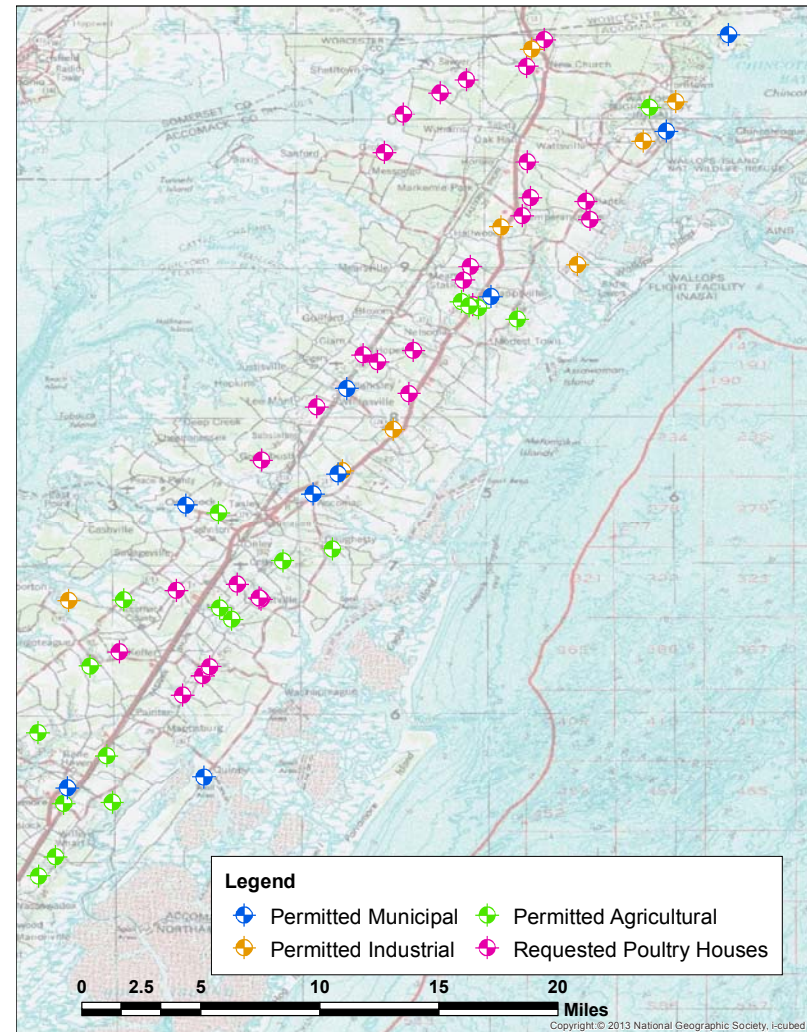


# DRAFT REVIEW OF POULTRY HOUSE GROUNDWATER WITHDRAWAL PERMIT APPLICATIONS

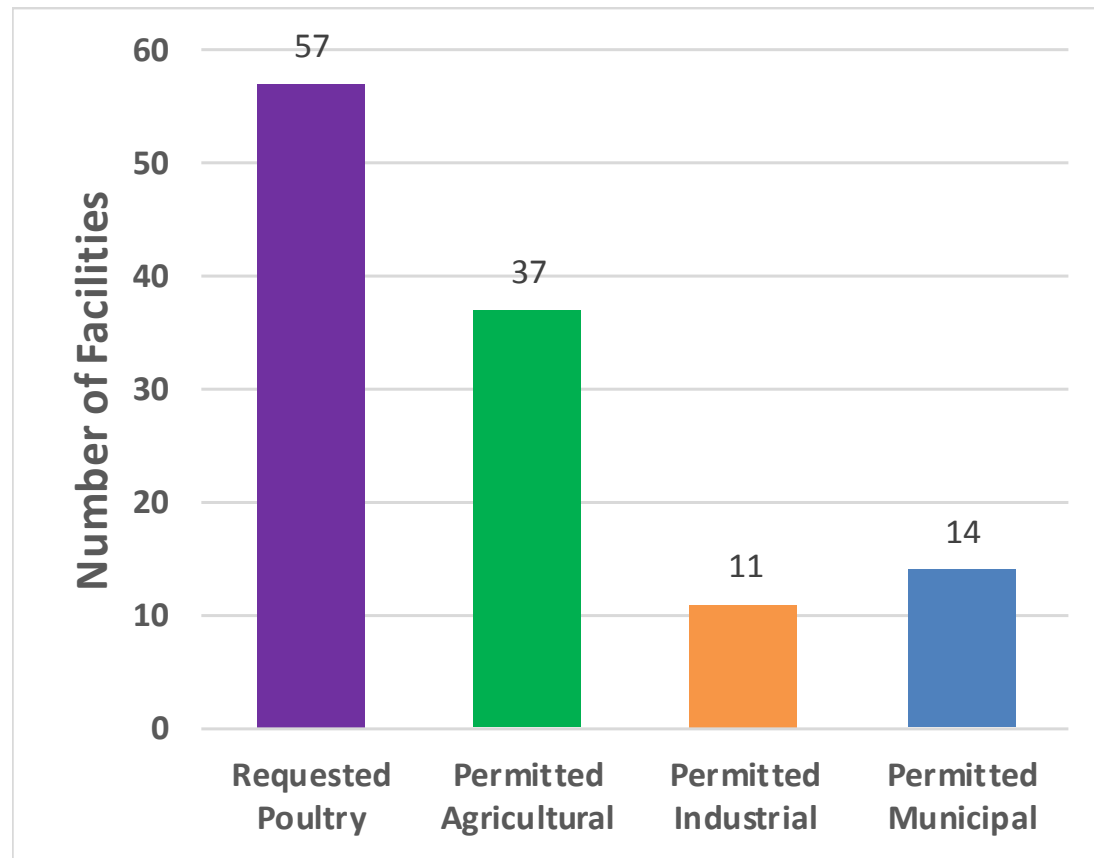
August 2018

## Locations of Poultry Houses that have submitted Groundwater Withdrawal Applications

- 57 Poultry Houses
- All located in Accomack County
- Distributed relatively uniformly N-S across the County
- Majority are close to the “Spine Recharge Area”
- Several are close to the coast, Bay-side or Sea-side
- At the time the Applications were submitted earlier this year a number of facilities were still under construction. Others were reporting groundwater use.

