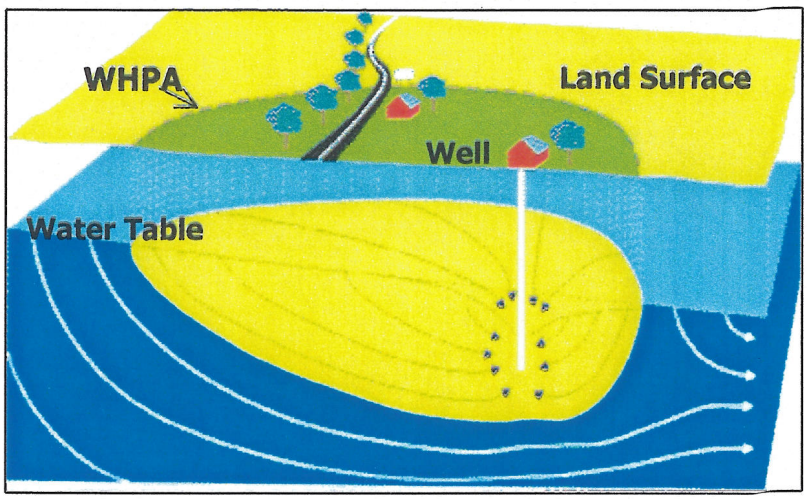
SOURCE WATER ASSESSMENT

FOR SMALL WATER SYSTEMS

IN HOWARD COUNTY



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MDE

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SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for eighteen small systems in Howard 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 conclude this report.

The sources of water supply wells in Howard County are unconfined fractured-rock aquifers. The twenty small water systems included in this report are currently using thirty-three wells that pump water from eight fractured-rock 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, controlled hazardous substance generators and ground water discharges commonly associated with commercial areas. The Maryland Office of Planning's 1997 land use map for Howard 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. All of the small systems in this report utilize on-site septic systems for the disposal of domestic wastewater. Figures showing land use, potential contaminant sources within Source Water Assessment areas, and aerial photographs of 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 many of the small water systems are susceptible to contamination by nitrate and radon, and a few to volatile organic compounds synthetic organic compounds and microbiological contaminants. Some small systems may be susceptible to one contaminant, while others are susceptible to one or more groups of contaminants.

INTRODUCTION

The Water Supply Program has conducted a Source Water Assessment for eighteen small water systems in Howard County (figure 1). Howard County is in the central part of the State, and is bounded by the Patapsco River in the north and the Patuxent River in the south. Based on July 2001 data, the total population of Howard County is 255,200 persons (Md. Assoc. of Counties, 2001). As defined in Maryland's Source Water Assessment Plan (SWAP), "small systems" are community and non-transient non-community water systems that have a ground water appropriation permit of less than 10,000 gallons average daily use. All the eighteen small systems covered in this report are non-transient non-community systems and obtain their water supply from unconfined fractured rock aquifers (16 in non-carbonate formations, 2 in carbonate formations).

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 31 wells are used by the nineteen systems assessed in this report. Twenty-three of the wells were drilled after 1973 and should comply with Maryland's well construction regulations. Eight of the wells were drilled prior to 1973, when current regulations went into effect, and may not meet the current construction standards. Well completion report data was not available for three of the wells. Table 1 contains a summary of well information for each of the small systems.

Field inspections were conducted for to verify the location of each well and to determine their condition. All the wells were cased above ground and with casings ranging from 6 inches to 2 feet above ground. The well cap for the Upper School Well (No.3) for Glenelg Country School (figure 2d) as loose and could easily be removed. This can provide an avenue for contaminants to get into the well and the aquifer. The cap should be replaced to protect the water supply for this facility.

HYDROGEOLOGY

Howard County lies within the Piedmont physiographic province. The Piedmont is characterized by gently rolling hills and valleys. The county is underlain by ancient (Precambrian) crystalline igneous and metamorphic rocks with a few lenses of marble (carbonate rock) in the central part of the County. All the aquifers in the Piedmont are unconfined fractured rock aquifers. Ground water flow in this geologic setting originates

primarily from precipitation that enters the permeable weathered overburden soils and saprolite (weathered rock), and then flows through joints, bedding plane contacts, and fractures in the rock (Dingman & Ferguson, 1956).

Ground water flow in carbonate rock is dominated by solution-enlarged fractures and bedding planes. Soil cover and overburden is generally thin or non-existent, due to the dissolution of the minerals that make up the rock, causing ground water to infiltrate rapidly from the surface to the water table. Usually the most productive wells are found in this type of aquifer due to flow through conduits formed by solution-enlarged fractures.

The eighteen small systems discussed in this report obtain water from eight aquifers (table 1). A brief description of each of these aquifers follows.

Boulder Gneiss of the Wissahickon Formation

The Boulder Gneiss is a thick–bedded to massive pebble and boulder bearing sandy to clayey metamorphic rock. It is typically a medium-grained garnet-oligoclase-mica-quartz gneiss (Nutter and Otton, 1969).

Setters Formation

The Setter Formation consists of feldspathic mica schist and mica gneiss, interstratified with impure quartzite (Nutter and Otton, 1969).

Wissahickon Formation (undivided)

The Wissahickon Formation (undivided) consists of banded or laminated quartz-Muscovite schist and phyllite of various composition; maybe rich in chlorite, Albite, or oligoclase (Dingman and Meyer, 1954).

Lower Pelitic Schist of the Wissahickon Formation

The Lower Pelitic Schist is a medium to coarse-grained biotite-oligoclase-muscovite-quartz schist with garnet, staurolite and kyanite. It also contains fine-to-medium grained clayey schist and fine-grained granular minerals (Nutter and Otton, 1969).

Baltimore Gneiss

The Baltimore Gneiss is a biotite-quartz-feldspar gneiss and biotite-hornblende gneiss. Amphibolite is widespread in the rock, but is a subordinate mineral. The rock is texturally varied and in places is complexly intermingled (Nutter and Otton, 1969).

Cockeysville Marble

The Cockeysville Marble is a coarse-grained crystalline calcite-dolomite marble. Minor calc-gneiss and calc-silicate marble are also present (Nutter and Otton, 1969). In many areas it occurs as lenses and is often interbedded with the Lower Pelitic Schist.

SOURCE WATER ASSESSMENT AREA DELINEATION

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 "small" public water systems using an average of less than 10,000 gallons per day (gpd), in unconfined fractured-rock aquifers is a fixed radius of 1,000 feet around the well. This radius is based on calculating the land area needed to provide a yield of 10,000 gpd assuming a 400 gpd per acre recharge rate (drought year recharge conditons) and a safety factor. The same WHPA applies to carbonate rock aquifer, unless the source has been determined to be ground water under the direct influence of surface water (GWUDI). GWUDI sources would require a more detailed study to delineate their WHPA. The one system that is using a carbonate aquifer (Central Maryland Research and Education Center) has not yet been evaluated for GWUDI. If the sources supplying this system are determined to be GWUDI, the WHPA for the system will be revised. The WHPAs for the nineteen systems are shown in Figures 2a through 2q. For systems that have multiple wells, the areas were merged to produce one larger WHPA.

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, large-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 or animal wastes, or septic systems that may lead to ground water contamination over a larger area.

Point Sources

Potential point sources of contamination were identified and mapped within and near the Wellhead Protection Areas of the eighteen small systems. Table 2 lists the potential contaminant sites identified with their associated contaminants and figures 2a-2p show the locations and WHPAs for each water system. The point sources listed are identified from MDE contaminant databases and field inspections conducted by MDE employees. Potential contamination sources that were investigated include: underground storage tanks (USTs), ground water discharge permit sites (GWD), Controlled Hazardous Substance Generators (CHS), and Pesticide Dealers (PD). 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), Radionuclides (R) and Microbiological Pathogens (MP).

Field inspections were conducted within and near the WHPAs to determine the potential of any unpermitted ground water discharges (e.g. open floor drains) to the aquifers being used by the small systems in Howard County. Facilities located within and near the WHPAs were inspected and Notice of Violation (NOV) were issued to three unpermitted discharges into these aquifers within the WHPAs.

