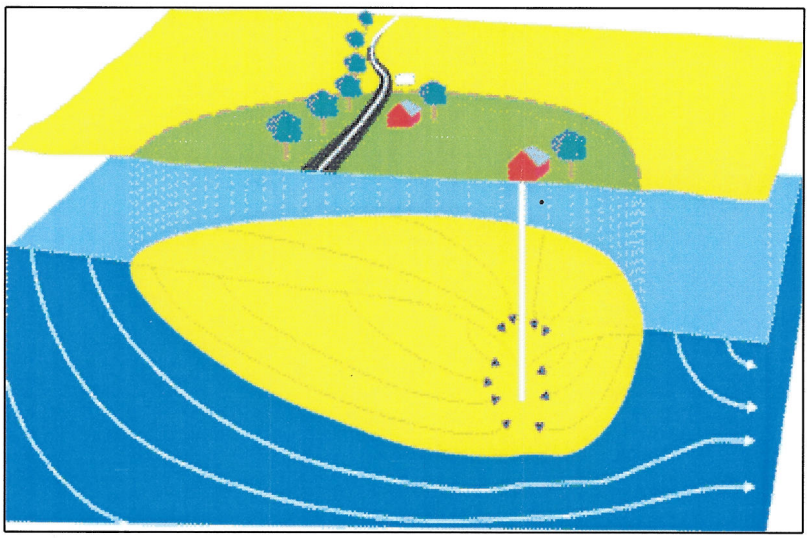
SOURCE WATER ASSESSMENT

FOR

TALBOT COUNTY, MD



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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for twenty-eight transient non-community water systems in Talbot County. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are: 1) delineation of an area that contributes water to the source; 2) identification of potential sources of contamination; and 3) determination of the susceptibility of the water supply to contamination. Recommendations for protecting the drinking water supply conclude this report.

Confined aquifers protect supplies from contaminants originating on the land surface. Transient water supply systems in Talbot County predominantly use confined aquifers. Thirty-one wells supply the twenty-eight transient systems in Talbot County. Through investigation of MDE records and interviewing system owners it was concluded that twenty-eight of these are completed in confined aquifers. Three wells were not determined to be completed in a confined aquifer, so they were considered unconfined. Three additional systems were visited and determined to be closed. The Source Water Assessment Area for the unconfined wells were delineated by the WSP using EPA approved methods specifically designed for unconfined sources.

Potential point sources of contamination within the assessment areas were identified from field inspections and contaminant inventory databases. One common potential source of contamination can be on-site septic systems. The Maryland Office of Planning's 2002 Land Use map for Talbot County was used to determine which land use was present in each assessment area. Open Urban Land and Medium Density Residential uses were most commonly identified within the assessment areas. Figures 4 a-c show well locations, assessment areas and potential contaminant sources overlain on aerial photographs.

The WSP reviewed water quality results, along with the presence of potential sources of contamination within the individual assessment areas, the integrity of the system's well, and the inherent vulnerability of the aquifer. It was determined that none of the transient systems are susceptible to contamination by nitrogen compounds or volatile organic compounds. However, some systems are susceptible to microbiological contaminants through well construction deficiencies. Repeated positive bacterial results may also be due to contamination of treatment units (such as ion exchange units), failure to disinfect after making improvements to a well pump or distribution system, or growth in the distribution systems at locations where water is stagnant. Recommendations for improving and maintaining the sanitary integrity of the water supply systems are described at the end of this report. These include disinfecting the system after work is performed on the system, installing a two-piece, insect proof cap on the well, protecting the wellhead from damage by vehicles of other machinery, caulking the electrical conduits and continuing regular inspections.

INTRODUCTION

The Water Supply Program (WSP) has conducted a Source Water Assessment for twenty-eight transient non-community water systems in Talbot County (Figure 1). As defined in Maryland's Source Water Assessment Plan (SWAP), a transient non-community water system is any non-community water system that does not regularly serve at least twenty-five of the same individuals over six months per year. Some good examples of transient water systems include hotels, restaurants, parks, fire departments, and churches. The transient systems must sample for two contaminants. The first is coliform, which is an indicator that other microbiological contaminants could be in the water supply. Systems are required to test for coliform regularly. Additional sampling is required following positive coliform results. The second contaminant is nitrogen in the form of nitrate or nitrite. This SWAP report will focus on these two contaminants, but will address other obvious potential sources of contamination.

Talbot County is located in the Eastern Shore portion of the State and is located in the Coastal Plain physiographic province. The Coastal Plain, geologically the youngest province in Maryland, covers nearly half of the State and consists entirely of unconsolidated sediments. All of the transient water supplies obtain their water from wells of various size and depth. Most of these wells are completed in confined aquifers, while three are possibly using an unconfined aquifer. For the purpose of this report, depth of well, lithology, and nitrate data were used to determine whether the wells are in confined or unconfined aquifers. If this information was not available then the well was considered unconfined. An accurate determination of the aquifer type is very important because it helps us understand the inherent vulnerability of a source to land use activities.

WELL INFORMATION

Well information for each system was obtained from the WSP's database, owner interviews, site visits, well completion reports, sanitary survey inspection reports, and published reports. A total of thirty-one wells are used by the twenty-eight transient systems assessed in this report. This excludes the standby well for Chesapeake Landing. The well tag number, which provides vital well information, was found for twenty-eight of the thirty-one wells that are being used by the systems (Table 1). From the well tag information, ground water appropriation data, and with the nitrate sampling data it was concluded that twenty-eight wells are completed in confined aquifers (Aquifer code "C"). Nitrate has never been detected in the well for Wye Mills Market. The shallow unconfined aquifer in this area is known to contain elevated levels of nitrate. It is suspected that the well serving Wye Mills Market is confined, but without any well information we cannot be certain. This well will be considered unconfined for this report. It cannot be determined if the remaining three wells are completed in a confined aquifer, so for this report it is assumed to be completed in an unconfined aquifer (Aquifer code "U"). Table 1 contains a summary of the well information for each system.

Much good well information for the transient systems in Talbot County was available at the start of this project. Using this information, it was determined that all but five of the wells were completed in confined aquifers. Thorough field investigations and interviews with the system owners revealed that another two wells were completed in

confined aquifers. The wells for Corner Market, Wye Mills Market and Hog Neck Golf Course could not be labeled as confined wells. Well and contaminant source locations were taken with a GPS unit at the five transient systems that required fieldwork. The other wells were located by using both the county sanitary survey and DNR DOQQ photos. Information was found that at least twenty-four of the thirty-one wells were completed after 1973, which is when the State adopted the well completion standards for wells.