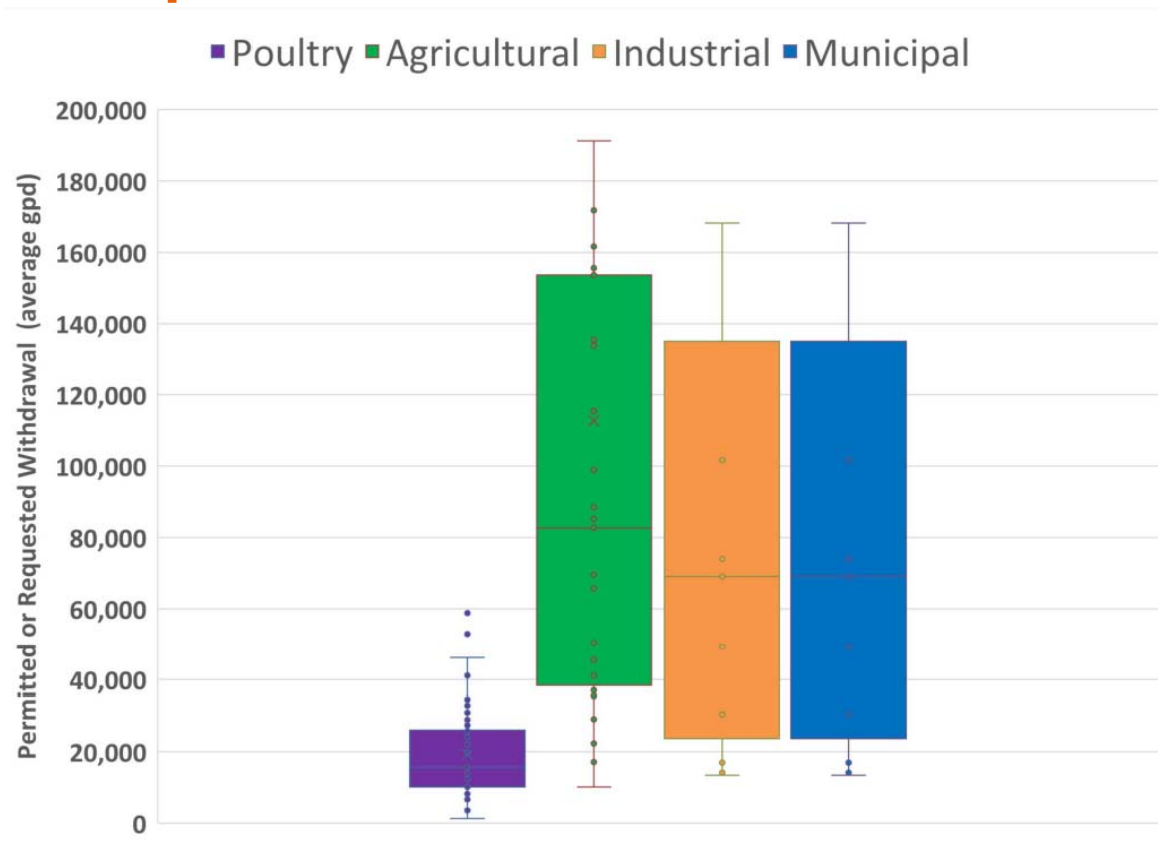


## Number of Requested and Permitted Groundwater Withdrawals



**Poultry Houses are the single largest category of withdrawals requiring a permit**

## Individual Requested and Permitted Use

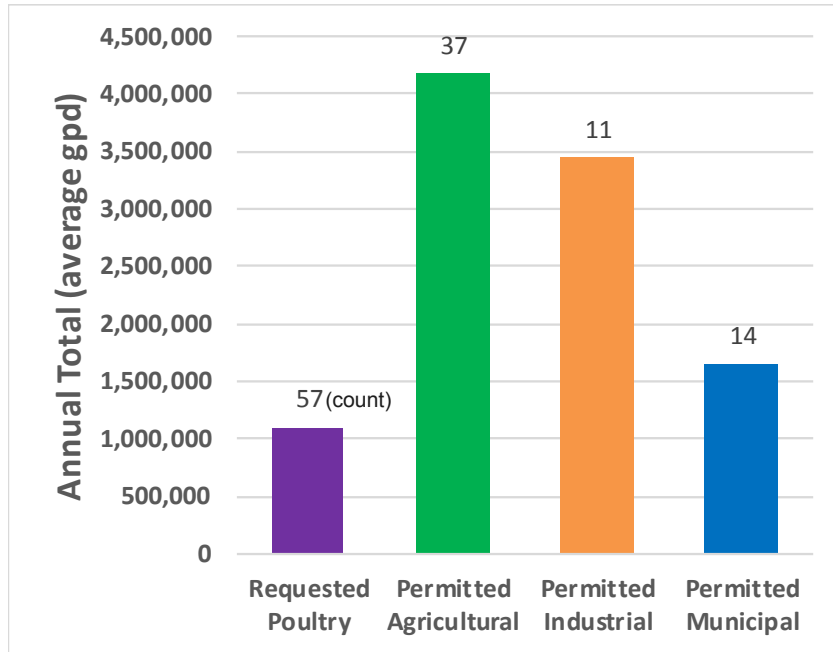


Note: Perdue (1.9 MGD avg) and Tyson (1.0 MGD avg) are included in the statistics but not show on the chart scale

