

**Focus
on the
Piney Point Aquifer
of
Virginia's Northern Neck**

By
SAIF Water Wells, Inc.
www.saifwater.org
saif@crosslink.net

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Contents

Introduction by SAIF Water

Reasons for Concern

Phase One- Compilation and Evaluation of Wells Drillers' Reports

Phase Two - Characterization of Quality of the Piney Point Aquifer

Summary of Significant Findings by aquaFUSION

SAIF Water Perspectives on Findings

Abbreviated resume of Dr. David Buss

Analysis of Groundwater Samples by David Buss/aquaFUSION

Text

Significant Findings

Summary

Table 1 – Statistical Summary of Selected Inorganic Constituents

Figure 1. Location of the Four Counties in the Northern Neck

Figure 2. Hydrogeologic Setting and Conceptual Cross-Section of the Virginia Coastal Plain

Figure 3. Elevation of the Top of the Piney Point Aquifer

Figure 4. Distribution of Filtered Residue

Figure 5. Distribution of pH values

Figure 6. Distribution of Total Iron

Figure 7. Distribution of Manganese

Figure 8. Distribution of Sodium

Figure 9. Distribution of Fluoride

Figure 10. Distribution of Relative Concentrations of Sodium, Fluoride, and Filtered Residue

Introduction by SAIF Water

SAIF Water Wells, Inc. is a faith-based community effort to assure safer drinking water in rural Virginia. Since 1989 the organization has helped homeowners without water and sanitation facilities and addressed sanitation concerns of older residential wells. Volunteer efforts of many professionals have helped bring a well supported scientific perspective to drinking water issues in the Northern Neck.

SAIF Water has completed a two phase study that helps to characterize the domestic water supply conditions in our rural area of the Northern Neck.

Phase 1: Review of logs of wells drilled in the Northern Neck

Phase 2: Detailed review of water quality analysis in the Piney Point Aquifer.

This cover is a plain language overview of the projects. The reader is referred to the appended report by aquaFUSION for more detailed technical explanations.

A significant database of well depths and water quality analysis from selected wells was compiled from multiple private and publicly available sources. The current SAIF database contains several hundred wells and over 60 reliable water quality analyses in the Piney Point Aquifer.

Our work provides a solid characterization of the groundwater conditions in the Northern Neck. The natural groundwater conditions in both the surficial (water-table) aquifer and underlying Piney Point aquifer in the Northern Neck do not meet some primary and secondary water quality standards and guidance levels as published nationally by the United States Environmental Protection Agency. Certain aspects of this characterization of the groundwater are a health concern for our rural populous. Dissemination of technical knowledge could improve well construction standards and save state agencies from inadequate and costly mistakes in well drilling in the Northern Neck.

Reasons for Concern:

Odor. SAIF Water has received complaints of wells from Warsaw to White Stone where the odor is so strong that the water is unsuitable for laundry and bathing. Although wells may be considered potable by passing a total coliform bacteria screening, the water is far too foul smelling for anyone to drink.

Sodium. Our population has a high percentage of retired elder residents and those who have a propensity for high blood pressure. Elevated sodium is a problem for those individuals. Currently articles about elevated sodium in our artesian water have not identified the aquifer from which the water was drawn. This leaves homeowners with guidance from aquifers that could be hundreds of feet different from their well depth. Even county Health Departments are not in a position to suggest sodium levels as drillers' records on file do not indicate the aquifer. The critical question when drilling a new well for persons with health concerns is whether they could get a lower sodium level by drilling in the Piney Point Aquifer instead of the Potomac Aquifer which is deeper and more costly and also exhibits elevated sodium levels.

Arsenic. Reports of arsenic in aquifers just across the river in Maryland raised concern, but a 2005 Health Department review¹ of public water systems in Virginia could not identify the aquifer in which the wells were drilled. The Health Department data base collected data on public systems which may be primarily in a deeper aquifer than individual residential wells in the Piney Point Aquifer.

Lack of Information. SAIF Water is deeply appreciative of and has cooperated with research projects conducted by the Virginia Department of Environmental Quality in our area. But currently available data on our Northern Neck groundwater is very limited in comparison with other parts of the Commonwealth.

¹Plan of Action for Arsenic in Drinking Water. Office of Drinking Water, Virginia Department of Health, March 22, 2005.