HYDROGEOLOGY

Talbot County is located in the central Eastern shore of Maryland. The entire county is located in the Coastal Plain physiographic province, which is characterized by low topography due to the underlying horizontal sedimentary layers. All of the transient wells in Talbot County draw water from unconsolidated sediments. Ground water flows through pores between gravel, sand, and silt grains in unconsolidated sedimentary aquifers. An aquifer is any formation that is capable of yielding a significant amount of water. Confined aquifers are those formations that are overlain by a confining layer consisting of clay or fine silt (Figure 2). This confining layer, generally composed of clay and silt, allows very little water to travel vertically through it. Confined aquifers are recharged from the water stored in the confining unit above and from precipitation that infiltrates into the formation where it is exposed at the surface. Unconfined aquifers are also known as water table aquifers. Precipitation that falls on the ground surface infiltrates the water table aquifer. Transient water systems in Talbot County pump water from one of five aquifers. The first, and the shallowest in Talbot County, is the Quaternary Aquifer. The Quaternary Aquifer is always considered unconfined in Talbot County. The second aquifer is the Federalsburg, the third is the Cheswold, the fourth is the Piney Point, and the deepest aquifer that the transient systems draw from is the Aquia. The Federalsburg and the Cheswold are mostly confined, but unconfined in some areas. The Piney Point and Aquia aquifers are always confined in Talbot County (DNR 1987) (Department of Geology, Mines and Water Resources State of Maryland, 1957).

Quaternary Aquifer (110C)

The Quaternary Formation contains the youngest deposits on the Eastern Shore. The Quaternary sediments form a surface blanket over most all of Talbot County, except in some stream valleys where Miocene sediments may be exposed. Most of this formation is sand and marl with some layers of silt and sandy clay. These clay layers are broken and thin enough that true confining layers are not present. These clay layers do however slow down the percolating water somewhat. The thickness of the Quaternary deposits range from 0 – 40 feet across Talbot County. The quantity of water available from this aquifer is very high. The water quality of the Quaternary Formation is quite variable depending on the local soil types and land use. Because it is shallow, the Quaternary Aquifer is vulnerable to contamination from surface sources. Chloride concentrations are moderately high, with an average concentration of 32 mg/L, due to contamination from surface sources. Nitrate concentrations are also high, with an average of 8 mg/L, due to agricultural application of fertilizer, septic disposal, and high dissolved oxygen concentrations, which prevent nitrate from degrading. Water in this

aquifer has mixed cation and anion types, ranging from calcium and magnesium bicarbonate types, to sodium chloride and nitrate types. The only water type not exhibited is the sodium-potassium bicarbonate type (DNR 1987) (Drummond, 2001).

Federalsburg Aquifer (122E) and Cheswold Aquifer (122C)

In all of the background literature that was collected, the Frederica, Federalsburg, and Cheswold aquifers were undifferentiated and collectively referred to as the "Miocene aquifers." The Miocene aquifers range in thickness from 0 – 360 feet in Talbot County. The Miocene aquifers only outcrop to the land surface where they are exposed in stream valleys. The Miocene aquifers consist of relatively thin aquifers of sand and marl separated by thick aquicludes of silt and sandy clay. Silty and clayey layers in the top aquifers generally act as a confining unit above the aquifer layers and prevent a direct hydraulic connection with the overlying Quaternary aquifer. Similarly, silty and clayey layers in the lower part of the Miocene aquifers act as a confining unit below the aquifer layers. In some areas, the confining units may be absent, in which case the aquifer layers would be in direct contact with the overlying Quaternary aquifer and the underlying Piney Point aquifer. Although the Miocene aquifers are relatively shallow, they are generally overlain by low-permeability confining units, which prevent downward migration of contamination from surface sources. Water quality in the Miocene aquifers is generally good in Talbot County. The aquifers have low chloride, nitrate, and iron concentrations. The water is dominated by calcium and sodium bicarbonate types (DNR, 1987) (Drummond 2001).

Piney Point Aquifer (124E)

The Piney Point aquifer is confined and does not outcrop in Maryland, so it is not vulnerable to contamination from surface sources. The Piney Point formation contains gray quartz sand and dark gray silt with clay and abundant shell material. It ranges in thickness between 0 – 175 feet. It is sufficiently permeable in parts to pass recharge up from the Aquia greensand. Water quality in the Piney Point aquifer is good and fairly consistent throughout Talbot County. Cation water types range from sodium to mixed calcium and magnesium. Anion water types are exclusively bicarbonate. This means that the water is moderately soft and somewhat alkaline. The water is also low in iron and low in chloride. Average dissolved solids total 440 ppm (DNR,1987) (Drummond, 2001) (Department of Geology, Mines and Water Resources State of Maryland, 1957).

Aquia Aquifer (125B)

The Aquia aquifer is the most widely used source of water in Talbot County. The Aquia aquifer consists of green quartz sand that is moderately glauconitic, with a few lenses of yellow and green clay. It also contains shell fragments and occasional hard beds. It ranges in thickness between 120 –250 feet. The water quality is good in the Aquia aquifer throughout all of Talbot County. The water in the aquifer is moderately high in sodium bicarbonate, low in iron, and slightly

alkaline. Hardness ranges from 2 ppm to 90 ppm (Drummond, 2001) (Department of Geology, Mines and Water Resources State of Maryland, 1957).

SOURCE WATER ASSESSMENT AREA DELINEATION

When Maryland's SWAP was written the method for delineating an assessment area for the unconfined transient systems using <10,000 gpd was not yet determined. An ongoing study between The United States Geologic Survey and MDE assisted MDE in selecting an appropriate method. One of the objectives of this study was to determine ground water flow paths for systems pumping <10,000 gpd in unconfined Coastal Plain aquifers. The study concluded that small users, pumping <10,000 gpd, have very little effect on the ambient ground water flow in unconfined aquifers. Using this information MDE created a wedge shape delineation area that will be used for all the transient systems where the basic direction of ground water flow is known. The wedge is based on an annual recharge of 1 ft and ground water flow directions. The wedge shape has an angle of 60 degrees that will extend against the ground water flow direction for a length of 1000-ft (Figure 3). The wedge was created to compensate for uncertainties in ground water flow direction and to provide sufficient recharge area to balance a withdrawal of 10,000 gpd. A circle with a radius of 1000 ft will be used for all systems that pump from unconfined aquifers where the ground water flow direction is not known. As defined in Maryland's SWAP, no delineation area will be created for the transient systems drawing from confined sources. This is because the monitoring of these wells for their regulated contaminants and geologic protection has established that they are not vulnerable to contamination. The assessment focuses on the integrity of their water supply well(s).

