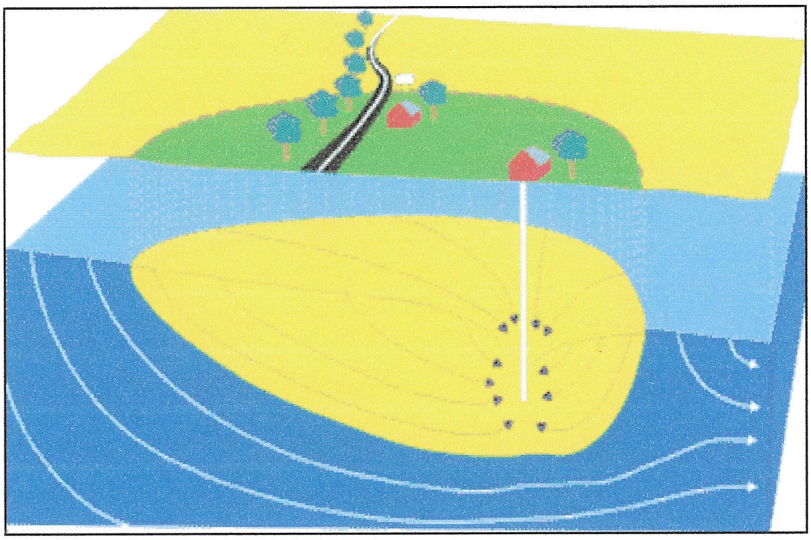
SOURCE WATER ASSESSMENT

FOR TEN COMMUNITY WATER SYSTEMS

WICOMICO COUNTY, MD



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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for ten community water systems in Wicomico County. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to each source, 2) identification of potential sources of contamination within the areas, and 3) determination of the susceptibility of each water supply to contamination. Recommendations for protecting the drinking water supplies are included in this report.

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. This report focuses on water systems using over 10,000 gallons per day (gpd) of water based on an annual average. The ten community water systems included in this report are currently using 24 wells that draw from unconsolidated Coastal Plain sediments. Nine (9) of the wells are completed in an unconfined aquifer and fifteen (15) are completed in a confined aquifer. The unconfined wells draw from the Quaternary System sediments, and the confined wells are completed in the Manokin and Frederica Aquifers. The Source Water Assessment areas were delineated by the WSP using U.S. EPA approved methods specifically designed for each source.

Potential point sources of contamination within the assessment areas were identified from field inspections and contaminant inventory databases. The more common potential sources of contamination identified are underground storage tanks and controlled hazardous substance generators commonly associated with commercial areas. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination. The most common type of land use that presents a potential for contamination is agricultural cropland. Private septic systems are another common non-point contaminant source. Residents in seven (7) of the ten (10) community water systems covered by this report are served by on-site waste disposal systems. Figures showing land use, potential contaminant sources within wellhead protection areas, and well locations are enclosed at the end of the report.

The susceptibility analysis is based on a review of the existing water quality data for each water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the water samples of some community water systems at some time had low level detections of nitrate, synthetic organic compounds, radon, cadmium, arsenic, and selenium. None of the community water systems are susceptible to any of the above mentioned contaminants.

EXECUTIVE SUMMARY
TOWN OF HEBRON

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

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Town of Hebron water system, located in the Coastal Plain Physiographic Province of north western Wicomico County, is currently using two wells that draw water from the confined unconsolidated sediments of the Frederica aquifer. The Wellhead Protection area was delineated by the WSP using U.S. EPA's approved methods specifically designed for this source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Town of Hebron water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers.

EXECUTIVE SUMMARY
POPLAR HILL PRE-RELEASE UNIT

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for ten community water systems in Wicomico County, including the Poplar Hill Pre-Release Unit community supply. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to the source, 2) identification of potential sources of contamination, and 3) determination of the susceptibility of the water supply to contamination. Recommendations for protecting the drinking water supply conclude this report.

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Poplar Hill Pre-Release Unit water system, located in the Coastal Plain Physiographic Province of western Wicomico County, is currently using two wells which draw water from the confined sediments of the Manokin aquifer. The Wellhead Protection Area was delineated by the WSP using U.S. EPA's approved methods specifically designed for each source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Poplar Hill Pre-Release Unit water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of iron from its raw water.

EXECUTIVE SUMMARY
TOWN OF WILLARDS

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

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Town of Willards water system, located in the Coastal Plain Physiographic Province of east Wicomico County, is currently using two wells that draw water from the confined sediments of the Manokin aquifer. The Wellhead Protection area was delineated by the WSP using U.S. EPA's approved methods specifically designed for each source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Town of Willards water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of iron from its raw water.

EXECUTIVE SUMMARY
TOWN OF PITTSVILLE

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

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Town of Pittsville water system, located in the Coastal Plain Physiographic Province of east Wicomico County, is currently using two wells that draw water from the confined Manokin aquifer. The Wellhead Protection area was delineated by the WSP using U.S. EPA's approved methods specifically designed for each source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Town of Pittsville water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of iron from its raw water.

EXECUTIVE SUMMARY
TOWN OF HEBRON

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

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Town of Hebron water system, located in the Coastal Plain Physiographic Province of north western Wicomico County, is currently using two wells that draw water from the confined unconsolidated sediments of the Frederica aquifer. The Wellhead Protection area was delineated by the WSP using U.S. EPA's approved methods specifically designed for this source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Town of Hebron water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers.

EXECUTIVE SUMMARY
POPLAR HILL PRE-RELEASE UNIT

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for ten community water systems in Wicomico County, including the Poplar Hill Pre-Release Unit community supply. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to the source, 2) identification of potential sources of contamination, and 3) determination of the susceptibility of the water supply to contamination. Recommendations for protecting the drinking water supply conclude this report.

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Poplar Hill Pre-Release Unit water system, located in the Coastal Plain Physiographic Province of western Wicomico County, is currently using two wells which draw water from the confined sediments of the Manokin aquifer. The Wellhead Protection Area was delineated by the WSP using U.S. EPA's approved methods specifically designed for each source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Poplar Hill Pre-Release Unit water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of iron from its raw water.

EXECUTIVE SUMMARY
TOWN OF WILLARDS

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

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Town of Willards water system, located in the Coastal Plain Physiographic Province of east Wicomico County, is currently using two wells that draw water from the confined sediments of the Manokin aquifer. The Wellhead Protection area was delineated by the WSP using U.S. EPA's approved methods specifically designed for each source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Town of Willards water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of iron from its raw water.

EXECUTIVE SUMMARY
TOWN OF PITTSVILLE

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

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Town of Pittsville water system, located in the Coastal Plain Physiographic Province of east Wicomico County, is currently using two wells that draw water from the confined Manokin aquifer. The Wellhead Protection area was delineated by the WSP using U.S. EPA's approved methods specifically designed for each source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Town of Pittsville water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of iron from its raw water.

EXECUTIVE SUMMARY
STEEPLECHASE SUBDIVISION

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

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Steeplechase Waterworks water system, located in the Coastal Plain Physiographic Province of west central Wicomico County, is currently using two wells that draw water from the confined Frederica aquifer. The Wellhead Protection area was delineated by the WSP using U.S. EPA's approved methods specifically designed for this source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Steeplechase Waterworks water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers.

EXECUTIVE SUMMARY
OAK RIDGE MOBILE HOME PARK

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

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Oak Ridge Mobile Home Park water system, located in the Coastal Plain Physiographic Province of south-western Wicomico County, is currently using two production wells that draw water from the confined Manokin aquifer. The Wellhead Protection area was delineated by the WSP using U.S. EPA's approved methods specifically designed for this source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Oak Ridge Mobile Home Park water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers.

EXECUTIVE SUMMARY
CEDARHURST MOBILE HOME PARK

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for ten community water systems in Wicomico County, including the Cedarhurst Mobile Home Park community water supply. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to the source, 2) identification of potential sources of contamination, and 3) determination of the susceptibility of the water supply to contamination. Recommendations for protecting the drinking water supply conclude this report.

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Cedarhurst Mobile Home Park water system, located in the Coastal Plain Physiographic Province of west-central Wicomico County, is currently using two wells that draw water from the unconfined sediments of the Quaternary System. The Wellhead Protection area was delineated by the WSP using U.S. EPA's approved methods specifically designed for this source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Cedarhurst Mobile Home Park water supply is not susceptible to contamination by nitrate, radiological compounds, volatile organic compounds, synthetic organic compounds, microbiological pathogens, or other regulated inorganic compounds.

EXECUTIVE SUMMARY
WALSTON MOBILE HOME PARK

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for ten community water systems in Wicomico County, including the Walston Mobile Home Park community water supply. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to the source, 2) identification of potential sources of contamination, and 3) determination of the susceptibility of the water supply to contamination. Recommendations for protecting the drinking water supply conclude this report.

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Walston Mobile Home Park water system, located in the Coastal Plain Physiographic Province of central Wicomico County, is currently using a total of six wells. Five wells that draw water from the unconfined sediments of the Quaternary System and one well that draws water from the confined Manokin aquifer. The Wellhead Protection areas were delineated by the WSP using U.S. EPA's approved methods specifically designed for this source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Walston Mobile Home Park water supply may be susceptible to contamination by microbiological pathogens due to buried wells supplying water to the system. It was determined that the Walston Mobile Home Park water supply is not susceptible to contamination by nitrate, radiological compounds, volatile organic compounds, synthetic organic compounds, or other regulated inorganic compounds.

EXECUTIVE SUMMARY
WESTSIDE MOBILE HOME PARK

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for ten community water systems in Wicomico County, including the Westside Mobile Home Park community water supply. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to the source, 2) identification of potential sources of contamination, and 3) determination of the susceptibility of the water supply to contamination. Recommendations for protecting the drinking water supply conclude this report.

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Westside Mobile Home Park water system, located in the Coastal Plain Physiographic Province of western Wicomico County, is currently using two production wells that draw water from the confined sediments of the Frederica aquifer. The Wellhead Protection area was delineated by the WSP using U.S. EPA's approved methods specifically designed for this source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Westside Mobile Home Park water supply is not susceptible to contaminants originating at the land surface due to the protected nature of confined aquifers. The water supply may be susceptible to naturally occurring iron, since the system has treatment for removal of iron from its raw water.

EXECUTIVE SUMMARY
HEBRON WOODS MOBILE HOME PARK

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for ten community water systems in Wicomico County, including the Hebron Woods Mobile Home Park community water supply. The required components of this report as described in Maryland's Source Water Assessment Program (SWAP) are 1) delineation of an area that contributes water to the source, 2) identification of potential sources of contamination, and 3) determination of the susceptibility of the water supply to contamination. Recommendations for protecting the drinking water supply conclude this report.

The sources of water supply wells in Wicomico County are unconfined and confined Coastal Plain aquifers. The Hebron Woods Mobile Home Park water system, located in the Coastal Plain Physiographic Province of western Wicomico County, is currently using two production wells that draw water from the unconfined sediments of the Columbia aquifer. The Wellhead Protection area was delineated by the WSP using U.S. EPA's approved methods specifically designed for this source.

Point sources of contamination were identified within and near the assessment area from field inspections and contaminant inventory databases. The Maryland Office of Planning's 2002 land use map for Wicomico County was used to identify non-point sources of contamination.

The susceptibility analysis is based on a review of the existing water quality data for the water system, the presence of potential sources of contamination in the individual assessment areas, well integrity, and the inherent vulnerability of the aquifer. It was determined that the Hebron Woods Mobile Home Park water supply is not susceptible to contamination by nitrate, radiological compounds, volatile organic compounds, synthetic organic compounds, microbiological pathogens, or other regulated inorganic compounds.

