

Figure 1, Word Cloud of 93 ESVA Ground Water Committee Captain's Cove In-Person Survey Remarks

CAPTAINS COVE GROUND WATER AND RESIDENTIAL WATER SUPPLY REPORT FEBRUARY 2023



VIRGINIA EASTERN SHORE GROUND WATER COMMITTEE

What's in Your Water?

PAUL MUHLY, GWC Chairman
KELLEN SINGLETON, GWC Staff
BRITT MCMILLAN, GWC Technical Advisor

Table of Contents

Introduction.....	2
The Wells.....	4
The Distribution System.....	5
Water Use.....	8
Household Surveys and Water Quality Testing Results.....	9
Water Quality.....	16
Summary of Water Quality.....	25
References.....	27

Ground Water Committee Report

*A survey of Captain's Cove Residents were asked the question
"Do you drink the water provided by AQUA?"
-Chairman Paul Muhly*

Introduction

The Ground Water Committee's mandate states that we assist local residents as an educational and informational resource and to initiate special studies concerning the protection and management of our Eastern Shore ground water aquifer.

Residents from the Captains Cove area in Greenbackville have spoken at meetings of the Accomack County Board of Supervisors and the Eastern Shore of Virginia Ground Water Committee, raising concerns about the quality of their potable water supply.

Visual evidence and resident testimonials over the past six months have identified objectionable qualities of their water supply that limit use. The scale and frequency of these issues have raised legitimate concerns regarding the water quality in the Captains Cove Community.

The principal concerns that have been expressed during public comment at Ground Water Committee meetings and by survey participants regarding the community water system are one, the ability to meet future demand with the proposed expansion and two, the existing water quality and potential changes to future water quality resulting from additional demand. (Leslie & Mogrogan, Eastern Shore of Virginia Ground Water Committee Minutes (p.4), 2022)

In keeping with the Ground Water Committee's mission "to serve as an educational and information resource," the Committee reached out to Dixon Tucker, PE, District Engineer of the Virginia Department of Health at the Office of Drinking Water; Britt McMillan, Principal Hydrologist at Arcadis U.S., Inc. and Eastern Shore of Virginia Ground Water Committee Advisor, as well as volunteered household water quality data from residents of Captain's Cove.

Ground Water Committee Report

In addition, the Chairman initiated both a door-to-door survey and an online survey of Captains Cove residents. A total of 323 primarily full-time residents have responded to both surveys, which will be covered in greater detail later in this report.

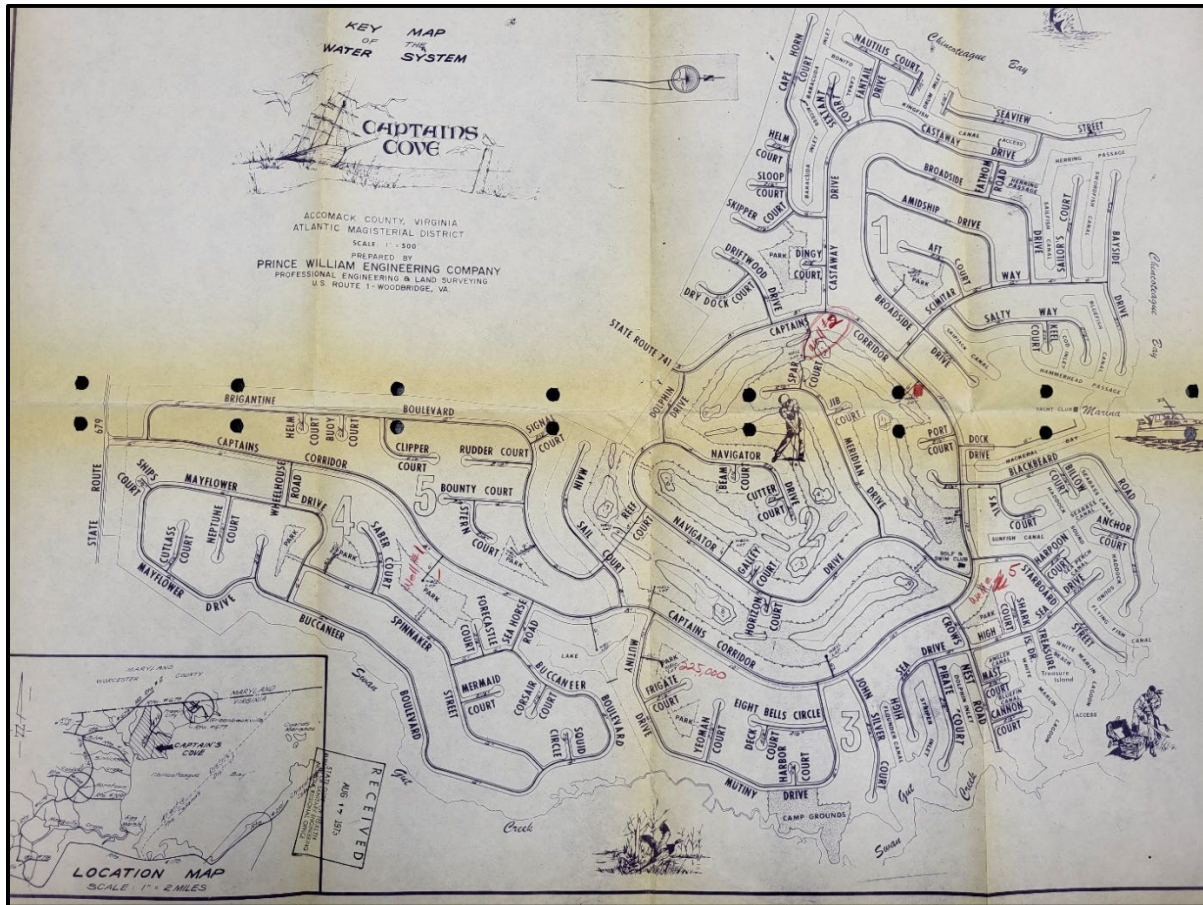


Figure 2, August 1975 Survey of Captain's Cove Utility System. Prince William Engineering Company

Captain's Cove was platted in the 1970s. The subdivision is comprised of 4,816 surveyed lots. These lots will develop over time at the discretion of the individual property owners. At present, a total of 2,429 serviceable lots are being billed for "water availability" as authorized by the Virginia State Corporation Commission. There are approximately 1250 homes that are presently connected to the water/sewer system, with 600 units being full-time residents. Captains Cove subdivision is expected to add 100 to 200 homes per year until fully buildout. Lots in Sections 12-18 are primarily owned by a privately held land trust and include 1,330 zoned residential lots. These sections do not currently have any water infrastructure.

Ground Water Committee Report

The Wells

The system consists of six wells.

Well # 1. Was completed on April 30, 1972, and yields 182 gallons per minute at a depth of intake at 239 feet.

Well # 2. Was completed July 24, 1970 and yields 63 GPM from a depth of 160 feet.

Well # 3. Completed on June 10, 1971 to a depth of 410 feet. The bore hole was filled with gravel from 270 to 410 feet and now draws water from 260 feet with a yield of 93 gallons per minute.

Well # 3U. Was drilled to a depth of 217 feet (Upper Yorktown formation) and completed December 22, 2005. A gravel pack was installed from 130 to 217 feet. The pump intake is set at 120 feet and yields 60 GPM.

Well # 4. Drilled to a depth of 295 feet and completed on March 15, 2005. The pump intake is set at 252 feet and yields 130 GPM.