POTENTIAL SOURCES OF CONTAMINATION

As stated in the introduction, the focus of this SWAP is on the sources of contamination that would cause a coliform or nitrite/nitrate problem in the unconfined aquifers. Potential sources of contamination can be broken into two types. The first type is point source contamination. Some examples of potential point source contaminants would be feed lots, ground water discharge permits, and underground storage tanks. The second type of potential sources of contaminants is non-point sources. Some types of non-point sources can include general row-crop farming; land application of waste, pesticide and herbicide application, and various land uses. On-site septic systems are often referred to as non-point pollution as they are very common in non-sewered residential areas. Over 300,000 households in Maryland rely on on-site sewerage disposal for domestic wastes. In this project the location of specific septic systems for the systems were identified. Therefore they have been included with point sources.

Point Sources

Within the area delineated on Figure 4a there were no mapped septic systems for Corner Market because public sewer serves Corner Market and the residents within the assessment area. Figure 4b shows the delineation area for Wye Mills Market. There are about twelve septic systems within the zone of contribution for their well. The delineation area for Hog Neck Golf Course is shown in Figure 4c. Only the septic system for Hog Neck Golf Course is within the zone of contribution for their well. This information was determined using the 2004 tax

map, 2002 land use information, aerial photos of the delineated area, and observations made from field investigation. Each of the properties within the assessment area for Wye Mills Market, and the property for Hog Neck Golf Course are served by on-site wastewater, which is a potential source of nitrates and pathogenic microorganisms. A properly sited, designed, installed, and maintained septic system is not a source of pathogenic bacteria or protozoa to the ground water due to the filtering capacity of the absorption bed and soil. On-site septic systems do not remove nitrogen from the wastewater. The dissolved nitrogen in the wastewater percolates down through the soil to the groundwater in the unconfined aquifer. Excessive concentrations in water supplies are prevented through requiring minimum lot sizes and strategic placement of wells relative to on-site disposal systems.

Land Use

The Maryland Office of Planning's (MOP) 2002 Land Use map for Talbot County was used to identify predominant types of land use within the three SWAP areas (Figure 5). The two largest proportions of land use for the SWAP areas are Open Urban Land (mostly contained in the Hog Neck Golf Course SWAP Area) and Medium Density Residential at 32.5% and 24.6% respectively. The next most common type of land use is under Forest cover at 11.8%. These three land uses make up 68.9% of the total land area within the three SWAP areas. The next four land uses; Cropland, Low Density Residential, Commercial and Water contribute another 31.2% (Figure 6). These types of land use would be expected since most of the systems are located in small population centers. Ground water contamination of unconfined aquifers is possible from multiple on-site systems, or from over fertilization of lawns or cropland.

Sewer

The Maryland Office of Planning 1999 Talbot County Sewer Map shows that only 4.45 percent of the county currently has sewer service (Figure 7). Another 1.5 percent is expected to have sewer service in 3 to 5 years. An additional 0.3 percent is scheduled to receive service in 6 to 10 years. At this time there are no plans to provide any new sewer service to the other 93.7 percent of Talbot County.

WATER QUALITY DATA

Water quality data was reviewed from the Water Supply Program's database for Safe Drinking Water Act (SDWA) contaminants. All data reported is from the water supplied to consumers. Only two of the Talbot County Transient Systems is known to have some type of water treatment. Table 2 summarizes the treatment methods and the reason for that treatment. None of the systems uses disinfection. If coliforms are not present in the finished water for the twenty-eight systems this data may be used to evaluate ground water or source water quality. A review of the monitoring data shows that there is some microbiological contamination believed to be caused by well construction, treatment, and/or distribution deficiencies. None of the systems were determined to be susceptible to nitrate or nitrite.

Nitrogen Compounds

Water quality data indicates that the nitrate levels for all of the transient non-community systems in Talbot County are <50% of the SDWA maximum contaminate level (MCL) standards (Table 3).

None of the systems had nitrite results that exceeded 50% of the MCL of 1 ppm for nitrite. This should be expected since twenty-nine of the thirty-one wells are completed in confined aquifers that shouldn't contain much if any nitrate or nitrite.

Microbiological Contaminants

All of the transient water suppliers are routinely sampled for microbiological contamination. If this routine sample is positive the system must then resample within twenty-four hours or as soon as possible. This bacteriological sampling is required by the SDWA (Table 4). Ten of the systems have never had a positive bacteriological sample. Nine systems have had more than twenty-five percent of their bacteriological samples come back positive since 1996. Miles River Yacht Club had a positive fecal sample in routine sampling once, but the repeat samples came up negative for fecal coliform. Tilghman Island Inn had positive fecal samples in routine and multiple repeat sampling during September of 1999.

SUSCEPTIBILITY ANALYSIS

Wells serving the Talbot County Transient Water Systems all draw their water from wells in unconsolidated sedimentary aquifers. The wells drawing from confined aquifers are protected from surficial contamination, if the well is maintained and constructed correctly. Deep wells, however, may be subject to elevated levels of naturally occurring contaminants, such as arsenic and iron. The unconfined aquifer wells are more susceptible to contamination from surface activities. Talbot County's unconsolidated sediments, and soil, provide protection from microbiological contamination as water percolates through the overlying soil and aquifer sediments. However, nitrate and other water-soluble contaminants can percolate through the soil and contaminate unconfined wells.

Inorganic Compounds

There were no significant nitrate or nitrite results for the twenty-eight systems. This was expected because all but three of the systems are determined to be confined and the nitrate levels in confined aquifers are very low to nonexistent. The three possibly unconfined systems in Talbot County do not have any detectable levels of nitrate or nitrite.

While outside the scope of this report, we have briefly summarized below the findings of arsenic surveys for systems in Talbot County. A survey of the major aquifers of Maryland's Coastal Plains (Interim Report Boulton, 2003), subsequent sampling by local health departments and compliance monitoring under the Safe Drinking Water Act by community and non-transient non-community water

systems has demonstrated that a significant portion of wells completed in the aquifers used by some of the transient systems in Talbot County have naturally occurring levels of arsenic above the newly established level of 10 parts per billion. The Aquia and Piney Point/ Nanjemoy Aquifers have been identified to have elevated arsenic levels. Twenty-five of the thirty-one wells were positively identified to use these aquifers. Arsenic testing is not required of transient non-community water systems, nor are these systems required to meet the new standard.