Non-Point Sources

The Maryland Office of Planning's 1997 Land Use map for Howard County was used to determine the predominant types of land use in each WHPA (figure 3). A summary of the total land use within the WHPAs for the eighteen systems is shown in Table 7. The top four land uses are cropland (36%), low density residential (21%), forest (20%) and commercial/institution (16%). It must be noted that these land uses are based on the 1997 Howard Land Use Map, and field inspections indicated that some of the cropland is now low-density residential land. Pesticides and herbicides used in agriculture are potential non-point sources of SOCs. The application of fertilizers on agricultural fields is a potential non-point source of nitrate. The use of private septic systems and lawn maintenance and landscaping activities in residential areas are potential non-point sources of nitrate and SOCs to ground water.

A review of the Maryland Office of Planning 1994 Howard County Sewerage Coverage map indicates that there are no plans for sewer service for 85.86% of the WHPAs (Figure 4 & Table 8). All the small systems in this report currently rely on onsite disposal of domestic wastewater. Two systems, Trinity School and Lubavitch Center for Jewish Education, are in the process of being connected to public sewer and water. Onsite septic are potential sources of nitrate and pathogens in ground water. Commercial or industrial land use areas outside the existing sewer service present a potential source of many types of contaminants if byproducts and wastes are not disposed of properly.

Other sources that may potentially contaminate the ground water supplies include unregulated heating oil USTs, stormwater drainage ditches, stormwater management ponds, and roads and parking lots within or near WHPAs. Roads are a concern in the event of chemical or petroleum spills, and from the over-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. Two systems (see table 6) are currently providing only bottled water for human consumption and therefore are not subject to SDWA

monitoring requirements except for bacteria and nitrate. The treatment methods currently in use for the eighteen 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 eighteen systems in this report currently meet the drinking water standards Table 4 lists the total water quality samples collected since 1993. Tables 5a-5c provide a list of all detections above 50% of the MCL.

Inorganic Compounds (IOCs)

Nitrate was the only IOC detected above 50% of their respective MCLs (table 5a). Nitrate was detected above the threshold level of 5 parts per million (ppm) in 14 of the 20 water systems in this report. Furthermore, nitrate was detected above the MCL of 10 ppm in 5 of the systems. The nitrate results that exceeded the MCL are shown in bold (table 5a). Nitrate levels not to exceed 20 ppm may be allowed for noncommunity systems if the water is not available to children under 6 months old. None of the five systems with nitrate levels detected above 10 ppm serve water to any children under 6 months old (table 5a).

Radionuclides

Non-transient non-community systems are currently not regulated for radionuclides, and may not be for radon. Sixteen of the systems which were tested for radon all had detects of this radionuclide (table 5b). 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 above 50% of the higher proposed MCL of 4000 pCi/L in 12 of the 16 systems that have tested for this contaminant (Table 5b). Four of these systems had radon detects above 4000 pCi/L. Two of the systems have no data available for this contaminant.

Volatile Organic Compounds (VOCs)

Only one VOC has been detected above the 50% MCL threshold. Two samples from West Friendship Shopping Center (Table 5c) detected tetrachloroethylene at 9.7 and 12.8 ppb, respectively. Other regulated VOCs like trichloroethylene (Glenelg Country School), toluene (Triadelphia Ridge Elementary) and methylene chloride (Ten Oaks Plaza) have been detected at levels well below their respective MCLs. Methyl-tert-butyl-ether (MTBE) is an oxygenate additive that makes gasoline burn cleaner. Due to MTBE's high solubility and mobility, it can enter an aquifer and may contaminate a ground water supply. MTBE is currently an unregulated VOC that has no MCL. EPA's advisory to avoid unpleasant taste and odors is currently at 20 - 40 ppb. MTBE has been detected at three systems since 1993: Peter Pan Learning Center (4.0, 4.6, 3.8 and 0.8 ppb), Transcontinental Gas Pipeline (1.8 ppb),

and Ten Oaks Plaza (5.6 ppb). MDE's Oil Control Program currently investigates areas for potential sources when MTBE levels exceed 10 ppb.

Synthetic Organic Compounds (SOCs)

No SOC has been detected above the 50% threshold in any of the systems since 1993. SOCs have been detected at 7 of the systems at levels below their respective MCLs.

Di- (2-ethylhexyl) phthalate was reported from samples at Glenelg Country School (0.7 ppb), Glenelg High School (0.7 ppb), Peter Pan Learning Center (1.2 ppb), Central Maryland Research and Education Center (0.6 ppb), Triadelphia Ridge Elementary School (1.2 ppb), and High Road Academy (1.3 ppb). These levels are all well below the MCL of 6 ppb.

Atrazine was detected at the Glenwood Office Park at levels of 0.17 ppb (11/98), 0.31 ppb (5/98) and 0.26 ppb (7/96), respectively. The MCL for atrazine is 3 ppb.

Microbiological Contaminants

Ground water under the direct influence of surface water (GWUDI) testing has been completed for eleven of the systems. GWUDI testing requires collection and analysis of raw water samples for bacteria (total and fecal coliform). None of the eleven systems had any detection of total coliform bacteria.

All of the systems do, however, have quarterly routine bacteriological samples that were collected as required by the Safe Drinking Water Act (Table 6). These samples are generally collected from finished (treated) water, which may not be indicative of the source water conditions. Seven of the systems have disinfection for treatment of their water supply (table 6). Of the six systems that had positive bacteria results, three have disinfection treatment, and the other three do not.

SUSCEPTIBILITY ANALYSIS

All of the wells serving the small water systems included in this report pump water from unconfined aquifers. In general, wells in unconfined aquifers are susceptible to contamination from activities on the land surface that occur within the wellhead protection areas. The susceptibility of the individual water supplies to each group of contaminants was determined 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. Tables 9a - e summarize the susceptibility of each of the eighteen systems covered in this report to each of the groups of contaminants.

Ground water in Piedmont Region comes from precipitation that passes through porous and permeable weathered overburden soil and saprolite and then flows in different directions through joints and fractures in the rock. Saprolite and overlying weathered soils serve as a natural filter and protective barrier from pathogens for properly constructed wells whose casing is extended to competent rock and properly encased in

grout. Properly constructed wells with no potential sources of contamination in their WHPAs should be well protected from contamination. However, wells drawing water from carbonate aquifers will be more vulnerable to activity on the land surface due to thin soil cover and development of karst features.

According to the Howard County 1997 Land Use Map, almost 20% of the total land use in all the WHPAs is forested. Systems whose recharge areas are within forested lands should be better protected from contamination. However, localized land use will play a role in a developed area. The most common threats of contamination in the WHPAs of Howard County are from the over-application of fertilizers on agricultural fields, and effluent from on-site septic systems. Both contribute to nitrate loading in ground water. The common presence of underground storage tanks and commercial activity in the WHPAs suggest that VOC threats are often prevalent.

Inorganic Compounds

Nitrate is present in the wells of 13 systems at 5 ppm or greater (Table 5a). The MCL for nitrate is 10 ppm. Five of the systems, Lisbon Elementary School, Peter Pan Learning Center, Central Maryland Research and Education Center, Mt. Airy Bible Church and Christian Academy, and Ten Oaks Plaza have exceeded the established MCL (Table 5a in bold). 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 1997 land use map, cropland is the major land use within the WHPAs (figure 3). In addition, 16 of the systems are in areas with no planned public sewerage service based on the 1995 Howard County Sewerage Coverage Map (figure 4).

Thirteen of the systems in this report **are** susceptible to nitrate due to the levels and persistence of this contaminant found, the vulnerability of the unconfined aquifers to land activity, and the presence of nitrate sources in their wellhead protection areas. Based on available sampling data reported since 1993, five of the systems were determined **not** susceptible to nitrate contamination. A nitrate susceptibility chart is outlined for each system in Table 9a.

Radionuclides

Non-transient non-community systems are currently not regulated for radionuclides. An MCL for radon-222 has not been adopted yet for Maryland. However, the U.S. EPA is proposing an MCL of 300 pCi/L or an alternative of 4000 pCi/L for community drinking water systems if the State has a program to reduce the more significant risk from radon in indoor air, which is the primary health concern. Radon is present in all sixteen systems that have tested for this contaminant. Two systems do not have any radon results available. Four water systems have radon levels above 50% of the higher proposed MCL of 4000 pCi/L. An additional three systems will have radon levels above 50% of the lower proposed MCL of 300 pCi/L.

The source of radon in ground water can be traced back to the natural occurrence of uranium in rocks. Radon is prevalent in ground water throughout the Piedmont Region of Howard County due to radioactive decay of uranium bearing minerals in the bedrock (Bolton, 1996).