Well # 4U. Was drilled starting on January 16, 2006 and was completed on January 19. Initial drilling depth was 215 feet, with a gravel pack installed from 130 to 215 feet. The pump intake is set at 120 feet, and output is 68 gallons per minute. (McMillan, 2022)

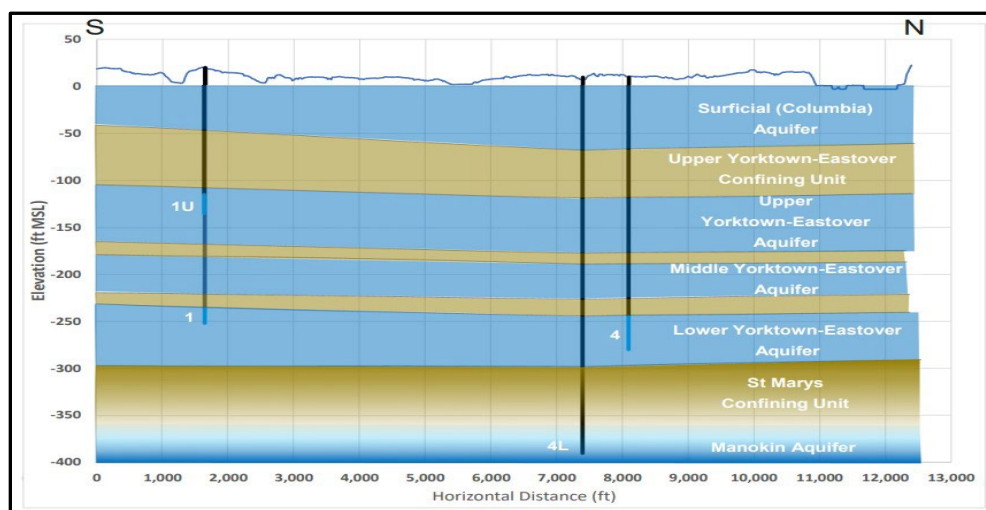


Figure 3, Captain's Cove Wells Sampled for Water Quality. ARCADIS

The Distribution System

Aqua Virginia, a subsidiary of Aqua America owns and operates the public water system for the Captain's Cove subdivision, having acquired the assets of the Captain's Cove Utility Company in 2015 (Business Wire, 2015).

Pumping Station.

There are three pumping locations. Each pumping location contains a chlorination system, an ion exchange system for color/organic carbon removal, and flow control valves. Wells number 3 and 3U, in addition, also have an absorption system for arsenic treatment.

Storage Facilities.

The storage facilities consist of two 5000-gallon (each) hydropneumatic tanks. These Hydropneumatic tanks hold water and air under pressure. They function to help regulate system pressures to quickly meet system demands and also to minimize excessive well pump cycling.

There is one (1) 500,000-gallon elevated tank that supplies storage and pressure. Internal corrosion, if it exists, can encourage biofilms that will allow bacteria and organism growth. If sediment and bacteria buildup is ignored, it can be a prime cause of color, odor, and suspended solids problems in a water system. Water tank maintenance is a crucial part of supplying good quality potable water to the system.

Distribution system.

The Aqua system provides potable water to the residents of the Captain's Cove subdivision, as well as the marina, a clubhouse, and the golf course. This water is primarily used for drinking water, bathing, cooking, dishwashing, cleaning and laundry, sanitation (toilets and lavatories). Some water is used as needed to flush the water lines. A small percentage is used for non-essential purposes such as vehicle washing, lawn and landscape irrigation, and swimming pools. The system has hydrants for fire suppression, and the golf course uses ponds to supply water for irrigation.

Ground Water Committee Report

Captain's Cove Distribution System currently has waterline mains fronting approximately 3,470 lots in Sections I – XI, of which 1257 are currently occupied and connected to the system. These mains have a mixture of pipe diameters presented on the map below; stars are well locations. (Tucker, History of Captain's Cove Waterworks System [Presentation], 2022)

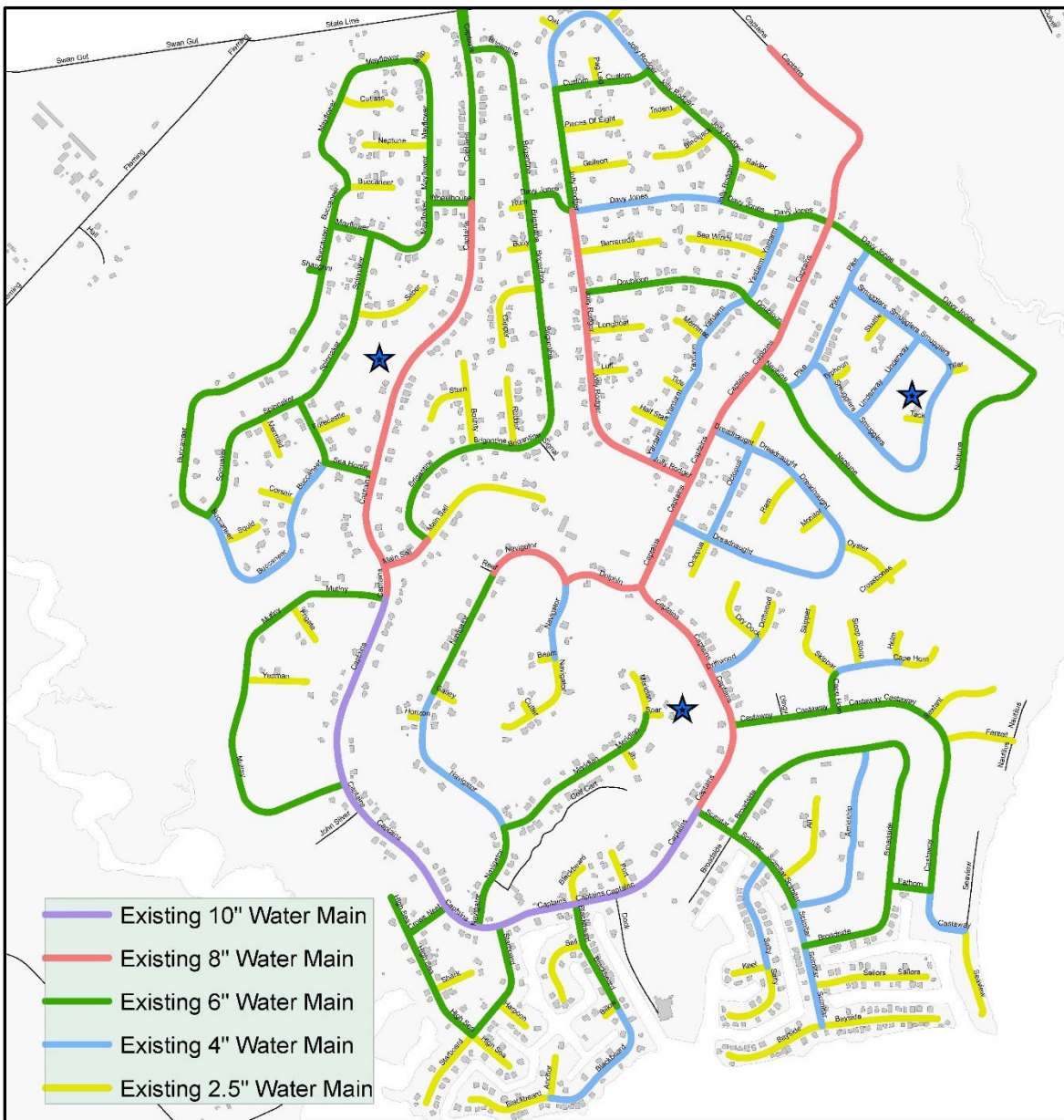


Figure 4, Captain's Cove Water Distribution and Well System. A-NPDC

Distribution System (continued)

Like the water storage system, bacteria can form as biofilms in the distribution lines. According to the EPA, “biofilm debris can accumulate in the periphery of distribution systems, leading to sediment accumulation and microbial proliferation.”

