CONTAMINATION THREATS

3

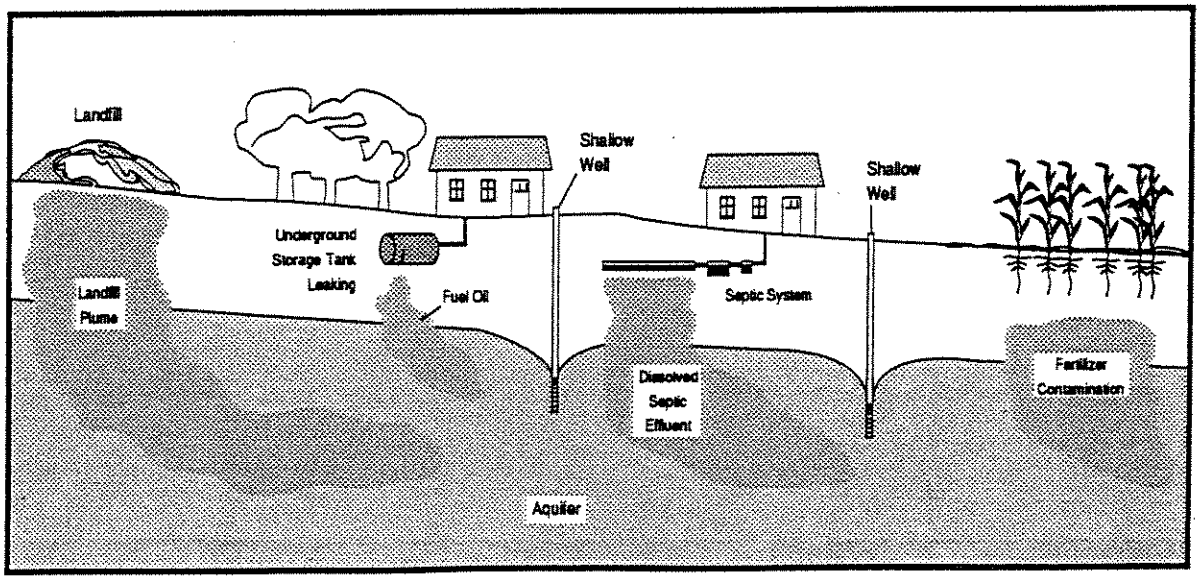
SECTION 3 - CONTAMINATION THREATS

In order to formulate an effective ground water protection strategy, it is necessary to analyze past, existing, and potential land uses. Sources of contamination must be assessed in order to be able to answer questions about present conditions and to make predictions about the long-term viability of the water supply. Because monetary resources are often limited, localities must prioritize their efforts by addressing those contaminant sources of most concern. In this section, several categories of potential contaminants such as waste water disposal, agriculture, industry, solid waste disposal, and septage disposal are examined.

Almost all of the ground water quality threats identified in the following section will have an impact on the Columbia aquifer on the Eastern shore. These land use threats discharge contaminants directly to the land surface or shallow ground water system. Only where public water supplies receive recharge from the Columbia aquifer would these threats be possible sources of contamination to those drinking water supplies. Many older wells serving private homes were drilled into the Columbia aquifer, and the threats outlined here are pertinent to owners of those wells.

Sources of contaminants can be broken down into two general categories: point source and non-point source. Point sources refer to easily-identified sources of contamination that typically concentrate waste discharges into a single point, such as sewage treatment plants and certain industrial discharges. Nonpoint sources refer to widespread sources of contamination which present significant threats to ground water quality. Road runoff drainage is an example of a nonpoint source of contamination to ground water. Many of these sources exist without specific discharge permits and water quality monitoring requirements. Individually, each source may not represent a serious threat to ground water supplies, but cumulatively they may. Most of the potential contamination on the Eastern Shore falls into the non-point source category.

Figure 3-1: Typical Sources of Contamination to Ground Water



WASTE WATER DISPOSAL

The majority of residents (92%) on the Eastern Shore of Virginia use private septic systems for discharge of household waste water (HWH calculations based on 1990 US Census). Two towns on the mainland of Virginia's Eastern Shore have public sewage systems. Larger facilities, such as industries, restaurants, and hospitals have permitted treatment facilities or are able to discharge waste into mass drainfields.

Public Sewage Systems

At present, there are only three incorporated towns with public sewage facilities. The towns of Onancock, Cape Charles, and Tangier Island have facilities which serve approximately 659 residents on Tangier Island and 1,398 in Cape Charles. It is unclear how many additional residents are served outside of Onancock's town population of 1,434. According to the Northampton Country Comprehensive Plan (1990), the Exmore/Willis Wharf area is planning to construct a central sewer system which would serve approximately 2,684 people. In addition, sewering is anticipated for the DeCanio property, and Northampton County now requires central sewage facilities for any large-scale development (County Planner, John Humphrey,1990).

The three sewage systems are designed to discharge at rates ranging from 100,000 to 250,000 gallons per day. It is estimated that town facilities are the largest sewage discharge systems in the two counties, other than the two poultry industries, Perdue Inc. and Holly Farms.

Table 3-1: Public Sewage Facilities

Facility	Receiving Stream	Design Flow (MGD)
Onancock	N. Branch of Onancock Creek	0.25
Tangier Island	Chesapeake Bay	0.10
Cape Charles	Cape Charles Harbor	0.25

From a ground water quality point of view, these sewage facilities present very little threat to the resource since they discharge to surface bodies of water at the coasts rather than on land. Discharged water is not available for recharge to the surficial aquifer or to the deeper confined aquifers. However, these sources clearly present potential threats to estuarine water quality.

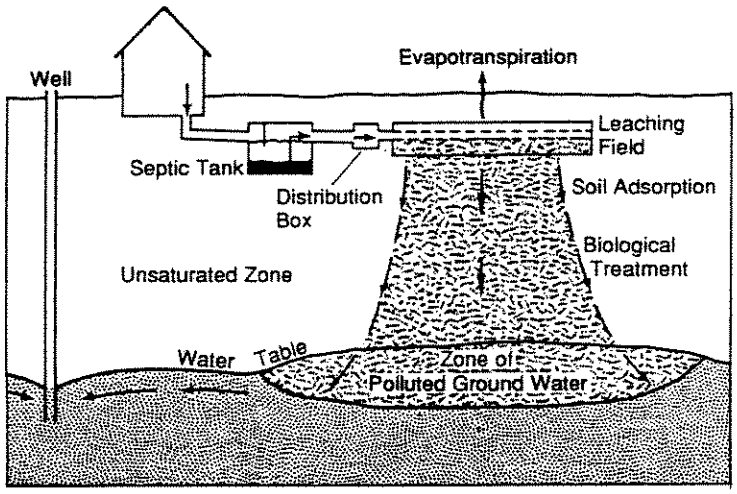
On-Site Septic Systems

Septic systems are the leading contributor to the total volume of waste discharged directly into the ground (more than a trillion gallons annually from residents in the U.S.), and according to the US EPA (1986), septic systems are the major source of ground water contamination. Contaminants introduced from septic systems include nitrate-nitrogen, coliform bacteria, viruses, and a variety of organic and inorganic chemicals from household products. In addition, sixty percent (60%) of the 23 million residential septic tanks in the United States are believed to be operating improperly (Weigmann and Kroehler, 1988).

Septic systems are comprised of a septic tank, distribution box, and a leaching facility. The septic tank provides for the separation of solids and liquids, during which time some waste is treated. The distribution box funnels waste to the leaching facility, where the liquid water is deposited into the soil. If septic tanks are not properly maintained by pumping every few years, solids may pass to the leaching facility causing plugging, backups into the dwelling, or breakouts of effluent on

the land surface. Once this has occurred, corrective actions are expensive and may result in ground water contamination if septic cleaners containing solvents are utilized.

Figure 3-2: Septic System and Ground Water Contamination



Conventional septic systems provide only minimal treatment of wastewater, and release effluent contains approximately 40-60 mg/l nitrogen. As the effluent mixes with ground water and moves downgradient, the nitrogen becomes more dilute. Given local geologic conditions, a flow distance of several hundred feet is required to reduce concentrations to meet the drinking water standard of 10 mg/l for nitrate-nitrogen (see Section 9). The cumulative effects of numerous small septic systems may result in excessive nutrient concentrations in ground water and downgradient surface waters. These impacts are dependent upon locations of septic systems relative to wells and the overall septic system density.

As noted above, the public sewer systems on the Eastern Shore of Virginia serve just over 3,000 people out of a total of 44,000, and the majority of residents use private septic systems to dispose of human waste. In a 1986 study, the Virginia Water Project estimated that there were 12,105 year-round housing units in Accomack County and 5,008 in Northampton County which had septic tanks, cesspools, or other sewage disposal means (not public). It was also estimated that in both counties there was a total of 1,359 homes with failing or inadequate disposal systems. The results are summarized in the following table.

Table 3-2: Residential Disposal of Septic Wastes

	Year-round Housing Units	Estimated GPD
ACCOMACK COUNTY		
Served by public sewer	1,044	156,600
With septic tank or cesspool	10,077	1,511,550
With other sewage disposal means	2,028	304,200
NORTHAMPTON COUNTY		
Served by public sewer	934	140,100
With septic tank or cesspool	3,948	592,200
With other sewage disposal means	1,160	174,000
TOTAL	19,191	2,878,650

Source: *Water For Tomorrow*, Virginia Water Project, Inc., 1988

Based on calculations from the nitrogen loading section (Section 8), approximately 381,000 pounds of nitrogen are discharged to the ground water of the Eastern Shore from on-site septic systems per year.

Proper maintenance of septic systems includes periodic pumping of solids (septage) from the tank. On the Eastern Shore, the contents are brought to one of three privately-owned septage lagoons. These are described later in this section.

Virginia Pollution Discharge Elimination System (VPDES) Permits and Mass Drainfields

There are numerous industries that are required to obtain a discharge permit in order to dispose of wastewater. According to State Water Control Board Regulations, those applying for land application of sewage, sludge, or industrial waste must obtain a Virginia Pollution Abatement Permit (VPA). Discharging of pollutants from a point source to surface waters requires a Virginia Pollution Discharge Elimination System (VPDES) Permit. The major VPDES dischargers on the Eastern Shore of Virginia are Holly Farms, Perdue, and the Wallops Island Flight Facility. The remaining establishments have small design flows. Table 3-3 lists those industrial and public VPDES permit holders.

There are 76 facilities that dispose of waste water in mass drainfields. Mass drainfields are simply larger septic systems that are shared by more than one building, residence, or industry. Such facilities typically include restaurants, schools, and campgrounds, however they can also be associated with several single family residences. The discharge rates of these facilities are not high; in fact, combining all these facilities would not equal the discharge rate in gallons per day of Holly Farms alone. Table 3-4 identifies these facilities.

AGRICULTURE

Agricultural practices introduce two types of contaminants, pesticides and nitrate-nitrogen from fertilizers and livestock. These chemicals can pose serious threats to human health in excessive concentrations. Nitrates are particularly dangerous to infants. Ingesting too much nitrate-nitrogen can result in methemoglobinemia, or "blue baby syndrome". Asphyxiation can occur when the nitrate-nitrogen that is ingested is reduced to nitrite and is absorbed into the circulation system. Nitrite reacts with hemoglobin to produce a compound that does not carry oxygen, thus depriving an infant of oxygen. The EPA recommends that nitrate-nitrogen levels in drinking water be less than 10 mg/l.

The serious toxicity of pesticides has been widely reported in the cases of Agent Orange and DDT. On the Eastern Shore where private wells are commonly less than 300 feet deep, one pesticide, Aldicarb or Temik, has been detected in drinking water (Weigmann and Kroehler, 1988). Aldicarb is highly soluble and mobile in water. Agent Orange and DDT were banned decades ago. Aldicarb is no longer used.

Fertilizers

High application rates of commercial fertilizers over large areas of land have been shown to contribute nitrogen to the ground water in an agriculturally intensive region like the Eastern Shore. Publications and studies supporting this hypothesis are numerous. For reference, a selection of examples include: USGS, 1989, p. 38; EPA, 1990, pp. 125-128; Association of Ground Water Scientists and Engineers, 1989, p. 262; Miller, David A., 1980, pp. 430-431; *Ground Water Quality*

Protection, State and Local Strategies, 1986, p. 84, p. 145; *Ground Water Pollution News*, 1989,pp. 1-2. However, as stated on page 1-4 of this document, the average nitrogen concentration in the ground water was calculated to be 2.0 milligrams per liter. The national drinking water standard for nitrogen is 10 milligrams per liter. On the average, the shallow ground water quality is considered very good, however users down gradient from high nitrogen use may experience problems.