The susceptibility of the systems to radiological contaminants is shown on table 9b. Based on the higher MCL of 4000 pCi/L, 11 systems **are** susceptible to radon. Based on the lower MCL of 300 pCi/L 15 systems **are** susceptible to radon. Determination of susceptibility to radon cannot be made for two systems due to lack of sampling data.

Volatile Organic Compounds

West Friendship Shopping Center is the only system that had VOC detections above 50% of the MCL. Tetrachloroethylene was detected two times in 2000 in samples collected from the water supply. MDE's Ground Water Permits Division staff investigated a dry cleaning facility at the site to determine whether there were any unregulated ground water discharges. Tetrachloroethylene is used at the dry cleaning facility, but it is recycled and not discharged into the ground water. Samples taken from the onsite septic effluent and at the supply well showed no detects of tetrachlorethylene. Subsequent VOC monitoring also showed no detects of the VOC. It is possible that there may have been an accidental spill of tetrachloroethylene at the site resulting in the detections in the water supply.

Other regulated VOCs like trichloroethylene (Glenelg Country School), toluene (Triadelphia Ridge Elementary), and methylene chloride (Ten Oaks Plaza) have been detected at levels well below their respective MCLs. No potential point sources of VOCs have been identified in the WHPAs for any of the systems except for Ten Oaks Plaza which has several potential sources of VOCs (figure2o). Trichloroethylene is used for cleaning metals and plastic moulds, toluene is a component of gasoline and has wide applications as a solvent and methylene chloride is also used as a degreaser and as a solvent in food processing.

MTBE has been detected at low levels in four samples collected from Peter Pan Learning Center since 1997 and one time in samples collected from Transcontinental Gas Pipeline and Ten Oaks Plaza. The WHPAs for Peter Pan Learning Center and Transcontinental Gas Pipeline have no known sources of MTBE. MDE's Oil Control Program investigates MTBE sources when detections of this VOC reach 10 ppb.

The predominant sources of VOCs are point sources of contamination outlined in Table 2. Table 9c provides a summary of the susceptibility of the twenty systems to VOCs. Some of the systems have potential VOC sources like USTs that are located within or near their respective wellhead protection areas. Most of these USTs are in compliance with State regulations, but there is a potential for accidental spills and leaks from underground piping. One system with no USTs had detections of VOCs.

Based on the above discussion, nine systems **are** susceptible to VOC contamination and nine are **not** susceptible to VOC contamination (figure 9c). No data is available for one system.

Synthetic Organic Compounds

The sources of SOCs to ground water include point and non-point sources such as pesticide application. No potential point sources of SOCs were identified within or near the WHPAs for any of the systems, except for Glenwood Office Park (figure 2f). Non-point sources include pesticides applied to agricultural fields, school and commercial properties, and residential lawns and animal yarding. Cropland and residential land making up the major portion of the land use within the respective WHPAs. Pesticides and chemicals used on residential and commercial lawns and gardens are a potential threat. However, typical lawn maintenance herbicides are very biodegradable and should not pose a significant SOC risk if applied properly.

No SOC above 50% of the MCL was detected in any of the twenty systems. Di (2-ethylhexyl) phthalate was detected in seven systems at levels below 50% of the MCL as described in the Water Quality Section. Phthalate was also detected in the laboratory blanks and its detection is not believed to represent actual water quality. Atrazine was detected at Glenwood Office Park three times at levels below the MCL. Atrazine is an herbicide used in cornfields. The WHPA for this site encompasses cropland and application of atrazine in those areas may have resulted in the detections in the water supply.

Based on the potential contaminant sources within or near the respective WHPAs, available water quality data, and the vulnerability of unconfined aquifers to contamination, one of the systems in this report **is** susceptible to SOCs, and 17 systems were determined **not** susceptible to SOCs. Susceptibility determination could not be made for one system due to lack of sampling data. The susceptibility determinations are presented in table 9d.

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 1) wells that are classified as "Ground water under the direct influence of surface water" (GWUDI), 2) wells that may be sensitive to viruses due to a short travel time of water from the source of viral contamination to the well and 3) septic systems that are improperly installed or designed can be a source of microbial contamination in fractured rock.

Raw water quality data is not available for six systems . Based on the geology and well construction information four of these systems have a low risk of contamination to protozoa and bacteria. The wells for Central Maryland Research &

Education Center and Trancontinental Gas Pipeline are in a carbonate aquifer and may have a higher risk of contamination to protozoa and bacteria. Since the wells are in a carbonate aquifer, additional raw water sampling after rainfall is being conducted to determine their risk to protozoa.

Based on the above discussion, eleven systems **not** susceptible to microbiological contaminants. Susceptibilty to microbiological contaminants cannot be determined for six systems due to lack of available raw water quality data (table 9e).

MANAGEMENT OF THE SOURCE WATER ASSESSMENT AREA

With the information contained in this report, the individual water system owners as well as the Howard County government have a basis for better understanding the risks to drinking water supplies for the small non-transient-non-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 effective outreach and education are examples of management practices that will help protect the water supply. Specific management recommendations for consideration are listed below. The following recommendations are intended for 1) a countywide wellhead protection effort, and 2) for individual water systems.

RECOMMENDATIONS FOR COUNTY AGENCIES:

Form a Local Planning Team

- A local planning team representing all the interests in the county should be formed to begin to implement a source water protection plan. Howard County Departments of Planning and Building, Health, and Education, private schools, day care and commercial facilities, farmers and local residents should work together to reach a consensus on how to protect the water supplies.
- A management strategy adopted by the county should be consistent with the level of resources available for implementation. Funding is available through MDE for wellhead protection programs.

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 outside of the planned service areas can be used to make the public aware of protecting their ground water resources, 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 small 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 non-transient non-community water systems owned by non-profit organizations. 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:

Planning/New Development

- MDE recommends that water supply system owners within Howard County should encourage the County to develop a countywide a wellhead protection ordinance to protect all public water systems.
- Individual systems should be aware of the WHPA and evaluate possible effects to their water supply before making any changes to their property. They should voice their concern to the zoning office when they become aware of any changes to neighboring properties

Cooperative Efforts with Other Agencies

- Systems 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 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.
- Systems are recommended to annually collect raw water for microbiological contaminants to evaluate the integrity of their well.

Contaminant Source Inventory Updates/ Inspections

- Water system owners should conduct its own survey of their wellhead protection area 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.
- Water system own should ensure that their USTs meet all the State standards and that any chemicals should be handled and stored in a safe and responsible manner.

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 useage. 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.

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Nutter, L.J., and Otton, E.G., 1969, Ground-Water Occurrence in the Maryland Piedmont: Maryland Geological Survey Report of Investigations 10, 56 p.

U.S. Environmental Protection Agency, 1991, Delineation of Wellhead Protection Areas in Fractured Rocks: Office of Ground Water and Drinking Water, EPA/570/9-91-009, 144 pp.

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 1997 Howard County Land Use Map
Maryland Office of Planning 1994 Howard County Sewer Map

TABLES

PWSID	PWS NAME	PLANT ID	SOURCE ID	SOURCE NAME	GAP	GAP AMOUNT (gpd)	WELL PERMIT	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED	AQUIFER
1130001	BUSHY PARK ELEMENTARY SCHOOL	01	01	BUSHY PARK WELL	HO1983G003 ~~HO1967G001~~	3,500	HO730882	219	69	1974	BOULDER GNEISS WISSAHICKON FRM
1130003	GLENELG COUNTRY SCHOOL	01	01	LOWER SCHOOL AND GYM WELL	HO1975G009	7000	HO731140	300	45	1975	SETTERS FORMATION
1130003	GLENELG COUNTRY SCHOOL	02	03	UPPER SCHOOL WELL	HO1975G009	7000	HO811113	260	77	1985	SETTERS FORMATION
1130003	GLENELG COUNTRY SCHOOL	03	04	MIDDLE SCHOOL WELL	HO1975G009	7000	HO941218	305	198	1996	SETTERS FORMATION
1130003	GLENELG COUNTRY SCHOOL	04	05	PRIMARY SCHOOL WELL	HO1975G009	7000	NA	NA	NA	2001	SETTERS FORMATION
1130004	GLENELG HIGH SCHOOL	01	01	GLENELG HIGH WELL 1	HO1973G003	5000	HO028474	140	59	1957	BOULDER GNEISS WISSAHICKON FRM
1130004	GLENELG HIGH SCHOOL	01	02	GLENELG HIGH WELL 2	HO1973G003	5000	HO026907	115	81	1957	BOULDER GNEISS WISSAHICKON FRM
1130005	GLENWOOD MIDDLE SCHOOL	01	01	GLENWOOD MIDDLE WELL 1	HO1967G001	5000	HO670023	125	50	1966	BOULDER GNEISS WISSAHICKON FRM
1130005	GLENWOOD MIDDLE SCHOOL	01	02	GLENWOOD MIDDLE WELL 2	HO1967G001	5000	HO670024	80	38	1966	BOULDER GNEISS WISSAHICKON FRM