Factors cited by EPA that contribute to biofilm development and associated debris are low flow due to “mains not arranged in a looped fashion, storage used only for high demand, oversized pipelines, and lack of valve exercise” (USEPA, 2002). Some or all of these are potential contributing factors for the Captain’s Cove system.

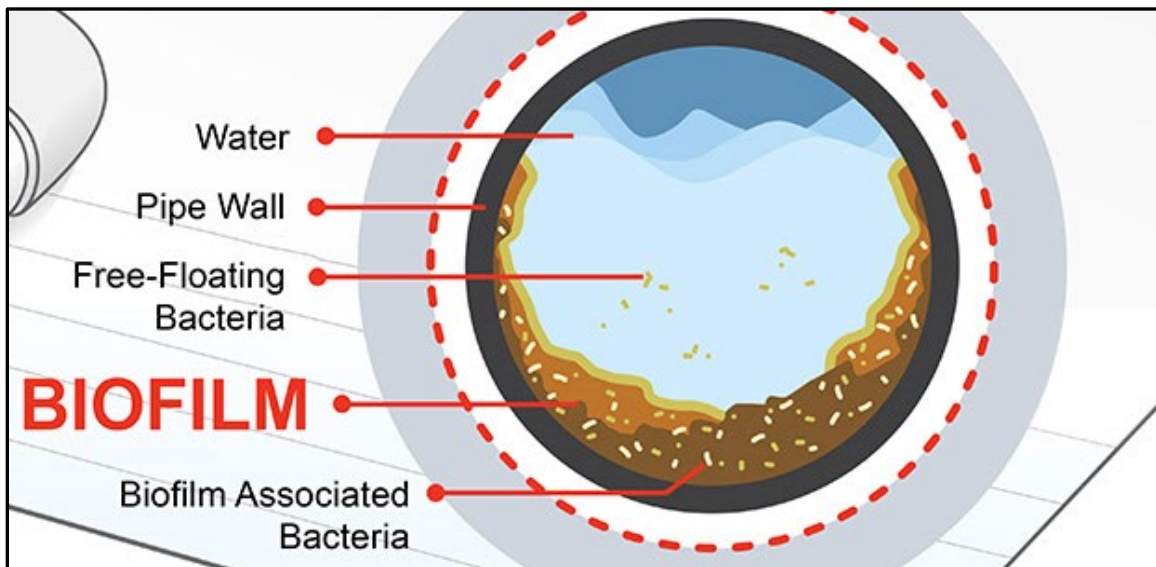


Figure 5, Biofilm in Distribution Lines. Antonino Cantone (2019), How CPVC Better Resists Biofilm Formation than Other Piping Materials [<https://www.flowguard.com/blog/>]

Ground Water Committee Report

Water Use

The current permit, effective March 1, 2014, is limited to 13,048,000 gallons per month maximum (averaging 434,933 gallons per day) and 80,861,100 gallons a year (averaging 221,537 gallons per day). On August 27, 2019, Aqua Virginia submitted Groundwater Withdrawal Permit Application #GW0044601. The current permit expires in 2024, and a request for an increase is in the process of evaluation by DEQ. Approximately 64% of the current permit limit was used in 2021. The current requested amounts are presented on the table below.

Document	Dates	Groundwater Withdrawal Summary					
		Annual Total			Monthly Max		
		gal/yr	gpd avg	Increase	gal	gpd avg	Increase
Current Permit	Effective: March 1, 2014 Expires: February 29, 2024	80,861,000	221,537		13,048,000	434,933	
Application	Submitted: August 2019	190,000,000	520,548	135%	39,000,000	1,300,000	199%
DEQ Tech Eval	Completed: April 9, 2021	107,000,000	293,151	32%	21,900,000	730,000	68%

Figure 6, Captain's Cove Utility Groundwater Withdrawal Permit Summary. ARCADIS.

The initial amount requested in the 2019 application represented a 135% increase over the current annual permit amount. This initial amount has been significantly reduced through the DEQ review to an amount representing a 32% of the current permit amount. In addition to the requested increase in use, the Utility is requesting changes to the withdrawal distribution between the Upper Yorktown-Eastover and Middle/Lower Yorktown-Eastover aquifer.

Currently, approximately 67% of the water is withdrawn from the Middle/Lower Yorktown-Eastover. If the renewed permit is issued with the requested withdrawal distribution, only 14% of the water will be withdrawn from the Middle/Lower Yorktown-Eastover aquifer. (McMillan, 2022)

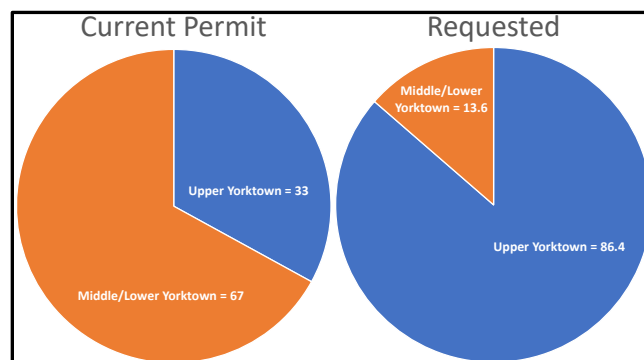


Figure 7, Allocation of Groundwater Withdrawal by the Captain's Cove Utility. ARCADIS

Resident Input: Surveys and Household Water Quality

In-Person and Online Surveys.

In the fulfillment of the Ground Water Committee’s mission to “assist local residents of the Eastern Shore to manage ground water resources” and “to serve as an educational and informational resource,” the Ground Water Committee Chairman has initiated a survey of Captain’s Cove Residents asking, “Do you drink the water at Captain’s Cove?” The survey consisted of two parts; an in person, door-to-door survey and an online survey developed by Ground Water Committee staff. Out of the estimated 600 full time residents, there were 93 and 230 respondents to the in-person and on-line surveys, respectively, yielding 323 total responses. Responses did not overlap. Online survey responses were voluntary, which often reflects bias. Survey responses were relatively evenly dispersed in a wide geographic area in the Captain’s Cove community, shown in the map below (Grey dots indicating respondents that drink water supplied by their water utility provider. Black for those that do not).