INTRODUCTION

The Maryland Department of the Environment Water Supply Program has conducted a Source Water Assessment for 10 community water systems in Wicomico County. Wicomico County is in the southeastern corner of the State, and is bounded by the Nanticoke River to the west, Somerset and Worcester Counties to the south and east, and Delaware to the north respectively. As defined in Maryland's Source Water Assessment Plan (SWAP), "large community water systems" are community and non-transient non-community water systems that have a ground water appropriation permit of more than 10,000 gallons average daily use. The County lies within the Delmarva Peninsula of the Atlantic Coastal Plain Physiographic Province. All of the community water systems in Wicomico County obtain their water supply from unconsolidated Coastal Plain sediments. Based on July 2001 data, the total population of Wicomico County is 84,644 persons (Md at a Glance, 2004). The ten systems discussed in this report serve a total of about 4,000 residents. The location and identification of the ten (10) systems are shown in Figure 1. Separate reports are available for the City of Salisbury, Sharpton, Delmar, and numerous small water systems in Wicomico County, from MDE's Water Supply Program.

WELL INFORMATION

Well information for each system was obtained from the Water Supply Program's database, site visits, well completion reports, and sanitary survey inspection reports. A total of 24 wells are used by the ten systems assessed in this report. All except one of the wells were drilled after 1973 and should comply with Maryland's well construction regulations. Table 1 summarizes construction information about each well.

Field inspection at the Walston Mobile Home Park discovered that 4 wells are buried below ground surface and one of these wells was drilled in 1968. Buried wells are potentially vulnerable to flooding during heavy rains. One of the wells at Hebron Woods MHP is located less than 100 feet from a storm water management pond which is also a man-made lake. Wells located near storm water management ponds are potentially more vulnerable to contaminants infiltrating during storm runoff. Wells located near roadway and parking lots may also be more easily damaged by vehicles.

HYDROGEOLOGY

Wicomico County is located on the unconsolidated sediments of the Coastal Plain Physiographic Province. The sediments were deposited in a southeasterly thickening wedge extending from the Fall Line to the Continental Shelf (Banks, Klohe, & Battigelli, 2001). The Coastal Plain sediments consist of unconsolidated beds of clay, silt, sand, gravel, and shells. The sediments consist of non-marine to marginal-marine deposits of Cretaceous age, overlain by marine, estuarine, and fluvial sediments of Tertiary to Quaternary age (Andreasen & Smith, 1997). Nine of the twenty four wells (38%) in this report are completed in the shallow, unconfined Quaternary System (also referred to as the Salisbury aquifer). The Salisbury aquifer consists of course sand and gravel with

transmissivity values ranging from 8200 to 57,000 feet squared per day (Andreasen & Fewster, 2001). The units that comprise the deeper confined wells used by the water systems described in this report in this report are the Manokin and Frederica aquifers. The Salisbury aquifer is separated from the Manokin aquifer by a 25 to 65 feet low permeability, bluish-gray clay confining layer (Andreasen & Fewster, 2001). In the western part of the County the Manokin aquifer is a gray medium to fine-grained sand containing some coarse sand in the lower portion, granules, and small lenses of fine gravel. The upper portion is fine to very fine sand, becoming silty in places. The Frederica aquifer is the deepest of the three aquifers. The water quality is generally good but has undesirable chemical characteristics in some locations (DNR, 1987).

Water-table depths in the Salisbury aquifer are shallow, and range from 0 to about 20 feet below ground surface in most areas (Hamilton & others, 1993). As a result, drainage ditch networks for irrigation purposes are common throughout Wicomico County. In general, the shallow Salisbury aquifer is prone to contamination from land use activities at the ground surface, whereas the deeper confined aquifers are not.

SOURCE WATER ASSESSMENT AREA DELINEATION

Unconfined Sources

For ground water systems, a Wellhead Protection Area (WHPA) is considered to be the source water assessment area for the system. As defined in Maryland's SWAP, the wellhead protection areas for unconfined public water systems using an average of more than 10,000 gallons per day (gpd) are to be delineated by using a modular semi-analytical model for the delineation of Wellhead Protection Areas (WHPAs) . The model was developed by the U.S. EPA to establish zones that can be used to determine the rate at which water-soluble contaminants are reasonably likely to move towards a pumping well*. Required input parameters to use the model are aquifer characteristics (porosity, thickness, hydraulic gradient, orientation of the ground water flow direction, pumping rate, and boundary conditions in the aquifer (MDE 1999). The localized ground water flow direction for each well was inferred based on topographic relief or previously published water table maps. The resulting polygons are oriented in the predominant ground water flow direction for each well. The WHPAs (both 1 and 10 year zones) for 9 of the wells were delineated using this method. For systems with multiple supply wells, the wells were combined to form one larger simplified variable shape.

Confined Sources

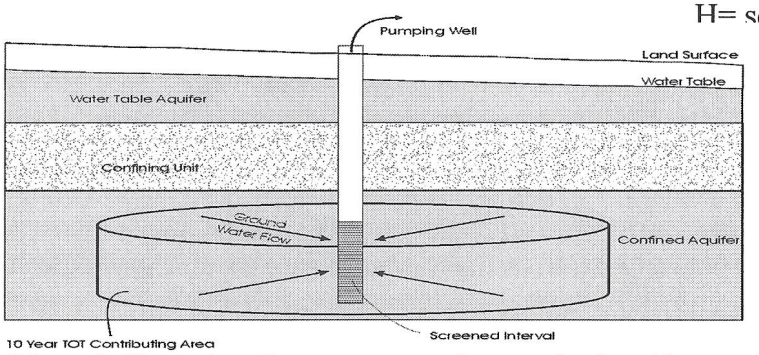
The Wellhead Protection area for community water systems using more than 10,000 gpd whose wells are completed in confined Coastal Plain aquifers is a circle whose radius is calculated using the Florida method (MDE, 1999). This radius is based on a volumetric equation equating the volume of water pumped over a given time period with the volume of aquifer needed to store an identical quantity of water.

* For each unconfined source, a 1 year and 10 year time of travel zone was calculated.

The equation can be written numerically as:

$$r = \sqrt{\frac{Q\,t}{\pi\,n\,H}}$$

Where r = fixed radius(ft)
t = time of travel (yrs)
Q= pumping rate (ft^3/yr)
n= aquifer porosity (dimensionless)
H= screen length (ft)



Schematic illustration of a transport zone for a confined aquifer.

Seven systems (15 wells) in this report have wells completed in confined Coastal Plain sediments. Confined aquifers are naturally protected from land use activities at the ground surface due to confining clay layers that inhibit the infiltration of contaminants from entering the aquifer. Note that the areas to be protected in this geologic setting are below the confining layers at depths below land surface.

POTENTIAL SOURCES OF CONTAMINATION

Potential sources of contamination are classified as either point or non-point sources. Examples of point sources of contamination are leaking underground storage tanks, landfills, discharge permits, community water-scale feeding operations, and known ground water contamination sites. These sites are generally associated with commercial or industrial facilities that use chemical substances that may, if inappropriately handled, contaminate ground water via a discrete point location. Non-point sources of contamination are associated with certain types of land use practices such as the use of pesticides, application of fertilizers, spreading of sludge or animal wastes, or septic systems all that may lead to ground water contamination over a community water area.

Point Sources

Potential point sources of contamination were identified and mapped within and near the Wellhead Protection Areas of the 10 community water systems. The point sources listed are identified from MDE contaminant databases and field inspections conducted by MDE staff. See Table 2 and Figures 2-11. Potential contamination sources that were investigated include: underground storage tanks (USTs), ground water discharge permit sites (GWDP), controlled hazardous substance generators (CHS), pesticide dealers, and ground water contamination sites (GWCS). Miscellaneous (MISC) potential contaminant sites include commercial buildings with chemical storage and vehicle maintenance facilities. The contaminants associated with the types of facilities are based on generalized categories and often the potential contaminant depends on the specific chemicals and processes being used at the individual facility. The potential contaminants

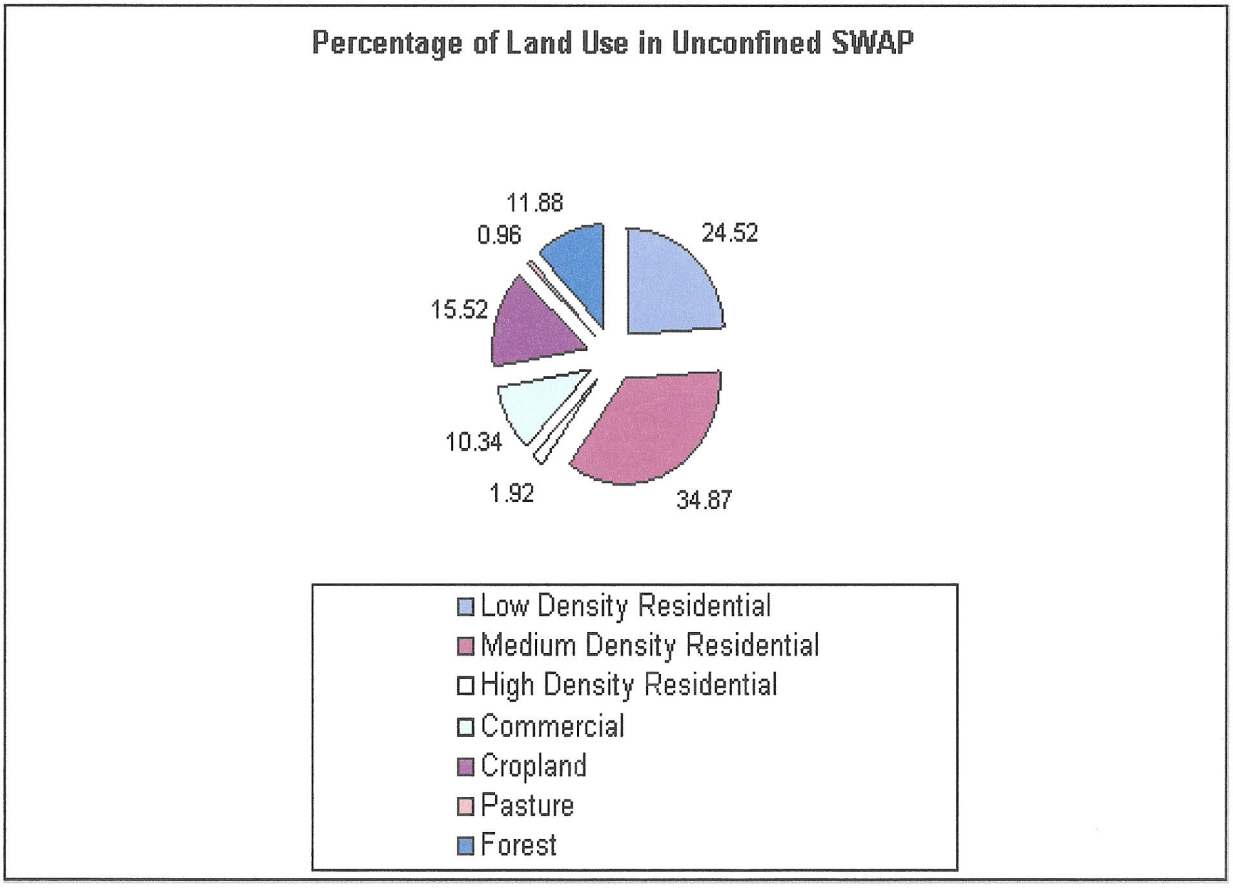
for an activity may not be limited to those listed in Table 2. Potential contaminants are grouped as Volatile Organic Compounds (VOC), Synthetic Organic Compounds (SOC), Heavy Metals (HM), Nitrate/Nitrite (NN), and Microbiological Pathogens (MP).

Non-Point Sources

The Maryland Office of Planning's 2002 Land Use / Land Cover map for Wicomico County was used to determine the predominant types of land use in each SWAP region (Figure 12). The nine unconfined wells in this swap were assessed for the type of land use in each of the SWAP zones. The results are given in the table and chart below.