Table 1. Well Information for the Howard County Small Systems

PWSID	PWS NAME	PLANT ID	SOURCE ID	SOURCE NAME	GAP	GAP AMOUNT (gpd)	WELL PERMIT	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED	AQUIFER
1130006	LISBON ELEMENTARY SCHOOL	01	01	LISBON ELEM WELL 1	HO1973G004	2000	HO731589	368	82	1976	WISSAHICKON FORMATION
1130006	LISBON ELEMENTARY SCHOOL	01	02	LISBON ELEM WELL 2	HO1973G004	2000	HO730883	351	108	1974	WISSAHICKON FORMATION
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	01	01	W. FRIENDSHIP ELEM WELL	HO1973G006	2000	HO731431	310	59	1976	LWR PELITIC SCHIST WISSAHICKON
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	01	LCC WELL	HO1981G003	1000	HO733785	200	19	1981	WISSAHICKON FORMATION
1130011	GLENWOOD OFFICE PARK	01	01	GLENWOOD OFFICE PARK. WELL	HO1987G009	1400	HO812060	300	20	1987	BOULDER GNEISS WISSAHICKON FRM
1130014	PETER PAN LEARNING CENTER	01	01	PPLC WELL	NA	NA	NA	80	NA	NA	BALTIMORE GNEISS
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	01	SHOPPING CTR WELL	NA	NA	HO730834	150	35	1974	LWR PELITIC SCHIST WISSAHICKON
1130017	TRANSCONTINENTAL GAS PIPELINE	01	01	TRASCON WELL 1	HO1950G001	500	HO006247	203	16	1950	COCKEYSVILLE MARBLE
1130017	TRANSCONTINENTAL GAS PIPELINE	01	02	TRANSCON WELL 2	HO1950G001	500	NA	202	15	1950	COCKEYSVILLE MARBLE

Table 1 (continued). Well Information for the Howard County Small Systems

PWSID	PWS NAME	PLANT ID	SOURCE ID	SOURCE NAME	GAP	GAP AMOUNT (gpd)	WELL PERMIT	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED	AQUIFER
1130017	TRANSCONTINENTAL GAS PIPELINE	01	03	TRANSCON WELL 3	HO1950G001	500	HO033444	403	83	1959	COCKEYSVILLE MARBLE
1130023	MANOR WOODS ELEMENTARY SCHOOL	01	01	MANOR WOODS 1	HO1992G014	5500	HO920266	260	205	1992	BALTIMORE GNEISS
1130023	MANOR WOODS ELEMENTARY SCHOOL	01	02	MANOR WOODS 2	HO1992G014	5500	HO920170	600	38	1992	BALTIMORE GNEISS
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	01	UM FARM WELL 1	HO1974G003	8000	HO730482	200	65	1973	COCKEYSVILLE MARBLE
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	02	02	UM FARM WELL 2	HO1974G003	8000	HO882274	520	60	1993	COCKEYSVILLE MARBLE
1130025	MT AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	01	LBS WELL 1	HO1979G005	1000	HO733366	245	66	1979	WISSAHICKON FORMATION
1130025	MT AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	02	LBS WELL 2	HO1979G005	1000	HO940675	240	25	1995	WISSAHICKON FORMATION
1130027	TRIADELPHIA RIDGE ELEMENTARY	01	01	WELL 1	HO1992G007	7500	HO940783	700	68	1996	LWR PELITIC SCHIST WISSAHICKON
1130027	TRIADELPHIA RIDGE ELEMENTARY	01	02	WELL 2	HO1992G007	7500	HO940784	400	65	1996	LWR PELITIC SCHIST WISSAHICKON

Table 1 (continued). Well Information for the Howard County Small Systems

PWSID	PWS NAME	PLANT ID	SOURCE ID	SOURCE NAME	GAP	GAP AMOUNT (gpd)	WELL PERMIT	TOTAL DEPTH (ft)	CASING DEPTH (ft)	YEAR DRILLED	AQUIFER
1130027	TRIADELPHIA RIDGE ELEMENTARY	01	03	WELL 3	HO1992G007	7500	HO940957	400	64	1996	LWR PELITIC SCHIST WISSAHICKON
1130031	TEN OAKS PLAZA	01	01	TEN OAKS PLAZA WELL	HO1981G007	2000	HO734141	260	85	1982	LWR PELITIC SCHIST WISSAHICKON
1130032	INWOOD VILLAGE CENTER	01	01	INWOOD VILLAGE CENTER WELL	HO1995G005	5000	HO940443	300	128	1995	BOULDER GNEISS WISSAHICKON FRM
1130033	HIGH ROAD ACADEMY	01	01	VALLEY BROOK CHURCH WELL	HO93G004	400	HO920340	300	53	1993	BALTIMORE GNEISS

Table 1 (continued). Well Information for the Howard County Small Systems

Type	Site Name	Address	Potential Contaminant	Reference Location	Status
UST	Bushy Park Elementary School	2670 Route 97	VOC	Figure 2a/1	I tank in use
UST	Glenwood Middle School	2680 Route 97	VOC	Figure 2a/2	1 tank in use
UST	Glenelg High School	10910 Route 108	VOC	Figure 2c	2 tanks not in use
UST	Lisbon Service Center	15882 Frederick Road	VOC	Figure 2d/1	Several tanks in use
UST	Lisbon CITGO	15943 Frederick Road	VOC	Figure 2d/2	Several tanks in use
GWD	Lisbon CITGO	15943 Frederick Road	VOC	Figure 2d/3	Floor Drain
GWD	West Friendship VFD	12460 Frederick Road	VOC	Figure 2e	Floor Drain
PD	Glenwood Gardens	2945 Roxbury Mills (Rt 97) Rd	SOC	Figure 2f	Active
UST	High's /CITGO	12780 Frederick Road	VOC	Figure 2h/1	2 tanks in use
CHS	West Friendship Dry Cleaners	12800 Frederick Road	VOC	Figure 2h/2	Active
CHS	Transcontinental Gas Pipeline	11919 Carroll Mill Road	VOC	Figure 2i	Active
UST	Poplar Springs UMC	915 E Waterville Road	VOC	Figure 2l	1 tank in use
GWD	Eyre Bus Service	13600 Tridelphia Road	VOC	Figure 2n/1	Active
UST	Royal Farm	Tridelphia and Ten Oaks Roads	VOC	Figure 2n/2	Several tanks in use
UST	High's/CITGO	13605 Tridelphia Road	VOC	Figure 2n/3	3 tanks in use
GWD	Joe Bell's Body Shop	3932 Ten Oaks Road	VOC, HM	Figure 2n/4	Floor Drain
CHS	Joe Bell's Body Shop	3932 Ten Oaks Road	VOC, HM	Figure 2n/5	Active
CHS	Inwood Dry Cleaners	Rt 97 at McKendree Road	VOC	Figure 2o	Active

Table 2. Potential Contaminant Sources within Wellhead Protection Areas (see figures for location).