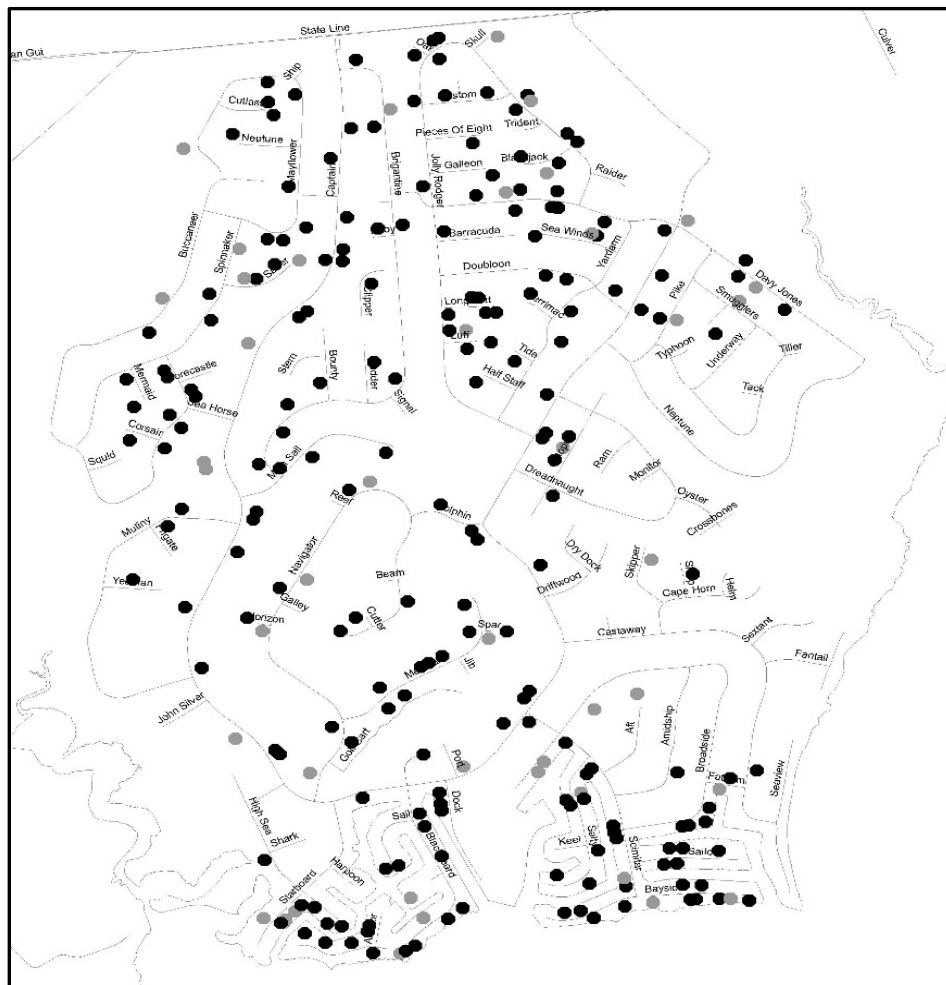


Figure 8, Plot Map Captain’s Cove Online and In-Person Survey Respondents. A-NPDC

Ground Water Committee Report

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From March 4, 2022 to April 4, 2022 a door-to-door survey was conducted asking Captains Cove residents, “Do you drink the water provided by Aqua?” In addition to this primary question, residents were asked their names, street addresses, and for remarks. 93 residents replied to this survey.

Out of the 93 respondents, five residents answered in affirmative, and 88 residents answered no. Of the residents answering yes to the question brought forward, many indicated that they purchased treatment systems for their household water supplies.

“Do You Drink the Water Provided by Aqua”	
NO	YES
88	5

Figure 9, In-Person Survey Results of 93 Respondents

Of the 93 in-person respondents, 88 residents answered “No.” Including remarks in concern to:

- Color (e.g., “Shower tan colored.” 3/22/22, “Yellow, brown.” 4/4/22, “discolored.” 3/25/22, “Yellow ring on glasses, brownish bath water after filter.” 3/22/22)
- Smell (e.g., “Water smells like rotten eggs.” 3/22/22, “stinky.” 3/22/22, “Strong smell.” 3/22/22)
- Taste (e.g., “Taste sometimes off color.” 3/25/22, “Bad taste – looks bad.” 3/24/2, “Bad taste.” 3/24/22)
- Costs (e.g., “It costs.” 4/4/22, “Poor quality, service, and cost.” 3/22/22)
- Solids in Water (e.g., “Sediment at bottom of tub.” 3/22/22, “Sediment.” 3/22/22, “Contains insects.” 3/21/22)
- Pet Consumption (e.g., “Don’t give to pets.” 3/25/22, “So bad won’t let my dog drink it either.” 3/22/22, “Buy bottled water for fish tank.” 3/22/22)
- Health concerns (e.g., “Unhealthy.” 3/22/22, “Pollution.” 3/26/22, “Have not drunk in 26 years.” 3/28/22, “Intestinal issues.” 3/25/22)

Ground Water Committee Report

Subsequently, since March 28, 2022, an online survey concerning the issue has been available to Captain's Cove Residents. The survey consisted of 11 questions:

1. "Captain's Cove Contact information." (To verify resident status).
2. "How long have you resided in Captain's Cove?"
3. "Who is your utility provider?"
4. "Do you use tap water supplied by your water utility provider to drink?"
5. "Do you purchase bottled water to address observations of your tap water supply?"
6. "Have you installed a water treatment system to address observations of your tap water supply?"
7. "If answering Yes to questions 5 and/or 6, how much cost have you incurred (in dollars) to filter and/or substitute your water supply in this way?"
8. "If answering Yes to questions 5 and/or 6, how long have you been experiencing related issues?"
9. "Do you use the water supplied by your utility provider for any of the additional domestic uses:
 - a. Food Preparation
 - b. Bathing
 - c. Washing Clothes
 - d. Dish Washing
 - e. Watering Lawns and/or Gardens
10. "Are your tap water observations similar to your immediate neighbor's?"
11. "May we further contact you concerning any of the questions above?"

For the purposes of this report, results of questions 4, 5, 6, and 9 are described below.

Ground Water Committee Report

78.70% of respondents (181/230) indicated that they do not use tap water supplied by their water utility provider shown in the graph below.

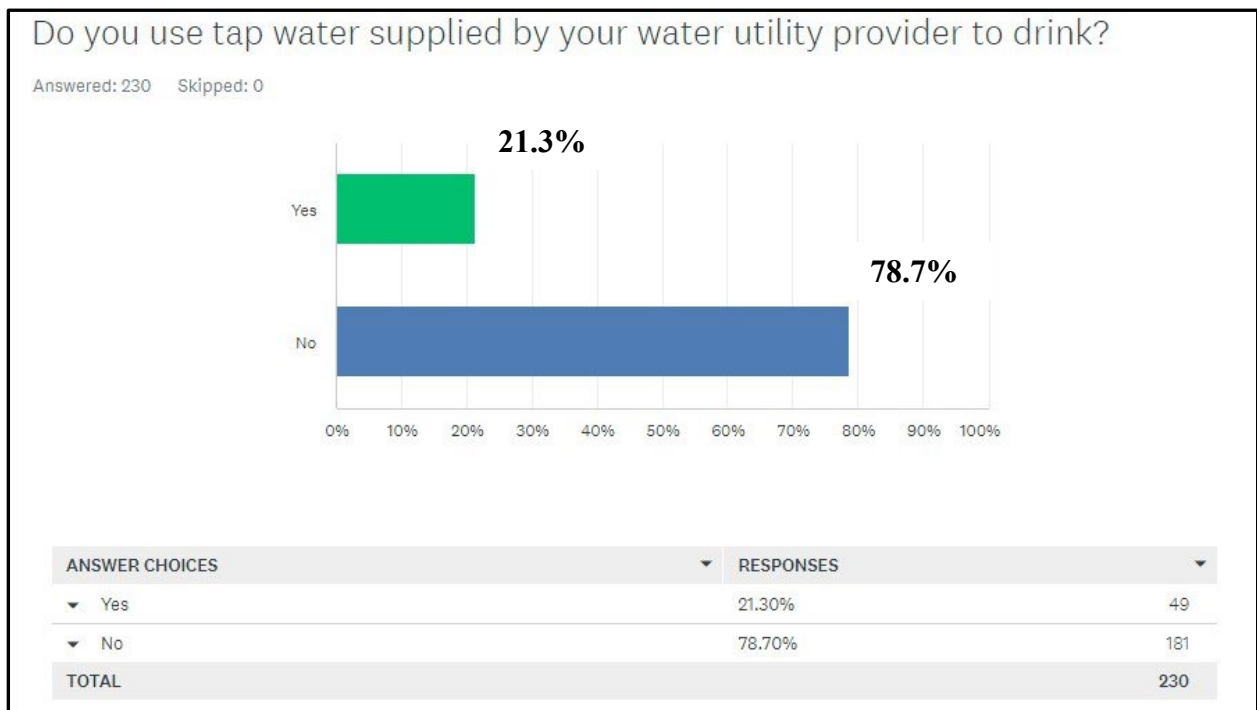


Figure 10, Bar Graph of Tap Water Use by 230 Online Survey Respondents

Ground Water Committee Report

70.43% of respondents (162/230) indicated that they had not installed water treatment systems to address observations of their tap water supply, shown in the graph below. 29.57% of respondents (68/230) have installed a water treatment system to address observations of their tap water supply, shown in the graph below.