Farmers generally follow recommended fertilizer application amounts. This makes it possible to estimate the quantities of nitrogen fertilizers applied to each crop type. Using 1990 crop acreage figures, agricultural practices required approximately 5.8 million pounds of nitrogen in fertilizers. Table 3-5 presents a breakdown of nitrogen requirements by crop type. Approximately 6.7% of the land is fertilized with manure; the remainder is supplied by commercial fertilizer (Accomack County Extension Agent, J. Belote, personal communication, 1991). Out of a total of 165,000 acres of farmland, 94,000 are used for soybeans, a crop which requires no nitrogen fertilization because the plant is a nitrogen-fixer.

Current methods for the Eastern Shore recommend that fertilizer be applied in two stages: a small amount at planting, the rest after growth occurs. In the case of corn, this second application occurs when the plant has reached ankle height. The fertilizer is *side-dressed*, which means that it is dribbled on each row at each plant, so that a small amount is wasted in the soil. With the implementation of side-dressing and the new phased technique, the intention is to hold leaching of nitrogen to a minimal amount. However, USGS sampling that is representative of current and/or recent fertilization practices shows a concentration of 20-25 milligrams per liter (mg/l) nitrate-nitrogen in ground water beneath farm fields in the shallow flow system (G. Speiran, USGS, personal communication, 1991).

Historically, the number of farmers and the acres farmed have been declining since 1930. The type of crops grown has also changed. Whereas crops grown in the earlier half of this century were of the garden vegetable kind and required fertilizers, today's crops are mainly soybeans and are not fertilized. Still, significant amounts of fertilizers are presently used, as shown in Table 3-5. Also, both the Accomack and Northampton County Comprehensive Plans see agriculture as continuing to be the main land use in the future. Thus, although nitrogen fertilizer use has been decreasing, it remains relevant to look towards agriculture as a potential source of contamination to ground water, both from former and current practices. For this study, 89 and 79 lbs/acre were used as average nitrogen application rates in Accomack and Northampton counties respectively.

On a smaller scale, home owners in general use fertilizers as a part of lawn maintenance. Nitrogen loading from lawn fertilizers was studied by Nelson et al. in 1988. They determined that, on average, the homeowner applies 3 lbs. of nitrogen for every 1,000 square feet of lawn per year. With a leaching rate of 30%, 0.9 lbs. of nitrogen are leached into the ground water system for every 1000 square feet of lawn. On the Eastern Shore, lawn maintenance is not a high priority.

Pesticides

Pesticides include a wide variety of chemicals utilized for the control of animal pests, insects, fungi, and weeds. Factors which affect the level of risk for contamination include the specific chemical formulation, rates of application, timing of application, soil conditions, and hydrologic conditions. Those that have a low solubility, are degraded by sunlight, or react with water to produce new compounds are not likely to contaminate ground water.

Table 3-3: Facilities With Discharge Permits, Eastern Shore, Virginia

Accomack County

Facility Name	Ind/Mun	VPDES#	City	Receiving Stream	Plant Outfall Latitude	Plant Outfall Longitude	Flow (MGD) Design
Accomack Co. Nursing Home	M	VA0063606	Parksley	N. FORK PARKER CREEK TO METOMPKIN BAY	374537	753719	0.02
Bonawell Brothers Seafood	I	VA0004201	Saxis	POCOMOKE SOUND	375515	754350	*.001(4)
Chincoteague Fish Co.	I	VA0051462	Chincoteague	CHINCOTEAGUE CHANNEL	375600	752254	
Chincoteague WTP	I	VA0051756	Chincoteague	CHINCOTEAGUE CHANNEL	375605	752239	*.
Drewer & Son, Inc.	I	VA0081361	Saxis	STARLING CREEK	375512	754351	*.035,.018(4)
Edgerton, D. L. Fish Co.	I	VA0055239	Chincoteague	CHINCOTEAGUE CHANNEL	375612	752227	*(6)
Edgewood Mobile Home Park	M	VA0065196	New Church	TRIB TO TUNNEL'S MILL BR TO BULLBEGGER CRK	375709	753216	0.006
External Assist. Sys. Pension Trust	M	VA0078204	Route 13	TRIB TO TUNNEL'S MILL BR TO BULLBEGGER CRK	375655	753238	0.035
F&G Laundromat	I	VA0050920	Chincoteague	CHINCOTEAGUE CHANNEL	375600	752200	*0.005
Fisher, Lance G. Seafood Co., Inc.	I	VA0079448	Sanford	POCOMOKE SOUND	375500	754130	*.02(4)
Hills Oyster Farms	I	VA0058874	Chincoteague	DEEP HOLE CREEK TO LITTLE OYSTER BAY	375612	752057	*.
Holly Farms	I	VA0004049	Temperanceville	SANDY BOTTOM BRANCH TO HOLDENS CREEK	375325	753339	0.98
Kuzzens, Inc.	I	VA0081809	Painter	DITCH TO TAYLOR BRANCH TO OCCOHANNOCK CRK	373352	754803	
Lewis Oyster Co.	I	VA0057673	Saxis	STARLING CREEK TO POKOMOKE BAY	375511	754353	no discharge
Marshall, William H. & Co.	I	VA0058360	Greenbackville	CHINCOTEAGUE BAY	380022	752326	
McCready Seafood	I	VA0095690	Chincoteague	EEK CREEK TO CHINCOTEAGUE BAY	375546	752232	no discharge
Messick & Wessells - Nelsonia	I	VA0051403	Nelsonia	MUDDY CREEK	374916	753515	*0.005
Messick & Wessells - Onley	I	VA0053899	Onley	JOYNES BRANCH TO ONANCOCK CREEK	374134	754244	*0.005
Nandua Seafood Co., Inc.	I	VA0051161	Hacksneck	BACK CREEK TO NANDUA CREEK	373802	755252	
New Curch Energy Associates	I	VA0058521	New Church	UNNAMED TRIB TO PITTS CRK & POCOMOKE SOUND	375858	753254	
North Accomack Elem. School	M	VA0027162	Mappsville	UNN. TRIB TO MESSONGO CREEK TO POCOMOKE BAY	375128	753357	0.009
Onancock WTP	M	VA0021253	Onancock	N. BRANCH OF ONANCOCK CREEK	374258	754452	0.25
Perdue, Inc.	I	VA0003808	Accomac	PARKER CREEK TO METOMPKIN BAY	374410	753920	*1.7,.01(4)
Reed, Thomas E. - Seafood, In.	I	VA0005738	Chincoteague	DEEP HOLE CREEK	375621	752045	*(6)
Russell Fish Co.	I	VA0054003	Chincoteague	CHINCOTEAGUE CHANNEL	375559	752255	*(6)
South Accomack Elem. School	M	VA0027171	Melfa	UNNAMED TRIB TO WAREHOUSE POND	373920	754738	0.009
Stubbs, Reginald - Seafood Co, Inc.	I	VA0056421	Chincoteague	ASSATEAGUE CHANNEL	375501	752224	*.002(4)
Tangier WTP, Town of	M	VA0067423	Tangier	CHESAPEAKE BAY	374940	760035	0.1
Taylor, J.W. - Packing	I	VA0002992	Hallwood	MESSONGO CREEK TO POKOMOKE SOUND	375224	753529	0.1
Taylor & Fulton, Inc.	I	VA0082538	Mappsville	UNNAMED TRIB OF ASSOWOMAN CRK TO ASSOWOMA	375216	753319	
US - NASA Wallops Flight Facility	M	VA0024457	Wallops Island	HOG CREEK AND MOSQUITO CREEK	375550	752859	0.8 & 0.03
Vasiliou, Tom - STP	M	VA0082287	Oak Hall	TRIB TO TUNNEL'S MILL BR TO BULBEGGER CRK	375649	753233	0.001
VDOT - Rt. 13 Information Center	M	VA0023078	New Church	TRIB TO PITTS CREEK	375927	753213	0.02
VDH - Septage Lagoon - Boggs 01		VDHSLBO-01	Wachapreague	eventually to Nickawampus Crk. to Finney Creek	373738	754222	
VDH - Septage Lagoon - Bundick 01		VDHSLBU-01	Atlantic	" to Little Mosquito Creek	375538	753158	
VDH - Septage Lagoon - Bundick 02		VDHSLBU-02	Mappsburg	" to Machipomgo River	373405	754611	
Virginia Carolina Seafood Co., Inc.	I	VA0050997	Chincoteague	WATTS BAY	375432	752831	*.
Watkinson, Paul - Seafood	I	VA0050491	Saxis	POCOMOKE SOUND	375511	754354	
Whispering Pines Motel	M	VA0063371	Ticktown	UNNAMED TRIB TO DEEP CREEK	374320	754141	0.019

Table 3-3: Facilities With Discharge Permits, Eastern Shore, Virginia

Northampton County

Facility Name	Ind/Mun	VPDES#	City	Receiving Stream	Latitude	Longitude	Design
America House Motor Inn	M	VA0064921	Cape Charles	CHESAPEAKE BAY	370813	755807	0.02
American Original Corp.	I	VA0028797	Willis Wharf	PARTING CREEK TO MACHIPONGO RIVER	373045	754824	*.151(4)
Ballard Fish & Oyster Co.	I	VA0073679	Cheriton	KINGS CREEK	371658	760039	
Bayshore Concrete Prod. - Cape Charl.	I	VA0085677	Cape Charles	CAPE CHARLES HARBOR	371541	760131	
Bell, B.L. & Son	I	VA0004219	Oyster	OYSTER HARBOR	371709	755532	*.001(4)
Broad Street Laundry	I	VA0056502	Exmore	UNNAMED TRIB TO NASSAWADOX CREEK	373138	754930	
Broadwater Bay Seafood	I	VA0086126	Marionville	REDBANK CREEK TO HOG ISLAND BAY	372644	755033	
C&D Seafood	I	VA0002917	Oyster	OYSTER HARBOR	371715	755520	stopped dis.
Cape Charles Fish & Scallop, Inc.	I	VA0083283	Cape Charles	CAPE CHARLES HARBOR	371548	760100	
Cape Charles STP	M	VA0021288	Cape Charles	CAPE CHARLES HARBOR	371550	760100	0.25
Cheriton Laundry, Inc.	I	VA0051136	Cheriton	TRIB TO KINGS CREEK	371510	755735	
Eastville Laundromat	I	VA0054437	Eastville	OLD CASTLE CREEK	372038	755716	
Hamblin, J.E. - Seafood	I	VA0085693	Willis Wharf	PARTING CREEK TO MACHIPONGO RIVER	373130	754815	no discharge
KMC Foods, Inc.	I	VA0054119	Cheriton	HANBY BRANCH	371744	755733	*.
Machipongo Elem. School	M	VA0023817	Machipongo	UNNAMED TRIB TO JACOBUS CREEK	372429	755458	0.0208
Northampton-Accomack Memorial Hosp.	M	VA0027537	Nassawadox	WAREHOUSE CREEK TO NASSAWADOX CREEK	372839	755144	0.1
R&C Seafood Co.	I	VA0052264	Oyster	OYSTER SLIP	371715	755515	
Terry, H.M. - Co., Inc.	I	VA0003956	Willis Wharf	PARTING CREEK TO MACHIPONGO RIVER	373037	754821	*.0004(4)
West, John H.	I	VA0083437	Oyster	OYSTER HARBOR	371714	755522	

Source: * - figure comes from the Water Quality Mgt. Plan, SWCB, 1980. The remaining numbers are up to date (1991) from the SWCB. They do not have flows for industrial facilities except Holly Farms and Taylor Packing.