Land Use in Unconfined SWAP Areas

Land Use Type	Land Use Code	Counts	Acres	% of Total
Low Density Residential	11	2	1.28	24.52
Medium Density Residential	12	3	1.82	34.87
High Density Residential	13	2	0.1	1.92
Commercial	14	1	0.54	10.34
Cropland	21,25	4	0.81	15.52
Pasture	22	1	0.05	0.96
Forest	42,43	3	0.62	11.88
Total			**5.22**	**100.00**



Pesticides and herbicides used on cropland are potential non-point sources of SOCs. The application of fertilizers on agricultural fields is a potential non-point source of nitrate. Chicken houses are prevalent throughout Wicomico County but none are present within or near the wellhead protection areas of the systems covered in this report. Chicken manure used as a fertilizer is another common source of nitrate in Wicomico County. Sludge application is a potential non-point source of nitrate, microbiological pathogens, and heavy metals. The use of private septic systems and lawn maintenance and landscaping activities in residential areas are potential non-point sources of nitrate and contaminants to ground water. Low –density residential areas are generally outside the existing sewer service area and may be a source of nitrate loading to ground water through private septic systems. Residents in seven of the ten systems (other than Pittsville, Willards, & Hebron) in this report rely on on-site disposal of domestic wastewater.

Other sources that may potentially contaminate the ground water supplies include unregulated heating oil USTs, stormwater drainage and irrigation ditches (common in Wicomico County), stormwater management ponds, roads, railroads, and parking lots within or near WHPAs. Roads are a concern in the event of chemical or petroleum spills, and from the application of salts and other chemicals used for snow removal.

WATER QUALITY DATA

Water Quality data was reviewed from the Water Supply Program's database for Safe Drinking Water Act (SDWA) contaminants. All data reported is from the finished (treated) water unless otherwise noted. All of the systems are currently treating the finished water for one reason or another. The most common treatment used at the ten systems is for disinfection followed by iron removal. The treatment methods currently in use for the 10 systems included in this report are summarized on Table 3.

In accordance with Maryland's SWAP, data from the treatment plant was compared with the Maximum Contaminant Levels (MCLs). If the monitoring data is greater than 50% of a MCL, the written assessment will describe the sources of such a contaminant and, if possible, locate the specific sources that are the cause of the elevated contaminant level. A review of the monitoring data since 1993 indicates that the water supplies for the 10 systems in this report meet the drinking water standards. Table 4 provides a list of all detections above 50% of the MCL for inorganic compounds. No Volatile Organic Compounds or Synthetic Organic Compounds other than di(2-ethylhexyl) phthalate were detected at levels above 50 % of MCL of any of the 10 systems in this report. In the single case where Di (2-ethylhexyl) phthalate was detected, it was were attributed to laboratory contamination as it was also detected in laboratory blanks.

Inorganic Compounds (IOCs)

IOC data at or above 50% of the MCL from the ten systems are compiled in Table 4. Nitrate was detected at levels above the MCL in the Town of Hebron water system prior to July 1995. Since then the Town installed new wells into a deeper aquifer to address the

elevated nitrate levels. No detections of nitrate have been observed since these new wells were installed into the Frederica aquifer. One other system, Cedarhurst MHP, has one sample above 50% of the MCL for nitrates. Cedarhurst relies on the unconfined Columbia aquifer for its water supply needs. Three systems (Poplar Hill Pre-Release, Hebron Woods MHP and Walston MHP) had at least one result of a heavy metal detect at or above 50% of the respective maximum contaminant level. The elevated results were not borne out in other sampling events. At each location where the elevated and lower level results were found, more than one well could have contributed to the result. It is therefore recommended that the systems analyse their wells individually for the heavy metals of concern to document if in fact one or more sources have had a significant contribution of the heavy metal. Cadmium was reported above the MCL in one sample from Poplar Hill Pre-Release Unit, and just above 50% of the MCL in one sample from Hebron Woods MHP. Selenium was reported at 50% of the MCL for Hebron Woods and Walston MHP. Arsenic was detected at greater than 50% of the MCL in a sample taken at Walston MHP. Another sample taken three months earlier indicated no arsenic. Arsenic was also detected above the MCL in a sample taken at Hebron Woods in 1999. Water samples for both systems have been tested at least six times over the last 11 years and each system has had only a single detection of arsenic.

All of the above mentioned detects were single occurances for the respective systems and occurred more than two years ago.

Radionuclides

There is currently no MCL for Radon-222, however EPA has proposed an MCL of 300 picocuries per Liter (pCi/L) or an alternate of 4000 pCi/L for community water systems if the State has a program to address the more significant risk from radon in indoor air. Radon-222 has been detected at levels slightly above 50% of the more conservative, proposed MCL of 300 pCi/L in 5 of the 10 community systems that have tested for this contaminant (Table 4).

Volatile Organic Compounds (VOCs)

No VOCs have been detected above the 50% MCL threshold for any of the 10 systems that were tested from this report.

Synthetic Organic Compounds (SOCs)

The only SOC detected above the 50% threshold was Di (2-Ethylhexyl) Phthalate. This contaminant is commonly found in laboratory blank samples accompanying these detections, and therefore should not reflect the actual water quality of these systems.

Microbiological Contaminants

Ground water under the direct influence of surface water (GWUDI) raw water testing was conducted for the three systems drawing water from the unconfined aquifer (Hebron Woods, Walston, and Cederhurst). All results were negative for the presence of total coliform bacteria.

All of the systems, however, have either monthly or quarterly routine bacteriological samples that were collected as required by the Safe Drinking Water Act. Every time a

sample tests positive for total coliform, the system is retested until the results are negative or the problem is corrected (Table 6).

SUSCEPTIBILITY ANALYSIS

Nine of the twenty four wells serving the community water systems included in this report draw water from the unconfined Quaternary System (Salisbury aquifer). In general, wells in unconfined aquifers are susceptible to contamination from activities on the land surface that occur within the wellhead protection areas. Sixteen of the wells are completed in deeper, confined Coastal Plain aquifers, and therefore should be well protected from activities at the ground surface. This is due to the presence of confining, low permeability, clay layers overlying the aquifer that may inhibit the infiltration of contaminants from entering the water supply. The susceptibility analysis of the individual water supplies to each group of contaminants has been completed based on the following criteria: 1) the presence of potential contaminant sources within the WHPA, 2) water quality data, 3) well integrity and 4) the aquifer conditions. Table's 7-11 summarizes the susceptibility of each of the 10 systems covered in this report to each of the groups of contaminants.

Inorganic Compounds

Nitrate

Nitrate was present in the wells of 2 systems at 5 ppm or greater (Table 4). The MCL for nitrate is 10 ppm. At the Town of Hebron, two new wells were drilled into the deeper, confined Frederica aquifer in 1995 and 1999. The old wells with high nitrates were properly abandoned and sealed. Currently, the system has had no nitrate detects since they began using the new wells. The Cedarhurst MHP had a detection of MCL above the 50% level in 2001 but since has had no re-occurrence of the same magnitude. Sources of nitrate can generally be traced back to land use. Fertilizer applied to agricultural fields and residential lawns, animal waste in pasturelands, and effluent from residential and commercial septic systems are all non-point sources of nitrate loading in ground water. According to year 2002 land use, nine wells using unconfined aquifers discussed in this report have cropland within their respective WHPAs. Routine monitoring has shown that levels of nitrate are not sufficient to clarify the sources as susceptible to elevated nitrate.

Based on available sampling data reported since 1993, none of the systems are determined to be susceptible to nitrate contamination. A nitrate susceptibility logic chart is outlined for each system in Table 7. It is recommended that whenever the finished water results are greater than 5 parts per million for nitrate, individual samples be taken at the well source to determine which well is the source of nitrate contaminated.

Iron

Iron is a naturally occurring element that is present in aquifer material at some of the systems in this report. Excessive iron levels can cause taste, color, and odor problems in drinking water as well as iron bacteria build-up around well screens. The secondary MCL for iron is 0.3 ppm. Four of the systems have installed treatment for iron removal (Table

3). Because iron is naturally occurring, the only solution to the problem is treatment of the water.

Selenium

Walston MHP and Hebron Woods MHP each had a positive detect of Selenium in 2002 at 50% of its respective MCL. Selenium is a natural element that may be present in aquifer material. One detect out of four at a level below the MCL is not enough to establish susceptibility. Each of these systems are subject to tri-annual sampling for selenium.

Cadmium

Poplar Hill Pre-Release Unit had cadmium exceeding the MCL in one sampling in 2002. Hebron Woods MHP had one detect at more than half of the MCL in 1999. Both systems are not susceptible to cadmium since the detects were on single occurrences with multiple sampling events in four years.

Arsenic

At Walston MHP, arsenic was detected at greater than 50% of the January 2006 MCL of 0.01 ppb (Table 4). This contaminant is often discharged from electronics, glass, or erosion of natural deposits. Another sample taken three months earlier indicated no detect. Arsenic was also detected to exceed the MCL in a sample taken at Hebron Woods in 1999. Water samples for both systems have been tested at least six times over the last 11 years and only a single detect have been made for arsenic in each case. Based on the available information, the systems are not susceptible to arsenic. It is recommended that whenever the finished water results are greater than 0.005 ppm for arsenic, individual samples be taken at the well source to determine which well is the source of arsenic.

Radionuclides

An MCL for radon-222 has not been adopted yet by the U.S. EPA. The U.S. EPA proposed an MCL of 300 pCi/L or an alternative of 4000 pCi/L for drinking water if the State has a program to reduce the more significant risk from radon in indoor air, which is the primary health concern. Five water systems had radon levels above 50% of the more conservative proposed MCL of 300 pCi/L (Table 4) and one exceeded 300pCi/L (Oakridge MHP). Note that the wells at Town of Hebron with the positive radon detection have since been properly abandoned and sealed, and replaced by deeper wells completed in confined aquifer sediments. The source of radon in ground water can be traced back to the natural occurrence of uranium in rocks. The health effects and risks of radon in drinking water are reviewed in the Committee on Health Risks of Exposure to Radon BEIRVI (1999) report. The EPA also has information on proposed regulations for radon in indoor air and drinking water on their web site (http://www.epa.gov/safewater-/radon.html) If the higher MCL of 4000 pCi/L is adopted, none of the systems that have tested for this contaminant will be susceptible to radon.

A susceptibility logic chart for each system is shown on Table 8.

Volatile Organic Compounds

No incidents of ground water contamination by VOCs are known to exist within or near the wellhead protection areas for any of the 10 systems included in this report.

Synthetic Organic Compounds

The sources of SOCs to ground water include point and non-point sources such as pesticide application. Point sources include pesticide dealers noted in wellhead protection area. Non-point sources include pesticides applied to agricultural fields, and residential lawns. Nine wells using unconfined aquifers have cropland making up some portion of the land use within their respective WHPAs. All of the nine unconfined wellhead protection areas have residential land within the wellhead protection areas. Pesticides and chemicals used on residential and commercial lawns and gardens are also a potential threat. However, typical lawn maintenance herbicides are very biodegradable and should not pose a significant SOC risk if applied properly.

The only contaminant in this group detected above 50% of the MCL was di (2-ethylhexyl) phthalate, which can be attributed to its presence in the laboratory environment.

Based on the available water quality data, none of the systems in this report are considered susceptible to SOCs.

Microbiological Contaminants

Sources of microbiological pathogens in surface water are improperly treated wastewater (discharge to surface water or failing septic systems), waste material from mammals, and urban runoff in developed areas. Ground water is generally thought to be not susceptible to contamination by pathogenic microorganisms due to the natural filtration ability of soil and aquifer material. The exceptions to this are wells that are classified as "Ground water under the direct influence of surface water" (GWUDI), and wells that may be susceptible to any microbiological contaminant present at the surface including *Giardia* and *Cryptosporidium.* Three of the ten community water systems have completed formal GWUDI testing for some or all of their water supply wells. Six of the ten systems are in the confined aquifer and are not susceptible to contamination. These wells completed in confined Coastal Plain sediments are considered "no risk" to surface water influence.

Four wells at Walston MHP are located below ground surface. One of the wells was completed before 1973 when more stringent well construction regulations were put in place to prevent contaminants from entering the well casing. A well capped below grade may allow contaminated surface water containing microbiological contaminants to enter through the well casing and ultimately reach the aquifer. Therefore, these wells are considered "moderate risk" to surface water influence, and require a raw water bacteriological sample to be collected from each well after a minimum of 0.5 inch of rainfall has occurred.