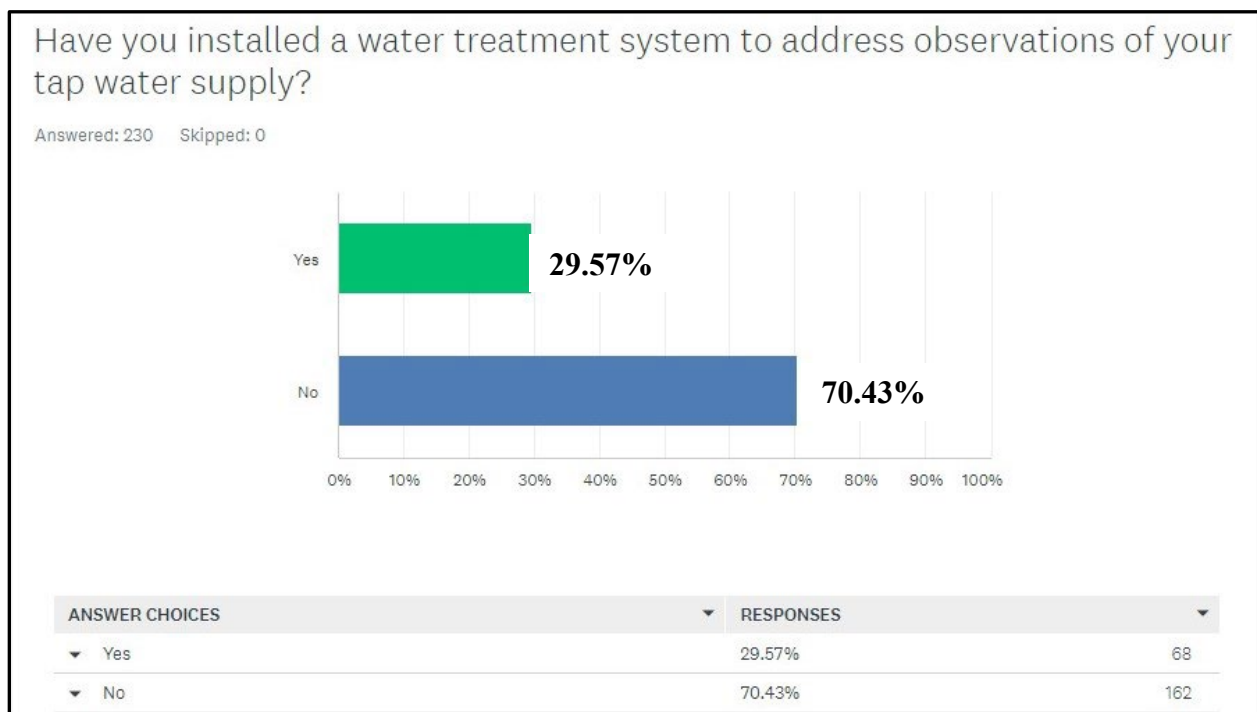


Figure 11, Bar Graph of Residential Water Treatment Installation Addressing Tap Water Supply of 230 Survey Respondents

Ground Water Committee Report

83.48% of respondents (192/230) indicated that they purchase bottled water to address observations of their tap water supply, shown in the graph below 29.57% of respondents (68/230) purchase bottled water to address observations of their tap water supply, shown in the graph below.

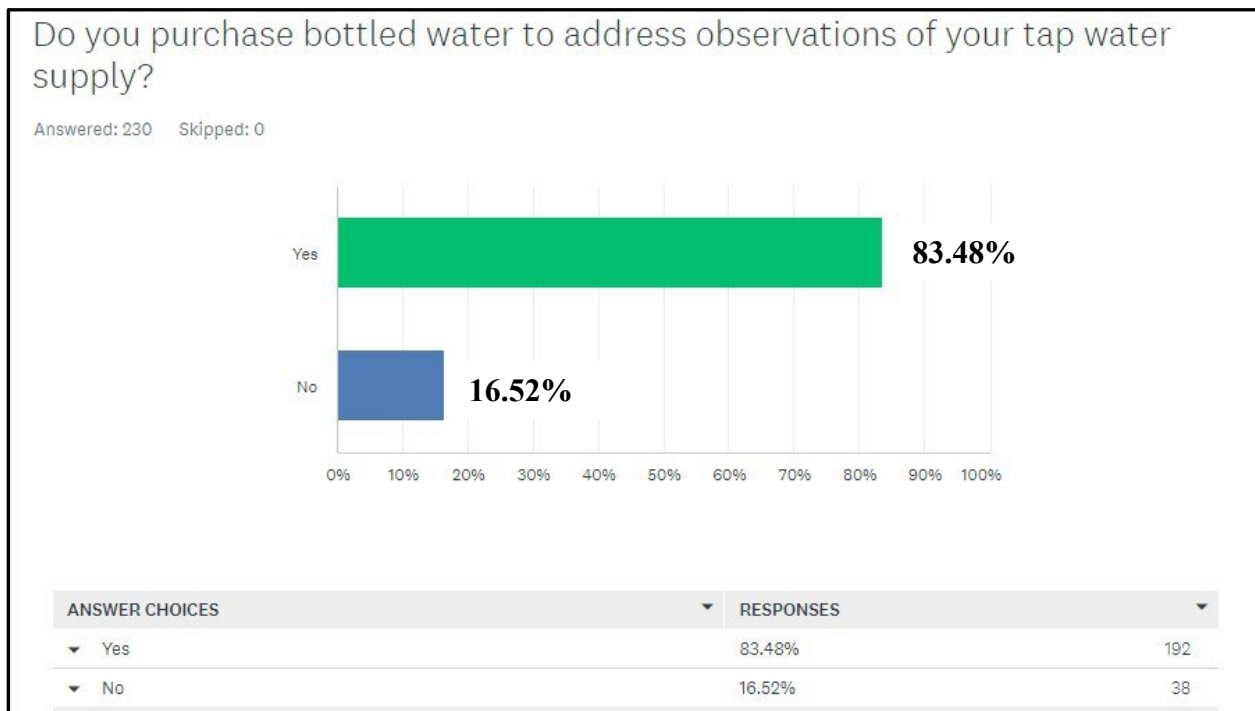


Figure 12, Bar Graph of Bottled Water Purchases Addressing Tap Water Supply of 230 Respondents

Ground Water Committee Report

A majority of respondents use water supplied by their utility provider for bathing - 96.92%, washing clothes - 98.24%, and dish washing - 96.92%. 70.48% of respondents utilize the water supplied to water their lawns and/or gardens. Less than half, only 45.37% (130/227), use the water supplied for food preparation, shown in the graph below.