SUMMARY OF SAIF Water Studies

Phase One - Compilation and Evaluation of Well Driller's Reports

With the assistance of funding from the Jessie Ball duPont Fund through the sponsorship of St. Mary's Whitechapel Episcopal Church, the staff of SAIF Water Wells compiled sample well drillers' reports for each tax map district in four counties of the Northern Neck—Lancaster, Richmond, Northumberland and Westmoreland. These reports were evaluated by ground water geologists Frank and Jeff Fletcher to determine the aquifer from which the well was deriving its water supply. Table A below shows aquifer designations for the 142 records reviewed. About 51 percent of the wells for individual homes were drilled in the Piney Point Aquifer in the Neck.

Northern Neck Aquifer Study, 2009
TABLE A. Aquifer Designations by County

AQUIFER	Lancaster	Northumber- Land	Richmond	Westmore- land	Total
Eastover	3				3
	6	23	22	22	73
Piney Point					
			5	12	17
Aquia	18	21	3	3	45
Potomac					
Either of Two aquifers					4
TOTAL	28	47	30	37	142

Phase Two – Quality of the Piney Point Aquifer

Many of the well records in Phase One were from old files which did not have information adequate to contact current owners. With assistance from the Jessie Ball duPont Fund through the sponsorship of St. Mary's Whitechapel Episcopal Church, SAIF Water took additional water samples across the Northern Neck and had them

analyzed for organic and inorganic compounds and combined these samples with Piney Point aquifer wells sampled by the United States Geological Survey in Professional Paper 1772¹

aquaFUSION, Inc. mapped location of the wells and the geographic distribution of concentration for some selected constituents from the database. Significant findings of this mapping exercise underscore the potential water supply problems facing our residents.

Significant Findings by aquaFUSION

1. Concentrations exceed water quality standards for the constituents of pH, total ion concentration (filtered residue), nitrite, iron, manganese, and fluoride and the guidance level for sodium in parts of the Piney Point Aquifer of the Northern Neck. These levels are widespread and suggest a need for treatment equipment. (The non-enforceable guidance level for sodium is 20 mg/l per day for individuals on a 500 mg/day restricted sodium diet.)
2. The Piney Point Aquifer shows a progressive down-dip evolution from west to east of its groundwater character from “hard to soft to salty” type.
3. The three types of groundwater found in the Piney Point of the Northern Neck present different water treatment problems for the domestic user. The soft water zone in the central portion of the Neck generally suitable for a wide variety of uses and typically requires no treatment except for sodium. The “hard” water zone, most commonly in the western portion of the Neck, is typically treated by ion exchange systems. The treatment of “salty” water, predominately in the eastern portion of the Neck, is more complicated requiring the removal of sodium, fluoride, and possibly chloride.
4. The Piney Point is generally a confined aquifer. But in some locations it mixes with the surficial aquifer.

The complete text of aquaFUSION report is appended.

¹McFarland, E.R., 2010, Groundwater-quality data and regional trends in the Virginia Coastal Plain, 1906-2007: U.S. Geological Survey Professional Paper 1772.

SAIF Water Perspectives on Findings

Odor Problem. Our investigations of existing treatment equipment and field trials at four homes for the sulfur odor problem showed that when appropriate aeration treatment technology is installed the odor is reduced to a barely noticeable level. These technologies include: 1) a storage tank designed for aeration and micronizer and 2) aeration devices such as bleedbacks. The aquaFUSION report indicates that this type of technology would not be appropriate in the western section of the Northern Neck.

Total Hardness. aquaFUSION suggests that in the western part of the Northern Neck where the Piney Point water is hard, types of treatment other than aeration would be necessary. Water softening technology and reverse osmosis are the most typically utilized technology for hard waters; however long-term maintenance costs can be prohibitive for some residents.

Sodium. Individuals who have been placed on a sodium restricted diet of less than 500 mg/day should, by all means, have their Piney Point well water analyzed for sodium by a Virginia certified laboratory. Persons whose health does not require sodium restrictions are free to enjoy the taste. This study confirms that the Piney Point Aquifer has an elevated sodium level across the entire Northern Neck.

Arsenic. The geology of the area and the laboratory results from this study do not indicate cause for concern about arsenic in the Piney Point Aquifer. While this is a comforting finding, this is a very limited data base for evaluation of the potential for arsenic.