Microbiological Contaminants

As stated earlier in this report, Talbot County's unconsolidated sediments, and soil, provide protection from microbiological contamination as water percolates through the overlying soil and aquifer sediments. Most, if not all, of the microbiological contamination of unconsolidated wells, confined or unconfined, comes from either well construction problems or contamination of the well water with bacteria from either treatment units or the distribution system.

Well construction problems can be caused from improper completion of the well by the well driller, but are mostly caused by vehicles hitting unprotected wells. Common problems include cracked or broken well casings, and well caps. Pitless adaptors and the grouting can also be damaged during well vehicle accidents. Wells constructed in pits or low areas that are subject to flooding should be inspected and sampled to ensure their integrity. All of these construction deficiencies can allow surface water containing microbial contaminants to enter a well. Two-piece insect proof caps should be installed on all wells to prevent insects from entering the wellhead, which can cause bacterial problems.

Contaminating clean well water with coliform is very easy. Ion-exchange units, and cartridge filters can harbor bacteria that will cause positive bacteriological samples. These units can be contaminated prior to installation. Storage or a distribution problem or repair can also introduce the coliform into the system. Correctly disinfecting the water system is very important after pulling a well pump or completing improvements to the distribution system. Dead ends in the water distribution can also cause bacteriological problems.

Confined Wells:

If there are no well construction problems with a well drawing from a confined aquifer the supply should be safe from microbiological contamination. A review of Table 4 indicates that sixteen of the twenty-five confined systems have had at least one positive total coliform sample in the past eight years. Eight of the systems have greater than twenty-five percent of their samples come back positive for coliform. A summary of our inspection results is described below.

There were no wellhead deficiencies found at Fairbank Bait and Tackle or Highs Dairy Store upon inspection. Sample results indicate that Fairbank Bait and Tackle was contaminated with total coliform from June until October in 2003.

Highs Dairy Store was contaminated in 2000 and 2001. There have not been bacteriological detects for either of the systems since that time.

The inspection of Moose Lodge revealed that there could be multiple problems causing their bacteriological problems. The well has a one-piece cap that should be replaced with a two-piece cap to prevent insects from entering the well. The Lodge has an ion-exchange tank to remove iron. Ion-exchange tanks can sometimes harbor bacteria that can cause positive bacteriological results. It was also observed that there was an extensive plumbing system that may contain dead ends.

The inspection of the wellhead at Stumps Seafood showed it suffered from vehicle damage. The cap was off and no longer connected to the casing. Inspection of the electrical conduit indicated that the well cap might have never been installed properly. The electrical wiring was run between the cap and the well casing, and not through the conduit opening.

The Oaks uses a well with a one-piece cap that should be replaced with an insect proof two-piece style. This is a large inn that has an extensive distribution system. During the off-season, or during times when business is slow, water can become stagnant within certain sections of the distribution system. Bacteria have time to grow within these stagnant areas of the distribution system causing positive total coliform samples.

Tilghman Island Inn accidentally hooked up the "old well" after renovations, which contaminated the entire water system with total and fecal coliform. The old well was unhooked from the system and the new well was hooked up. The system was then chlorinated. The new well is in the flowerbed in front of the Inn and is somewhat protected from vehicles. The Inn hasn't had a positive bacteriological sample since April of 2003.

There were no defects found upon inspection of the well serving Town and Country Liquors. There is no treatment on the water supply. A thorough sanitary survey of the distribution should be performed identifying dead ends and cross connections.

The Talbot County Community Center has total coliform problems from time to time. The Center has an elaborate treatment system for the water that is used for the multiple ice surfaces. The intermittent coliform problems are most likely coming from bacteria growth within the distribution system. The water system should be thoroughly inspected focusing on cross connections between the drinking water supply and the supply and treatment used to treat the water for the ice.

Unconfined Wells:

If a well is drawing from an unconfined aquifer, it could be contaminated from various sources. However, a source of microbiologic contamination would have

to be very close to a well because of the high filtration effectiveness of the unconsolidated soils. Maryland regulations require at least a four-foot separation between the seasonal high water table and the bottom of the absorption bed. The regulations also require at least a 100-foot separation between on-site septic systems and unconfined wells. These distances are adequate to prevent microbial (bacteriological) contamination from on-site septic systems. If a well has any of the construction deficiencies listed above it could be susceptible to surficial sources of pathogens. Surface water can carry contaminants down a well if these conditions are present.

Corner Market uses a buried well. The integrity of the wellhead cannot be examined without excavation. This well should be extended above grade to conform to the well construction regulations. Corner Market is the only unconfined system that has greater than twenty-five percent of their samples come back positive for coliform.

SUMMARY AND RECOMMENDATIONS FOR PROTECTING WATER SUPPLIES

Key Findings:

This report identified transient water supplies in Talbot County as being more likely to be contaminated by microbial contaminants than nitrate or nitrite nitrogen. Sources of microbial contamination, however, are not believed to be related to ground water contamination, but rather the maintenance of the integrity of the individual water supply system. The report also identified specific areas (SWAP areas) immediately surrounding the transient water supply sources. This delineated area has the greatest potential to influence the quality of that water supply. Open Urban Land was the most common type of land use within the SWAP areas. The recommendations that immediately follow are a result of the investigations required during the writing of this report.

Recommendations for Individual Water System Owners:

- The sanitary integrity of the water supply system must be maintained. Sanitary defects noted in county sanitary surveys should be corrected. All work on the water system should be performed in a sanitary manner and followed with a one-time disinfection.
- Coliform testing results are a good indication if the sanitary integrity of the system has been affected. All positive results should be investigated to determine the cause of the positive tests. Corrective action should be taken to eliminate the source of the problem. Any sources with confirmed fecal contamination must be rehabilitated or abandoned.
- Installing new two-piece well caps is a good way to reduce potential contamination from insects. Caulking of the electrical conduit is needed to ensure a sanitary seal.
- Any wells in areas subject to flooding or just above grade should be sampled following significant rain events to demonstrate if they are sensitive to flooding impacts.

- Water systems for seasonal facilities should be disinfected and flushed prior to the opening of a new season.
- Wells should be protected from damage by vehicles or other machinery. If a well is or was damaged, it should be repaired. All work on wells should be followed by disinfection to avoid contamination of the water supply.
- Owners should keep track of potential changes in land use that might impact their water supply. Letting neighboring property owners and local officials know their concerns can prevent problems from occurring. The individual maps of Figure 4a-c should be a useful starting point as these identify the specific areas that have the greatest potential to impact the water quality of each water supply.
- Owners using wells in the Aquia or Piney Point aquifers may wish to test their supply for arsenic.