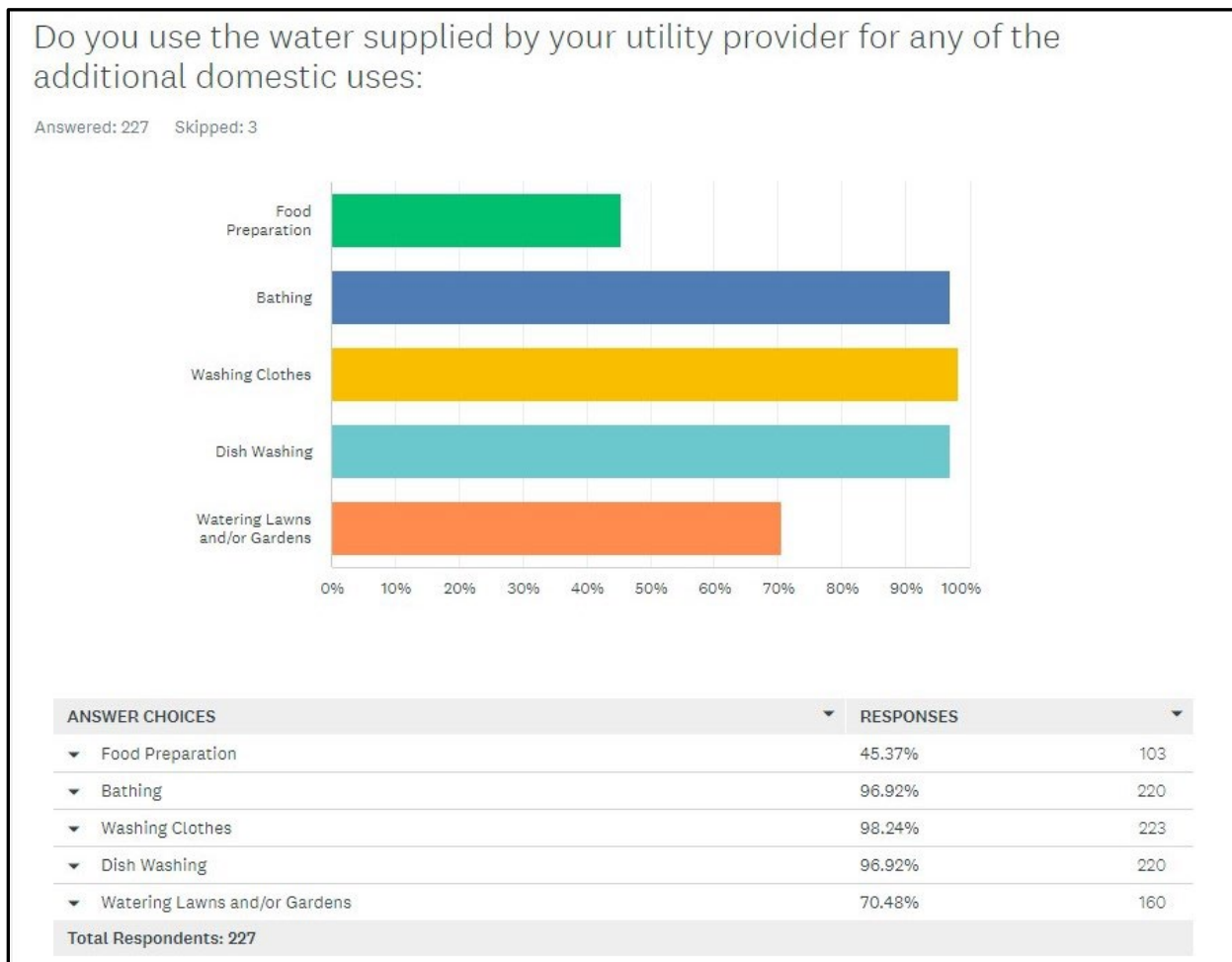


Figure 13, Bar Graph of Additional Domestic Water Uses of 227 Respondents

Ground Water Committee Report

Household Water Quality Results

On June 27 and 28, 2022, the Virginia Cooperative Extension, a partnership of Virginia Tech, Virginia State University, the U.S. Department of Agriculture, and local governments, conducted their annual Eastern Shore Household Water Quality Clinic. Iron, Manganese, Arsenic, Hardness, Sulfate, Fluoride, Total Dissolved Solids, pH, Sodium, Nitrate-N, Coliform, E. coli Bacteria, Copper, and Lead levels were tested. Eight residents took part in the water quality clinic and volunteered their results to Ground Water Committee staff for investigation.

Five out of the eight households tested indicated Total Dissolved Solids (TDS) levels above the recommended 500 mg/L level. Four out of the eight tested above the maximum 6.5 to 8.5 recommended pH range. All households tested above the 20 mg/L recommended Sodium level. In four out of eight households, Coliform Bacteria was present. All other measurements are below or within the recommended measured values. The eight residential water test results are described in the graph below.

	Salty Way	Octopus Road	Mayflower Drive	Meridian Drive	Yardarm Drive	Captains Corridor	Davey Jones Boulevard	Anonymous	
Test (units)	Water Quality Sample Results								Maximum Recommended Level or Range
Iron (mg/L)	0.018	0.133	0.096	0.013	0.015	0.028	0.011	0.098	0.3
Manganese (mg/L)	0.007	0.006	0.004	0.011	0.003	0.007	0.002	0.006	0.05
Arsenic (mg/L)	0.002	0.002	0.004	ND	0.002	0.002	0.003	0.002	0.01
Hardness (mg/L)	23.6	31.2	26.2	21	28.3	26.2	28.5	29.5	180
Sulfate (mg/L)	4.6	4	4.3	4	2.5	5.3	3.7	6.1	250
Fluoride (mg/L)	0.27	0.29	0.31	0.24	0.35	0.31	0.35	0.31	2
Total Dissolved Solids (mg/L)	457	622	546	375	567	492	551	596	500
pH	8.6	7.8	8.7	8.7	8.4	8.5	8.7	8.1	6.5 to 8.5
Sodium (mg/L)	148	183.12	182.01	121.76	181.56	161.97	181.87	181.27	20
Nitrate-N (mg/L)	ND	ND	ND	ND	ND	0.26	ND	ND	10
Total Coliform Bacteria Data: Presence/Absence	PRESENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	ABSENT	ABSENT
Most Probable Number Count (MPN/100mL)	1.01	2.04	ND	2.04	ND	1.01	ND	ND	
E. coli Bacteria Data: Presence/Absence	ABSENT	ABSENT	ABSENT	ABSENT	ABSENT	ABSENT	ABSENT	ABSENT	ABSENT
Most Probable Number Count (MPN/100mL)	ND	ND	ND	ND	ND	ND	ND	ND	
First Draw Data: Copper(mg/L)	0.01	0.023	0.064	0.051	0.03	0.01	0.008	0.037	1.3
Lead (mg/L)	ND	ND	ND	ND	ND	0.001	ND	ND	0.015
Flush Data: Copper (mg/L)	0.006	0.014	0.014	0.013	0.008	0.005	0.012	0.013	1.3
Lead (mg/L)	ND	ND	ND	ND	ND	0.002	ND	ND	0.015
Measured value exceeds recommendation for household water. ND indicates not detected (below the instrument detection limit)									

Figure 14, Residential Water Tests of Eight Homes in Captain's Cove Community

Water Quality

Principal sources of water quality are:

- a. Routine VDH reporting as part of the Utility's CWS permit, and
- b. DEQ reporting as part of the Utility's Groundwater withdrawal permit.

These two sources address water within the system (VDH) and source water from the aquifer (DEQ).

Water quality considerations, based on EPA Drinking Water classifications, can be broken down into Primary Drinking Water Regulations and Secondary Drinking Water Regulations. The Primary regulations are established to protect human health and are enforceable. The Secondary regulations are established to address constituents that can result in cosmetic effects (such as skin or tooth discoloration), or aesthetic effects (taste, color, odor, staining, corrosion), and are not enforceable.

Primary Drinking Water constituents:

Arsenic is the only constituent that, in the past, exceeded the Primary Maximum Contaminant Level at a frequency that required corrective action. The Utility implemented changes to the system that addressed the arsenic exceedances and is currently in compliance.