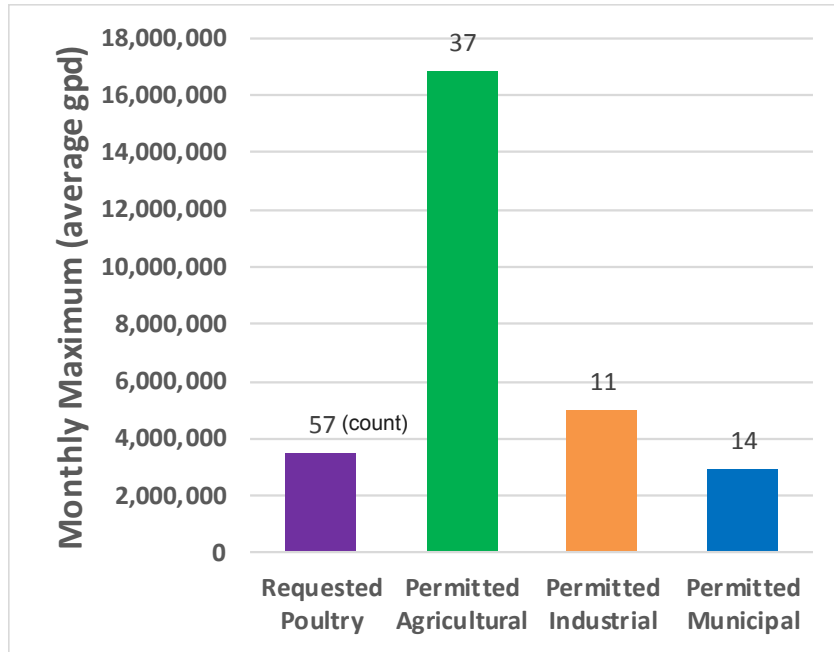
**Relative to other Permitted Withdrawals, Individual poultry houses use less water on average**

# Total permitted withdrawals by category

**Annual Total**



**Monthly Maximum**

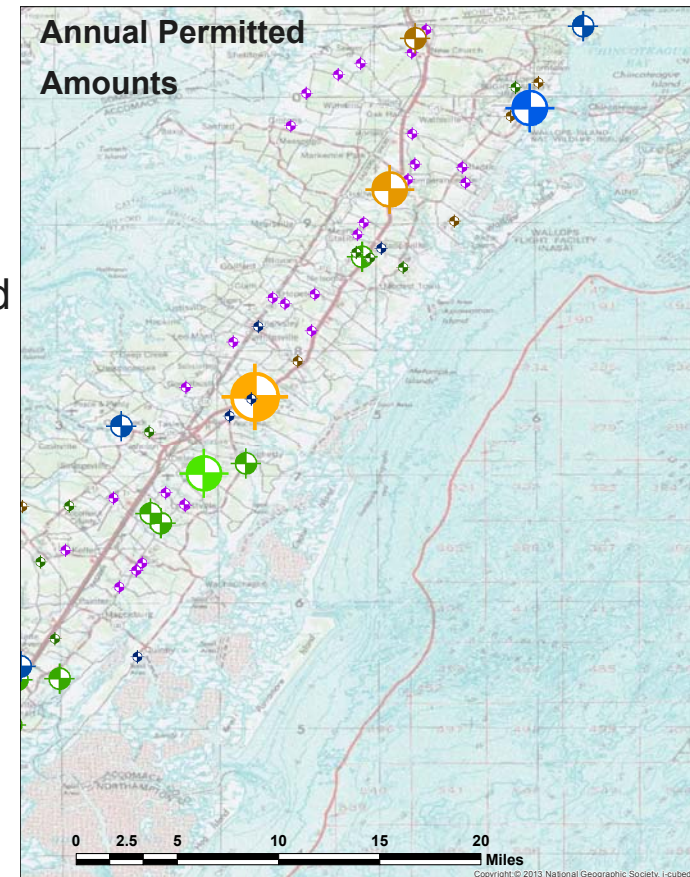
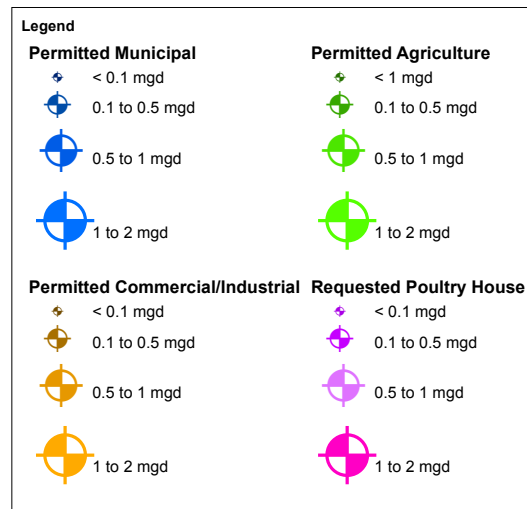


Notes: Ag: Actual agricultural use is predominantly for drought use, and normal year use is typically less than 20% of permitted use.  
 Ind: Actual industrial use almost equal permitted use (>90% for most users).  
 Municipal: Actual Municipal use is close to permitted use (close to 80% for most users).

**Poultry use expected to more closely follow municipal demand with seasonal (winter-summer) cycle.**

## Comparison of Annual Average Permitted Withdrawal to Requested Poultry Withdrawals

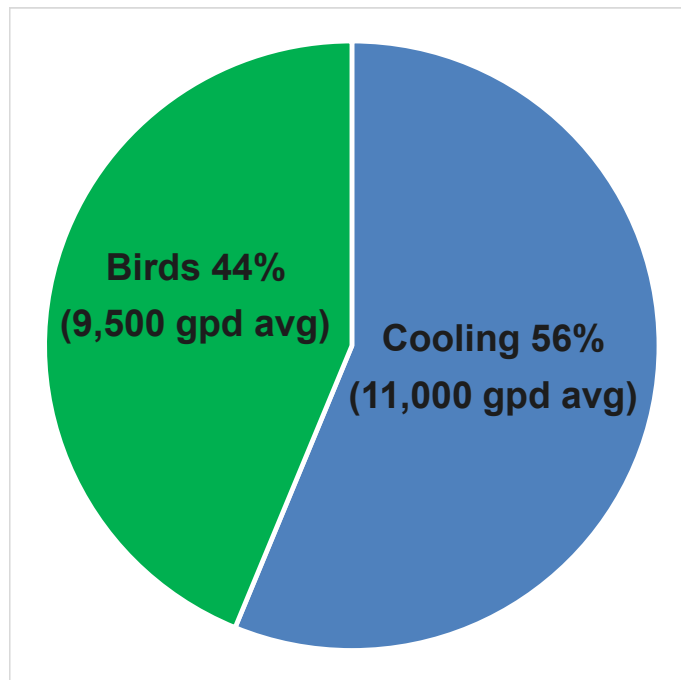
- Industrial withdrawal amounts are concentrated on two users.
- Larger Agricultural withdrawals tend to be clustered.
- Poultry houses are individually much smaller and distributed more evenly across Accomack County