NOTE: (2) NPDES permit limits (1980)
(4) Estimated
(6) No limits - has an NPDES permit, but is not required to monitor (things like crab shedding)

Table 3-4: Facilities Using Mass Drainfields, Eastern Shore, Virginia

FACILITY NAME	TOWN	gallons per day
ACCOMACK COUNTY		
Virginia Landing	Quinby	90000
Tom's Cove	Accomack County	N/A
Trail's End Chincoteague Bay	Horntown	20000
Inlet View/Bunker Hill	N/A	N/A
Maddox Family Campground	Chincoteague	N/A
Pine Grove Campground	Chincoteague	N/A
Island Motor Inn	Chincoteague	6400
Refuge Motor Inn	Chincoteague	8800
Driftwood Motor Lodge	Chincoteague	6700
Chincoteague Motor Lodge	Chincoteague	9360
Waterside Motor Inn	Chincoteague	5700
Conner & McGee	Chincoteague	3300
Eastwind Townhouse	Chincoteague	9600
Assateague Inn	Chincoteague	4040
Don's Seafood Market & Restaurant	Chincoteague	4000
Seatag Lodge	Chincoteague	3000
Birchwood Motel, Inc.	Chincoteague	5400
Mulberry Street Townhouse	Chincoteague	9600
David P. Burgess Townhouse	Chincoteague	2700
R&S Dry Cleaning & Laundry	Chincoteague	N/A
McDonald's	Chincoteague	4000
ETTAS Restaurant	Chincoteague	4300
Landmark Crab House	Chincoteague	12500
R&S Laundromat	Chincoteague	5500
Mr. Chocolate Island Creamery	Chincoteague	4500
Oak Ridge Townhouse	Chincoteague	9000
Reed Triplexes	Chincoteague	2700
Chincoteague High School	Chincoteague	4000
Chincoteague Elementary	Chincoteague	2000
Parks Mobile Park	Oak Hall	7200
Pizza Hut	Oak Hall	2500
Arcadia High School	Accomac	6912
Wright's Seafood Restaurant	Atlantic	5000
Eastern Shore Seafood Production	Mappsville	1500
Byrd Foods	Mappsville	2000
Parksley Middle School	Parksley	2000
Red & White Stores	Parksley	1500
St. Paul's Lutheran School	Hallwood	3000
Bi County N.H. Nursing Center	Gargatha	6400
Accomac Office Complex	Accomac	9600
Mary N. Smith Middle School	Accomac	6000
Nandua High School	Onley	13826
Redwood Gables Restaurant	Onley	1800
Chesapeake Square Shopping Center	Onley	12000
Four Corners Plaza	Onley	12000
Eastern Shore Comm. College	Melfa	12000
Ches-Atlantic	Painter	1500

Table 3-4: Facilities Using Mass Drainfields, Eastern Shore, Virginia

FACILITY NAME	TOWN	gallons per day
Exmore Moose Lodge	Belle Haven	5000
Kuzzen's Ames Farm/ MLC	Painter	10500
Peerless Sterling Bull Camp	Modest Town	1200
Peerless Sterling Gargatha	Temperanceville	4500
Peerless Sterling Somers Farm	Bloxom	4500
Peerless Sterling Lakeview	Accomac	2600
Taylor & Fulton Inc.	Hallwood	9000
Taylor & Fulton Poulson House	Hallwood	1500
Virginia Farms/ Farm Exchange	Tasley	1500
Raymond A. Last-VPDES	Chincoteague	7650
Willett's Laundromat-VPDES	Lee Mont	3200

Accomack TOTAL **394988**

NORTHAMPTON COUNTY		
Cherrystone Holiday KOA	Northampton Co.	
Paul's Restaurant	Cheriton	3500
Capeville Campground	Northampon Co.	7500
Cheriton Day Care	Cheriton	2000
Trawler Seafood Restaurant	Exmore	700
Hardees	Exmore	2500
Silver Beach Camping	Silver Beach	2700
Broadway Academy	Exmore	3000
McDonald's	Nassawadox	4500
Anchor Motel Restaurant	Nassawadox	7640
Candlelight Restaurant	Birdsnest	5760
Holiday Motel	Townsend	18000
Burger Unlimited	Eastville	1500
Curtis Jones & Son Packing Sh	Eastville	2240
Kuzzens - Newman	Eastville	1800
Northampton High School	Eastville	16000
Cape Center Inc.	Capeville	2500
Holiday Acres Mobile Home Park	Weirwood	4800
Curtis Jones, Jr.	Bayford	1550
P.C. Kellam Potato Shed	Bridgetown	2000

Northampton TOTAL **90190**

GRAND TOTAL **485178**

Source: Virginia Tech (N/A indicates information not available)

The primary crops grown on the Eastern Shore of Virginia are soybeans, small grains (wheat and barley), potatoes, a variety of garden vegetables, and some ornamental plants. Several different types of pesticides are used depending on the pest, crop type, and application requirement. These factors significantly vary from farm to farm. Since there is no formal reporting of pesticide use, other than that of restricted-use pesticides, it is impossible to surmise the quantities and brands that are applied each year. As such, it need be stressed that the leaching of pesticides into the ground water is a threat to water quality and should be monitored.

Animal Wastes and Animal Carcasses

Animal wastes can contaminate ground water with nitrate-nitrogen and bacteria. In 1990, 21 million chickens were raised for poultry on the Eastern Shore of Virginia. Commercial poultry is the only significant livestock industry in the area, and is contained entirely within Accomack County. Commonly, contamination results from feedlots and improperly constructed or leaking manure storage piles or pits. Eastern Shore chicken growers apparently do not store wastes in such piles, but instead clean the chicken houses out once or twice yearly whereupon the manure is spread onto the farm land.

The Virginia State Extension Service reports that for every thousand chickens, one ton of poultry manure is produced (W. Weaver, Virginia Tech, personal communication, 1991). Tests done by Perdue and Tyson of 57 poultry litter samples indicate that nitrogen constitutes 44.73 pounds per ton of manure (Virginia Tech, 1991). Therefore, in 1990, 21,000 tons of poultry manure was produced, contributing a total of 940,000 pounds (470 tons) of nitrogen. During the year or so that manure remains in the chicken houses, some of the nitrogen volatizes. However, on a weight basis, chicken manure has the highest nutrient availability rate, compared to that of horse, cattle, and hog manure. While this makes it a good fertilizer, it is also most easily leached into ground water.

In large quantities, chicken carcasses can also pose a threat to ground water quality. A natural mortality rate of about 5% creates a need to dispose of dead chickens. Assuming that the majority of chickens die within the first two weeks after hatching, mortality of dead birds can be split between those that die at 0.5 lbs. and those that die weighing 3 lbs (C. Larsen, Virginia Tech Veterinary Medicine, personal communication, 1991). A 5% mortality rate accounts for 1.05 million dead birds in a year with a population of 21 million chickens. Multiplying half of those by 0.5 lbs. and half by 3 lbs. gives a yearly rate of 1.84 million lbs. of dead birds. Dead chickens are disposed of in one of four ways: burial, incineration, composting, or rendering for use as chicken or hog feed. In Accomack County, the Tyson rendering plant is available for growers. The facility is used by growers primarily during times of abnormally high mortality. An estimated 400,000 lbs. are brought to the rendering plant per year, but there is no data to support this. The one facility that had been incinerating has decided to compost, since it is more economical (J.R. Lewis, SCS, personal communication, 1991).The majority of dead birds are thus either buried or composted. Burial (or dumping in the woods, in some cases) poses a threat to ground water quality. Section 9 briefly discusses composting.

Table 3-5: Nitrogen Fertilizer Requirements, Eastern Shore of Virginia

ACCOMACK COUNTY

Crop Type	1990 Acreage	Recommended N in lbs/acre	lbs. N Used
Soybeans	62,000	0	0
Corn	5,500	75-175	687,500
Small grains	25,000	50-80	1,625,000
Irish potatoes	5,500	150	825,000
Sweet potatoes	1,600	50-75	100,000
Stalked tomatoes	2,200	80-90	187,000
Snap beans (Spring)	1,000	40-80	60,000
Snap beans (Fall)	2,300	40-80	138,000
Cucumbers (Spring)	1,000	100-125	112,500
Cucumbers (Fall)	2,000	100-125	225,000
Others	2,500	50-150	250,000
Ornamentals	700		
Grapes and Orchards	120		

Accomack Total N applied acres	47,420		4,210,000
Average N Application (lbs/acre)*		89	

NORTHAMPTON COUNTY

Crop Type	1990 Acreage	Recommended N in lbs/acre	lbs. N Used
Soybeans	32,000	0	0
Corn	500	75-175	62,500
Small grains	12,000	50-80	780,000
Cotton	1,300	60	78,000
Potatoes	2,500	50-150	250,000
Snap beans (Spring)	600	40-80	36,000
Snap beans (Fall)	600	40-80	36,000
Cucumbers (Spring)	800	100-125	90,000
Cucumbers (Fall)	800	100-125	90,000
Tomatoes	650	80-90	55,250
Peppers	100	100-130	11,500
Spinach	280	100-125	31,500
Nursery	840		
Others	1,000	50-150	100,000

Northampton Total N applied acres	20,570		1,620,750
Average N loading (lbs/acre)*		79	
TOTAL FERTILIZED	**67,990**		**5,830,750**
***Total Average Nitrogen Loading:** (Calculated by subtracting out Spring Acres Double Cropped)		**84**	

Sources: Fact Sheet - Accomack County, 1989 National Survey of Conservation Tillage Practices, personal conversation with Northampton Extension Agent Fred Diem, 2/26/91

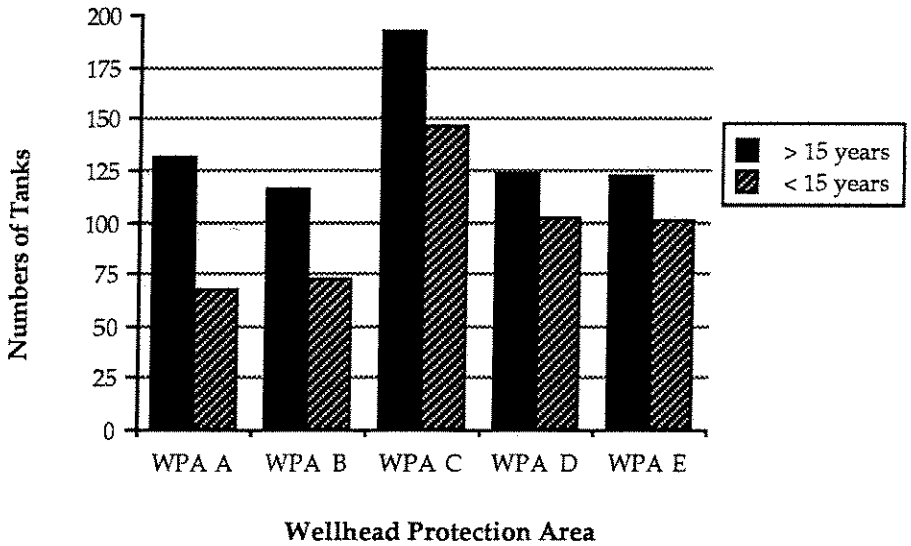
INDUSTRIAL/COMMERCIAL LAND USES

Underground Storage Tanks

Petroleum stored in underground storage systems is one of the greatest national threats to ground water quality. The EPA estimates that approximately one-third of all existing systems nationwide are currently "non-tight", or potentially leaking. The average expected life span of unprotected steel tanks in acidic soils is approximately 15 years, although new steel underground storage tanks are warranted for 30 years. After time, corrosion may begin, resulting in pin-hole sized leaks which may discharge hundreds of gallons of fuel over a several-month period. These leakage rates are small enough to go unnoticed to the tank owner for several months, but are large enough to cause significant ground water contamination problems. Gasoline contains a variety of components including benzene, toluene, and xylene, all which are known to have negative health affects. Newer tanks are being constructed with materials resistant to corrosion and with cathodic protection, which is aimed at decreasing the likelihood of leakage.

A total of 1,154 underground storage tanks are located in Accomack and Northampton Counties. Of these, 684 or (59%) are over 15 years old. The majority of all storage tanks store gasoline and are made of steel. Together, they have a storage capacity of 4,462,347 gallons.

Figure 3-4: Underground Storage Tanks Broken Down By Age and Wellhead Protection Area, Eastern Shore of Virginia



Source: Virginia State Water Control Board

Underground storage tanks were grouped by Wellhead Protection Area (WPA) in Table 3-6. WPA's are introduced and described in Section 5. WPA C, which covers the largest land area, also has the greatest number of underground storage tanks, with a total of 329. The remaining wellhead protection areas all contain close to 200 tanks. The town of Chincoteague, located in WPA A, contains 129 tanks which is the most located in any one town. WPA A also has the highest percentage of storage tanks older than fifteen years.

State Water Control Board records indicate that there have been leakage problems in several tanks in the two counties. Of the total, 3.6% of the tanks in Accomack and Northampton Counties have been reported as leaking. As of July 3, 1991, there are twenty-nine contaminated sites in Accomack County, and twelve contaminated sites in Northampton County. A column in Table 3-6 on the next page identifies the leaking tanks by town and wellhead protection area. WPA A has the highest percentage of leaking underground storage tanks, with 9 out of 199 tanks leaking (4.5%). According to the SWCB, seven tanks in Accomack County and one in Northampton County have been closed and are no longer leaking. Only two tanks in Accomack County have a monitoring program underway. It may be of interest to determine which of the leaking and non-leaking tanks lie on the spine recharge area, and install monitoring programs for those tanks.

TOXIC CHEMICALS

A wide variety of commercial and industrial land uses represent contamination threats to ground water. Small scale businesses such as auto body shops or dry-cleaning establishments, which may not be regulated by federal or state laws, utilize significant quantities of toxic chemicals such as solvents. Accidental or inappropriate disposal of hazardous wastes, even in small quantities, may result in ground water contamination exceeding state and federal drinking water standards. For example, many of the drinking water standards for volatile organic compounds (VOC's) are in the low parts-per-billion range.