Ground Water Committee Report

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Secondary Drinking Water constituents:

Based on available information, the following appear to be the Secondary constituents most commonly identified as objectionable within the Utility:

Total Dissolved Solids (TDS): are associated with excessive hardness, scaling and deposits, colored water, staining, and taste (salty). The EPA has established a non-enforceable secondary standard (SMCL) of 500 mg/L. For groundwater on the Eastern Shore, the most common components comprising the TDS is the cation Sodium (Na) and anions Chloride (Cl) and Bicarbonate (HCO₃). Based on samples collected from the source aquifers from the Captain's Cove system, the dominant ions are Na and Cl (sodium chloride), which is consistent with Bay or sea water as the principal source of the TDS. TDS was not reported for the groundwater samples collected as part of the DEQ required monitoring. TDS collected from most of the homes in the Captains Cove Utility service area as part of the Virginia Household Water Quality Program exceeded the SMCL of 500 mg/L, with a range of concentrations from 375 mg/L to 622 mg/L.

Sodium (Na): is the dominant metal (cation) that comprise the majority of the dissolved solids present in groundwater on the Eastern Shore and is principally derived from sea water. While EPA does not directly regulate sodium in drinking water, EPA has published a Drinking Water Advisory (2003) that can be accessed at:

https://www.epa.gov/sites/default/files/2014-09/documents/support_cc1_sodium_dwreport.pdf

The conclusion and recommendations from the EPA document are:

- (i) *"This Advisory recommends reducing sodium concentrations in drinking water to between 30 and 60 mg/L based on esthetic effects (i.e., taste). This recommendation is not federally enforceable but is intended as a guideline for States."*
- (ii) *"A goal of 2.4 g/day dietary sodium has been proposed by several government and health agencies. Drinking water containing between 30 and 60 mg/L is unlikely to be perceived as salty by most individuals and would contribute only 2.5% to 5% of the dietary goal if tap water consumption is 2 L/day."*

Ground Water Committee Report

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- (iii) *“At the present time the EPA guidance level for sodium in drinking water is 20 mg/L. This value was developed for those individuals restricted to a total sodium intake of 500 mg/day and should not be extrapolated to the entire population.”*
- (iv) *The World Health Organization has established a drinking water guideline of 200 mg of sodium/L on the basis of esthetic considerations (i.e., taste).*

Based on samples collected from the production wells, Sodium is elevated in the source water from both the upper Yorktown-Eastover aquifer and Middle Yorktown-Eastover aquifer (Virginia Department of Environmental Quality Office of Water Supply, 2022):

Well	Aquifer	Count	Min	Avg	Max
#1U (WQ)	Upper YT	48	215	236	259
#1 (WQ)	Middle YT	56	250	301	770
#4 (&WQ)	Middle YT	46	126	234	277
OW4L (WQ)	Lower YT	22	260	676	818

Figure 15, Sodium Concentrations in Groundwater from Production Wells.

Ground Water Committee Report

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Chloride (Cl): is the dominant anion that, along with sodium, comprise the majority of dissolved solids present in groundwater on the Eastern Shore and is principally derived from sea water. The EPA has established a non-enforceable secondary standard of 250 mg/L associated with objectionable taste (salty).

Chloride Concentrations in Groundwater (mg/L)					
Well	Aquifer	Count	Min	Avg	Max
SMCL			250		
#1 (WQ)	Middle YT	56	164	196	243
#1U (WQ)	Upper YT	52	46	58	180
#4 (&WQ)	Middle YT	48	17	121	145
OW4L (WQ)	Lower YT	22	135	964	1,190

Figure 16, Chloride Concentrations in Groundwater from Production Wells.

Overall, the chloride concentrations are elevated, but on average, currently less than the EPA Secondary Maximum Contaminant Level based on objectionable taste. More significantly, chloride trends in at least one of the Middle Yorktown-Eastover wells (Well #1) are consistent with effects from saltwater intrusion (see graph below). These trends support the DEQ technical evaluation of the 2014 Ground Water Permit that there is “a potential for adverse changes to water quality due to simulated chloride concentration increase as a result of the proposed pumping.”

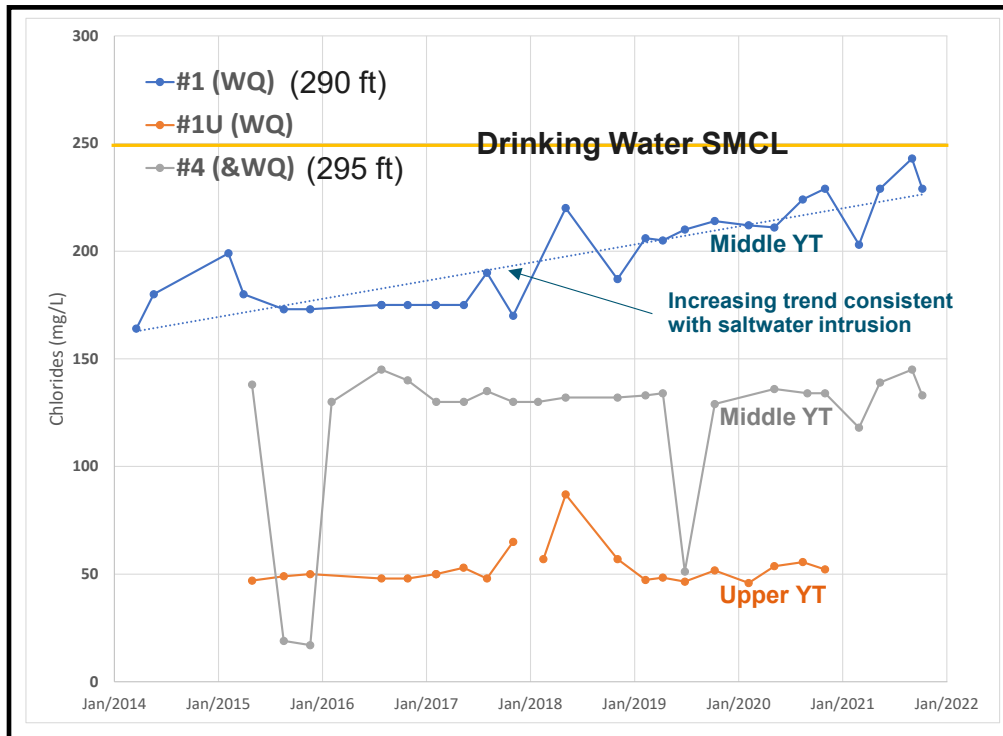


Figure 17, Line Graph of Production Wells Chloride Concentrations in Groundwater Relative to EPA Secondary Maximum Contaminant Level (SMCL). ARCADIS

Total Coliform: Coliform bacteria are not considered a normal inhabitant of groundwater or disinfected surface water. Their presence may suggest that there has been a breach, failure, or other change in the integrity of the water system. Disease-causing microorganisms may also have gained entry into the water system. While coliform bacteria themselves pose little health risk, their presence indicates that other health-threatening microorganisms may also be present. (Minnesota Department of Health, 2018)

Ground Water Committee Report

Turbidity, Color, Taste, and Odor: While there are no specific laboratory results reported for turbidity, color, taste, and odor, there have been anecdotal reports that water from some of the household taps had visible turbidity and objectionable color and odor. The color, taste, and odor issues are consistent with bacterial growth in the system (as previously noted) or stagnant conditions caused by low flow velocity in the distribution lines or poor flushing in certain portions of the system, or some combination of factors. While the high TDS can contribute to the color and taste problems, it is not likely a primary cause for the odor issues.