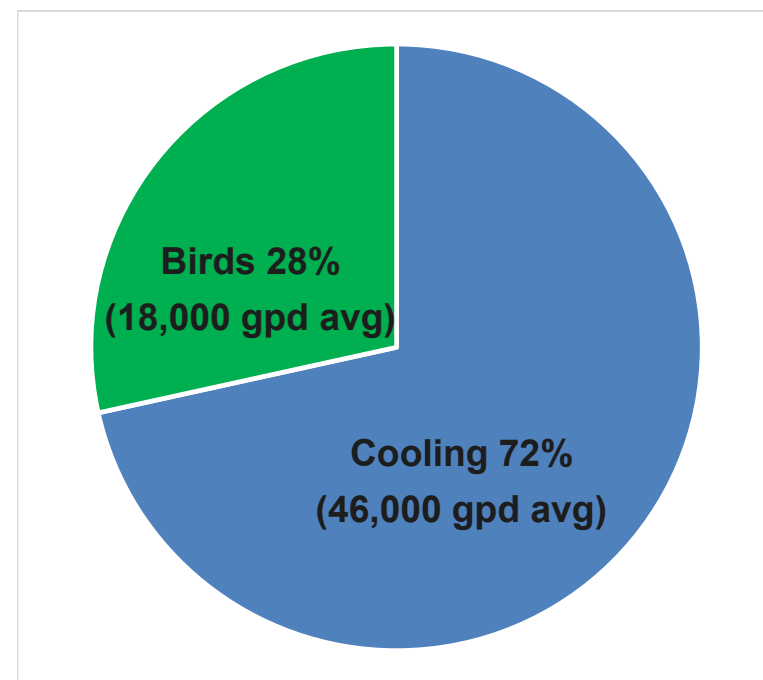
**Number of withdrawals, amounts per facility, and varying locations complicate direct comparisons**