Based on available data, the susceptibility analysis for microbiological pathogens is summarized in Table 11 and only Walston MHP may be susceptible to microbiological contaminants.

MANAGEMENT OF THE SOURCE WATER ASSESSMENT AREA

With the information contained in this report, the individual water system owners as well as the Wicomico County government have a basis for better understanding the risks to drinking water supplies for these ten community ground water systems. Being aware of the areas delineated for wellhead protection, knowing potential contaminant sources, evaluating future development, working with agricultural producers and soil conservation agencies, and carrying out effective outreach and education to the business community are examples of management practices that will help protect water supplies. A management strategy adopted by the county should be consistent with the level of resources available for implementation.

Specific management recommendations for consideration are listed below. The following recommendations are intended for both a countywide wellhead protection effort, and for individual water systems.

RECOMMENDATIONS FOR COUNTY AGENCIES:

Form a Local Planning Team

- This is a general recommendation to start the process. The team should include representatives including the water suppliers, the County Health Department, county and local planning agencies, local businesses, and residents. Those living within and near wellhead protection areas should take an active role in addressing the protection of the water supplies.

Public Awareness and Outreach

- Conduct education outreach to the facilities listed in Table 2. Important topics include: (a) minimizing the risk of contamination from all in-ground tanks and lines (b) inspection of all waste streams that may go into dry wells, septic tanks or other ground water discharge points, (c) reporting chemical and petroleum spills, and (d) proper material and chemical storage practices.
- Informing property owners and businesses located within WHPAs that their activities could have serious impacts on the respective water supplies.
- Road signs at the boundaries of wellhead protection areas for both confined and unconfined aquifers are an effective way of making the public aware of protecting their source of water supply, and to help in the event of spill notification and response.

Planning/ New Development

- Plans for new commercial development should consider placement of water supply wells a priority for such facilities as gas stations, and other users of hazardous materials. Additionally, ensuring the adequacy of the well to supply water for the facilities in the long term will ensure that additional wells in less desirable locations are not necessary.
- A Countywide strategy for addressing water quality protection issues for community water community systems deserves consideration. A cooperative effort is needed to minimize future risks to contamination beyond minimum setback requirements.

Land Acquisition/Easements

- The availability of loans for purchasing land or easements for the purpose of protecting designated wellhead protection areas is available from MDE for community water systems. Loans are offered at zero percent interest and zero points.

Contingency Plan

- Develop a spill response plan in concert with the Fire Departments and other emergency response personnel.

RECOMMENDATIONS FOR INDIVIDUAL SYSTEMS:

Public Awareness and Outreach

- The Consumer Confidence Report should provide a summary of this report and indicate that the full report is available to the general public at the county library, county government, or by contacting MDE.

Planning/New Development

- MDE recommends that water supply system owners within Wicomico County should encourage the County to evaluate applying a wellhead protection ordinance to community water systems.

Cooperative Efforts with Other Agencies

- Systems using unconfined sources that have cropland making up part of their wellhead protection areas can request the assistance of the University of Maryland Agricultural Extension Service and the Soil Conservation Service to work with farmers to adopt Best Management Practices (BMP's) for cropland located in their WHPA.
- The systems using unconfined aquifers may also encourage farmers to participate in the New Conservation Reserve Program (CREP) applicable to the cropland located within wellhead protection areas. Government funding is available to qualified farmers equal to the cost and financial benefit of farming the area. The Natural Resources Conservation Service is responsible for determining the environmental benefits of each acre offered for participation.

Monitoring

- Systems should continue to monitor for contaminants that have been previously detected to ensure public health protection.
- Systems should continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.
- Annual raw water sampling for microbiological contaminants is a good check on well integrity. Systems that have not completed any raw water testing for microbial contaminants since the time the well was drilled should do so.
- Systems should conduct sampling at the individual wells when finished water results show detections of nitrate and or arsenic at 50% of their MCL.

Contingency Plan

- All water system owners should have a Contingency Plan for their water system. COMAR 26.04.01.22 requires all community water systems to prepare and submit for approval a plan for providing a safe and adequate drinking water supply under emergency conditions.

Contaminant Source Inventory Updates/ Inspections

- Water system owners should conduct their own survey of their wellhead protection areas to ensure that there are no additional potential sources of contamination. Updated records of new development within the WHPA should be maintained.
- Periodic inspections and a regular maintenance program for the supply wells will ensure their integrity and protect the aquifer from contamination.
- Systems that have wells that are below ground surface should consider extending the casing to prevent surface waters from entering the well. In addition, depressions around wells should be properly filled and graded to prevent surface water from ponding and to allow for proper drainage away from the wells.

Changes in Use

Water system owners are required to notify the MDE Water Supply Program if new wells are to be added or if they wish to increase their water usage. Drilling a new well outside the current wellhead protection area would modify the area; therefore the Water Supply Program should be contacted if a new well is being proposed.

REFERENCES

Andreasen, David C., and Fewster, Brandon T., 2001, Estimation of Areas Contributing Recharge to Selected Public-Supply Wells in Designated Metro Core Areas of Upper Wicomico River and Rockawalking Creek Basins, Maryland: Maryland Geological Survey Open-File Report No. 2001-02-14, 54 p.

Andreasen, David C., and Smith, Barry S., 1997, Hydrogeology and Simulation of Ground-Water Flow in the Upper Wicomico River Basin and Estimation of Contributing Areas of the City of Salisbury Well Fields, Wicomico County, Maryland: Maryland Geological Survey Report of Investigations No. 65, 87 p.

Banks, William S.L., Klohe, Cheryl A., and Battigelli, David A., Occurrence and Distribution of Enteric Viruses in Shallow Ground Water and Factors Affecting Well Vulnerability to Microbiological Contamination in Worcester and Wicomico Counties, Maryland: U.S. Geological Survey Water-Resources Investigations Report 01-4147, 23 p.

Committee on Health Risks of Exposure to Radon, 1999, Health Effects of Exposure to Radon: BEIR VI, (http://www.epa.gov/iaq/radon/beirvi1.html).

Hamilton, P.A., Denver, J.M., Phillips, P.J., and Shedlock, R.J., 1993, Water Quality Assessment of the Delmarva Peninsula, Delaware, Maryland, and Virginia – Effects of agricultural activities on, and distribution of, nitrate and other inorganic constituents in the surficial aquifer: U.S. Geological Survey Open-File Report 93 – 40, 87 p.

Maryland Association of Counties, 2001/2002 Directory of County Officials, 419 p.

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Shedlock, Robert J., Denver, Judith M, Hayes, Martha A., Hamilton, Pixie A., Koterba, Michael T., Bachman, Joseph L., Phillips, Patrick J., and Banks, William S.L., 1999, Water-Quality Assessment of the Delmarva Peninsula, Delaware, Maryland, and Virginia: Results of Investigations, 1987-91: U.S. Geological Survey Water-Supply Paper 2355-A, 41 p.

Weigle, J.M., 1972, Part 2: Exploration and mapping of Salisbury Paleochannel, Wicomico County, Maryland: Maryland Geological Survey Bulletin 31, p. 61-124.

OTHER SOURCES OF DATA

Water Appropriation and Use Permits
Public Water Supply Sanitary Survey Inspection Reports
MDE Water Supply Program Oracle® Database
MDE Waste Management Sites Database
Department of Natural Resources Digital Orthophoto Quarter Quadrangles
USGS Topographic 7.5-Minute Quadrangles
Maryland Office of Planning 2002 Wicomico County Land Use Map

FIGURES

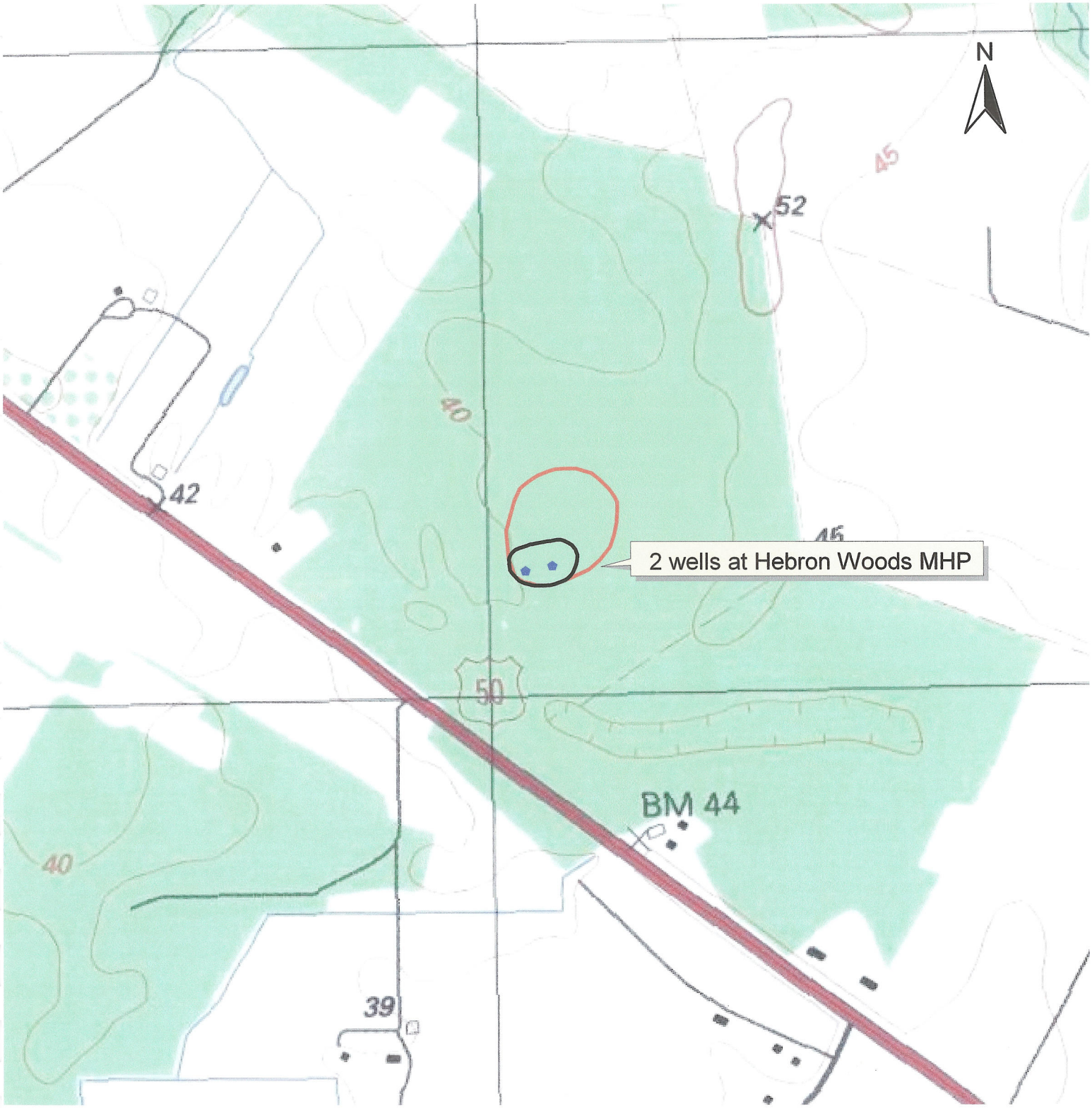


Figure 2: Topomap of Hebron Woods MHP with 1 and 10 years WHPAs outlined

500 0 500 1000 Feet

Legend

1 Yr WHPA

Supply Wells

10-year WHPA

Figure 3: Topomap of Poplar Hill Pre-Release Unit with WHPA outlined.