According to United States Environmental Protection Agency National Primary Drinking Water Regulations:

“The National Primary Drinking Water Regulations (NPDWR) are legally enforceable primary standards and treatment techniques that apply to public water systems. Primary standards and treatment techniques protect public health by limiting the levels of contaminants in drinking water.”

“Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (such as whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.”

“EPA's surface water treatment rules require systems using **surface water or ground water under the direct influence of surface water** to...”

“For systems that use conventional or direct filtration, at no time can turbidity (cloudiness of water) go higher than 1 Nephelometric Turbidity Unit (NTU), and samples for turbidity must be less than or equal to 0.3 NTUs in at least 95 percent of the samples in any month. Systems that use filtration

Ground Water Committee Report

other than the conventional or direct filtration must follow state limits, which must include turbidity at no time exceeding 5 NTUs.”

The EPA has established non-enforceable secondary standards for color and odor of 15 color units (“visible tint”) for color and 3 threshold odor units (“rotten-egg, musty or chemical smell”).

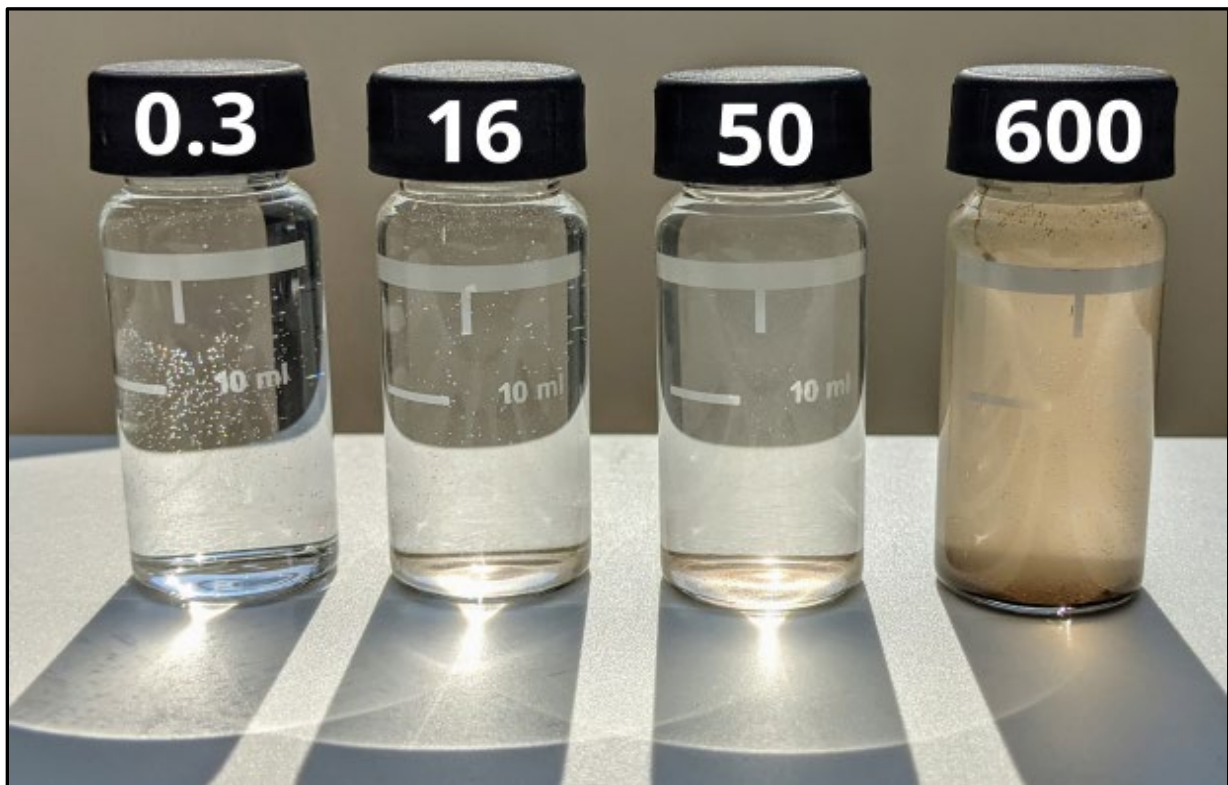


Figure 18, Four solutions with turbidities of 0.3, 16, 50 and 600 NTU. FreeUp Limited.



Figures 19-22, Photographic Examples of Residential Water in the Captain's Cove Community July-August 2022 (Leslie, Email Correspondence, 2022)

Ground Water Committee Report

Turbidity is regulated by the EPA for surface water and groundwater under the direct influence of surface water (GUDI). The Captain's Cove system does not fall under these categories, and the current permit does not require measurement for turbidity. Because the source of the turbidity is potentially from biofilm development in the storage and distribution system, turbidity for the source water (groundwater) will not be representative of turbidity at the household tap (point of use).

VDH has established the following requirements for turbidity for systems like Captains Cove that are not required to filter (Tucker, Email Correspondence, 2022).

"Turbidity in groundwater sources not required to filter shall not:

1. Interfere with disinfection throughout the distribution system;
2. Cause taste and odors upon disinfection; or
3. Cause consumers to question the safety of their drinking water."

Based on the consumer survey, number 3 and number 2 may appear to apply to the Captain's Cove system.

Summary of Water Quality

Water quality from the Yorktown-Eastover aquifers used by Captains Cove Utility has elevated dissolved solids levels, principally consisting of sodium, chloride, and bicarbonate. These constituents are **not** identified by the EPA as having an adverse health effect for **most** individuals. Some people can find the water objectionable at these levels, specifically with regard to excessive hardness, scaling and deposits, colored water, staining, and taste (salty). In addition to these issues related to the source water, it is possible that turbidity and objectionable odor, taste, and color that have been cited by Captain’s Cove residents may originate within the storage and distribution system from biofilm development due to stagnant or poorly flushed water. The **EPA** has identified the following methods to control or mitigate biofilms in distribution systems:

- **Main Flushing, pigging, and cleaning**
 - **Disinfectant residual**
 - **Main repair and replacement**
- **Minimization of dead ends / flow management**
 - **Corrosion control program**
- **Proper storage tank / reservoir operations and maintenance**
 - **Control and mitigation of system hydraulic problems**
 - **Nutrient suppression**
 - **Cross-connection control**

It is possible that some or all of these controls would reduce turbidity and associated odor, taste, and color issues cited in the consumer survey.

Additionally, there is evidence, both from water quality samples and DEQ modeling, that saltwater intrusion is occurring in portions of the Middle Yorktown-Eastover aquifer that can make these water quality issues worse.

Aqua’s Captain’s Cove Public Water System has submitted an application to DEQ to increase the amount of groundwater allowed to be pumped and is planning on shifting the principal withdrawal from the Middle Yorktown-Eastover aquifer to the (lower TDS) Upper

Ground Water Committee Report

Yorktown-Eastover aquifer. Increased pumping may increase the potential for saltwater intrusion,

the shift from the Middle to the Upper Yorktown-Eastover aquifer may also improve TDS, sodium, and chloride levels. It is not clear if these changes will address the reported odor and color issues with the system. Because testing has not been conducted, it is not known if use of the surficial aquifer is viable within the service area, and if water quality could be improved with the use of the surficial aquifer.

The Ground Water Committee has found no indication of actionable contamination in the aquifers that supply Captain's Cove.

Turbidity along with associated objectionable taste, color, and odor issues cited by consumers potentially originate within the storage and distribution system and may not meet VDH requirements for groundwater sources such as the Captain's Cove system. Specifically, based on the survey responses, the water meets the criteria to "*cause consumers to question the safety of their drinking water*" and "*cause taste and odors upon disinfection*".

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