Recommendations for County Officials

- Continue regular inspection, oversight and testing of transient non-community water systems. Ensure that systems correct the cause of positive bacteriological test results.
- Test results show that some systems have a high percentage of positive results. Priority should be placed on those systems that have not corrected the root causes of past positive results.
- Provide information to owners of systems regarding the potential for elevated levels of arsenic in the water supply and the public health significance for both transient users and regular consumers.

Reference

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Hulme Arthur, Murphy J., Rasmussen William, Turbit Slaughter, 1957, Caroline, Dorchester, and Talbot Counties Water Resources: Bulletin No. 18

Drummond David, 2001, Hydrogeology of the Coastal Plain Aquifer System in Queen Anne's and Talbot Counties, Maryland, with Emphasis in Water-Supply potential and Brackish-Water Intrusion in the Aquia Aquifer: (DNR) Report of Investigations No. 72

Bolton David, 2003, Summary of Ground-water arsenic Concentrations in the Major Aquifers of the Maryland Coastal Plain: (DNR) Interim Report

Other Sources of Data

Water Appropriation and Use Permits
Talbot County Sanitary Survey Inspection Reports
MDE Water Supply Program (PDWIS) Database
MDE Waste Management Sites Database
Department of Natural Resources Digital Orthophoto Quarter Quadrangles
USGS Topographic 7.5 Minute Quadrangles
Maryland Office of Planning 2000 Talbot County Land Use Map
Maryland Office of Planning 1996 Talbot County Sewer Map

PWSID	System Name	Source #	Plant #	Use Code	Ground Water Appropriation	Aquifer Code	Aqifer Type	Well Tag #	Casing Depth	Well Depth
1201003	Bay Hundred	3	1	P	TA1970G001	125B	C	TA811738	180	385
1201008	Chubbies Deli	1	1	P	TA2004G015	125B	C	TA880474	389	399
1201010	The Bridge Restaurant	1	1	P	TA1976G003	125B	C	TA730831	150	375
1201012	Carrolls Market	1	1	P	TA1989G009	125B	C	TA880166	506	586
1201013	Clarks Market	1	1	P	TA1985G010	125B	C	TA810958	161	430
1201017	Fairbank Bait and Tackle	1	1	P	TA2004G012	125B	C	TA810798	158	386
1201018	Fast Stop	2	1	P	TA1987G004	122C	C	TA812179	174	194
1201021	Harrisons Country Inn	1	1	P	TA1973G005	125B	C	TA940015	181	401
1201022	Hog Neck Arena/Talbot Co Comm Ctr	1	1	P	TA1977G006	125B	C	TA731089	422	662
1201030	Miles River Yacht Club	1	1	P	TA1963G002	125B	C	TA940294	240	482
1201032	Moose Lodge	1	1	P	TA1962G001	122E	C	TA046277	126	190
1201035	Higgins Crab House	1	1	P	TA1975G002	125B	C	TA811477	184	440
1201037	The Oaks	2	1	P	TA1977G002	125B	C	TA730922	326	326
1201037	The Oaks	1	1	P	TA1977G003	125B	C	TA881058	508	528
1201038	A-1 Liquor &Deli	1	1	P	TA1977G008	124E	C	TA731077	309	309
1201041	Bella Luna Italian Market	1	1	P	TA1991G013	125B	C	TA880668	515	526
1201045	Best Western	1	1	P	TA1982G015	125B	C	TA810276	405	426
1201046	Talbot Co. Country Club	1	1	P	TA1956G004	125B	C	TA022598	191	634
1201046	Talbot Co. Country Club	3	1	P	TA1956G004	125B	C	TA880829	280	645
1201046	Talbot Co. Country Club	2	1	P	TA1956G004	125B	C	TA940827	195	641
1201050	Corner Market	1	1	P	TA2004G018	9999	U			
1201052	Tilghman Island Inn	1	1	P	TA1993G004	125B	C	TA881357	200	406
1201053	Town and Country Liquors	1	1	P	TA1993G005	125B	C	TA881378	200	595
1201059	Wye Mills Market	1	1	P	TA2004G014	9999	U			
1201061	Easton Point Marina	1	1	P	TA1988G009	125B	C	TA881395	222	608
1201063	Gateway Marina	1	1	P	TA1985G005	124E	C	TA810819	380	400

Table 1, Well information for Talbot County Transient Systems.

PWSID	System Name	Source #	Plant #	Use Code	Ground Water Appropriation	Aquifer Code	Aqifer Type	Well Tag #	Casing Depth	Well Depth
1201065	Chesapeake Landing	2	1	S	TA1990G008	125B	C	TA002352	24	357
1201065	Chesapeake Landing	1	1	P	TA1990G008	125B	C	TA881000	204	385
1201066	Hog Neck Golf Course	1	1	P	UNKNOWN	9999	U			
1201071	Lowes Warf Marina	1	1	P	TA1946G002	9999	C			400
1201077	Highs Dairy Store	1	1	P	TA1983G007	125B	C	TA810378	420	450
1201078	Stumps Seafood	1	1	P	TA1991G005	122E	C	TA880614	130	140

Table 1 (Continued), Well information for Talbot County Transient Systems.

Aquifer Code	Aquifer Name
125B	Aquia
122C	Cheswold
122E	Federalsburg
124E	Piney Point
9999	Unknown

PWSID	System Name	Plant ID	Known Treatment Methods	Reason for Treatment
1201038	A-1 LIQUOR & DELI	1	No Treatment	None
1201003	BAY HUNDRED	1	No Treatment	None
1201041	BELLA LUNA ITALIAN MARKET	1	No Treatment	None
1201045	BEST WESTERN	1	No Treatment	None
1201012	CARROLLS MARKET	1	No Treatment	None
1201065	CHESAPEAKE LANDING	1	No Treatment	None
1201008	CHUBBIES DELI	1	No Treatment	None
1201013	CLARKS MARKET	1	No Treatment	None
1201050	CORNER MARKET	1	No Treatment	None
1201061	EASTON POINT MARINA	1	No Treatment	None
1201017	FAIRBANK BAIT & TACKLE	1	No Treatment	None
1201018	FAST STOP	1	No Treatment	None
1201063	GATEWAY MARINA	1	No Treatment	None
1201021	HARRISONS COUNTRY INN	1	No Treatment	None
1201035	HIGGINS CRAB HOUSE	1	No Treatment	None
1201077	HIGHS DAIRY STORE	1	No Treatment	None
1201022	HOG NECK ARENA/TALBOT CO COMM CTR	1	No Treatment	None
1201066	HOG NECK GOLF COURSE	1	No Treatment	None
1201071	LOWES WHARF MARINA	1	No Treatment	None
1201028	MCDANIEL COUNTRY STORE	1	No Treatment	None
1201030	MILES RIVER YACHT CLUB	1	No Treatment	None
1201032	MOOSE LODGE	1	Ion Exchange	Iron Removal
1201078	STUMPS SEAFOOD	1	No Treatment	None
1201046	TALBOT CO. COUNTRY CLUB	1	No Treatment	None
1201010	THE BRIDGE RESTAURANT	1	No Treatment	None
1201037	THE OAKS	1	No Treatment	None
1201052	TILGHMAN ISLAND INN	1	Permanganate	Iron Removal
1201053	TOWN AND COUNTRY LIQUORS	1	No Treatment	None
1201058	WITTMANS MARKET	1	No Treatment	None
1201059	WYE MILLS MARKET	1	No Treatment	None

Table 2, Known treatment methods for Talbot County Transient Systems.