PWSID	PWS NAME	PLANT ID	TREATEMENT METHOD	REASON FOR TREATMENT
1130001	BUSHY PARK ELEMENTARY SCHOOL	01	pH ADJUSTMENT	CORROSION CONTROL
1130003	GLENELG COUNTRY SCHOOL	01	pH ADJUSTMENT	CORROSION CONTROL
1130003	GLENELG COUNTRY SCHOOL	02	pH ADJUSTMENT	CORROSION CONTROL
1130003	GLENELG COUNTRY SCHOOL	03	pH ADJUSTMENT	CORROSION CONTROL
1130003	GLENELG COUNTRY SCHOOL	03	FILTRATION, PRESSURE SAND	IRON/SEDIMENT REMOVAL
1130004	GLENELG HIGH SCHOOL	01	pH ADJUSTMENT	CORROSION CONTROL
1130005	GLENWOOD MIDDLE SCHOOL	01	pH ADJUSTMENT	CORROSION CONTROL
1130006	LISBON ELEMENTARY SCHOOL	01	pH ADJUSTMENT	CORROSION CONTROL
1130006	LISBON ELEMENTARY SCHOOL	01	HYPOCHLORINATION	DISINFECTION
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	01	pH ADJUSTMENT	CORROSION CONTROL
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	FILTRATION, CARTRIDGE	PARICULATE REMOVAL
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	ION EXCHANGE	SOFTENING
1130011	GLENWOOD OFFICE PARK	01	pH ADJUSTMENT	CORROSION CONTROL
1130011	GLENWOOD OFFICE PARK	01	ION EXCHANGE (NON-SDWIS	IRON REMOVAL
1130011	GLENWOOD OFFICE PARK	01	ION EXCHANGE	SOFTENING
1130014	PETER PAN LEARNING CENTER	01	ION EXCHANGE	SOFTENING
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	ULTRAVIOLET RADIATION	DISINFECTION
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	FILTER, CARTRIDGE	PARICULATE REMOVAL
1130017	TRANSCONTINENTAL GAS PIPELINE	01	NO TREATMENT	NONE
1130023	MANOR WOODS ELEMENTARY SCHOOL	01	HYPOCHLORINATION, POST	DISINFECTION
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	HYPOCHLORINATION, POST	DISINFECTION
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	02	NO TREATMENT	NONE
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	HYPOCHLORINATION, PRE	DISINFECTION

Table 3. Treatment Methods for Howard County Small Systems

PWSID	PWS NAME	PLANT ID	TREATEMENT METHOD	REASON FOR TREATMENT
1130027	TRIADELPHIA RIDGE ELEMENTARY	01	HYPOCHLORINATION, POST	DISINFECTION
1130027	TRIADELPHIA RIDGE ELEMENTARY	01	ION EXCHANGE	SOFTENING
1130031	TEN OAKS PLAZA	01	pH ADJUSTMENT	CORROSION CONTROL
1130032	INWOOD VILLAGE CENTER	01	NO TREATMENT	NONE
1130033	HIGH ROAD ACADEMY	01	NO TREATMENT	NONE

Table 3 (continued). Treatment Methods for Howard County Small Systems

PWSID	PWS NAME	PLANT ID	Nitrate		SOCs		VOCs		IOCs (except nitrate)	
			No. of Samples	No. of samples > 50% MCL	No. of Samples	No. of samples > 50% MCL	No. of Samples	No. of samples > 50% MCL	No. of Samples	No. of samples > 50% MCL
1130001	BUSHY PARK ELEMENTARY SCHOOL	01	16	5	2	0	8	0	3	0
1130003	GLENELG COUNTRY SCHOOL	01	10	0	2	0	9	0	3	0
1130003	GLENELG COUNTRY SCHOOL	02	10	0	2	0	11	0	3	0
1130003	GLENELG COUNTRY SCHOOL	03	4	0	1	0	5	0	1	0
1130004	GLENELG HIGH SCHOOL	01	15	0	2	0	8	0	3	0
1130005	GLENWOOD MIDDLE SCHOOL	01	24	20	4	0	8	0	3	0
1130006	LISBON ELEMENTARY SCHOOL	01	26	21	5	0	9	0	3	0
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	01	15	3	2	0	8	0	3	0
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	20	16	2	0	9	0	3	0
1130011	GLENWOOD OFFICE PARK	01	11	0	11	0	5	0	3	0
1130014	PETER PAN LEARNING CENTER	01	23	19	2	0	12	0	3	0
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	27	26	2	0	15	2	4	0

Table 4 . Total Water Quality Samples for the Howard County Small Systems

PWSID	PWS NAME	PLANT ID	Nitrate		SOCs		VOCs		IOCs (except nitrate)	
			No. of Samples	No. of samples > 50% MCL	No. of Samples	No. of samples > 50% MCL	No. of Samples	No. of samples > 50% MCL	No. of Samples	No. of samples > 50% MCL
1130017	TRANSCONTINENTAL GAS PIPELINE	01	27	1	4	0	10	0	5	0
1130023	MANOR WOODS ELEMENTARY SCHOOL	01	10	0	2	0	7	0	3	0
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	21	20	2	0	8	0	2	0
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	24	24	2	0	7	0	3	0
1130027	TRIADELPHIA RIDGE ELEMENTARY	01	11	1	6	0	9	0	7	0
1130031	TEN OAKS PLAZA	01	18	16	0	0	8	0	1	0
1130032	INWOOD VILLAGE CENTER	01	11	5	1	0	8	0	1	0
1130033	HIGH ROAD ACADEMY	01	3	0	1	0	5	0	2	0

Table 4 (continued). Total Water Quality Samples for the Howard County Small Systems

PWSID	PWS NAME	PLANT ID	CONTAMINANT NAME	MCL (PPM)	SAMPLE DATE	RESULT (PPM)
1130001	BUSHY PARK ELEMENTARY SCHOOL	01	NITRATE	10	17-Jan-96	8.69
1130001	BUSHY PARK ELEMENTARY SCHOOL	01	NITRATE	10	26-Aug-96	5.2
1130001	BUSHY PARK ELEMENTARY SCHOOL	01	NITRATE	10	24-Oct-96	5.04
1130001	BUSHY PARK ELEMENTARY SCHOOL	01	NITRATE	10	23-Jan-97	6.16
1130001	BUSHY PARK ELEMENTARY SCHOOL	01	NITRATE	10	26-Aug-97	5.32
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	7-Feb-94	5.03
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	31-Aug-94	5.42
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	14-Nov-94	6.02
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	18-Jan-95	6.85
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	1-May-95	5.88
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	13-Nov-95	6.48
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	17-Jan-96	5.91
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	3-Apr-96	5.6
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	29-Apr-96	5.5
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	26-Aug-96	5.6
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	24-Oct-96	6.97
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	23-Jan-97	8.13
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	26-Aug-97	6.51
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	20-Jan-98	6.2
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	21-Apr-98	9.07
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	25-Aug-98	6.84
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	19-Jan-99	6

Table 5a. Inorganic Compound (IOC) results above 50% of the MCL

PWSID	PWS NAME	PLANT ID	CONTAMINANT NAME	MCL (PPM)	SAMPLE DATE	RESULT (PPM)
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	23-Mar-99	6.2
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	14-Mar-00	8.5
1130005	GLENWOOD MIDDLE SCHOOL	01	NITRATE	10	8-Feb-01	9
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	26-Jan-93	6.2
1130006	**LISBON ELEMENTARY SCHOOL**	**01**	**NITRATE**	**10**	**22-Jun-93**	**10.6**
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	30-Sep-93	9.04
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	9-Nov-93	8.42
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	7-Feb-94	5.7
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	3-May-94	7.2
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	31-Aug-94	6.81
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	14-Nov-94	6.91
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	18-Jan-95	9.74
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	1-May-95	5.46
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	18-Sep-95	5.8
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	13-Nov-95	7.31
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	16-Jan-96	7.17
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	29-Apr-96	6.7
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	26-Aug-96	7.27
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	18-Sep-96	5.3
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	24-Oct-96	6.48
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	23-Jan-97	7.6
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	24-Jan-97	7.6

Table 5a (continued). Inorganic Compound (IOC) results above 50% of the MCL

PWSID	PWS NAME	PLANT ID	CONTAMINANT NAME	MCL (PPM)	SAMPLE DATE	RESULT (PPM)
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	26-Aug-97	5.98
1130006	LISBON ELEMENTARY SCHOOL	01	NITRATE	10	27-Sep-99	7.5
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	01	NITRATE	10	7-Feb-94	7.07
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	01	NITRATE	10	9-Jan-95	5.16
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	01	NITRATE	10	23-Jan-97	5
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	11-Feb-93	7.2
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	22-Jul-93	5.4
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	4-Nov-93	5.8
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	28-Apr-94	5.6
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	27-Oct-94	5.6
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	18-May-95	5.5
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	29-Feb-96	6.1
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	19-Aug-96	5.3
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	30-Oct-97	5
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	30-Oct-97	5
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	4-Feb-99	5.1
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	25-Mar-99	5
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	22-Nov-00	5.1
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	2-Jan-01	5.9
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	8-Mar-01	5.1
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	NITRATE	10	17-May-01	5.6
1130014	PETER PAN LEARNING CENTER	01	NICKEL	0.1	30-Mar-99	0.1