# Portion of Withdrawal Used for Cooling

**Annual Total**



**Monthly Maximum**



**Majority of the water will be used for cooling. Less than 1/2 is used by the birds for consumption.**



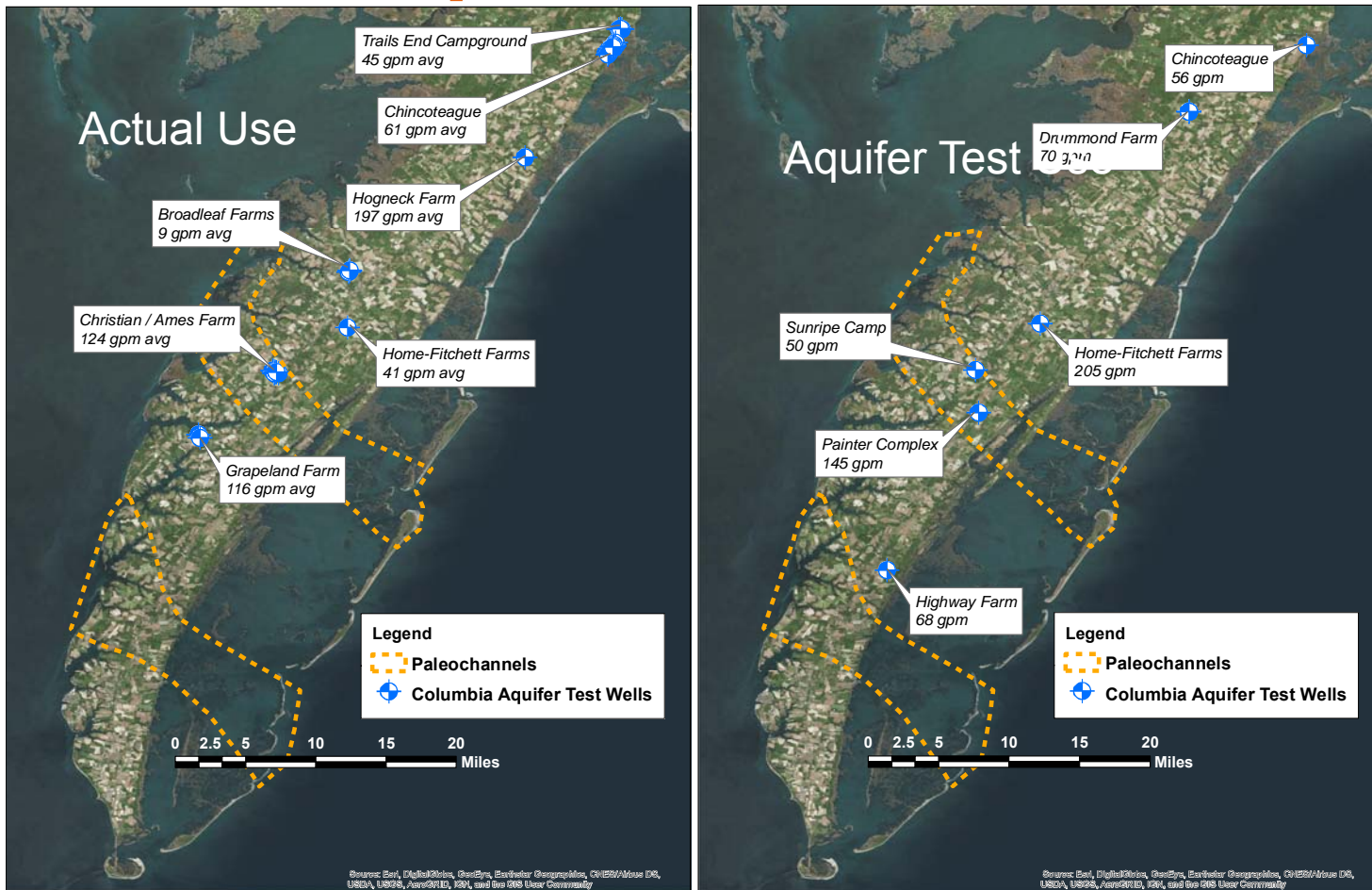
# Source Aquifers

- None of the 42 applications reviewed have wells screened in the Columbia (surficial) aquifer
- Some wells were installed earlier (greater than 10-years ago). Other wells were installed as recently as July 2018.
- There is no documentation of test wells for the Columbia aquifer at any of the facilities from these applications.
- Most of the applications give one of the following reasons for not screening the Columbia aquifer:
  - *“it is believed that a shallow groundwater supply system would lack the reliability, volume, and/or quality”*
  - *“the surficial aquifer does not yield water of sufficient quantity or suitable quality for meat production at this location”*

**The Groundwater Committee has made preferred use of the Columbia aquifer to reduce stress on the Yorktown-Eastover aquifer a major goal to maintain a sustainable resource for over 20-years.**



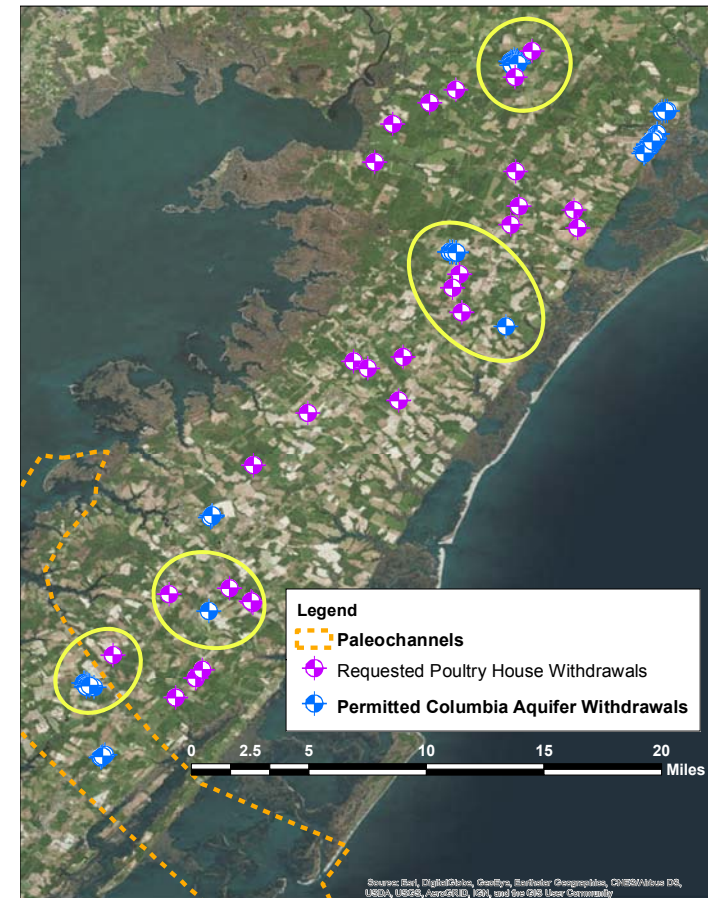
# Columbia Aquifer Documented Use



From available data, the Columbia aquifer can yield in excess of 40 gpm over most of Accomack County. 40 gpm meets the requirements for most of the poultry houses.

## Poultry House Location Relative to Columbia Aquifer Test Sites

- Many poultry houses are near other permitted users where the Columbia aquifer yield has been demonstrated.
- Average requested cooling water demand is 46,000 gpd average under maximum month use.
- Lowest aquifer test for the Columbia aquifer was 50,000 gpd.



**There is no reason to believe the yield will be substantially different at the poultry house site.**

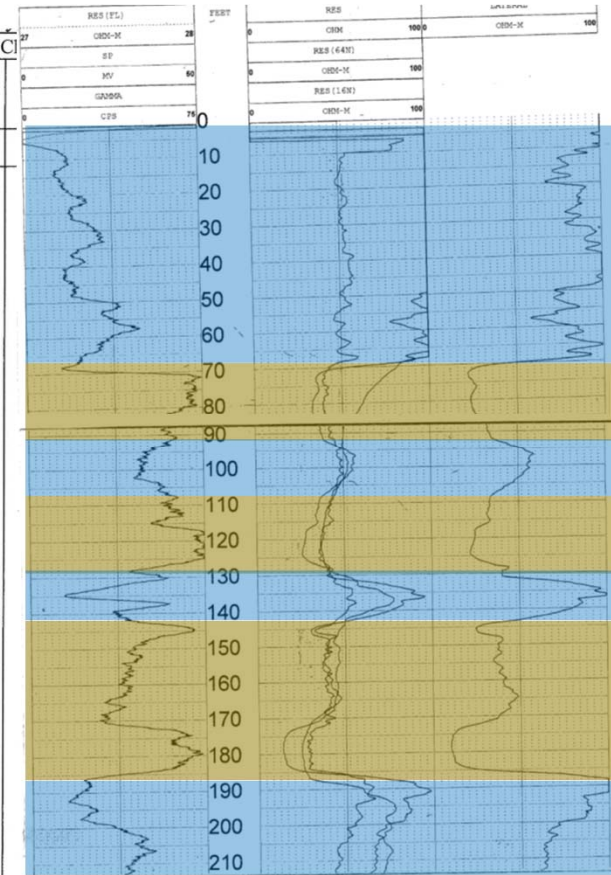
**Well designation, Name or Number: 17-100-0538 C**

Depth (feet)		Type of Rock or Soil
From	To	(Color, material, fossils, hardness, etc.)
0	5	Surface Soil
5	13	Tan Sand
13	27	Brown & Gray Sand
27	57	Gray Sand & Gravel
57	77	Gray Sand & Shell
77	132	Gray Clay & some Shell
132	147	Gray & Brown Clay with Brown Shell
147	169	Gray Clay, Shell, Sand
169	176	Gray & Brown Clay, some Shell
176	185	Gray & Blue Clay with some Shell
185	220	Gray Sand, Shell, some fine Clay