PWSID	PWS_NAME	Total # of Nitrate Samples	Number of Nitrate		Total # of Nitrite Samples	Number of Nitrite Samples > 50% MCL
			> 1 ppm	> 50% MCL		
1201038	A-1 LIQUOR & DELI	8	0	0	4	0
1201003	BAY HUNDRED	7	0	0	2	0
1201041	BELLA LUNA ITALIAN MARKET	2	0	0	1	0
1201045	BEST WESTERN	6	0	0	5	0
1201012	CARROLLS MARKET	6	0	0	3	0
1201065	CHESAPEAKE LANDING	6	0	0	4	0
1201008	CHUBBIES DELI	8	0	0	4	0
1201013	CLARKS MARKET	8	0	0	2	0
1201050	CORNER MARKET	8	0	0	4	0
1201061	EASTON POINT MARINA	5	0	0	1	0
1201017	FAIRBANK BAIT & TACKLE	7	0	0	3	0
1201018	FAST STOP	8	0	0	3	0
1201063	GATEWAY MARINA	6	0	0	3	0
1201021	HARRISONS COUNTRY INN	6	0	0	3	0
1201035	HIGGINS CRAB HOUSE	7	0	0	3	0
1201077	HIGHS DAIRY STORE	6	0	0	3	0
1201022	HOG NECK ARENA/TALBOT CO COMM CTR	8	0	0	4	0
1201066	HOG NECK GOLF COURSE	4	0	0	2	0
1201071	LOWES WHARF MARINA	7	0	0	3	0
1201030	MILES RIVER YACHT CLUB	9	0	0	4	0
1201032	MOOSE LODGE	6	0	0	2	0
1201078	STUMPS SEAFOOD	1	0	0	1	0
1201046	TALBOT CO. COUNTRY CLUB	5	0	0	2	0
1201010	THE BRIDGE RESTAURANT	6	0	0	3	0
1201037	THE OAKS	7	0	0	4	0
1201052	TILGHMAN ISLAND INN	7	0	0	4	0
1201053	TOWN AND COUNTRY LIQUORS	6	0	0	3	0
1201059	WYE MILLS MARKET	8	0	0	4	0

Table 3, Total IOC water quality samples collected for transient systems.

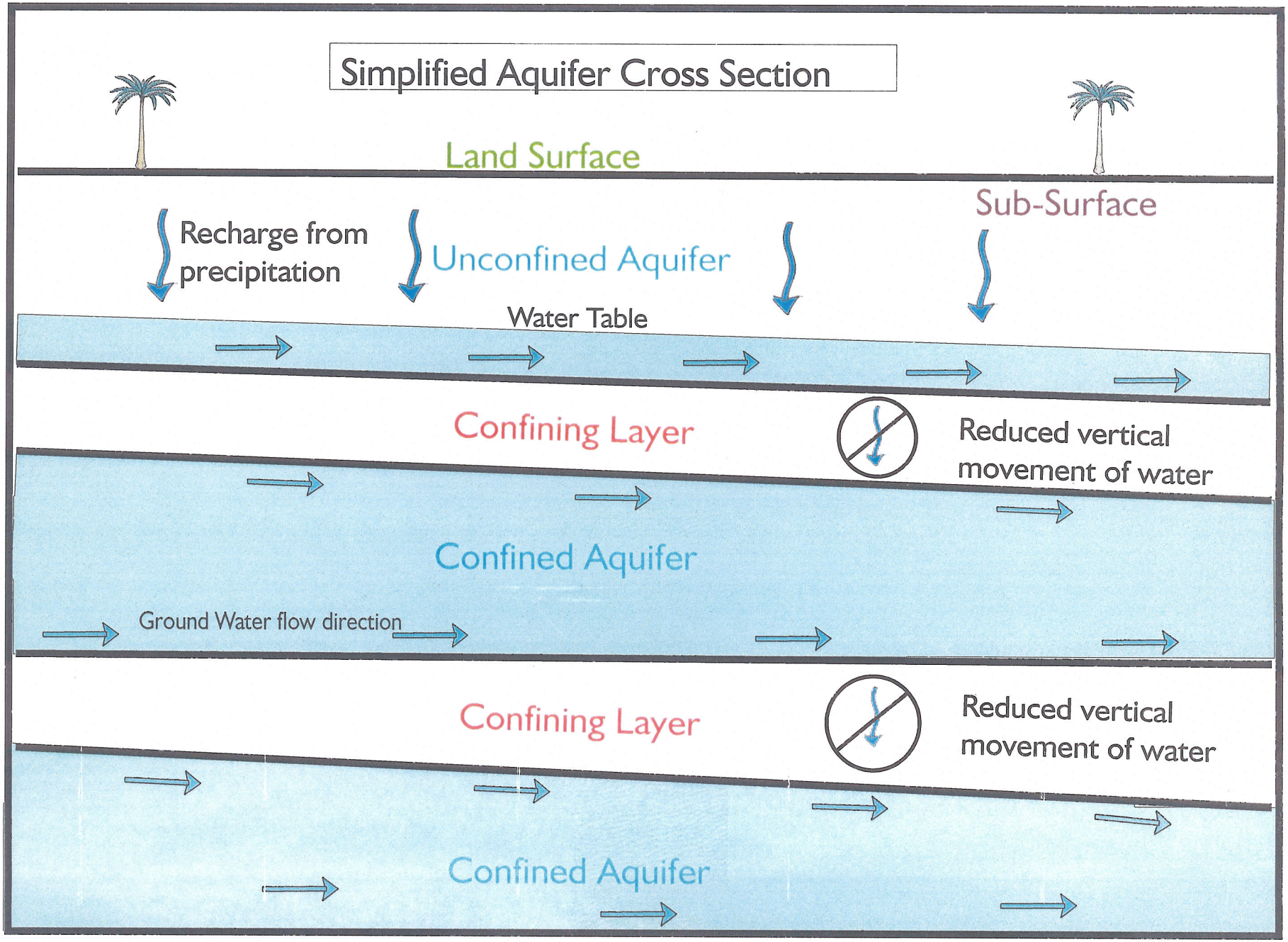
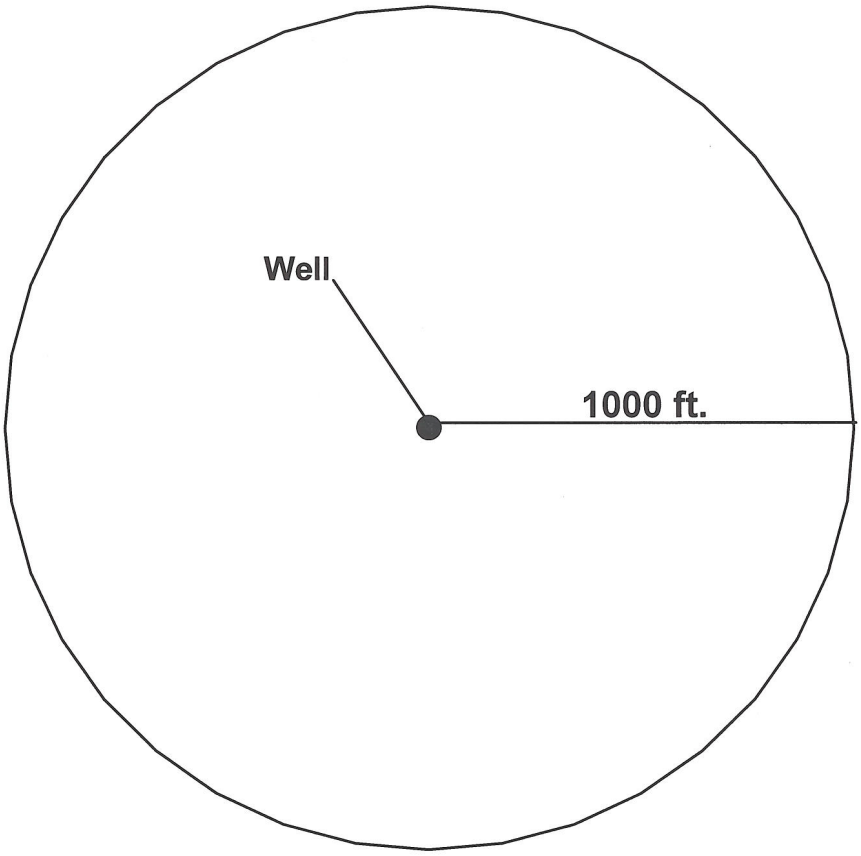