Industries are required to report use and manufacturing of chemicals under several federal and state laws. EPA's Toxic Substances Control Act (TSCA, P.L. 94-469) requires that all manufacturers or importers of chemical substances be identified. Under the Superfund Amendments and Reauthorization Act (SARA, 1986), specific chemicals and amounts used must be reported. In Virginia, the Toxic Substances Information Act of 1976 requires that all businesses must report all chemicals that are manufactured or used in the manufacturing process. Reports must be updated annually.

On the Eastern Shore of Virginia, there are no Superfund or toxic dump sites. Several industries do use toxic materials, however. Tables 3-7 and 3-8 identify these industries as reported separately to the State and to EPA.

Table 3-6: Underground Storage Tanks by Wellhead Protection Area

WPA	TOWN	NUMBERS		TANK TYPE			PRODUCT					1000'S GAL	AGE	
		COUNT	LEAKING	STEEL	F.GLASS	UNKN.	DIESEL	GAS	KERO	F.OIL	U.OIL	CAPACITY	>15yrs	<15yrs
ACCOMACK COUNTY														
A	CHINCOTEAGUE	129	2	126	2	1	9	54	11	52	1	152.955	87	42
	GREENBACKVILLE	15	0	15	0	0	5	10	0	0	0	10.25	12	3
	HORNTOWN	12	0	12	0	0	0	4	0	8	0	10.85	10	2
	NEW CHURCH	20	3	20	0	0	3	13	1	1	0	90.9	9	11
	WALLOPS STATION	3	4	3	0	0	2	0	0	0	1	12.55	3	0
	WATTSVILLE	20	0	20	0	0	2	15	1	2	0	80.8	10	10
	total	199	9	196	2	1	21	96	13	63	2	358.305	131	68
B	ATLANTIC	18	0	18	0	0	1	8	4	5	0	17.35	11	7
	HALLWOOD	11	1	8	0	3	0	5	1	2	0	7.65	9	2
	HORSEY	1	0	1	0	0	0	1	0	0	0	1	0	1
	MAPPSVILLE	7	1	7	0	0	0	6	1	0	0	15.5	6	1
	MEARS	3	0	3	0	0	1	2	0	0	0	1.38	0	3
	NELSONIA	21	1	19	0	2	1	16	0	1	0	79.55	11	10
	OAK HALL	33	0	32	0	1	3	24	4	1	1	90.55	11	22
	TEMPERANCEVILLE	36	2	34	0	2	8	16	1	5	3	166.05	25	11
	WALLOPS ISLAND	56	0	47	9	0	24	21	1	5	0	2137.132	40	16
	WITHAMS	3	1	3	0	0	0	2	0	1	0	1.65	3	0
	total	189	6	172	9	8	38	101	12	20	4	2517.812	116	73
C	ACCOMAC	81	1	78	1	2	11	40	11	8	3	173.64	56	25
	BLOXOM	14	1	13	0	1	4	8	1	1	0	19.93	7	7
	CENTERVILLE	5	0	5	0	0	0	5	0	0	0	16	5	0
	GREENBUSH	7	0	6	0	1	0	6	0	0	0	4.6	6	1
	LEEMONT	4	0	4	0	0	0	2	1	1	0	2.4	4	0
	LOCUSTVILLE	3	0	3	0	0	0	2	1	0	0	1.22	3	0
	MELFA	31	1	30	0	1	6	23	1	0	0	60.2	16	24
	ONANCOCK	59	1	58	0	1	9	37	5	6	0	95.9	22	37
	ONLEY	41	2	40	0	1	4	26	4	3	2	106.8	26	15
	PARKSLEY	62	3	60	2	0	6	40	7	4	0	113.005	31	31
	TASLEY	22	1	21	0	1	8	8	2	0	2	37.925	16	6
	total	329	10	318	3	8	48	197	33	23	7	631.62	192	146
D	BELLE HAVEN	23	1	23	0	0	6	15	2	0	0	84.08	12	11
	CRADDOCKVILLE	10	0	10	0	0	3	6	1	0	0	7.05	9	1
	DAVIS WHARF	4	0	4	0	0	1	3	0	0	0	2.6	0	4
	KELLER	15	0	13	0	2	2	9	2	0	1	24.63	8	7
	MIDDLESEX	3	0	3	0	0	2	0	1	0	0	20.5	0	3
	PAINTER	26	1	26	0	0	5	15	4	1	0	36.7	12	14
	PUNGOTEAGUE	5	0	5	0	0	0	5	0	0	0	2.75	5	0
	QUINBY	4	0	4	0	0	1	3	0	0	0	2.65	0	4
	WACHAPREAGUE	8	0	6	0	2	1	5	0	0	0	11.55	5	3
	HARBORTON	5	1	5	0	0	1	2	1	0	0	3.65	2	3
	total	100.5	3	96.5	0	4	21.5	62	10.5	1	1	194.335	52	48.5
OUT of WPA	SANFORD	3	0	3	0	0	0	2	1	0	0	1.83	3	0
OUT of WPA	SAXIS	13	1	13	0	0	4	8	1	0	0	9.6	7	6
COUNTY TOTAL		836	29	801	14	21	133	467	71	107	14	3715.327	502	343
NORTHAMPTON COUNTY														
D	BAYFORD	4	0	4	0	0	1	2	0	0	0	2.2	2	2
	BIRDS NEST	3	0	3	0	0	0	2	0	1	0	1.1	2	1
	BRIDGETOWN	1	0	1	0	0	0	1	0	0	0	1	0	1
	EXMORE	77	4	71	3	3	10	53	7	2	2	142.04	45	32
	JAMESVILLE	4	0	4	0	0	0	1	0	1	0	2.2	4	0
	NASSAWADOX	27	0	25	0	2	2	14	3	1	0	62.03	14	13
	SILVER BEACH	1	0	1	0	0	1	0	0	0	0	0.275	1	0
	WEIRWOOD	7	1	7	0	0	1	6	0	0	0	17.1	2	5
	WILLIS WHARF	1	0	1	0	0	1	0	0	0	0	2	1	0
	CHURCHNECK	1	0	1	0	0	0	0	0	1	0	1	1	0
	total	126	5	118	3	5	16	79	10	6	2	230.945	72	54
E	CAPE CHARLES	84	2	80	1	3	16	47	9	3	0	226.255	49	36
	CAPEVILLE	16	0	16	0	0	5	10	1	0	0	51.55	9	7
	CHERITON	30	2	30	0	0	2	24	3	1	0	67.63	11	19
	CHESAPEAKE	8	0	8	0	0	0	3	0	0	0	10	8	0
	DALBYS	3	0	3	0	0	0	2	1	0	0	8.55	1	2
	EASTVILLE	30	1	29	0	1	3	22	4	0	0	86.94	14	16
	MACHIPONGO	12	1	12	0	0	1	10	1	0	0	30.05	7	5
	SEAVIEW	5	0	5	0	0	0	4	0	1	0	16.55	5	0
	TOWNSEND	4	0	4	0	0	0	3	0	0	1	18.55	4	0
	total	192	6	187	1	4	27	125	19	5	1	516.075	108	85
COUNTY TOTAL		318	12	305	4	9	43	204	29	11	3	747.02	180	139
GRAND TOTAL		1154	41	1106	18	30	176	671	100	118	17	4462.347	682	482

Source: Virginia State Water Control Board

SOLID WASTE DISPOSAL

The predominant form of solid waste disposal on the Eastern Shore is through landfilling. There are currently two public landfills in Accomack County and one public and one private landfill in Northampton County. Two additional landfills have been filled and are now closed. They are located in Chincoteague and northern Accomack County. Incorporated towns in the Accomack-Northampton Planning District utilize their respective county landfills for solid waste needs. Locations of landfills in both counties are included in Figure 3-5.

The Northampton County landfill was opened in 1985 and is expected to be in service for 20 years. It is located less than a mile north of the village of Oyster. The entire site is approximately 174 acres, with the landfill portion containing 78 acres. The landfill is to be used in phases and is divided into four cells, each of which is expected accept waste for five years. This landfill is lined and has a leachate collection system. Sampling is conducted quarterly from six shallow monitoring wells and the leachate pond. Without conducting a detailed analysis, a review of the sampling data revealed that the wells located downgradient from the landfill are displaying poorer water quality than the background well. Monitoring of the ground water quality should continue at this landfill with the consideration of the installation of wells screened deeper in the aquifer than the current wells. The inclusion of these wells will help to determine if any leachate is migrating in a vertical direction and recharging the Yorktown-Eastover aquifer.

The southern landfill in Accomack County is located at Bobtown. Opened in 1973, 86 acres of its 113-acre property are filled. Virginia Department of Waste Management, Solid Waste Management Regulations require that any solid waste management facility for which a permit was issued prior to the effective date of the new regulations comply with all of the provisions of the regulations by July 1, 1994. The regulations now require all landfills to be lined. The southern landfill was constructed without a liner and old landfills must either be brought up to standard or be closed by 1992.

The northern landfill in Accomack County is located approximately one mile north of Temperanceville. It was permitted for use in 1985 and comprises 150 acres. The landfill has been divided into three adjacent, independent, fill areas and is estimated to handle approximately 22 tons of waste per day. At the time of construction, the projected life span of the landfill was between 20 and 30 years. At this time, approximately 9 acres have been used. Should an accident occur, this landfill poses a significant threat to the quality of ground water on the Eastern Shore since it is located directly on the spine recharge area. Any leakage of leachate from the landfill into the ground water could potentially reach the lower Yorktown-Eastover aquifer. The Northern Landfill is lined, and has two components which help reduce the chance of contamination to the ground water. First, there is a stormwater management system in place to catch water contributed by rain. The landfill is also equipped with a leachate system which collects liquids originating in the waste, all of which are stored in 10,000 gallon tanks. When the tanks fill, they are brought to a wastewater treatment plant in Onancock. This landfill has fourteen monitoring wells installed to collect ground water quality samples. These wells are sampled quarterly for a range of chemical parameters. Currently, the samples are not showing any signs of significant contamination of the ground water. According to the Director of Public Works for Accomack County,Joe DeMarino, there have been "no problems" with any sample results from the monitoring wells (personal conversation, 7/24/91). Sampling should continue for both the northern landfill which is currently in operation and the southern landfill which is planned to be closed. Monitoring wells with screens located deeper in the aquifer should be installed to assess any vertical migration of leachate to the Yorktown-Eastover aquifer. The sample results are available for review in the Department of Public Works office in Accomac.

Table 3-7: EPA List of Active Generators and Transfer Storage Disposal Facilities, Accomack and Northampton Counties

ID#	Facility Name	Location	Date reported	Generation of Non-Acutely hazardous waste (kg/mo.)			Other
				<100	100-999	> 1000	
ACCOMACK COUNTY							
VA9143609148	Chincoteague National Wildlife Refuge	Chincoteague	2/4/87		X		
VAD023812878	Davis Auto Center, Inc.	New Church	10/28/86		X		
VA7800020888	GSFC/NASA Wallops Flight Facility	Wallops Island	4/7/89		X		
VAD044983658	Holly Farms Poultry Ind. Inc.	Temperanceville	10/28/86		X		
VA8800010763	NASA Wallops Flight Center	Wallops Island	8/15/80			X	Land Disposal
VAD023864127	Parks Motor Co. Inc.	Parksley	10/28/86		X		
VAD980715312	Perdue Inc.	Accomac	12/29/86		X		
VAD982578155	VA Dept. of Transportation	Accomac	1/12/89		X		
VAD982677874	Vaarng-Armory-Onancock	Onancock	5/14/90		X		
VAD988172151	Whittaker Bioproducts	Chincoteague	7/5/90			X	
NORTHAMPTON COUNTY							
VAD982709784	Alban Engine Power	Cape Charles	12/22/89		X		
VAD982565830	Bayshore Concrete Products	Cape Charles	1/15/88		X		
VA2572124483	Cape Charles Air Force Station*	Cape Charles	8/18/80			X	
VAD000650531	Municipal Corp. of Cape Charles	Cape Charles	8/18/80			X	
VAD023725572	Center Chevorlet, Inc.	Exmore	11/24/86			X	
VAD009091620	Chesapeake Bay Bridge-Tunnel	Wise Point	3/13/90			X	
VAD988186144	Chesapeake Hardware Products	Chesapeake	10/2/90		X		
VAD051365120	Eastern Shore Railroad, Inc.	Cape Charles	7/7/86			X	
VAD988194429	Exxon Co. USA #26457	Exmore	3/28/91	X			

* - Currently the Eastern Shore National Wildlife Refuge.
Source: US EPA, Region III Office, Philadelphia