From Depth (ft)	To Depth (ft)	Type of Rock or Soil	Rei
	5	Surface Soil	
5	7	Tan Sand	
7	11	White Clay	
11	14	Tan Sand	
14	21	Blue Clay	
21	66	Coarse Tan Sand & Gravel	
66	112	Blue Clay	
112	130	Gray Sand with Shells & Clay	
130	131	Hard Layer (1 Minute Chevron Bit)	
131	161	Gray Sand with Clay	
161	162	Hard Layer (5 Minutes Chevron Bit)	
162	180	Gray Sand with Clay	
180	235	Gray Sand with Shells & Clay	
235	260	Gray Sand with Shells	
260	268	Blue Clay	
268	300	Gray Sand & Shells	

**Well designation, Name or Number: 17-100-0530 C**

Depth (feet)		Type of Rock or Soil
From	To	(Color, material, fossils, hardness, etc.)
0	5	Surface Soil
5	10	Tan/Brown Sand
10	20	Tan/Brown Sand
20	27	Tan/Brown Sand
27	37	Tan Sand
37	47	Tan Sand
47	57	Tan/Gray Sand, some Shell
57	67	Gray Sand, some Shell, some Clay
67	77	Gray Sand, some Shell, some Clay
77	87	Gray Sand, some Shell
87	97	Gray Sand, more Clay starting at 93'
97	107	Gray Sand & Clay
107	117	Gray Clay & Sand, some Shell
117	127	Gray Clay & some Sand & Shell
127	137	Gray Clay, Sand & Shell
137	147	Some Chatter, Gray Sand, Shell & some Clay
147	157	Chatter, Gray Sand & Shell, some Clay
157	167	Some Chatter, Gray Sand, Shells, Clay mixed
167	177	Very little Chatter, Gray Sand, Shells, Clay
177	187	No Chatter, Gray Clay, Sand & Shells
187	197	Chatter, Gray Sand, Shell, some Clay, hard Sand
197	207	Chatter, Gray Sand, Shell, some Gray Clay
207	217	Chatter, Gray Sand, Shell, some Gray Clay
217	227	Less Chatter, Gray Sand, Clay, Shell
227	237	Less Chatter, Clay, Sand, Shell mix



**Based on available boring and geophysical logs provided in the Poultry House Applications, there is no reason to believe the Columba aquifer is not available.**

## Columbia aquifer Water quality is “different” but in some ways may be better for certain uses

- Based on water quality samples there is no reason to believe the Columbia has substantially worse water quality:

- Iron is about the same
- Yorktown-Eastover chlorides (salt) is higher
- Columbia nitrate (nutrients) is higher
- Susceptibility to contamination
  - Columbia aquifer is more susceptible to contamination from land-use practices (mostly nutrients)
  - Yorktown-Eastover is more susceptible to contamination from over pumping

Aquifer	Average (mg/L)		
	Iron	Chloride	Nitrate
Columbia aquifer	1.7	24	4.5
Yorktown-Eastover aquifer	1.2	147	0.3

Source: DEQ Database and Virginia Household Water Quality

**Lower chlorides in the Columbia aquifer make it less corrosive for cooling water use than some Yorktown-Eastover groundwater. Increasing withdrawals from the Columbia for uses tolerant to nutrient levels helps to maintain a sustainable Yorktown-Eastover aquifer**



## DEQ Permit Requirements for Water Sources

The following is part of the regulatory requirements when evaluating sources of water:

*C. The applicant shall provide an alternatives analysis that evaluates sources of water supply other than groundwater and the availability and use of lower qualities of groundwater that can still be put to beneficial use. For all proposed withdrawals, the applicant shall demonstrate to the satisfaction of the board:*

*2. The project utilizes the lowest quality water for the proposed activity;*

*4. Practicable alternatives, including design alternatives, have been evaluated for the proposed activity. Measures that would avoid or result in less adverse impact to high quality groundwater shall be considered to the maximum extent practicable.*

**Maximizing use of the Columbia aquifer meets the regulatory requirement of: “would avoid or result in less adverse impact to high water groundwater”**

# DEQ Well Construction Requirements

<p><b>Date Completed:</b> 2016-09-28</p> <p><b>Class Well:</b> IV</p> <p><b>Screen Intervals:</b></p> <table border="1"> <thead> <tr> <th>Size (in)</th> <th>From Depth (ft)</th> <th>To Depth (ft)</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>230</td> <td>260</td> </tr> </tbody> </table> <p><b>Grout:</b></p> <table border="1"> <thead> <tr> <th>Grout Type</th> <th>From Depth (ft)</th> <th>To Depth (ft)</th> </tr> </thead> <tbody> <tr> <td>Bentonite</td> <td>50</td> <td></td> </tr> </tbody> </table>	Size (in)	From Depth (ft)	To Depth (ft)	4	230	260	Grout Type	From Depth (ft)	To Depth (ft)	Bentonite	50	
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4	230	260										
Grout Type	From Depth (ft)	To Depth (ft)										
Bentonite	50											
<p><b>Date Completed:</b> November 08 2017</p> <p><b>Screen Size &amp; Mesh:</b> <input checked="" type="checkbox"/> IV</p> <p>2 inches from 280 to 300</p> <p><b>Grout Type:</b> from 0 to 50 ft.</p>												
<p><b>Date Completed:</b> Jul-28-2016 <input checked="" type="checkbox"/> IV</p> <p><b>Screen Size &amp; Mesh:</b></p> <p>4 inches from 215 to 230</p> <p><b>Grout Type:</b> from 0 to 20 ft.</p>												
<p><b>Date Completed:</b> Feb-23-2017 <input checked="" type="checkbox"/> IV</p> <p><b>Screen Size &amp; Mesh:</b></p> <p>4 inches from 185 to 200</p> <p><b>Grout Type:</b> from 0 to 30 ft.</p>												
<p><b>Date Completed:</b> 2017-10-17</p> <p><b>Screen Intervals:</b></p> <table border="1"> <thead> <tr> <th>Size (in)</th> <th>From Depth (ft)</th> <th>To Depth (ft)</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>165</td> <td>180</td> </tr> </tbody> </table> <p><b>Grout:</b></p> <table border="1"> <thead> <tr> <th>Grout Type</th> <th>From Depth (ft)</th> <th>To Depth (ft)</th> </tr> </thead> <tbody> <tr> <td>bentonite</td> <td>50</td> <td></td> </tr> </tbody> </table>	Size (in)	From Depth (ft)	To Depth (ft)	4	165	180	Grout Type	From Depth (ft)	To Depth (ft)	bentonite	50	
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bentonite	50											

