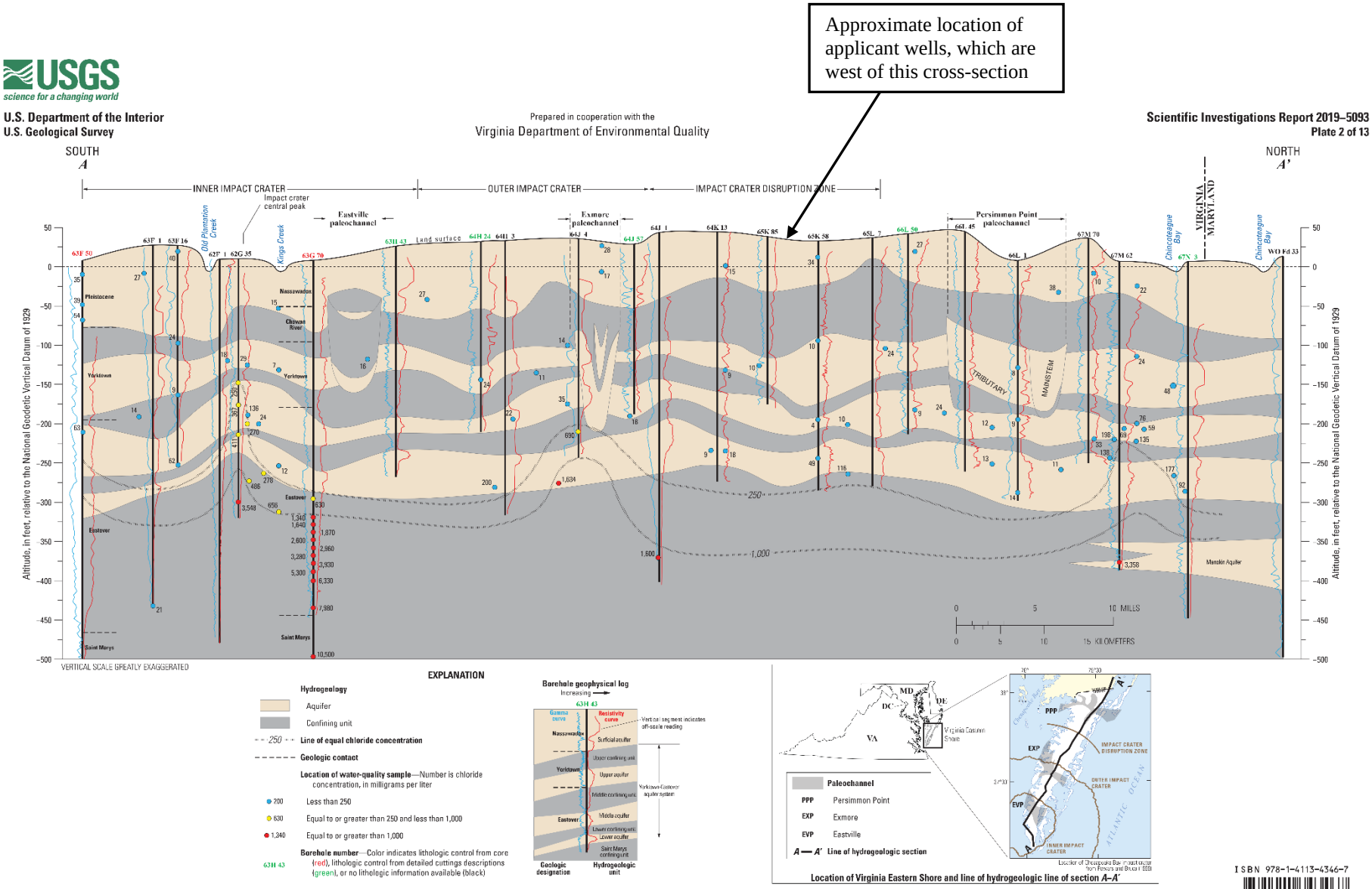

Cross-Section A-A' from USGS Scientific Investigations Report 2019-5093 (2019).