New Wells. State and private agencies which provide new wells should be advised that they are likely to need treatment equipment if wells are located in the Piney Point Aquifer. The initial cost of drilling deeper to the Potomac Aquifer may be superior to saddling the well owner with maintenance of treatment equipment.

Upper and Lower Piney Point Aquifer Mapping. Hydrogeologic mapping for the upper part of the Piney Point is still generalized. Future studies by the Groundwater Characterization staff of the Virginia Department of Environmental Quality may refine mapping to

give better guidance to well drillers regarding the depth of the “cleaner sands” of the Piney Point to avoid odor and iron water quality problems.

Cautionary Note. While the Piney Point is usually considered a confined (artesian) aquifer, aquaFUSION notes that it becomes unconfined (closely connected with the water-table aquifer) along the Potomac River where erosion has exposed the Piney Point. This suggests that homeowners can no longer assume that their well water will remain bacteria free just because it looks like it is artesian (or tapping a confined aquifer). Well owners in this area should plan to periodically send water samples to a laboratory for coliform bacteria screening. Use of the deeper Potomac Aquifer is preferable when drilling a new well.

Public Policy. It simply is not acceptable for state agencies to blindly accept a general contractor’s bid on a home without specific knowledge of the aquifer in which they plan to drill the well. At present the only requirement is to follow the Health Department’s permit for location. But that location is only designed to protect the water supply from septic systems and surface contaminants. The lowest bid on the well may leave the homeowner to install thousands of dollars worth of treatment equipment which will require a lifetime of maintenance.

The current inspection procedure of new wells by the **Health Department** does not allow monitoring of the well depth or include authorization to insist on water quality that meets the National Drinking Water Standards. The well inspection requirements are not as stringent as the care that is taken through the stages of construction of a septic system. There are several well drillers in our area who insist on quality well construction and try to find acceptable water quality. But these are not required standards. The bottom line on some contracts is a guarantee to get water, but no guarantee on the quality of it.

The current policy of Virginia’s **Department of Housing and Community Development** calls for abandoning large diameter water-table wells (surficial aquifer) and replacing them with “artesian” wells that are not easily contaminated from the ground surface.

According to the aquaFUSION report, in some areas the Piney Point is not separated from the water-table aquifer. Thus the homeowner could easily be spending thousands of dollars to put in a Piney Point well that is susceptible to surficial contamination. (The surficial aquifer is in unconfined sediment which allows for relatively easy infiltration of contaminants. When an aquifer is separated from the surface by clay layers which resist infiltration it is called a “confined” aquifer. The subsurface water is under pressure from the confining layers.)

SAIF Water has also witnessed some wells installed by state-sponsored programs in the Yorktown-Eastover Aquifer which is only a few feet below the water-table aquifer. Geologists from the Virginia Department of Environmental Quality have indicated that this aquifer is not separated from the water-table aquifer in many locations and that it is impossible to tell prior to drilling the well whether an Eastover well will be any safer than a water-table well. Again, thousands of dollars have been spent to abandon large diameter water-table wells and replace them with wells that have little better capacity to prevent contamination from the ground surface.

Hope for the Future. *This offering is only a limited look at one of our aquifers.* It is an attempt to gather some basic data so that hypotheses for research can be formed. SAIF Water offers this contribution with the hope that it will inspire legislators and agency staff to expand the research they have begun. As concerns for sustainability of Virginia’s water supply grow, it will be critical to have an adequately researched base for decision making.

Abbreviated Resume of Dr. David Buss

Dr. Buss is the Principal Hydrogeologist for aquaFUSION, Inc. located in Oakton, Virginia, a hydrogeologic consulting company specializing in analysis of soil and ground water problems in diverse settings. His doctorate in geology was received from Pennsylvania State University. He has had 32 years of experience as a professional geologist and has directed projects in 32 states. His project work has included studies of the migration of inorganic, organic, and radionuclide constituents in surface and groundwater; investigations of hazardous waste disposal facilities; and hydrogeologic assessments for quarries and mines.

Dr. Buss has authored numerous articles for professional journals, served as a presenter for the Geological Society of America Symposium, and prepared papers for international conferences on groundwater.

Dr. Buss currently serves as the Environmental Industry Representative on the Geologic Mapping Advisory Committee of the Division of Mines, Minerals, and Energy in the Commonwealth of Virginia.