Table 3-8: Virginia Toxic Substances Chemical Inventory, Accomack and Northampton Counties

			SUBSTANCE				Amount Used - (kg/yr)				
Facility Name	Latitude	Longitude	Acid	Base	Organic	Nutrient	10-100	101-1000	1,001-10,000	10,001-100,000	>100,000
ACCOMACK COUNTY											
Harry Drummond, Inc.	373325	754920			X		X				
Eastern Shore Printers	374247	754435	X	X	X		X				
A J Gray & Son, Inc.	375528	753331	X		X	X	X	X		X	
Helena Chemical Co.	374238	754216	X			X	X	X		X	X
New Church Energy Associates	375900	753200			X						X
Stony Point Decoys	375647	753218			X			X			
NORTHAMPTON COUNTY											
Bayshore Concrete Products Corp	371545	760130			X			X	X		
Lebanon Chemical Corp.	371606	755424	X						X	X	X

Source: Virginia Department of Health, Bureau of Toxic Substances

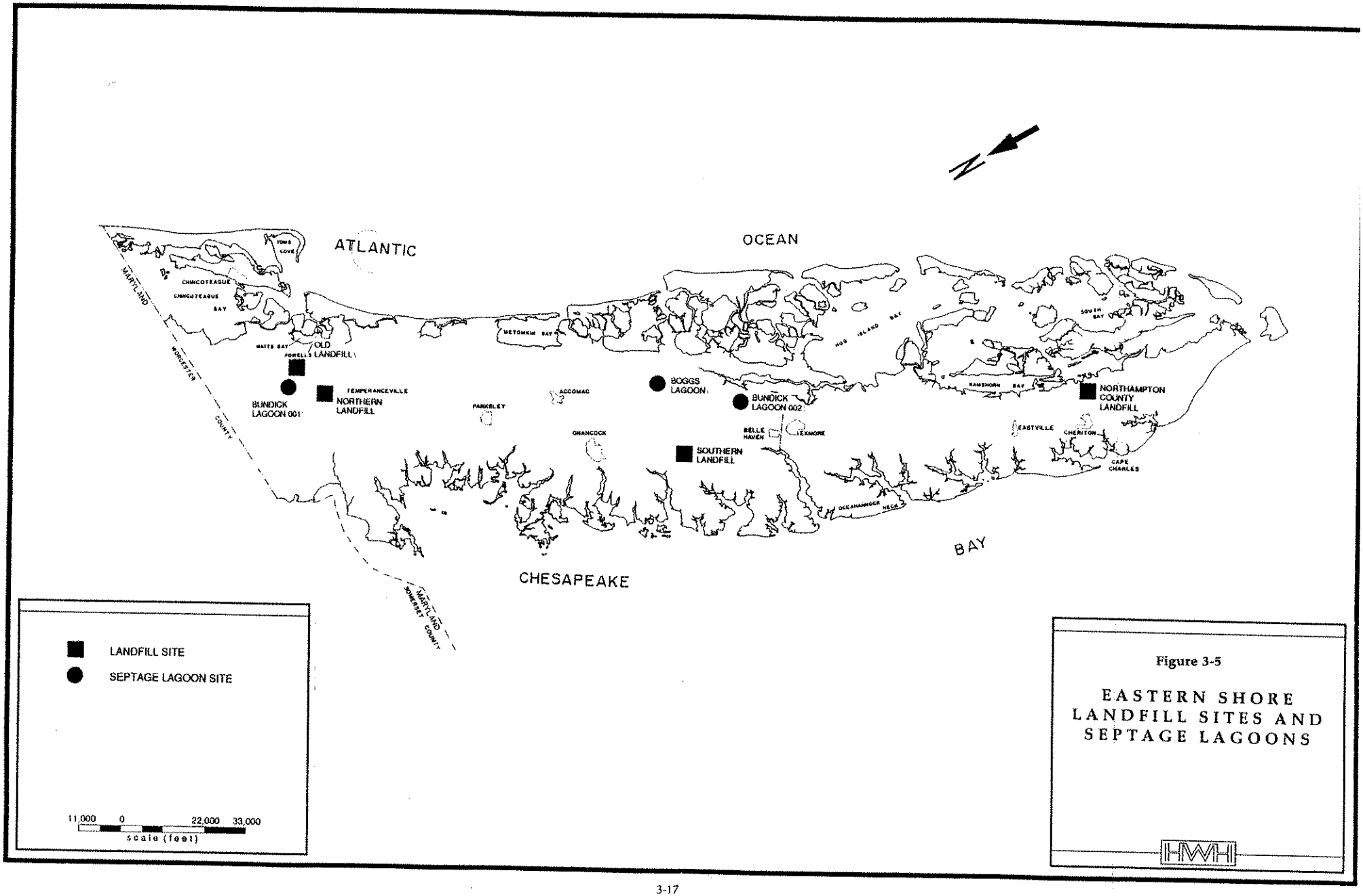


Figure 3-5

EASTERN SHORE LANDFILL SITES AND SEPTAGE LAGOONS

SEPTAGE DISPOSAL

There are three anaerobic septage lagoons located in the two counties which are owned by two well-drilling companies (Figure 3-5). The lagoons are in wooded areas which are set aside as receptacles for septage. When septic tanks are periodically emptied, the waste gets dumped into these lagoons. Lagoons are usually earth-diked ponds, varying in shape and size, and are relatively maintenance-free. The entire lagoon stabilizes biodegradable organics under anaerobic conditions where the rate of reaction or stabilization is slow. Bad odors are a characteristic of these areas, and lagoons can threaten the ground water quality because they contain concentrations of organisms close to that of primary waste water sludge.

One of the companies which owns the lagoon estimates that their lagoon receives waste from 1,000 septic tanks a year. The other reports that its two lagoons combined receive an average of 75,000 gallons of septage per month. According to the Northampton County Ordinance, septic tanks must be emptied every five years. This follows the recommendation of the Chesapeake Bay Preservation Act. As yet, Accomack has not adopted this as policy and has no set standard for emptying-intervals of septic tanks. Undoubtedly with the enforcement of the Preservation Act, these lagoons will be used more heavily.

In Virginia, septage was essentially unregulated prior to 1982. Now septage is subject to on-site sewage handling and disposal regulations requiring pumpers to take septage to approved facilities. Such facilities are municipal treatment plants or state-approved lagoons, which are aerobically digested by bacteria. In counties with population densities of less than 100 persons per square mile, septage can be directly applied to the land with the approval of several boards (Weigmann and Kroehler, 1988). The Eastern Shore lagoons are not required to follow the 1982 legislation because of a grandfather clause. The lagoons are not lined, and thus pose a threat to the ground water supply. In particular, one of the lagoons in Accomack County lies within the spine recharge area. As with the landfill, the location of this lagoon in this special area poses a serious threat to ground water quality as deep as the lower confined aquifer. No contamination has been documented to date, and it is speculated that sediments have lined the bottom of the lagoon (J. Green, personal communication, 1991).

Review of ground water samples taken in 1985 from two monitoring wells located at the private lagoons in Accomack County revealed that as of that time there was no impact on ground water quality from these lagoons. In order to be assured that water quality beneath the site is not impacted, ground water quality monitoring should continue, and the sampling should include analysis for organic compounds. In addition, the ground water flow direction should be determined to ensure that the wells are indeed capturing recharge from the lagoons.

EXISTING LAND USE

4

SECTION 4 - EXISTING LAND USE

PURPOSE

The purpose of this section of the report is to appraise the existing land use conditions on the Eastern Shore of Virginia and to analyze the ways which land use distribution, controls, and other factors may have an overall effect on ground water. The use and good condition of the ground water supply is critical for the continued viability of human habitation in the region since ground water is the only source of potable water. In the buildout and nitrogen loading portion of this study, scenarios for assessing the impacts of land use development on ground water are explored. In conjunction, land use instruments which govern the development within the spine recharge area and wellhead protection areas must also be analyzed.

OVERALL STATUS OF LAND USE CONTROLS

Currently, both Accomack and Northampton Counties have recently revised their comprehensive land use plans (Accomack in 1989, Northampton in 1990). Each county also has a zoning ordinance, both of which are under revision. In this report, the comprehensive plans are the primary sources for general information on existing land use. Separate from the county bylaws, there are town plans and zoning ordinances for 12 incorporated towns in the region--8 in Accomack and 4 in Northampton. Two other towns, one in each county, have zoning ordinances, but no plan. Eight of these towns also have subdivision ordinances. Since the percent of overall land area of the region they affect is relatively small, they are not examined separately here.

Each county's comprehensive plan is designed to set development policy only, as they do not have legally enforceable land use maps. The Accomack Plan states that, "adoption of the Comprehensive Plan is only the beginning of the planning process. To derive any benefit from the plan, steps must be taken toward its implementation. The principal instruments of plan implementation are the zoning and subdivision ordinances, and sufficient staffing of the Accomack County Department of Environmental Affairs to effectively administer these ordinances" (Accomack County Comprehensive Plan, 1989, p. i-4).

The Northampton plan states that the "phase of the Comprehensive Plan that addresses private sector issues is the land use plan, together with the regulatory ordinances and policies adopted by local government. The Land Use Plan is the umbrella document that sets the pattern and provides overall guidance" (Northampton County Comprehensive Plan, 1990, p. II-9). The Northampton Plan further states that it "presents a Land Use Plan for Northampton County. The Plan has been prepared in coordination with updated land development regulations to address issues with which the county is faced in the late 1980's and which will likely continue during the 1990's. Northampton County is currently considering significant changes to its existing zoning ordinance.

The advisory nature of both county plans presents a conservative approach to the interpretation of Virginia Law in defining the purpose of the Comprehensive Plan and Land Use Plan. In comparison, the counties of Fairfax and Loudoun, which are facing substantial issues of growth including traffic and transportation problems and a severe strain on county public facilities, have developed comprehensive plans (particularly the land use plan and map) that are enforceable legal documents which can supersede zoning and other development regulations in many cases. In these Northern Virginia cases, the long-range impacts of future county development have been assessed according to plan projections of population, employment, land-use density and other factors to assess future county service and facility needs, funding requirements, and needed changes in other county regulatory instruments.

Because Eastern Shore of Virginia Plans are primarily to be carried out through the zoning and related ordinances, such as subdivision, these ordinances will be the primary focus of this section.

There are other factors that affect existing land use development on the Eastern Shore. These include regulations for wells, septic systems, forestry, agriculture, mining, and stream and shore bank protection. While such regulations have been in effect for varying periods of time and have been enforced to varying degrees, many regulations are fairly recent and their effects thus far on the long-term development of existing land use is thought to be relatively slight. Therefore it is only necessary to assess these regulations in terms of their effects in the future. In addition, the recently enacted Chesapeake Bay Preservation Act is a comprehensive and potentially far-reaching instrument that can have substantial effects on future land use. Both counties have guidelines in place to comply with the Act. Potential effects of the Act on ground water are examined at the end of this chapter.

EXISTING PATTERNS OF LAND USE

Agricultural land under irrigation, residential land in subdivisions, and industrial land occupied by industries that are intensive water users are the most significant factors of existing land use patterns that influence ground water withdrawal on the Eastern Shore. All of these factors will be examined in the context of existing land use in the region.

Table 4-1 summarizes the existing distribution of land in broad categories within the region. The categories of land use as defined in the Accomack and Northampton Plans do not completely coincide, but they are close enough that a broad land use profile of the region can be assembled. The table illuminates several contrasts between the two counties:

1) nearly 57% of all land in the region lies in Accomack County;
2) nearly 70% of all land in agriculture and forestry uses is located in Accomack;
3) nearly 66% of all land in marshes, wetlands and tidal areas is located in Northampton;
4) nearly 78% of all residential land lies in Accomack;
5) over 96% of all industrial land lies in Accomack.

Thus, the overall picture of land use in the region is one of more intense development in Accomack County, even in the land use categories often viewed as land extensive such as agriculture and woodlands. Agricultural, residential, and industrial uses could have potentially significant affects for ground water consumption in Accomack County. Within Northampton County, agricultural and residential uses are worth a closer look.

Table 4-1: Existing Land Use - Accomack and Northampton

Category	Northampton (Acres)	%	Accomack (Acres)	%	Total (Acres)	%
Agriculture & Woodlands	87,025	37.8	198,879	65.3	285,904	53.2
Residential	3,800	1.6	13,361	4.4	17,161	3.2
Commercial	123	0.1	407	0.1	530	0.1
Industrial	102	0.1	2,454	0.8	2,556	0.5
Institutional	715	0.3	840	0.3	4,111	0.8
Recreation	177	0.1	8,332	2.7	8,509	1.6
Marsh/Tidal	135,500	58.9	70,371	23.1	205,871	38.3
Other*	2,505	1.1	9,996	3.3	12,501	2.3
TOTAL	**229,947**	**100.0**	**304,640**	**100.0**	**537,143**	**100.0**

*In Northampton, roads and utilities are included; in Accomack, figure includes land identified as vacant, but not roads and utilities. Vacant land is not identified in Northampton.