Table 5a (continued). Inorganic Compound (IOC) results above 50% of the MCL

PWSID	PWS NAME	PLANT ID	CONTAMINANT NAME	MCL (PPM)	SAMPLE DATE	RESULT (PPM)
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	9-Feb-93	8.7
1130014	**PETER PAN LEARNING CENTER**	**01**	**NITRATE**	**10**	**30-Sep-93**	**14.5**
1130014	**PETER PAN LEARNING CENTER**	**01**	**NITRATE**	**10**	**23-Nov-93**	**11.1**
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	25-Nov-93	8.88
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	28-Feb-94	9.8
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	8-Sep-94	6.84
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	21-Nov-94	7.8
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	9-Jan-95	8.49
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	22-May-95	5.74
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	18-Sep-95	7.67
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	4-Dec-95	7.95
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	7-Feb-96	7.32
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	24-Apr-96	7.7
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	21-Aug-96	5.78
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	24-Oct-96	7.85
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	26-Jan-98	6.86
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	30-Mar-99	6.9
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	14-Mar-00	5.5
1130014	PETER PAN LEARNING CENTER	01	NITRATE	10	12-Dec-00	5.3
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	10-Mar-93	6.3
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	6-Aug-93	8.6
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	14-Oct-93	8.49

Table 5a (continued). Inorganic Compound (IOC) results above 50% of the MCL

PWSID	PWS NAME	PLANT ID	CONTAMINANT NAME	MCL (PPM)	SAMPLE DATE	RESULT (PPM)
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	18-Mar-94	6.36
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	22-Jun-94	7.34
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	26-Jan-96	5.58
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	25-Jun-96	6.59
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	17-Jul-96	6.8
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	6-Aug-96	8.5
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	29-Oct-96	6.4
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	16-Jan-97	6.5
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	8-Apr-97	6.5
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	23-Sep-97	7.66
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	18-Nov-97	7.95
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	3-Feb-98	7.2
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	26-May-98	6.83
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	21-Jul-98	7.81
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	3-Nov-98	8.7
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	12-Jan-99	7.73
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	14-Dec-99	7.78
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	7-Mar-00	7.42
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	2-May-00	6.87
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	31-Oct-00	8.76
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	2-Nov-00	8.94
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	30-Mar-01	7.4

Table 5a (continued). Inorganic Compound (IOC) results 50% of the MCL

PWSID	PWS NAME	PLANT ID	CONTAMINANT NAME	MCL (PPM)	SAMPLE DATE	RESULT (PPM)
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	NITRATE	10	1-May-01	7.7
1130017	TRANSCONTINENTAL GAS PIPELINE	01	NITRATE	10	24-Mar-99	6.6
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	15-Dec-93	7.75
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	16-May-94	9.64
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	8-Feb-95	9.1
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	22-May-95	7.67
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	22-Nov-95	8.37
1130024	**CENTRAL MD RESEARCH & EDUCATION CENTER**	**01**	**NITRATE**	**10**	**26-Jan-96**	**10**
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	8-Apr-96	6.7
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	24-Jul-96	9.8
1130024	**CENTRAL MD RESEARCH & EDUCATION CENTER**	**01**	**NITRATE**	**10**	**4-Feb-97**	**11.7**
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	12-Feb-97	8.72
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	7-Apr-97	8.25
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	3-Sep-97	7.13
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	1-Oct-97	5.21
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	1-Oct-97	5.21
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	2-Mar-98	6.65
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	27-Apr-98	6.42
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	17-Aug-98	7.57
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	9-Nov-98	6.4
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	19-Aug-99	5.9
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	NITRATE	10	18-Jul-00	5.44

Table 5a (continued). Inorganic Compound (IOC) results above 50% of the MCL

PWSID	PWS NAME	PLANT ID	CONTAMINANT NAME	MCL (PPM)	SAMPLE DATE	RESULT (PPM)
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	27-Mar-96	6.5
1130025	**MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY**	**01**	**NITRATE**	**10**	**3-Sep-96**	**12.8**
1130025	**MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY**	**01**	**NITRATE**	**10**	**3-Sep-96**	**12.8**
1130025	**MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY**	**01**	**NITRATE**	**10**	**16-Sep-96**	**11.8**
1130025	**MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY**	**01**	**NITRATE**	**10**	**17-Sep-96**	**12**
1130025	**MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY**	**01**	**NITRATE**	**10**	**9-Dec-96**	**13**
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	24-Jul-97	8.12
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	12-Nov-97	7.87
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	26-Feb-98	7.7
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	15-May-98	7.82
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	15-May-98	7.82
1130025	MT. AIRY BIBLECHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	26-Aug-98	9.72
1130025	MT. AIRY BIBLECHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	3-Nov-98	7.32
1130025	MT. AIRY BIBLECHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	25-Mar-99	7.7
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	29-Apr-99	7.06
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	28-Jul-99	9.65
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	8-Oct-99	9.19
1130025	**MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY**	**01**	**NITRATE**	**10**	**2-Feb-00**	**10.2**
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	7-Apr-00	7.47
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	21-Aug-00	8.99
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	12-Oct-00	7.94
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	26-Jan-01	8.32

Table 5a (continued). Inorganic Compound (IOC) results above 50% of the MCL

PWSID	PWS NAME	PLANT ID	CONTAMINANT NAME	MCL (PPM)	SAMPLE DATE	RESULT (PPM)
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRATE	10	2-May-01	8.87
1130025	**MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY**	**01**	**NITRATE**	**10**	**9-Jul-01**	**10.9**
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	NITRITE	1	26-Jan-99	8.85
1130027	TRIADELPHIA RIDGE ELEMENTARY	01	NITRATE	10	27-Oct-99	6.8
1130031	TEN OAKS PLAZA	01	NITRATE	10	6-Feb-96	7.8
1130031	TEN OAKS PLAZA	01	NITRATE	10	3-Mar-97	7.9
1130031	TEN OAKS PLAZA	01	NITRATE	10	16-Dec-98	7.6
1130031	TEN OAKS PLAZA	01	NITRATE	10	17-Feb-99	6.7
1130031	TEN OAKS PLAZA	01	NITRATE	10	18-Mar-99	7.6
1130031	TEN OAKS PLAZA	01	NITRATE	10	24-Mar-99	8.2
1130031	TEN OAKS PLAZA	01	NITRATE	10	21-Apr-99	6.9
1130031	**TEN OAKS PLAZA**	**01**	**NITRATE**	**10**	**12-Aug-99**	**25**
1130031	**TEN OAKS PLAZA**	**01**	**NITRATE**	**10**	**13-Sep-99**	**10.5**
1130031	TEN OAKS PLAZA	01	NITRATE	10	16-Nov-99	8.8
1130031	TEN OAKS PLAZA	01	NITRATE	10	21-Jan-00	8.9
1130031	**TEN OAKS PLAZA**	**01**	**NITRATE**	**10**	**10-Nov-00**	**16.3**
1130031	TEN OAKS PLAZA	01	NITRATE	10	14-Dec-00	9.4
1130031	TEN OAKS PLAZA	01	NITRATE	10	27-Mar-01	8.5
1130031	**TEN OAKS PLAZA**	**01**	**NITRATE**	**10**	**29-Jun-01**	**13**
1130031	**TEN OAKS PLAZA**	**01**	**NITRATE**	**10**	**20-Jul-01**	**10**
1130032	INWOOD VILLAGE CENTER	01	NITRATE	10	16-Nov-99	8.9

Table 5a (continued). Inorganic Compound (IOC) results above 50% of the MCL

PWSID	PWS NAME	PLANT ID	CONTAMINANT NAME	MCL (PPM)	SAMPLE DATE	RESULT (PPM)
1130032	INWOOD VILLAGE CENTER	01	NITRATE	10	16-Nov-99	8.8
1130032	INWOOD VILLAGE CENTER	01	NITRATE	10	28-Jul-00	5.2
1130032	INWOOD VILLAGE CENTER	01	NITRATE	10	13-Oct-00	7.4
1130032	INWOOD VILLAGE CENTER	01	NITRATE	10	29-Jun-01	6

Table 5a (continued). Inorganic Compound (IOC) results above 50% of the MCL

PWSID	PWS NAME	PLANT ID	CONTAMINANT NAME	Proposed MCL (pCi/L)	SAMPLE DATE	RESULT (pCi/L)
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	01	RADON-222	300/4000	24-Apr-97	575
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	01	RADON-222	300/4000	18-Feb-97	3385
1130027	**TRIADELPHIA RIDGE ELEMENTARY**	**01**	**RADON-222**	**300/4000**	**11-Nov-96**	**4597**
1130027	TRIADELPHIA RIDGE ELEMENTARY	01	RADON-222	300/4000	11-Nov-96	3331
1130033	**HIGH ROAD ACADEMY**	**01**	**RADON-222**	**300/4000**	**22-Mar-01**	**5875**

Table 5b (continued). Radionuclide results above 50% of the proposed MCL.