500 0 500 1000 Feet

Legend

Supply Wells

Confined Wells WHPA

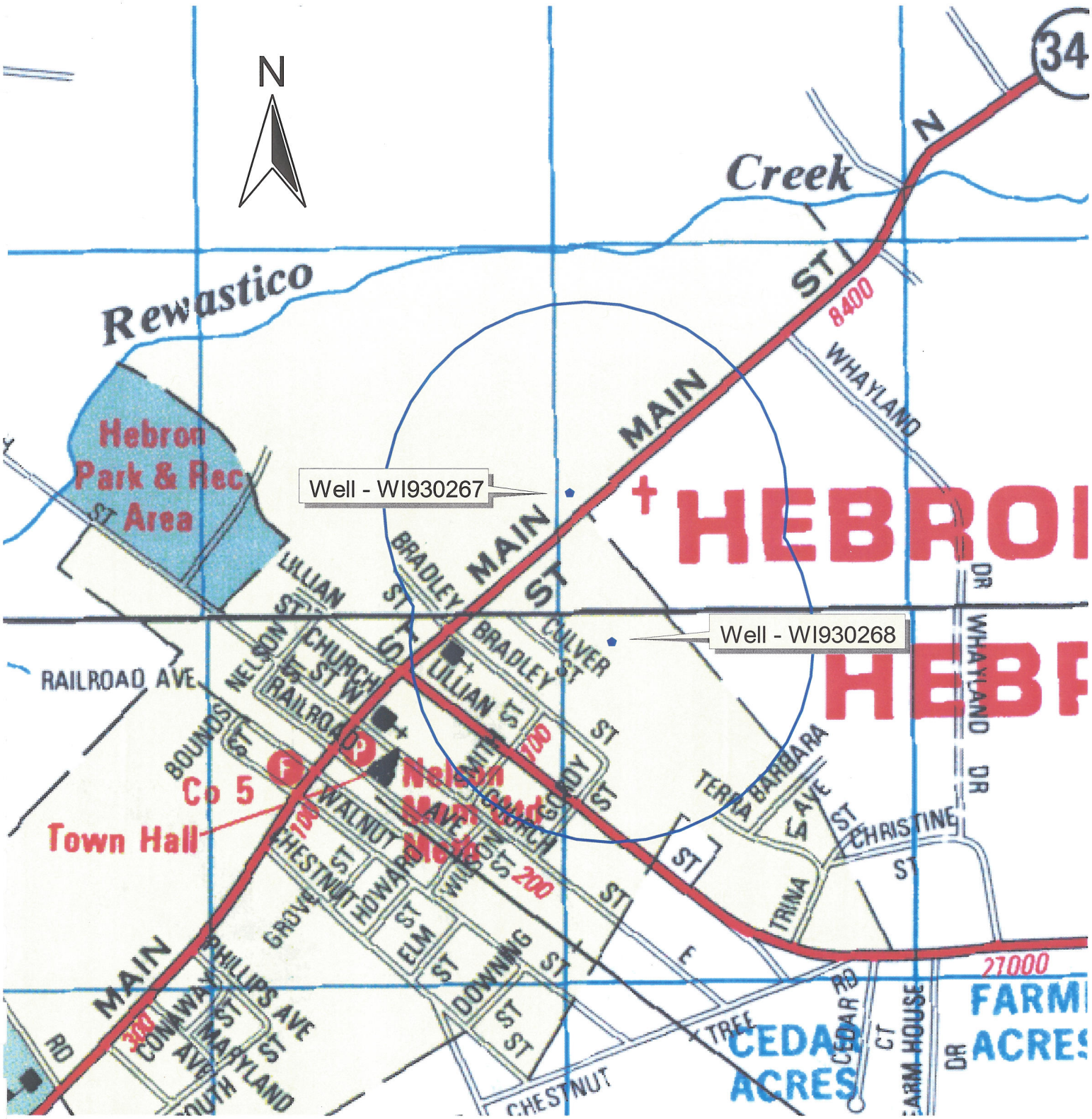


Figure 4: Hebron Community wells with WHPA outlined

800 0 800 1600 Feet

Legend

Supply Wells

Confined Wells WHPA

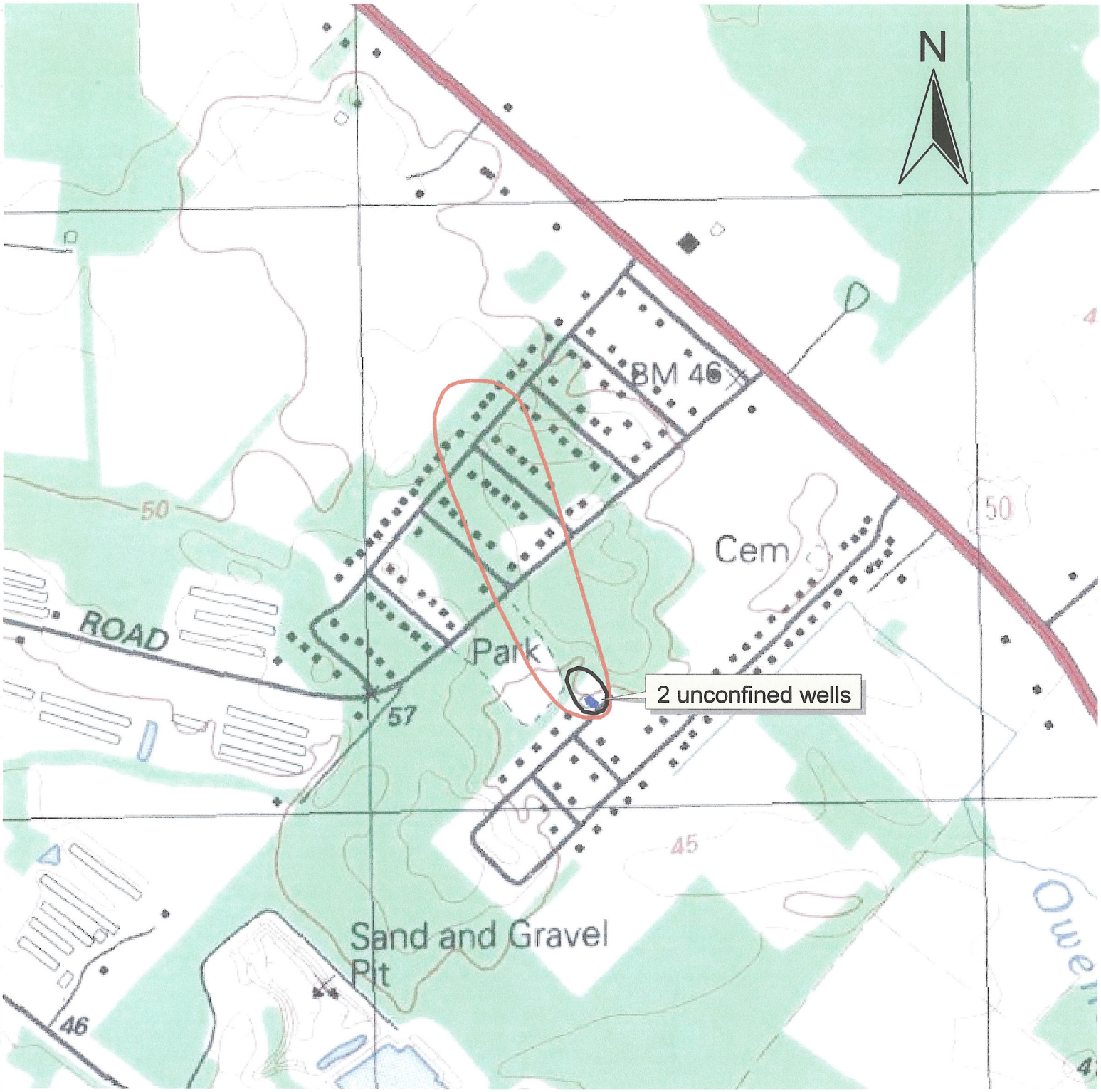


Figure 5: Topomap of Cedarhurst MHP with WHPAs outlined

Figure 6: Steeplechase subdivision community wells with WHPA outlined

N

600 0 600 1200 Feet

Legend

Supply Wells

Confined Wells WHPA

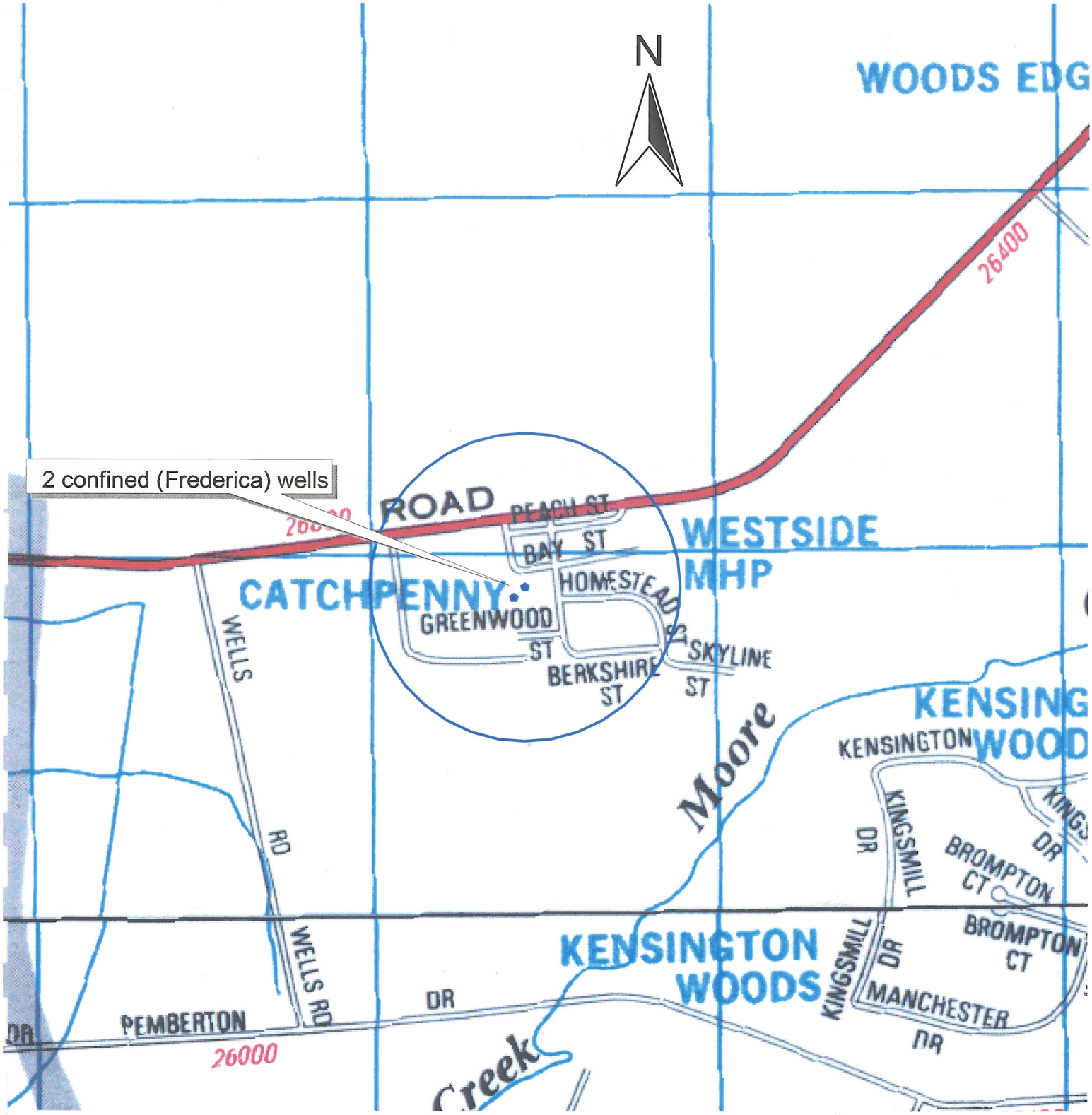