Source: Northampton and Accomack Comprehensive Plans (1990, 1989)

LAND USE AND OPEN SPACE REQUIREMENTS FOR WATER AND SEWER

There are three general conditions under which drinking water and waste water can be provided on a building lot. In some cases there are central or "public" systems for water and sewer, including a central or common septic field for sewage disposal. In others, a central water system is available, but individual sewerage, usually a septic system, must be located on each lot. The third case is the most common on the Eastern Shore of Virginia, where both individual water from a well and individual sewerage are provided on each lot.

An individual septic system, including a holding tank and drain field, can occupy about 5,000 square feet when sized for a three or four bedroom, two bath house. Setback distances are required for wells from building foundations and from the septic system, and this adds another several thousand square feet. Current subdivision regulations in Northampton require, and the Accomack Comprehensive Plan recommends, that space be available on each lot for a reserve drainfield. This adds another requirement for unobstructed open space, perhaps another 4,000 square feet.

Land above septic systems cannot be used for other purposes such as plantings (excluding grass), walkways, driveways, parking areas, or any other use that would possibly result in the blockage of, or damage to, the system. Additionally, "protection areas" around wellheads are now being set up to help assure that contaminants will not penetrate the well and seep into the ground water below.

When the requirements for wellhead protection, primary septic system and backup drainfield are taken together, there may be a need for upwards of 11,000 square feet on each lot devoted to these systems. A septic system and backup drainfield, when used in conjunction with a central water system, may still require 8 to 9,000 square feet or more. These figures should be kept in mind when developable land in the two counties are examined in the following pages.

EXISTING LAND USE IN ACCOMACK COUNTY

Tables 4-2 and 4-3 summarize existing zoning controls in both Eastern Shore counties.

Agriculture and Agricultural Districts

Agriculture in Accomack County accounts for over 65% of all land use. Potential problems exist for ground water conditions in such areas from the improper application of pesticides and fertilizers, inadequate handling of animal wastes, poor methods of retaining soils, and other land-based conditions that can affect ground water through runoff of, or percolation from, surface water to ground water recharge areas.

There are several conditions in the Accomack agricultural areas (A-districts) that are noteworthy. First, large amounts of such land under active crop production are irrigated. Improper irrigation accelerates the removal of soils, pesticides, fertilizers, and other matter from irrigated land. Some of the chemicals may remain dissolved in water and percolate through to the ground water.

Second, the minimum lot requirement under Accomack zoning and subdivision regulations is 30,000 square feet per lot (Table 4-3). While only single family residences are permitted as a matter of right in the A-districts, there are no discernable restrictions on subdivisions. Thus, subdivision of land in agricultural districts into 30,000 square foot lots, is possible. Under current zoning regulations, up to 46 percent or 13,800 square feet of each lot can be covered by a primary structure. There are no limitations on coverage of secondary or auxiliary structures except those established by setback requirements. Such structures could easily add another 3-4,000 square feet of impervious surface. The remaining 11-12,000 square feet of open area may be adequate for a well and septic system, but the relatively small lot size and possibility of substantial numbers of such lots close together raises the possibility of deleterious effects on the ground water.

A third land condition in agricultural districts is the frequent juxtaposition of agricultural and forestry uses with areas which often have direct relationships with ground water sources. These areas can include bogs or marshy areas; exposed, sloping banks; streams or other water bodies; wellhead areas; natural springs; pits used for dry waste or garbage disposal; and septage lagoons.

Housing and Residential Districts

Residential uses account for slightly less than 4.5% of land uses in Accomack County, but they account for over 13,000 acres of land area. Currently, conditions in residential areas (R-districts) that could adversely affect ground water include potentially high subdivision densities, lack of sufficient space on each lot for proper wastewater disposal, and high densities of multi-family buildings on relatively small lots.

There are at least three densities of single family usage permitted in the R-District. As seen in Table 4-3 if a lot has central water and either public or private sewer, the lot area requirement is 10,000 square feet. If the lot has either central water or central sewer, but not both, the lot size must be increased to at least 15,000 square feet. If the lot must accommodate both its own water and sewer systems, then it cannot be less than 20,000 square feet in size. Setback requirements mean that about 60 to 70 percent of these lots that are 10,000-12,000 square feet may not be occupied by the primary structure. However, ancillary structures, driveways and other features often found in residential areas, such as walks, trees, and other landscaping, can cut down the amount of open space available for well and septic areas. Thus, as lot size increases substantially to accommodate individual water and sewer systems, the amount of space usable to such systems may only increase marginally, if at all, and the percentage of such space relative to lot size actually decreases.

Table 4-2: Land Use Category by Zoning District, Eastern Shore of Virginia

Use Category	Districts														
	Accomack					**Northampton**									
	A	R	B	I	BI	AR	R20	R11	RM	MHP	CN	CG	CW	PI	IL
Ag./Forestry	x	a	a		e	xe	xe							x	
Preserve	x	a	a		x	x	x							x	
Lodge/Club	x	a	x			x	x		e				x		
Rec./Private	x	e	a			x		e	e	xe		x	x		
Rec./Public	e	x	a			x		e		xe		x	x		
Dock, Private	x	a	a			x							x		
Dock, Public	a	e	a			x							x		
Single Family	x	x	e			x	x	x	x						
Multi-Family	e	e	a			x	x	x	x	x	x	x	xe		
Mobile Home	e	e	e			xe	xe	xe		x					
Mobile Home Park	e	e	e							x					
Camp/Trailer	e	e	a			e							x		
Seas. Housing	a	a	a		x	x									
Home Office	x	x	a			x	x	x	x						
School Library	x	x	x			e	e	x	e		x	x		x	
Religious	x	x	x			x	x	x	x	x					
Cemetery	x	a	a			e									
Post Office	x	x	x				e	x		e			x		
Other Public	a	a	a			e	e	x	e	e			x	x	
Utility	x	x	a	x		x	xe	xe	xe	xe	xe	x	xe	x	x
Retail Gen.	e	e	x								x	x	x		
Public Assem.	a	a	x								x	x			
Restaurant	e	a	x			e					x	x	x		
Hotel/Motel/Transient	e	e	x			e	e					x	x		
Industry General	e	a	e	x								e	e	x	x
Ag. Processing	a	a	e	x											
Seafood Plant	e	e	e	x		e							e		
Sawmill	a	a	e	x		e								x	
Quarrying /Conc.	a	a	a	x		e								x	
Marine Comm.	e	e	x	x		x							x	x	
Serv. Sta./Gar.	a	a	x	x							e	x			
Dry Cleaning/Laundry	e	e	x	x							x	x			
Build. Supply	a	a	x	x											x
Indoor Stor.	a	a	a	x											
Printing/Mach.	e	e	x					e			x	x		x	
Office, General	e	e	x						e		x	x		x	
Hospital	e	e	x						e				xe		
Other Health	e	e	x						e			xe			x
Funeral Home	a	a	x				e	e			e	x			
Junkyard	a	a	a									e			
Other Outdoor Stor.	a	a	a	x											x
Airport	a	a	a			e									x
Outdoor Adv.	a	a	a			x	x	x	x	x	x	x		x	x
Other Trans.	a	a	a	e							x	xe		x	x
Landfill	a	a	a			e									

a = any other use, review needed, e = exception, review needed, x = permitted, xe = permitted in some areas, review needed in others.

Table 4-3: Zoning Lot Sizes and Open Space, Accomack and Northampton Counties

Zone District By County	Minimum Lot Size Sq. Ft.	Dimensions Min. Lot Size in Feet	Gross Open Space* Sq. Ft.	Percent Open Space
ACCOMACK				
A - Agriculture	30,000	150 x 200	16,200	54.00
R - Residential				
Central Water/Sewer	10,000	100 x 100	8,950	89.5
Cent. Water/Indiv. Sewer	15,000	100 x 150	10,450	69.7
Indiv. Water/Sewer	20,000	100 x 200	11,950	59.7
Multi-Family				
Central Water/Sewer				
Number of Units				
2	12,000	100 x 120	9,550	79.6
3	14,000	100 x 140	10,150	72.5
4	15,000	100 x 150	10,450	69.7
5	16,000	100 x 160	15,750	67.2
20	31,000	100 x 310	15,750	50.8
B - Business	NA	NA	NA	NA
I - Industrial	NA	NA	NA	NA
BI - Barrier Island	174,240	200 x 871	84,460	48.5
NORTHAMPTON				
AR - Ag. Residential	43,560	125 x 348	26,400	60.6
Residential				
R-20 Single Family	20,000	80 x 250	12,250	61.3
R-11 Single Family				
Public Water/Sewer	11,000	60 x 183	5,860	53.3
Public Water or Sewer	20,000	60 x 333	8,860	44.3
RM - Multi-Family				
Duplex: Public Water/Sewer	40,000	110 x 363	10,498	52.5
Indiv. Water & Sewer	50,000	110 x 227	11,568	46.3
Patio/Atrium	100,000	880 x 113	26,400	26.4
Townhouse	40,000	346 x 101	19,800	49.5
Multi-family, Other	25,000	140 x 179	15,250	61
MHP - Mobile Home Park	5,000	40 x 125	4,000	80
CN - Commercial Neighborhood	15,000	100 x 150	6,840	45.6
CG - Commercial General	15,000	100 x 150	6,840	45.6
CW - Commercial Waterfront	15,000	100 x 150	4,500	30
PI - Planned Industrial	50 acres	1000 x 2178	1,506,800	69.2
IL - Industrial Limited	43560	200 x 218	27,960	64.2
IG - Industrial General	30000	150 x 200	21,070	70.2
HD - Historic District	NA	NA	NA	NA
AP - Airport Protection	NA	NA	NA	NA
PUD - Planned Unit Develop.	NA	NA	NA	NA
FH - Flood Hazard	NA	NA	NA	NA

*This figure represents the minimum open space per lot or development possible under existing yard requirements. Driveways, walks, accessory uses and other site features could further reduce this area. Conversely, not all buildings are built to these setback lines.

Potentially inadequate space for water and sewer systems is also found in R-Districts where multi-family structures are allowed. Table 4-3 indicates that while two-family structures require at least 6,000 square feet each per lot, the construction of a five-family structure would effectively double the unit density. If a twenty-unit structure were constructed, the density would be doubled again, and the potential effects on ground water more pronounced. A two-unit structure would have a possible 9,550 square feet of open space for water and sewer systems. Three or more units would increase this acreage only marginally. The amount of open space per unit would actually decrease as would the percentage of such space relative to the size of lot. As with the single-family examples, other features could further reduce the space available.

One anomaly present in the Accomack Subdivision Regulations is found in Section 5., Paragraphs 5.2.4-1 through 5.2.4-3. These paragraphs repeat the requirements of varying lot sizes found in the R-District. (Table 4-3). However, uniformly larger lots (15,000 square feet) are required if the area has either public water or public sewer. This seems to make sense in the case of central water and individual sewer (septic or septage) because of increased land requirements for the sewage system. However, the reverse situation would not seem to require additional lot size. Individual wells may require somewhat more area due to well location requirements, but not as much as individual sewerage.

Industry, Business and Industrial/Commercial Districts

Industry and commercial uses occupy less than one percent of the land in Accomack County. However, estimates of water consumption by some of the major water users in Accomack suggest that industry uses in excess of 30 percent of the ground water on a daily basis (Comprehensive Plan, 1989, p. II-68). There is no minimum lot size in either industrial or commercial districts. While facilities with individual sewage disposal systems must have their lot sizes approved by the state health official for the county, the criteria for such approval are not clear in the Zoning Regulations. Thus, uses on one site could substantially affect uses on an adjacent site.

EXISTING LAND USE IN NORTHAMPTON COUNTY

Table 4-3 also summarizes existing open space due to zoning controls in Northampton County.

Agriculture and Agricultural Districts

Agriculture and woodlands in Northampton account for almost 38 percent of all land use. Similar potential problems are associated with agriculture in Northampton County as with Accomack County. Ground water contamination may result from the activities of pesticide and fertilizer applications, problems with soil erosion from improper tillage or forestry harvesting, and leaking septic or cesspool facilities. As in Accomack County, large portions of agricultural land in Northampton are irrigated, and it is estimated that 19-23 percent of all agricultural land in Northampton is currently under irrigation.