Simplified Aquifer Cross Section
Land Surface
Recharge from precipitation
Unconfined Aquifer
Sub-Surface
Water Table
Confining Layer
Reduced vertical movement of water
Confined Aquifer
Ground Water flow direction
Confining Layer
Reduced vertical movement of water
Confined Aquifer

Figure 2

Circle and Wedge Delineation Areas



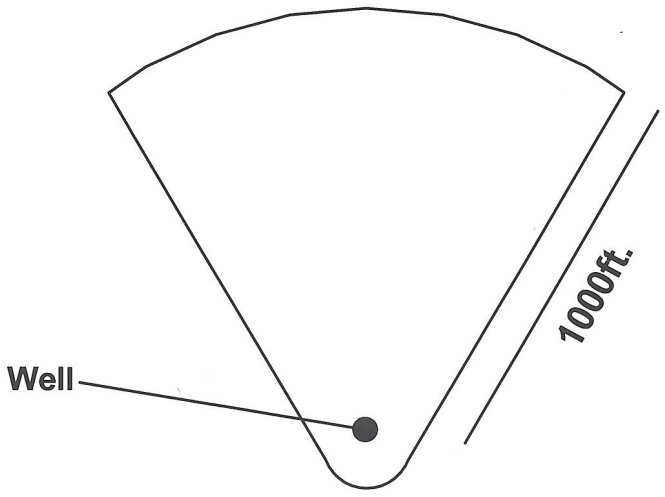
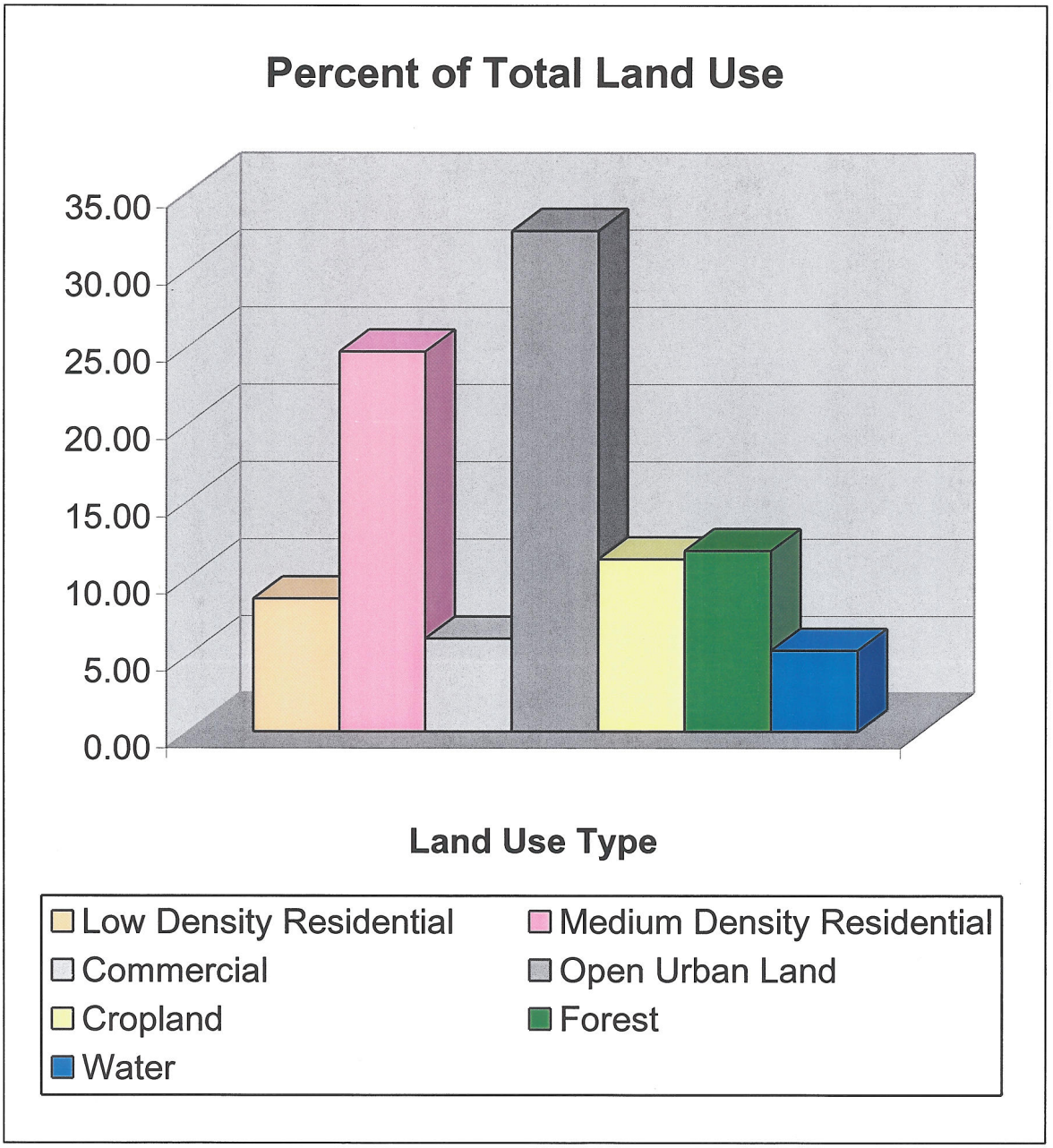