PWSID	PWS NAME	PLANT ID	CONTAMINANT NAME	MCL (ppb)	SAMPLE DATE	RESULT (ppb)
1130015	WEST FRIENSHIP SHOPPING CENTER	01	TETRACHLOROETHYLENE	5	31-Oct-00	9.7
1130015	WEST FRIENSHIP SHOPPING CENTER	01	TETRACHLOROETHYLENE	5	21-Nov-00	12.8

Table 5c. Volatile Organic Compound (VOC) results aboave 50% of the MCL

PWSID	PWS NAME	PLANT ID	CONTAMINANT NAME	Proposed MCL (pCi/L)	SAMPLE DATE	RESULT (pCi/L)
1130001	BUSHY PARK ELEMENTARY SCHOOL	01	RADON-222	300/4000	28-Apr-97	3500
1130003	**GLENELG COUNTRY SCHOOL**	**01**	**RADON-222**	**300/4000**	**25-Jun-96**	**14300**
1130003	**GLENELG COUNTRY SCHOOL**	**01**	**RADON-222**	**300/4000**	**14-Apr-97**	**13550**
1130003	**GLENELG COUNTRY SCHOOL**	**01**	**RADON-222**	**300/4000**	**12-Jun-97**	**5110**
1130003	**GLENELG COUNTRY SCHOOL**	**02**	**RADON-222**	**300/4000**	**14-Apr-97**	**11200**
1130003	**GLENELG COUNTRY SCHOOL**	**02**	**RADON-222**	**300/4000**	**12-Jun-97**	**6060**
1130003	**GLENELG COUNTRY SCHOOL**	**03**	**RADON-222**	**300/4000**	**11-Jan-01**	**6500**
1130004	GLENELG HIGH SCHOOL	01	RADON-222	300/4000	14-Apr-97	1865
1130005	GLENWOOD MIDDLE SCHOOL	01	RADON-222	300/4000	28-Apr-97	2625
1130006	LISBON ELEMENTARY SCHOOL	01	RADON-222	300/4000	18-Sep-96	1125
1130006	LISBON ELEMENTARY SCHOOL	01	RADON-222	300/4000	7-May-97	1240
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	01	RADON-222	300/4000	18-Sep-96	2985
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	01	RADON-222	300/4000	4-Mar-97	2280
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	RADON-222	300/4000	19-Aug-96	2215
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	01	RADON-222	300/4000	7-May-97	2995
1130011	GLENWOOD OFFICE PARK	01	RADON-222	300/4000	28-Apr-97	3450
1130011	GLENWOOD OFFICE PARK	01	RADON-222	300/4000	19-Jun-97	3370
1130014	**PETER PAN LEARNING CENTER**	**01**	**RADON-222**	**300/4000**	**18-Mar-97**	**20200**
1130015	WEST FRIENDSHIP SHOPPING CENTER	01	RADON-222	300/4000	4-Mar-97	3330
1130017	TRANSCONTINENTAL GAS PIPELINE	01	RADON-222	300/4000	8-Apr-96	815
1130017	TRANSCONTINENTAL GAS PIPELINE	01	RADON-222	300/4000	24-Apr-97	315
1130023	MANOR WOODS ELEMENTARY SCHOOL	01	RADON-222	300/4000	7-May-97	370

Table 5b. Radionuclide results above 50% of the proposed MCL.

PWSID	PWS NAME	No. of samples	No. of positive samples	Disinfection Treatment?	Bottled Water?
1130001	BUSHY PARK ELEMENTARY SCHOOL	21	0	N	N
1130003	GLENELG COUNTRY SCHOOL	23	0	N	N
1130004	GLENELG HIGH SCHOOL	52	0	N	N
1130005	GLENWOOD MIDDLE SCHOOL	23	0	N	N
1130006	LISBON ELEMENTARY SCHOOL	21	2	Y	N
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	20	0	N	N
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	21	2	N	Y
1130011	GLENWOOD OFFICE PARK	20	0	N	N
1130014	PETER PAN LEARNING CENTER	20	2	N	N
1130015	WEST FRIENDSHIP SHOPPING CENTER	21	1	Y	N
1130017	TRANSCONTINENTAL GAS PIPELINE	20	0	N	N
1130023	MANOR WOODS ELEMENTARY SCHOOL	19	0	Y	N
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	28	0	Y	N
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	22	4	Y	N
1130027	TRIADELPHIA RIDGE ELEMENTARY	11	0	Y	N
1130031	TEN OAKS PLAZA	10	1	N	N
1130032	INWOOD VILLAGE CENTER	10	0	N	N
1130033	HIGH ROAD ACADEMY	6	0	N	Y

Table 6. Routine Bacteriological Samples from distribution for each system since 1996.

LAND USE CATEGORIES	AREA (in acres)	PERCENTAGE OF TOTAL AREA
Low Density Residential	323.64	20.51
Medium Density Residential	14.22	0.90
Commercial/Institutional	244.20	15.58
Industrial	18.69	1.18
Open Urban Land	37.27	2.36
Cropland	564.87	35.79
Pasture	42.23	2.68
Orchard	20.97	1.33
Forest	312.57	19.8

Table 7. Summary of Land Use within all the WHPAs for the Howard County Small Systems

SEWER SERVICE AREA	AREA (in acres	PERCENTAGE OF TOTAL AREA
No Planned Service Area	1350.64	85.56
Existing Service Area	37.05	2.35
Service within 0 to 5 years	38.59	2.44
Comprehensive Priority Area (beyond 10 years)	152.38	9.65

Table 8. Summary of Sewer Service Areas within all the WHPAs for the Howard County Small Systems

PWSID	PWS NAME	Are Contaminant Sources present in the 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?
1130001	BUSHY PARK ELEMENTARY SCHOOL	YES	YES	NO	YES	YES
1130003	·GLENELG COUNTRY SCHOOL	YES	NO	NO	YES	NO
1130004	GLENELG HIGH SCHOOL	YES	NO	NO	YES	NO
1130005	GLENWOOD MIDDLE SCHOOL	YES	YES	NO	YES	YES
1130006	LISBON ELEMENTARY SCHOOL	YES	YES	NO	YES	YES
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	YES	YES	NO	YES	YES
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	YES	YES	NO	YES	YES
1130011	GLENWOOD OFFICE PARK	YES	NO	NO	YES	NO
1130014	PETER PAN LEARNING CENTER	YES	YES	NO	YES	YES
1130015	WEST FRIENDSHIP SHOPPING CENTER	YES	YES	NO	YES	YES
1130017	TRANSCONTINENTAL GAS PIPELINE	YES	YES	NO	YES	YES
1130023	MANOR WOODS ELEMENTARY SCHOOL	YES	NO	NO	YES	NO
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	YES	YES	NO	YES	YES
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	YES	YES	NO	YES	YES

Table 9a. Susceptibility Chart for Nitrate.

PWSID	PWS NAME	Are Contaminant Sources present in the 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?
1130027	TRIADELPHIA RIDGE ELEMENTARY	YES	YES	NO	YES	YES
1130031	TEN OAKS PLAZA	YES	YES	NO	YES	YES
1130032	INWOOD VILLAGE CENTER	YES	YES	NO	YES	YES
1130033	HIGH ROAD ACADEMY	YES	NO	NO	YES	NO

Table 9a (continued). Susceptibility Chart for Nitrate.