Residential zones in Northampton agricultural areas offer larger minimum open space potentials than those in Accomack. The minimum lot size for residential development in Northampton agricultural districts (AR) is one acre (Table 4-3). Using minimum frontage and setback requirements, it may be ascertained that 26,400 square feet of each one acre lot not fronting on water or Route 13 would be available for open space. This compares to a figure of 16,200 square feet in the A Districts of Accomack. As in Accomack, this open space may be covered by outbuildings, walks, driveways, or other features that further restrict the space used for wells or septic systems. Again,

the result of these relatively small areas introduces the potential for forcing wells and sewerage to co-exist in somewhat restricted areas.

The land use categories that cover the largest portion of Northampton are marsh/tidal areas; these occupy almost 59 percent of the county, over 135,000 acres. Agriculture and woodlands take up about 38 percent. Inevitably these two uses are intertwined in many parts of the county, in that water from wetland areas associated with dammed creeks may be used for irrigation purposes, and crops may have been planted within drained marsh areas. Where this happens there is the potential for direct contamination of ground water by agricultural or forestry practices.

Housing and Residential Districts

Residential land use in Northampton occupies a much smaller land area in Northampton than in Accomack--3,800 acres versus 13,361 acres respectively. Residential zoning in Northampton, however, is somewhat more diverse than in Accomack. While the single residential district used in Accomack can accommodate single family and multifamily housing in several configurations, the Northampton R Districts are more detailed in the number and type of housing units permitted and the conditions under which such units are permitted given types of water and sewer systems.

More importantly for ground water protection, Northampton single family districts often require larger lots for single family houses for either central, combined or individual water/sewer systems. For example, central water and individual sewer in Northampton require a lot size of 20,000 square feet. In Accomack, the corresponding lot size would be 15,000 square feet. However, in Northampton County the primary building coverage can occupy nearly 66 percent of the lot, leaving only 8,860 square feet or less for a well and sewer system. In Accomack, the building coverage is restricted to about 30 percent, leaving over 10,400 square feet for landscaping, well, and sewer space.

Current zoning in Northampton County provides for a Residential Multi-family or "RM" District. Duplex, patio/atrium, townhouse and apartment structures are permitted in this district. Of these, the patio/atrium option can occupy at least 73 percent of the lot area, based on a configuration incorporating a minimum of 10 dwelling units. The remaining 2,640 square feet per unit would be very crowded should individual septic systems be installed. Additional landscape features such as driveways, parking areas and plantings would further reduce the space for septic systems. It is typical that this type of unit is built to the lot line on at least two sides, and thus the close proximity of individual septic systems is almost guaranteed.

Given the current zoning, townhouse units have the potential to be even more crowded than the multi-family residential units. Individual units could have just slightly over 1,500 square feet for septic systems, and multifamily apartment units can have about 3,200 square feet of open space per unit. These units can also be in tight configurations raising some of the same concerns expressed about the atrium units. At least 10 parking spaces must be provided for the minimum 5 units, which would occupy about 560 feet per unit. Thus the space available for septic systems would be reduced to about 2,600 square feet per unit. Additional landscape features could reduce this figure even further.

Industry, Business and Industrial/Commercial Districts

Industrial and commercial uses occupy about 225 acres or less than one-fifth of one percent of all land in the county. While such minimal areas are not likely to have major impacts on ground water supplies, several features of the zoning requirements for such areas are worth noting. For example, in any commercial district, CN, CG, or CW, the building and parking spaces can occupy over 50 percent of any development parcel. The amount of open space left for the well and septic system--

6,800 square feet in the configuration adopted for the assumption used here--may be minimal given other features, such as trash disposal, landscaping and parking and circulation, that can occupy the site. In the CW or Commercial Waterfront District, there are no open areas required, thus allowing for a particularly crowded water and sewage system for those sites adjacent to water bodies.

Other Uses

Northampton has a Planned Unit Development District in which 75 percent of the land area may be occupied by lots, buildings, streets and off-street parking. If such lots were developed as townhouse or atrium developments, then on-lot space for septic systems would be extremely limited. The 150 units or lots that would be permitted under the minimum development size of 15 acres and the maximum density of 10 dwelling units per acre for RM zoning could result in a substantial demand for a central, land based sewage disposal system. Of the 25 percent of the development left in open space, about 3.75 acres, much or most could be occupied by such a system.

By far the largest land use in Northampton County is that occupied by marsh or tidal areas. However, there is no specific zone district to treat such land. The Northampton Comprehensive Plan addresses the need for special treatment of tidal wetlands, barrier islands, and wetlands bordering on Bay side creeks and their branches. Additionally, in the Zoning Regulations, the use of wetlands in calculating developable areas on development parcels is excluded. However, there appears to be no specific protection plan for non-tidal wetlands, which are important for the recharge of ground water supplies.

Table 4-2 sets out detailed use categories and establishes their status in each zoning district for the two counties. In general, Accomack County appears to have a less restrictive, more inclusive ordinance. As evident in the table, nearly every land use is either permitted or excepted in agricultural, residential, and business districts. Comparatively, industrial zoning is highly restrictive, allowing only industrial and utility uses, with no exceptions allowed for other non-residential or residential uses.

Northampton's approach to zoning is quite the opposite. The county has an agricultural district, four residential districts, three business or commercial districts, and three industrial districts. Northampton also has four "overlay zones": historic, airport protection, planned unit development, and flood hazard, which can be used with the plan review to modify the underlying zones for the purposes of each overlay. In addition, Northampton has further front yard setbacks required in its Zoning Regulations along U.S. Route 13 that would increase the area space per lot. This is designated as "Highway Protection" in the Comprehensive Plan.

Northampton's zoning is substantially restrictive. For example, some agricultural uses are permitted only with special exceptions in the Agricultural/Residential District. Few industrial uses, even sawmills and agricultural processing plants, are permitted in the Agriculture/Residential District. In residential districts, many public facilities are either prohibited or only permitted with a special exception. Some anomalies do exist. For example, in the Residential Multi-family District, usually the least restrictive of any residential zone, only religious uses are permitted as a matter of right. Schools, libraries and some other public facilities are permitted only with special exceptions. Post offices are prohibited, as they are in AR Districts.

LAND USE CONTROLS AND EFFECTS ON GROUND WATER

The following chart summarizes land uses, the categories that may have particularly substantial effects on ground water, the general nature of those effects, and the status of those land use categories under present zoning or other review.

Table 4-4: Analysis of Land Use Effects on Ground Water Supplies

LAND USE/ USE CATEGORY	NATURE OF GROUND-WATER EFFECT	REVIEW STATUS
<u>Agriculture</u>		
Cropping	Pesticides, fertilizers may penetrate to water table and ground water	Matter of right (MOR) in both counties.* (see last page of table)
	Irrigation draws substantial amounts of water in dry periods.	Most withdrawals are not metered.
Grazing	Animal wastes may contaminate water table and ground water.	Review under Northampton Zoning only*.
Forestry	Pesticides may penetrate to ground water; cutting may enhance erosion.	Matter of right (MOR) in both counties.
<u>Residential</u>		
Single Family	Some lots may be too small to comfortably accommodate wells and/or septic systems, and drainfield reserve areas.	Matter of right, but VA health review is required.
Mobile Homes	Mobile Home Parks must have enough land per unit to accommodate well and/or septic system.	Special exception or health depart review; both counties.
Multi-Family	As for single family.	Matter of right, but VA health review is required.
<u>Utility</u>	This category can include public and private water and sewage operators that can withdraw large amounts of water and dispose of large amounts of waste water. The methods, condition of equipment, and conservation practices of the operator can affect ground water supplies.	Matter of right in Accomack A, R and I zones. Review in B zone. MOR in Northampton AR, CG, PI and IL zones. Possible review in others. VA Water Control Board requires permit for large withdrawals, discharges.

Table 4-4: Analysis of Land Use Effects on Ground Water Supplies (Continued)

Retail		
Restaurant	Restaurants can be large water users and often, discharge substantial amounts of waste water.	Accomack - reviewed in A,R zones. MOR in B. Northampton - MOR in C zones. Reviewed by VA Board of Health for minimum water flow.
Hotel, Motel, Other Transient Facilities	Can be large water user and waste water discharger. Especially in combination with a restaurant.	Accomack - reviewed in A, R zones. MOR in B. Northampton - reviewed in AR, R20 zones. MOR in CG, CW.
Industry		
General Industry	A variety of industries including research labs, production facilities, and service industries--especially food and bottling industries--can be major water users and can discharge toxic wastes, depending on their processes.	Accomack - MOR in I zone; Reviewed in A, R and B zones. Northampton - MOR in PI, IL and IG zones. Exception in CG and CW zones. Major water withdrawals subject to VA State Water Control Board approval.
Ag. Processing, Seafood Plant	These industries usually use large amounts of water for cleaning the product and usually discharge waste water filled with food wastes.	Accomack - See above. Northampton - Exception in IG for Ag. : in CW, IG for seafood.
Sawmill, Quarrying, Concrete Mix	Sawmills may use water for cooling and discharge waste pulp; quarries sometimes act as "drain holes" for surrounding area contaminants; concrete plants use substantial water and discharge waste filled with lime and toxics.	Accomack - MOR in I. Exception in A, R, B. Northampton - Sawmill MOR in IG; Quarry, Conc. MOR in PI. Exception in IG.
Marine Commer., Service Station, Airport, Junk yard	These uses often discharge or leak petroleum products to the ground. Additionally, battery acid and other by-products may leak from junk yards.	Accomack - Marine Serv. Stn. MOR in B,I. Airport , junk yard exception in A,R, B Northampton. Marine MOR in AR, CW, PI and IG. Serv. Stn. MOR in CG, Junk yard MOR in IG exception in CG; Airport MOR in IG, exception in AR.

Table 4-4: Analysis of Land Use Effects on Ground Water Supplies (Continued)

Dry Cleaning, Building Sup. Other Storage	These uses can discharge distillates and and other toxics to land areas.	Accomack - Dry Clean Bldg. Supply Exception in A, R; Other Stor. MOR in I, Exception in A, R, B. Northampton - Dry Clean MOR in CN, CG; Bldg. Supply MOR in IL. Indoor Stor. MOR in IG; Outdoor Stor. MOR in IL, IG.
Landfill	Landfills have been shown to be potentially major polluters of ground water sources. Substantial amounts of toxic materials have been--and are--dumped in these locations and, depending on ground soil and geology, may leach these toxics to aquifer.	Accomack - Exception only in A, R and B zones. Northampton Evidently prohibited in all zones.

*Farm Use Only

Generally, where the above uses are a matter of right, that is, where they can proceed to construction without review by government authorities and other advisers qualified to assess their effects on soil and ground water conditions, they may pose a distinct threat to ground water supplies. Degradation can occur either from overuse or contamination of ground water aquifers, in areas where soil and geological conditions indicate a high susceptibility. In cases where potentially harmful uses are reviewed, the review process may need strengthening to assure that such reviews are accomplished beyond that of the normal site plan or other process. After the review and possibly the remediation, the uses which could have highly adverse long and short-term effects should be monitored on a periodic basis to be sure that the remediation remains in place. A field survey and engineering/planning studies should be conducted to determine what existing land uses are potentially threatening to ground water and soil conditions so that remedial measures may be carried out.

SUBDIVISION OF LAND

Both counties have subdivision ordinances in place. In Accomack, final plats must be approved by the county and State Highway Department for public streets and drainage, and by the State Health Department for water and sewer facilities. Health and public road improvements must be secured by cash or a bond. In addition, trailer parks must also be approved by the State Bureau of Tourism. Accomack's subdivision ordinances also states that the State Health Department can order lot sizes larger than the minimum sizes established in the Zoning and Subdivision Ordinances if "factors of drainage, soil condition, population density or other conditions can cause potential health problems." Additional open space requirements are set out in the ordinance for buffering trailer parks from surrounding property. Lots larger than 3 acres in size are excluded from subdivision requirements under the Subdivision Ordinance in Accomack County. All final subdivision plats must be prepared by a state-registered engineer or surveyor. There is currently no

requirement for drainfields reserved for septic systems in Accomack, although that is suggested in the County Comprehensive plan.

In Northampton, divisions of land are apparently excluded from subdivision review if the resultant lots are 5 acres or greater in size and if a single subdivision of a lot or parcel is made for the purpose of sale or gift to a member of the immediate family of the property owner. If the subdivision has 26 or more lots created, it is considered a major subdivision. A major subdivision must be reviewed by the State Highway Department, the State Health Officer, each incorporated town within 2 miles of the project, each utility company providing service to the project, and all abutting property owners and other agencies the Planning Director deems appropriate. The State Highway and Health Department comments must be received prior to review and action by the County Planning Commission. Plans must be prepared by a state-licensed surveyor or engineer. All major subdivisions must have a central water system in Northampton. All proposed improvements are bonded for implementation by the owner or his/her agent.