Figure 3

Talbot County SWAP Land Use Summary

Land Use Type	Land Use Code	Counts in SWAPs	Acres in SWAP	% of Total Area
Low Density Residential	11	3	18.597	8.64
Medium Density Residential	12	4	53.034	24.64
Commercial	14, 16	4	13.027	6.05
Open Urban Land	18	2	69.862	32.46
Cropland	21	6	24.104	11.20
Forest	41	5	25.285	11.75
Water	50	3	11.349	5.27
	Totals	27	215.258	100.00

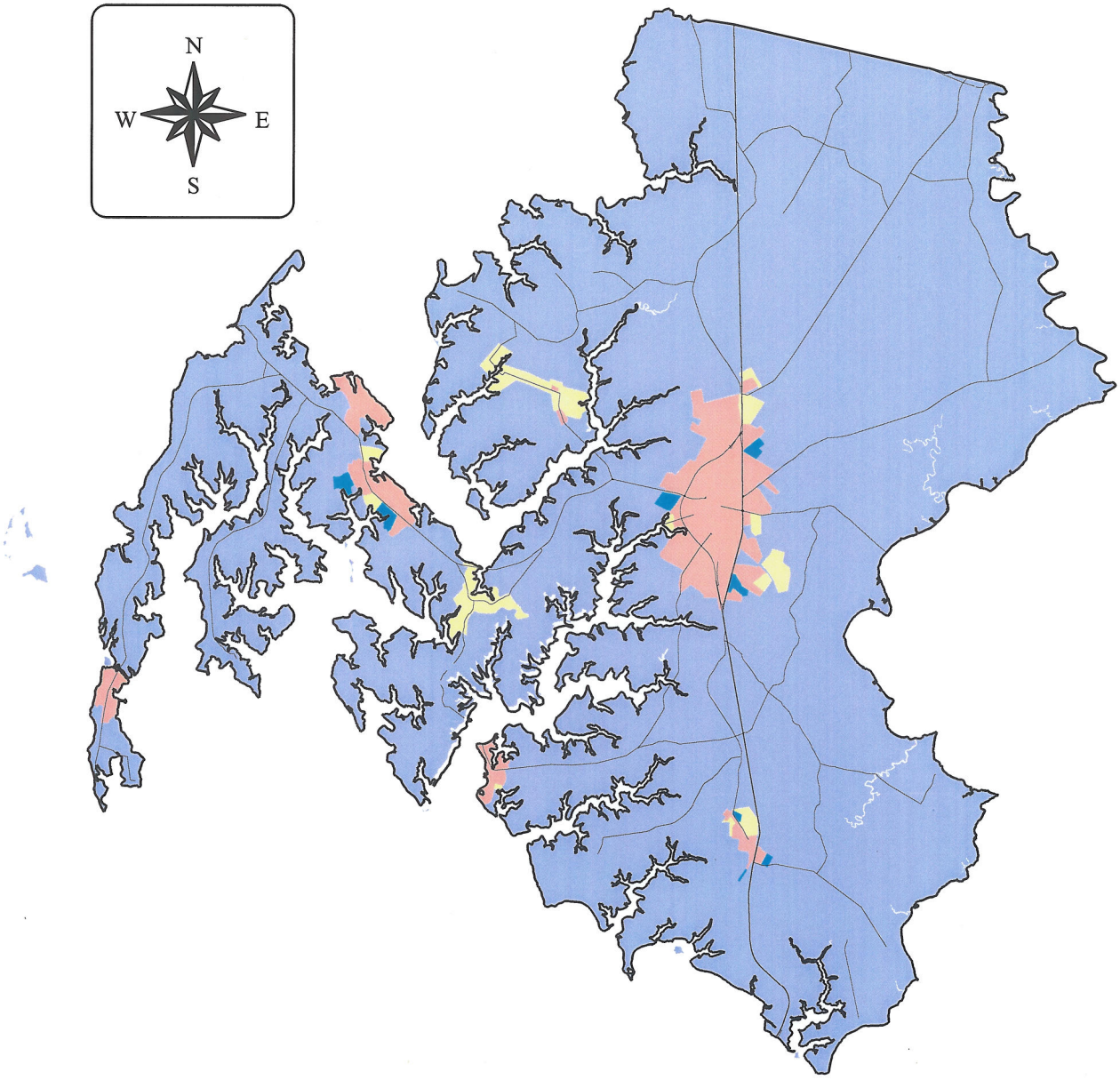


N
W E
S
2 0 2 4 Miles

MOP 2002 Talbot County Land Use

- Low Density Residential
- Medium Density Residential
- High Density Residential
- Commercial
- Industrial
- Extractive
- Open Urban Land
- Cropland
- Pasture
- Orchards
- Forest
- Water
- Wetlands
- Feeding Operations
- Barren Land

Figure 5



Sewer Service Map of Talbot County (1999)

Existing Service or Under Construction

Programmed for Service Within 3 - 5 Years

Programmed for Service Within 6 - 10 Years

Major Roads

No Planned Service

4 0 4 8 12 Miles

Figure 7