Figure 7: Westside MHP community wells with WHPA outlined

800 0 800 1600 Feet

Legend

Confined Wells WHPA

Supply wells.shp

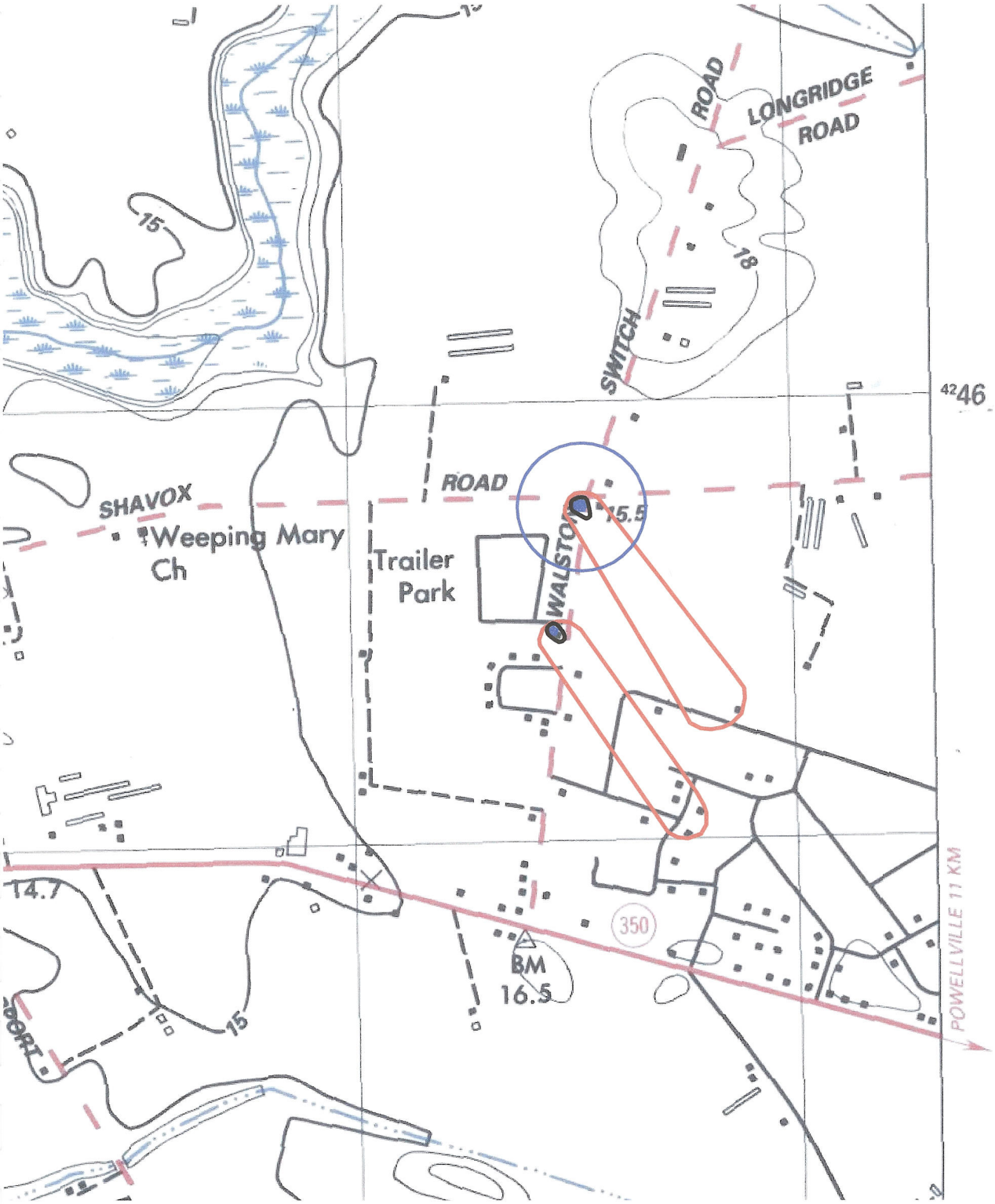


Figure 8: Walston MHP with 2 WHPAs outlined. 4 unconfined wells are clustered with 1 Manokin well. A single unconfined well is located at the southern end of the park.
1 and 10 year time of travel zones are shown.

1000 0 1000 2000 Feet

Legend

1-yr WHPA

Confined Wells WHPA

10-yr WHPA

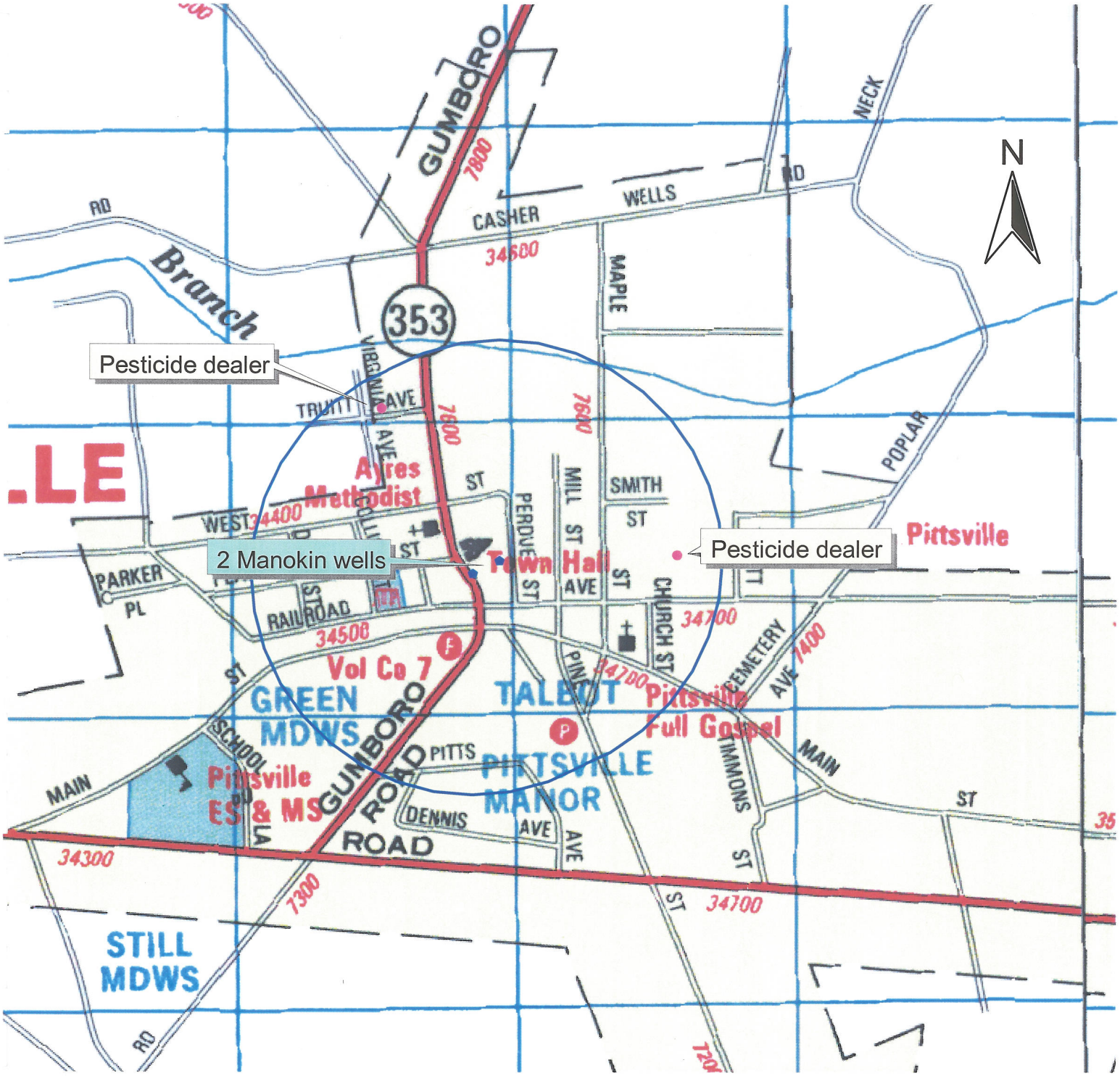


Figure 9: Pittsville WHPA outlined.