### DEQ Factsheet: Groundwater Well Installation in Groundwater Management Areas

#### Well Construction to Avoid - Example 2

#### Improper Well Construction

- Extending the Gravel pack beyond the top of the screened interval and/or extending the gravel pack into other aquifers as shown in Example 2
- Including multiple aquifers in the well screen or extending the well screen through multiple aquifers or as shown in Example 2 and 2a
- Wells with this type of construction often do not meet regulatory requirements due to the unintended impact on overlying aquifers and the pump intake limit may be impacted limiting capacity. This means the well may have to be abandoned and a new well constructed.** Even if the wells may be usable, this construction can cause the need for expensive and complex aquifer testing in order to obtain a permit, and for the pump intake limit to be shallow (above Aquifer A in Example 2)

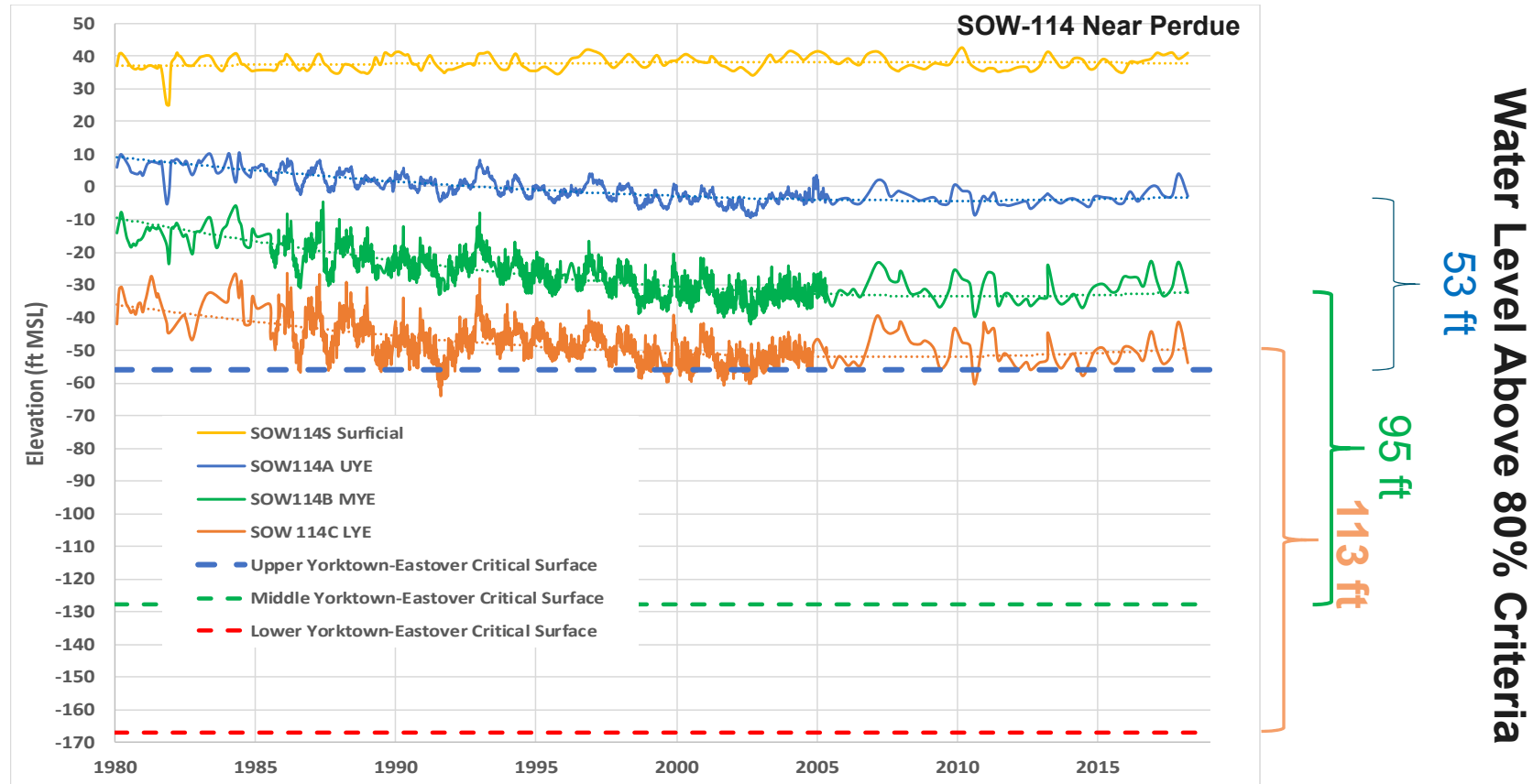
#### Other Common Well Construction Problems

- No geophysical log : Geophysical logging data is necessary for permit issuance in almost every case. Collection of geophysical and geologist's logs must be performed during well drilling and cannot be collected once the well is completed. Drilling an additional bore hole and conducting geophysical logging may be necessary if geophysical data is not available for the location.
- No well completion form : This information is necessary to issue a permit. If the depth of the well, the screened intervals, the grout depth, and the gravel pack extent are not documented, a camera survey may be necessary to determine the basic well construction.
- No documentation of the Pump Intake depth **It is illegal for a pump intake to be set (1) below the top of the uppermost confined aquifer in use or (2) below the bottom of an unconfined aquifer.** If the pump depth is not documented, the pump may have to be pulled to determine the depth or to raise the pump. Raising the pump can reduce the well yield, sometimes significantly.