The procedure for approval of minor subdivisions, those with 25 lots or less and with lot areas of less than five acres, is the same as that of major subdivisions except that final approval can be granted by the Planning Director rather than the Planning Commission.

Lots in Northampton that use private, individual wells and septic systems must provide an additional, non-overlapping replacement drainfield site. No such site is required if a well is not located on the lot. Additionally, wetlands cannot be separated from a lot. All wetlands must be incorporated into an adjoining lot where they are counted against the lot size for purposes of establishing minimum lot area and for calculating buildable portions of the lot. This can have the effect of allowing building and development adjacent to wetlands on the subject lot. It also removes the wetland as a special area separated from development and subject to special protection.

Subdivisions in Accomack County

There have been over 160 subdivisions in Accomack County (Table 4-5) approved between 1972 and 1990. Of these 15 are campgrounds or other seasonal developments. These 15 subdivisions have 4,193 lots of which nearly 66 percent, or 2,765, currently have structures or trailers on them. Another 44 subdivisions are trailer parks containing 2,813 lots. Nearly 56 percent, or 1,563, of these are occupied by units. The remaining 113 subdivisions are primarily occupied by single-family houses ranging in size from 2 to 5 bedrooms. There are a few duplexes, but these units are primarily 3-bedroom, 2-bath dwellings. Of the approximately 8,500 lots in these subdivisions, only 19 percent or 1,627 are currently improved with structures.

Table 4-5: Subdivision Development in Accomack County, 1972-1990

Type of Subdivision	Number in County	Number of Lots	Number Improved	% Improved
Campground or Seasonal/Vacation	15	4,193	2,765	65.9
Trailer Parks	44	2,813	1,563	55.6
Single or Multi-Family	104	8,449	1,627	19.3
Total Subdivisions	163	15,455	5,955	38.5

Source:Accomack County Department of Environmental Affairs, Zoning Administrator's Office, April 1991.

Of the 163 subdivisions referenced above, at least 60 have central water systems. The remainder have individual wells on each lot. Over 100 subdivisions have both individual water and septic on each lot. Eleven subdivisions have central holding tanks for sewage that are pumped out periodically. The septage is then disposed of in lagoons. One subdivision has both central water and a central drainfield for wastewater disposal.

Subdivisions in Northampton County

There were about 150 subdivisions approved in Northampton between 1974 and early 1991. Between 1970 and 1980 approximately 320 trailers and 602 other year-round housing units were added to the existing housing stock. If one assumes a similar proportion of development in the subdivisions recorded, the results would be as those set out in Table 4-6. The number of lots recorded in these subdivisions total 2,016. Of these, it is surmised that about 1,154 have been improved. It is further surmised that 542 of the lots are improved with trailers, while 322 are improved with single family houses. Accordingly, an additional 290 camping and seasonal lots would be currently active.

Table 4-6: Subdivision Development in Northampton County

Type of Subdivision	Number in County	Number of Lots	Number Improved	% Improved
Campground or Seasonal/Vacation	49*	431*	290*	67.3
Trailer Parks	34*	673*	542*	80.3
Single or Multi-Family	68*	912*	322*	35.3
Total Subdivisions	151	2,016	1,154	57.2

Source: *Derived figures Director, Planning and Zoning, Northampton County; Northampton County Comprehensive Plan and Plan Background, July 1989. It is thought by county planners that all of these subdivisions are served by individual water and sewer.

THE CHESAPEAKE BAY PROGRAM ON THE EASTERN SHORE OF VIRGINIA

Introduction

The Virginia State Chesapeake Bay Preservation Act (CBPA) of 1988 - Chapter 21 of the Virginia State Code, Sections 10.1-2100 through 10.1-2115 - sets out requirements for all local governments in Tidewater Virginia to develop land use regulations based on the state code in order to protect water quality in the Chesapeake Bay and its tributaries. Each locality will incorporate the new regulations into their comprehensive plan, zoning bylaws, subdivision plans, and other land development ordinances. Both counties on the Eastern Shore and the self-governing towns are required to prepare such regulations. Under the CBPA where a town does not have planning, zoning, or other such regulations, or chooses not to prepare regulations on its own, it may act to be subject to the county program.

Basic Approach

The state program is overseen by the Chesapeake Bay Local Assistance Board. The Board is comprised of nine members appointed by the Governor. The Board is staffed by the Local Assistance Department, a state agency that provides technical support to the Board and technical advice and

assistance to the local governments. The Board has developed regulations for the designation of Chesapeake Bay Preservation Areas and for land use management to accomplish the aims of the legislation in those areas. It also provides financial and technical assistance to local governments where required. The Board must approve all locally prepared plans and assure compliance of each local government with the Act, but is not responsible for specific decisions about particular sites in the Preservation Areas. Those decisions will continue to be made by the local government based on the locally prepared regulations.

The Chesapeake Bay Preservation Area (CBPA) contains three general land categories: the Resource Protection Area (RPA); the Resource Management Area (RMA); and the Intensely Developed Area (IDA). Very generally, an RPA is land at or near the shore of the Bay or tributary which can protect water quality but, if damaged by development or other disturbance, can degrade water quality. These areas include tidal wetlands, nearby non-tidal wetlands, tidal shores and other lands whose disturbance would harm the area. An RPA must contain a buffer area along the landward side measured from the landward face of the above features. Only redevelopment and new, water-dependent uses can be developed in an RPA.

An RMA is land which protects the RPA. Development and other land disturbance in these areas can have adverse effects on the RPA and ultimately degrade water quality. Floodplains, steep slopes, soils susceptible to erosion, soils with a high degree of permeability, non-contiguous non-tidal wetlands and lands required to protect water quality are to be included as RMA's. In some cases the entire drainage basin of a water body may be designated as an RMA boundary. RMA's must be designated landward of RPA's. Any use permitted by local zoning can be developed in an RMA, subject to certain performance criteria.

An IDA is an area that, due to previous development, may be located in an RPA or RMA. Redevelopment and infill development can take place in these areas where little natural land area remains. An IDA must be so designated if an area has more than 50 percent of its surfaces in impervious materials, or is served by public water and sewer, or has a housing density of 4 or more dwellings per acre.

State regulations were adopted in September, 1989 and became effective October 1 of that year. Lots recorded after the effective date are subject to the regulations. However, local governments may allow modification of the buffer up to 50 feet, and may not require a reserve drainfield (one of the regulatory requirements) depending on the local program developed. All local governments are to have their adopted local regulatory programs in place by November 19, 1991. Northampton's program was incorporated into its Draft Comprehensive Plan in late 1990 and was drafted as an overlay district for the zoning ordinance. Accomack's program was also drafted as a zoning overlay district and is currently being assessed by the County Board of Supervisors.

Implications for Ground Water Protection

All locally prepared programs for Chesapeake Bay Preservation Areas (CBPA's) must meet general performance criteria. These criteria are designed primarily to reduce nonpoint source pollution of surface water and to protect sensitive lands from disturbance. The criteria include:

1) preservation of natural vegetation;
2) restricting disturbance of land;
3) restricting impervious cover;
4) controlling soil erosion--especially in areas of susceptible soils and during land clearing construction and other land-disturbing activities, such as tillage;
5) controlling the volume and quality of stormwater runoff;

6) controlling the overflow and leaching of septage from tanks and drainfields by regular, mandatory pumping;
7) providing for reserve drainfield capacity for septic systems that equals the treatment capacity of the primary drainfield;
8) requiring site plan review and the preparation of various studies such as a water quality impact assessment and a site plan review document;
9) control of stormwater quality in agricultural and forestal areas within or adjacent to the RPA.

Of the above performance criteria, all relate to the ultimate use and condition of ground water. However, several have the potential for more directly affecting ground water withdrawals and quality.

Overflow and leaching of septic drainfields and tanks, especially when they are in close proximity to wells, can cause both immediate and long term effects on drinking water. The inclusion of provisions for pumping out systems every five years is a start to controlling this overflow and leaching. The requirement of provisions for back-up drainfields in areas that do not overlap the original facility provides a longer-term solution to the problem.

Control of storm water quality in agricultural and forestal areas is also important to ground water quality. This performance criteria is primarily directed toward the protection of surface water from pollution by soil erosion, pesticides and fertilizers. These problems also can affect ground water, but not simply through storm water runoff. The large amount of water used for irrigating crops in the area can carry these pollutants into the soil as well. Where surface soils have a high degree of porosity, especially where the subsurface soils are not clay or clay loam, chemical compounds used in agriculture and silviculture can be transmitted to ground water fairly quickly. Where wells and watering ponds draw from this contaminated ground water, especially in the upper aquifer, deleterious effects on humans and animals from consumption can be expected to be noticed relatively quickly.

Another area where there may be beneficial effects on ground water quality is in the attention of the Act and local programs to protect wetlands. Depending on substrata conditions, wetlands can act as large filtration systems for broad areas that drain surface waters to the wetland. This water may then penetrate to ground water aquifers at a faster rate than is possible when water seeps into surrounding upland soils. The process of filtering out harmful substances is enhanced where wetlands and marshy areas are protected by buffers of natural vegetation. Such a buffer zone is called for in the Act and its attendant regulations. The capacity of the buffer to adsorb pollutants is further increased where these substances are further controlled through agricultural best management practices and erosion control plans.

In addition to the performance criteria set out in the Act, state agencies have called for further performance standards. Briefly, these are as follows:

1) prevent any increase in pollution from new development;
2) achieve a 10% reduction in pollution from redevelopment;
3) achieve a 40% reduction in pollution from agriculture;
4) limit any land disturbance to 60% of a site;
5) preserve vegetation and limit impervious coverage;
6) require a soil erosion and sediment control permit;
7) stormwater from new development must be limited to pre-development levels;
8) federal and state wetlands permits are needed before grading and clearing;

9) agriculture requires a Conservative Plan of Best Management Practices approved by the Soil & Water Conservation District and put in place by 1995.

There are several points worth noting. The limitation of development of a site to 60 percent of the total area is commendable. However, as can be seen in the studies done for existing land use (Table 4-3), some zone districts already limit building area to substantially less than this figure. There may be substantial problems of pervious areas sufficient for individual well and septic systems, as well as for any requirements for reserve drainfields, given such figures and the size of lots.

There are some differences in the CBPA regulations drafted by the two Eastern Shore counties. For example, Northampton will require a Minor Water Quality Assessment of a proposed action if the action disturbs less than 10,000 square feet of land. For Accomack, the same figure is 5,000 square feet. In each draft there is considerable attention paid to requirements for RPA's, but less definition to the requirements for RMA's. Requirements for IDA's are not included in either county's draft.

Some selected modifications of the current regulations shall be made to increase the potential for ground water protection. Attention would have to be paid to space requirements for drainfields, impervious surfaces, and developments adjacent to the buffer areas. Protection of wellhead areas is one open space requirement that could be added, especially if the type of relationship between underground aquifers and surface water bodies can be identified.

SUMMARY OF LAND USE ON THE EASTERN SHORE

Both Accomack and Northampton Counties are currently revising their zoning based upon recently completed comprehensive plans, and the need to comply with the Chesapeake Bay Act. The pattern of land use on the Eastern Shore has been very stable over the past. In summary, nearly 70% of all land in agriculture and forestry uses is located in Accomack; nearly 66% of all land in marshes, wetlands, and tidal areas is located in Northampton; nearly 78% of all residential land lies in Accomack; over 96% of all industrial land lies in Accomack. Thus, the overall picture of land use in the region is one of more intense development in Accomack County, even in the land use categories often viewed as land extensive such as agriculture and woodlands. Agricultural, residential, and industrial uses could have potentially significant affects for ground water consumption and water quality in Accomack County. Northampton County has the majority of its land in marsh and wetlands, however, development densities could be quite high along the center of the county, where the ground water is recharged.

Many of the land uses are allowed by right, meaning that permits and reviews by each county are not required to determine if the development will have an impact on ground water use or quality. In cases where potentially harmful uses are reviewed, the review process may need strengthening to assure that such reviews are accomplished beyond that of the normal site plan or other process. After the review, the uses which could have highly adverse long and short-term effects should be monitored on a periodic basis to be sure that the ground water quality is not affected.

Both counties have a significant number of approved subdivisions with a high percentage of undeveloped lots. Of the 15,455 approved lots between 1972 and 1990 in Accomack County, only 39% have structures. In Northampton County 2,016 lots were approved during the same time period and 57% are improved with structures. This indicates that there is a significant potential to increase the number of housing units, population, water needs, and wastewater disposal needs without additional approvals required.

The Chesapeake Bay Act once implemented in both counties, will help to control negative ground water quality impacts from existing and future development with the requirements for periodic pumping of septic systems, leach field reserve area requirements, site plan review, restrictions on amounts of impervious areas on building lots, stormwater quality management considerations, and the protection of valuable wetlands.