1000 0 1000 2000 Feet

Legend

Confined Wells WHPA

Supply wells.shp

Pesticide dealer.shp

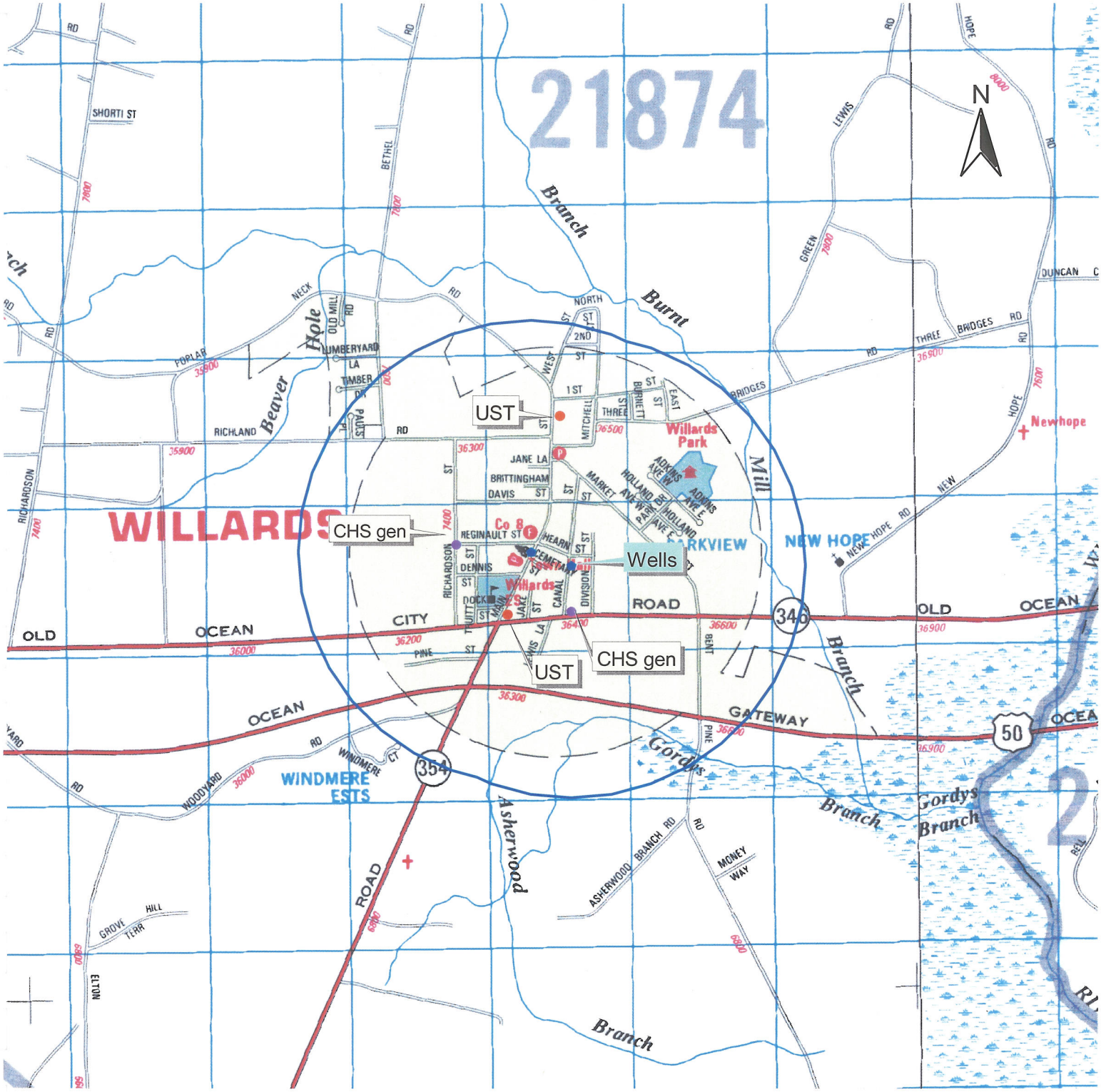


Figure 10: Willards WHPA outlined with potential contaminant sites identified

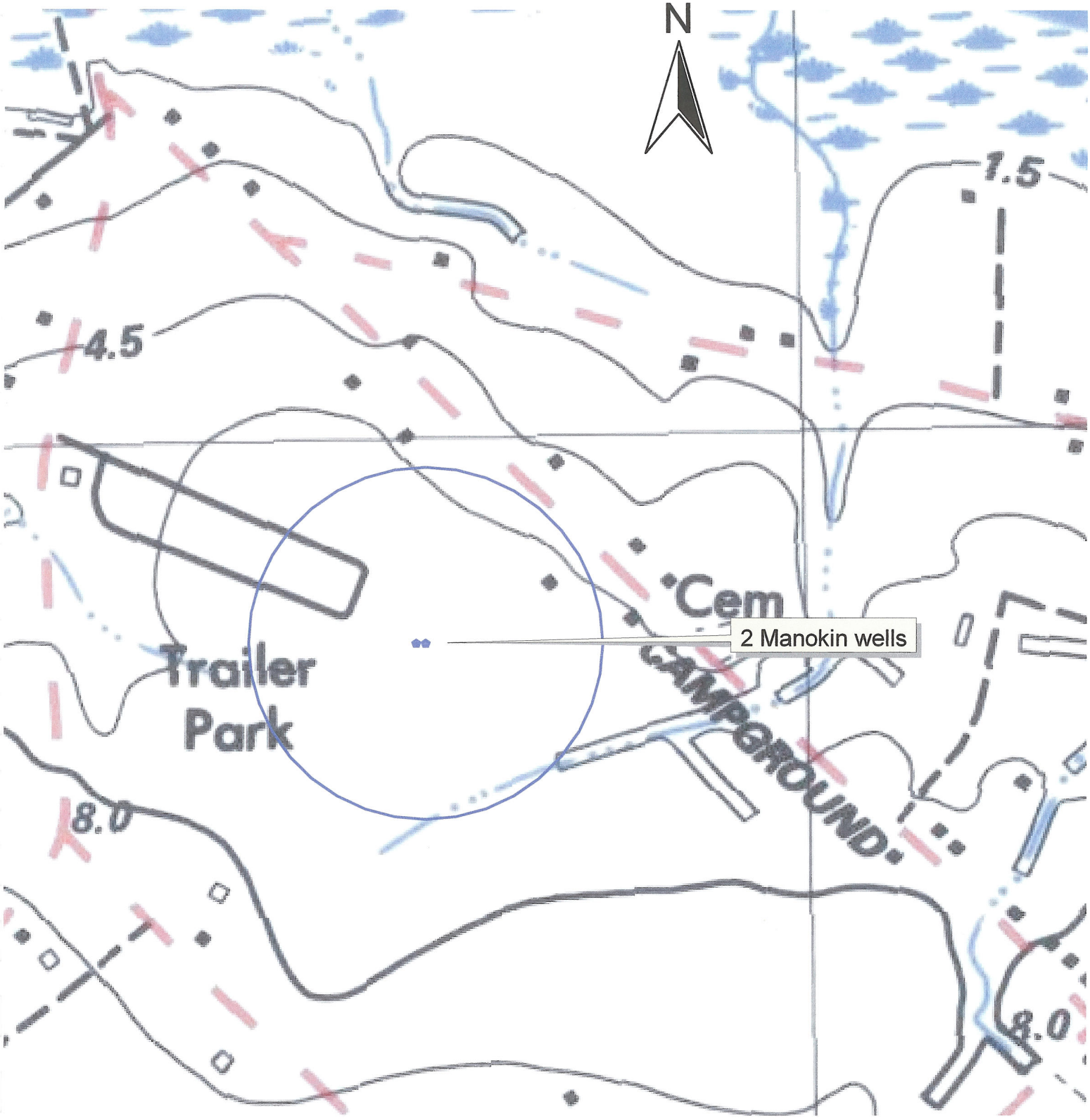


Figure 11: Topomap of Oakridge MHP with 10 year WHPA outlined.

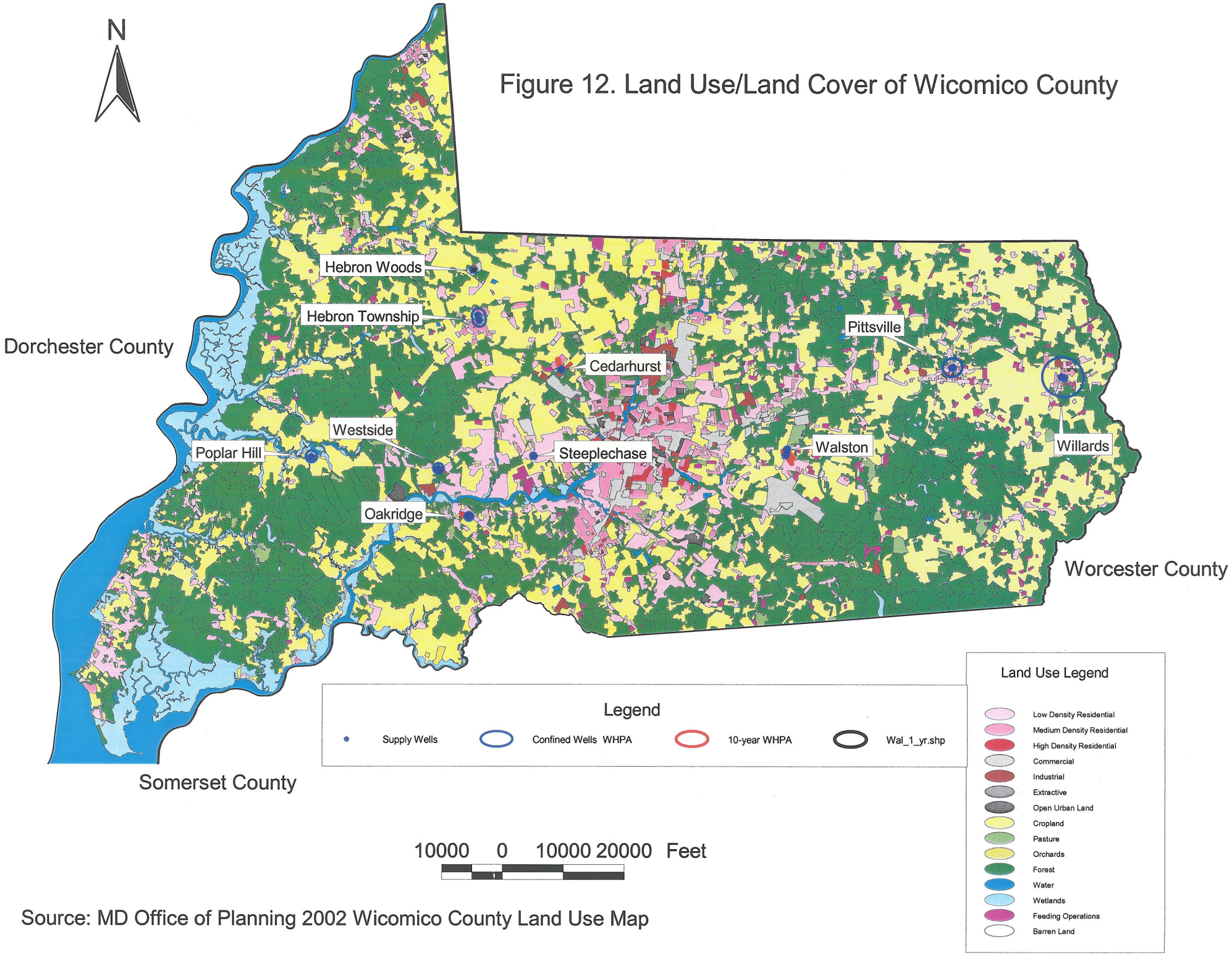
500 0 500 1000 Feet

Legend

Supply Wells

Confined Wells WHPA

Figure 12. Land Use/Land Cover of Wicomico County



Source: MD Office of Planning 2002 Wicomico County Land Use Map

TABLES

PWSID	System Name	Plant ID	Source ID	Water Appropriation Permit ID	Average Pumpage (gpd)	Well Permit	Top of Screen	Bottom of Screen	Screen Length (ft)	Pumpage (cf/yr)	WHAPA Radius	Aquifer
0220002	HEBRON	02	05	WI1989G001	96000	WI930267	320	370	50	4684492	**1092**	C
0220002	HEBRON	02	06	WI1989G001	96000	WI930268	332	382	50	4684492	**1092**	C
0220003	POPLAR HILL PRE-RELEASE UNIT	01	02	WI1959G001	29000	WI880152	100	105	5	1415107	**1898**	C
0220003	POPLAR HILL PRE-RELEASE UNIT	01	03	WI1959G001	29000	WI921669	100	105	5	1415107	**1898**	C
0220007	WILLARDS	01	01	WI1979G020	79000	WI731255	315	320	5	3854947	**3133**	C
0220007	WILLARDS	01	02	WI1979G020	79000	WI731256	315	320	5	3854947	**3133**	C
0220009	PITTSVILLE	01	01	WI1981G015	113000	WI737181	80	111	31	5514037	**1505**	C
0220009	PITTSVILLE	01	02	WI1981G015	113000	WI737180	80	111	31	5514037	**1505**	C
0220010	STEEPLECHASE WATERWORKS	01	01	WI1992G048	38000	WI921127	400	450	50	878342	**473**	C
0220010	STEEPLECHASE WATERWORKS	01	02	WI1992G048	38000	WI921623	400	450	50	878342	**473**	C
0220209	OAK RIDGE MOBILE HOME PARK	01	02	WI1967G013	15000	WI813515	220	245	25	731952	**611**	C
0220209	OAK RIDGE MOBILE HOME PARK	01	03	WI1967G013	15000	WI881099	210	230	20	731952	**683**	C
0220216	CEDARHURST MOBILE HOME PARK	01	03	WI1974G008	10000	WI812256	90	95	5	487968		U
0220216	CEDARHURST MOBILE HOME PARK	01	04	WI1974G008	10000	WI930964	85	95	10	487968		U
0220217	WALSTONS MOBILE HOME PARK	01	01	WI1968G016	2200	WI680113	84	90	6	107353		U
0220217	WALSTONS MOBILE HOME PARK	01	02	WI1968G016	2200	WI813459	80	90	10	107353		U
0220217	WALSTONS MOBILE HOME PARK	01	03	WI1968G016	2200	WI810308	94	99	5	107353		U
0220217	WALSTONS MOBILE HOME PARK	01	04	WI1968G016	2200	WI810311	78	83	5	107353		U
0220217	WALSTONS MOBILE HOME PARK	01	06	WI1968G016	11000	WI945669	160	190	30	536765	**477**	C
0220217	WALSTONS MOBILE HOME PARK	01	97	WI1968G016	2200	WI921896	80	90	10	107353		U
0220220	WESTSIDE MOBILE HOME PARK	01	01	WI1984G005	12000	WI812282	210	220	10	585561	**863**	C
0220220	WESTSIDE MOBILE HOME PARK	01	02	WI1984G005	12000	WI882996	200	245	45	585561	**407**	C
0220224	HEBRON WOODS MOBILE HOME PARK	01	01	WI1994G026	10000	WI921113	52	72	20	487968		U
0220224	HEBRON WOODS MOBILE HOME PARK	01	02	WI1994G026	10000	WI930426	50	70	20	487968		U

Table 1. Community Water Systems in Wicomico County and well info .
Florida method radius calc.
All distance measurements are in feet
C - confined aquifer
U - unconfined aquifer