Page 2  
February 2017

Grout for many recently constructed wells extend no more than 50-ft, this does not appear to meet DEQ construction requirements and other permit holders have been required to construct replacement wells. Most wells are classified as “IV (private for use other than drinking water)”

## Most of the proposed withdrawals are from the deeper portions of the Yorktown-Eastover Aquifers



Most wells are currently screened in the deeper middle or lower Yorktown-Eastover aquifers. It is likely most if not all of the proposed withdrawals screened in the middle or lower Yorktown-Eastover aquifers will meet the 80% criteria.



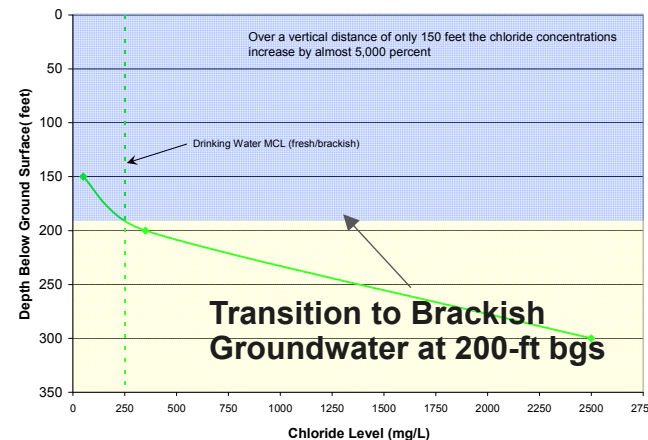
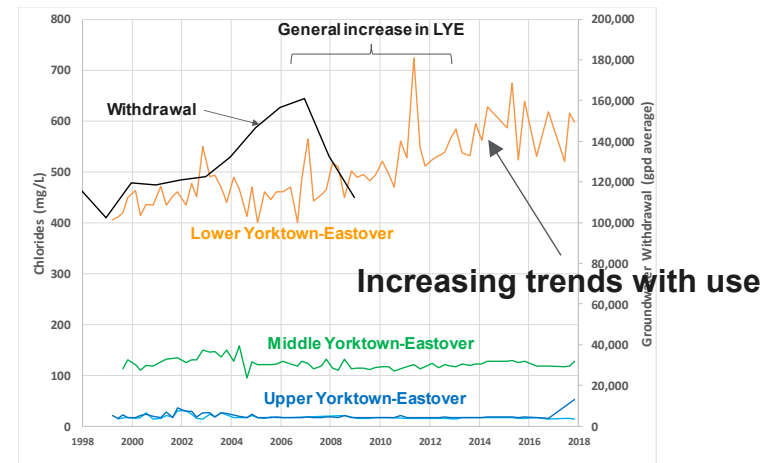
# 80% Drawdown Criteria Summary

- It is likely most if not all of the requested Poultry House withdrawals will meet the DEQ 80% drawdown criteria based on the following observations:
  - Withdrawal per facility is relatively low, reducing drawdown impacts at each individual location;
  - Distribution of facilities is relatively uniform across Accomack County reducing the impact of “clustered” withdrawals; and
  - Most of the wells are screened in the deeper middle and lower Yorktown-Eastover aquifer, where there is more head above the “critical surface” as defined by the 80% criteria.

**It is unlikely the 80% drawdown criteria will result in a substantial number of wells relocated to the Columbia aquifer**

## Potential Adverse Impacts from the Deeper Withdrawals

- Recharge to the deeper aquifers is progressively less (as the intervening clays restrict flow).
- Reduced recharge results in increased loss of storage and increased potential for salt water intrusion.
- Deeper screen intervals greatly increase potential for upconing.
- Some wells are screened as deep as 300 feet bgs.
  - Water quality results were not provided in any of the 41 applications.
  - Even if current water quality is sufficiently fresh, it could very easily become brackish with use.



**Some of the deeper wells may be, or may become brackish with use which may affect both cooling water use and consumption.**

# Summary

- 42 applications of 57 Poultry House applications have been reviewed.
  - This represents the majority (almost  $\frac{3}{4}$ ) of the applications.
  - Requested withdrawal amounts and targeted aquifers are sufficiently similar to support the following observations.
  - As a class, the poultry house withdrawals:
    - Are the largest number of facilities
    - Individual withdrawal amounts are lower
    - Net effect is the total withdrawal amounts are smaller, and more widely distributed than the other permitted withdrawals.
  - Most of the demand is for cooling. Use of the Columbia aquifer for irrigation and cooling has been a primary use goal to reduce stress on the confined Yorktown-Eastover aquifer for the Groundwater Committee for over 20-years.
  - All of the wells reviewed are screened in the Yorktown-Eastover aquifer.
    - Most are in the deeper middle and lower Yorktown-Eastover aquifer.
    - These wells are more likely to meet the 80% drawdown criteria used by DEQ.
    - They have a substantially higher risk for saltwater intrusion (no water quality information was provided).
    - Many do not meet the DEQ construction requirements (for ground / gravel pack. DEQ has required some other permit holders to replace wells that do not meet the construction requirements.

## Summary (continued)

- Based on aquifer tests and actual use, the Columbia aquifer is capable of providing 50 gpm or more over many / most areas of Accomack County. This yield should be sufficient to meet the cooling water demand.
- Water quality for the Columbia is not quantitatively “worse” than the Yorktown-Eastover.
  - Iron levels are similar
  - Nitrates are higher
  - Chlorides (salt) are lower
- High chlorides can be very detrimental to a cooling water system.
- The primary regulatory requirement for Columbia aquifer use is under the alternative source analysis requiring use of groundwater *“would avoid or result in less adverse impact to high water groundwater”*

**Based on all available data the Columbia aquifer is capable of providing yield and quality that meets the need for cooling water. Maximizing use of the Columbia aquifer meets a primary goal of the Groundwater Committee for maintaining a sustainable groundwater supply.**