132,996 | 154
1,773,279 | 868

Pwsid	Plant	Name	Type of Treatment	Reason for Treatment
220002	1	HEBRON	HYPOCHLORINATION, POST	DISINFECTION
220002	1	HEBRON	HYPOCHLORINATION, PRE	DISINFECTION
220002	2	HEBRON	HYPOCHLORINATION, PRE	DISINFECTION
220003	1	POPLAR HILL PRE-RELEASE UNIT	pH ADJUSTMENT, POST	CORROSION CONTROL
220003	1	POPLAR HILL PRE-RELEASE UNIT	pH ADJUSTMENT, PRE	CORROSION CONTROL
220003	1	POPLAR HILL PRE-RELEASE UNIT	INHIB., POLYPHOSPHATE	CORROSION CONTROL
220003	1	POPLAR HILL PRE-RELEASE UNIT	GASEOUS CHLORINATION, PRE	DISINFECTION
220003	1	POPLAR HILL PRE-RELEASE UNIT	FILTRATION, GREENSAND	IRON REMOVAL
220003	1	POPLAR HILL PRE-RELEASE UNIT	PERMANGANATE	TASTE & ORDER CONTROL
220007	1	WILLARDS	pH ADJUSTMENT	CORROSION CONTROL
220007	1	WILLARDS	GASEOUS CHLORINATION, POST	DISINFECTION
220007	1	WILLARDS	ION EXCHANGE -IRON (NON-SDWIS CODE)	IRON REMOVAL
220009	1	PITTSVILLE	pH ADJUSTMENT	CORROSION CONTROL
220009	1	PITTSVILLE	GASEOUS CHLORINATION, PRE	DISINFECTION
220009	1	PITTSVILLE	AERATION, DIFFUSED	IRON REMOVAL
220009	1	PITTSVILLE	FILTRATION, GREENSAND	IRON REMOVAL
220009	1	PITTSVILLE	GASEOUS CHLORINATION, PRE	IRON REMOVAL
220009	1	PITTSVILLE	PERMANGANATE	IRON REMOVAL
220009	1	PITTSVILLE	SEDIMENTATION	IRON REMOVAL
220010	1	STEEPLECHASE WATERWORKS	GASEOUS CHLORINATION, POST	DISINFECTION
220209	1	OAK RIDGE MOBILE HOME PARK	HYPOCHLORINATION, POST	DISINFECTION
220216	1	CEDARHURST MOBILE HOME PARK	HYPOCHLORINATION, POST	DISINFECTION
220217	1	WALSTONS MOBILE HOME PARK	HYPOCHLORINATION, POST	DISINFECTION
220220	1	WESTSIDE MOBILE HOME PARK	HYPOCHLORINATION, POST	DISINFECTION
220220	1	WESTSIDE MOBILE HOME PARK	ION EXCHANGE -IRON (NON-SDWIS CODE)	IRON REMOVAL
220224	1	HEBRON WOODS MOBILE HOME PARK	pH ADJUSTMENT	CORROSION CONTROL
220224	1	HEBRON WOODS MOBILE HOME PARK	HYPOCHLORINATION, POST	DISINFECTION

Table 3.Treatment methods for ten Wicomico County Community Water Systems

PWSID	System Name	Contaminant Name	MCL	Sample Date	Results
220002	HEBRON	NITRATE	10	28-Apr-93	11.3
220002	HEBRON	NITRATE	10	17-May-93	6.2
220002	HEBRON	NITRATE	10	9-Jul-93	11
220002	HEBRON	NITRATE	10	24-Aug-93	10.3
220002	HEBRON	NITRATE	10	19-Nov-93	10.4
220002	HEBRON	NITRATE	10	9-Mar-94	11
220002	HEBRON	NITRATE	10	25-Jul-94	10.4
220002	HEBRON	NITRATE	10	17-Oct-94	10.4
220002	HEBRON	NITRATE	10	7-Nov-94	5.3
220002	HEBRON	NITRATE	10	9-Feb-95	8.5
220002	HEBRON	NITRATE	10	24-Apr-95	9.7
220002	HEBRON	NITRATE	10	15-May-95	9.6
220002	HEBRON	NITRATE	10	26-Jun-95	9.1
220002	HEBRON	NITRATE	10	26-Jul-95	10
220002	HEBRON	RADON-222	300 *	28-Mar-93	180
220003	POPLAR HILL	CADMIUM	0.005	10-Sep-02	0.008
220007	WILLARDS	RADON-222	300 *	3-Aug-99	250
220010	STEEPLECHASE	TURBIDITY	5	2-Oct-02	3.18
220010	STEEPLECHASE	RADON-222	300 *	5-Nov-98	210
220209	OAK RIDGE	RADON-222	300 *	8-Nov-99	360
220216	CEDARHURST	RADON-222	300 *	8-Nov-99	215
220216	CEDARHURST	NITRATE	10	4-Jan-01	5.4
220217	WALSTONS	ARSENIC	0.01	12-Jun-02	0.006
220217	WALSTONS	SELENIUM	0.05	26-Mar-02	0.025
220224	HEBRON WOODS	ARSENIC	0.01	22-Mar-99	0.023
220224	HEBRON WOODS	CADMIUM	0.005	22-Mar-99	0.0031
220224	HEBRON WOODS	SELENIUM	0.05	11-Apr-02	0.025

* Proposed MCL not adopted

Table 4. Results where the concentration of an inorganic contaminant (IOC) is at or above fifty percent (50%) of the respective maximum contaminant level (mcl) allowed.

PWSID	System Name	Source ID	Decision	Rain Amt (in)	Weather Condition	Sample Date	Temp. (C)	PH	Turbidity (NTU)	Total Coliform (COL/100ml)	Fecal Coliform (COL/100ml)
220224	Hebron Woods MHP	1	N	1.1	WET	11-Dec-98	13	5.9	1.1	2.2	2.2
220224	Hebron Woods MHP	1	N	0.5	WET	27-Dec-02	14	6	3.5	-2.2	-2.2
220224	Hebron Woods MHP	2	N	0.5	WET	27-Dec-02	13	6	3.2	-2.2	-2.2
220217	Walston MHP	1	N	1.1	WET	10-Dec-98	13	5.7	8.1	-1.1	-1.1
220217	Walston MHP	2	N	1.1	WET	10-Dec-98	14	6.2	6.3	-1.1	-1.1
220217	Walston MHP	3	N	1.1	WET	10-Dec-98	15	6.1	3.1	-1.1	-1.1
220217	Walston MHP	4	N	1.1	WET	9-Dec-98	15	5.8	8.3	-1.1	-1.1
220217	Walston MHP	97	N	1.1	WET	10-Dec-98	14	6.5	1.8	-1.1	-1.1
220216	Cedarhurst MHP	3	N	1.1	WET	10-Dec-98	13	5.3	1.1	-1.1	-1.1
220216	Cedarhurst MHP	4	N	1.1	WET	10-Dec-98	13	5.7	1	-1.1	-1.1

Table 5: Ground Water Under the Direct Influence Testing Results (Unconfined Systems)

PWS NAME	PWSID	SAMPLE DATE	NUM TAKEN	NUM TC POS	NUM FECAL_POS	NUM RPT TAKEN	NUM RPT POS
WILLARDS	220007	01-Jun-01	1	1	1	4	0
WESTSIDE MOBILE HOME PARK	220220	01-Sep-04	1	1	0	4	0
HEBRON WOODS MOBILE HOME PARK	220224	01-Feb-99	1	1	0	8	0
HEBRON WOODS MOBILE HOME PARK	220224	01-Mar-99	1	1	0	4	4
HEBRON WOODS MOBILE HOME PARK	220224	01-Apr-99	4	4			
HEBRON WOODS MOBILE HOME PARK	220224	01-May-99	4	1	0	0	0

Table 6. Routine Microbiological Sampling Results only for Systems Testing Positive

PWSID	PWS Name	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected in WQ Samples at Levels of Concern?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible to Nitrate?
220002	TOWN OF HEBRON	NO	NO	NO	NO	NO
220003	POPLAR HILL PRE-RELEASE	NO	NO	NO	NO	NO
220007	TOWN OF WILLARDS	NO	NO	NO	NO	NO
220009	TOWN OF PITTSVILLE	NO	NO	NO	NO	NO
20010	STEEPLECHASE WATERWORKS	NO	NO	NO	NO	NO
220209	OAK RIDGE MHP	NO	NO	NO	NO	NO
220216	CEDARHURST MHP	NO	YES	NO	NO	NO
220217	WALSTON MHP	NO	NO	NO	NO	NO
220220	WESTSIDE MHP	NO	NO	NO	NO	NO
220224	HEBRON WOODS MHP	NO	NO	NO	NO	NO

Table 7. Susceptibility Logic Chart for Nitrate

PWSID	PWS Name	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected in WQ Samples at Levels of Concern?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible to Radiological Compounds?
220002	TOWN OF HEBRON	NO	NO	NO	NO	NO
220003	POPLAR HILL PRE-RELEASE	NO	NO	NO	NO	NO
220007	TOWN OF WILLARDS	NO	YES	NO	NO	NO
220009	TOWN OF PITTSVILLE	NO	NO	NO	NO	NO
20010	STEEPLECHASE WATERWORKS	NO	YES	NO	NO	NO
220209	OAK RIDGE MHP	NO	YES	NO	NO	NO
220216	CEDARHURST MHP	NO	YES	NO	NO	NO
220217	WALSTON MHP	NO	NO	NO	NO	NO
220220	WESTSIDE MHP	NO	NO	NO	NO	NO
220224	HEBRON WOODS MHP	NO	NO	NO	NO	NO

Table 8. Susceptibility Logic Chart for Radiological Compounds

PWSID	PWS Name	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected in WQ Samples at Levels of Concern?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible to VOCs?
220002	TOWN OF HEBRON	NO	NO	NO	NO	NO
220003	POPLAR HILL PRE-RELEASE	NO	NO	NO	NO	NO
220007	TOWN OF WILLARDS	NO	NO	NO	NO	NO
220009	TOWN OF PITTSVILLE	NO	NO	NO	NO	NO
20010	STEEPLECHASE WATERWORKS	NO	NO	NO	NO	NO
220209	OAK RIDGE MHP	NO	NO	NO	NO	NO
220216	CEDARHURST MHP	NO	NO	NO	NO	NO
220217	WALSTON MHP	NO	NO	NO	NO	NO
220220	WESTSIDE MHP	NO	NO	NO	NO	NO
220224	HEBRON WOODS MHP	NO	NO	NO	NO	NO

Table 9.Susceptibility Logic Chart for Volatile Organic Compounds

PWSID	PWS Name	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected in WQ Samples at Levels of Concern?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible to SOCs?
220002	TOWN OF HEBRON	NO	NO	NO	NO	NO
220003	POPLAR HILL PRE-RELEASE	NO	NO	NO	NO	NO
220007	TOWN OF WILLARDS	NO	NO	NO	NO	NO
220009	TOWN OF PITTSVILLE	NO	NO	NO	NO	NO
20010	STEEPLECHASE WATERWORKS	NO	NO	NO	NO	NO
220209	OAK RIDGE MHP	NO	NO	NO	NO	NO
220216	CEDARHURST MHP	NO	NO	NO	NO	NO
220217	WALSTON MHP	NO	NO	NO	NO	NO
220220	WESTSIDE MHP	NO	NO	NO	NO	NO
220224	HEBRON WOODS MHP	NO	NO	NO	NO	NO

Table10.Susceptibility Logic Chart for Synthetic Organic Chemicals

PWSID	PWS Name	Are Contaminant Sources Present in WHPA?	Are Contaminants Detected in WQ Samples at Levels of Concern?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible to Microbiological Pathogens?
220002	TOWN OF HEBRON	NO	NO	NO	NO	NO
220003	POPLAR HILL PRE-RELEASE	NO	NO	NO	NO	NO
220007	TOWN OF WILLARDS	NO	YES	NO	NO	NO
220009	TOWN OF PITTSVILLE	NO	NO	NO	NO	NO
20010	STEEPLECHASE WATERWORKS	NO	NO	NO	NO	NO
220209	OAK RIDGE MHP	NO	NO	NO	NO	NO
220216	CEDARHURST MHP	NO	NO	NO	NO	NO
220217	WALSTON MHP	NO	NO	YES*	NO	YES*
220220	WESTSIDE MHP	NO	YES	NO	NO	NO
220224	HEBRON WOODS MHP	NO	YES	NO	NO	NO

* One well currently in use WI-68-0113 completed in 1968 to a depth of 90 feet was installed before the new standards for water wells was introduced in 1973. This is a buried well.

Table11.Susceptibility Logic Chart for Microbiological Pathogens