PWSID	PWS NAME	Are Contaminant Sources present in the 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
1130001	BUSHY PARK ELEMENTARY SCHOOL	YES (naturally occurring)	YES	NO	YES	YES
1130003	GLENELG COUNTRY SCHOOL	YES (naturally occurring)	YES	NO	YES	YES
1130004	GLENELG HIGH SCHOOL	YES (naturally occurring)	MAYBE	NO	YES	MAYBE
1130005	GLENWOOD MIDDLE SCHOOL	YES (naturally occurring)	YES	NO	YES	YES
1130006	LISBON ELEMENTARY SCHOOL	YES (naturally occurring)	MAYBE	NO	YES	MAYBE
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	YES (naturally occurring)	YES	NO	YES	YES
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	YES (naturally occurring)	YES	NO	YES	YES
1130011	GLENWOOD OFFICE PARK	YES (naturally occurring)	YES	NO	YES	YES
1130014	PETER PAN LEARNING CENTER	YES (naturally occurring)	YES	NO	YES	YES
1130015	WEST FRIENDSHIP SHOPPING CENTER	YES (naturally occurring)	YES	NO	YES	YES
1130017	TRANSCONTINENTAL GAS PIPELINE	YES (naturally occurring)	MAYBE	NO	YES	MAYBE
1130023	MANOR WOODS ELEMENTARY SCHOOL	YES (naturally occurring)	MAYBE	NO	YES	MAYBE
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	YES (naturally occurring)	MAYBE	NO	YES	MAYBE
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	YES (naturally occurring)	YES	NO	YES	YES

Table 9b. Susceptibility Chart for Radiological Compounds

PWSID	PWS NAME	Are Contaminant Sources present in the 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
1130027	TRIADELPHIA RIDGE ELEMENTARY	YES (naturally occurring)	MAYBE	NO	YES	YES
1130031	TEN OAKS PLAZA	YES (naturally occurring)	NO DATA	NO	YES	CANNOT BE DETERMINED
1130032	INWOOD VILLAGE CENTER	YES (naturally occurring)	NO DATA	NO	YES	CANNOT BE DETERMINED
1130033	HIGH ROAD ACADEMY	YES (naturally occurring)	YES	NO	YES	YES

Table 9b (continued). Susceptibility Chart for Radiological Compounds

PWSID	PWS NAME	Are Contaminant Sources present in the 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?
1130001	BUSHY PARK ELEMENTARY SCHOOL	YES	NO	NO	YES	YES
1130003	GLENELG COUNTRY SCHOOL	NO	NO	NO	YES	NO
1130004	GLENELG HIGH SCHOOL	YES	NO	NO	YES	YES
1130005	GLENWOOD MIDDLE SCHOOL	YES	NO	NO	YES	YES
1130006	LISBON ELEMENTARY SCHOOL	YES	NO	NO	YES	YES
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	YES	NO	NO	YES	NO
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	YES	NO	NO	YES	YES
1130011	GLENWOOD OFFICE PARK	NO	NO	NO	YES	NO
1130014	PETER PAN LEARNING CENTER	NO	YES	NO	YES	YES
1130015	WEST FRIENDSHIP SHOPPING CENTER	YES	YES	NO	YES	YES
1130017	TRANSCONTINENTAL GAS PIPELINE	YES	NO	NO	YES	NO
1130023	MANOR WOODS ELEMENTARY SCHOOL	NO	NO	NO	YES	NO
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	NO	NO	NO	YES	NO
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	YES	NO	NO	YES	YES

Table 9c. Susceptibility Chart for Volatile Organic Compounds

PWSID	PWS NAME	Are Contaminant Sources present in the 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?
1130027	TRIADELPHIA RIDGE ELEMENTARY	NO	NO	NO	YES	NO
1130031	TEN OAKS PLAZA	YES	YES	NO	YES	YES
1130032	INWOOD VILLAGE CENTER	YES	NO	NO	YES	NO
1130033	HIGH ROAD ACADEMY	NO	NO	NO	YES	NO

Table 9c (continued). Susceptibility Chart for Volatile Organic Compounds

PWSID	PWS NAME	Are Contaminant Sources present in the 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?
1130001	BUSHY PARK ELEMENTARY SCHOOL	NO	NO	NO	YES	NO
1130003	GLENELG COUNTRY SCHOOL	NO	NO	NO	YES	NO
1130004	GLENELG HIGH SCHOOL	NO	NO	NO	YES	NO
1130005	GLENWOOD MIDDLE SCHOOL	NO	NO	NO	YES	NO
1130006	LISBON ELEMENTARY SCHOOL	NO	NO	NO	YES	NO
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	NO	NO	NO	YES	NO
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	NO	NO	NO	YES	NO
1130011	GLENWOOD OFFICE PARK	YES	YES	NO	YES	YES
1130014	PETER PAN LEARNING CENTER	NO	NO	NO	YES	NO
1130015	WEST FRIENDSHIP SHOPPING CENTER	YES	NO	NO	YES	NO
1130017	TRANSCONTINENTAL GAS PIPELINE	NO	NO	NO	YES	NO
1130023	MANOR WOODS ELEMENTARY SCHOOL	NO	NO	NO	YES	NO
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	YES	NO	NO	YES	NO
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	NO	NO	NO	YES	NO

Table 9d. Susceptibility Chart for Synthetic Organic Compounds

PWSID	PWS NAME	Are Contaminant Sources present in the 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?
1130027	TRIADELPHIA RIDGE ELEMENTARY	NO	NO	NO	YES	NO
1130031	TEN OAKS PLAZA	NO	NO	NO	YES	NO
1130032	INWOOD VILLAGE CENTER	NO	NO	NO	YES	NO
1130033	HIGH ROAD ACADEMY	NO	NO	NO	YES	NO

Table 9d (continued). Susceptibility Chart for Synthetic Organic Compounds

PWSID	PWS NAME	Are Contaminant Sources present in the WHPA ?	Are Contaminants detected in raw water?	Is Well Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible to Microbiological Contaminants?
1130001	BUSHY PARK ELEMENTARY SCHOOL	YES	NO	NO	YES	NO
1130003	GLENELG COUNTRY SCHOOL	YES	NO	NO	YES	NO
1130004	GLENELG HIGH SCHOOL	YES	NO	NO	YES	NO
1130005	GLENWOOD MIDDLE SCHOOL	YES	NO	NO	YES	NO
1130006	LISBON ELEMENTARY SCHOOL	YES	NO	NO	YES	YES
1130008	WEST FRIENDSHIP ELEMENTARY SCHOOL	YES	NO	NO	YES	NO
1130010	LISBON CHILDRENS CHRISTIAN CARE CENTER	YES	NO DATA	NO	YES	CANNOT BE DETERMINED
1130011	GLENWOOD OFFICE PARK	YES	NO DATA	NO	YES	CANNOT BE DETERMINED
1130014	PETER PAN LEARNING CENTER	YES	NO	NO	YES	NO
1130015	WEST FRIENDSHIP SHOPPING CENTER	YES	NO	NO	YES	NO
1130017	TRANSCONTINENTAL GAS PIPELINE	YES	NO DATA	NO	YES	CANNOT BE DETERMINED
1130023	MANOR WOODS ELEMENTARY SCHOOL	YES	NO	NO	YES	NO
1130024	CENTRAL MD RESEARCH & EDUCATION CENTER	YES	NO DATA	NO	YES	CANNOT BE DETERMINED
1130025	MT. AIRY BIBLE CHURCH & CHRISTIAN ACADEMY	YES	NO	NO	YES	NO

Table 9e. Susceptibility Chart for Microbiological Contaminants

PWSID	PWS NAME	Are Contaminant Sources present in the WHPA ?	Are Contaminants detected in raw water? (no disinfection)	Is Well Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible to Microbiological Contaminants?
1130027	TRIADELPHIA RIDGE ELEMENTARY	YES	NO	NO	YES	NO
1130031	TEN OAKS PLAZA	YES	NO DATA	NO	YES	CANNOT BE DETERMINED
1130032	INWOOD VILLAGE CENTER	YES	NO DATA	NO	YES	CANNOT BE DETERMINED
1130033	HIGH ROAD ACADEMY	YES	NO	NO	YES	NO

Table 9e (continued). Susceptibility Chart for Microbiological Contaminants

FIGURES

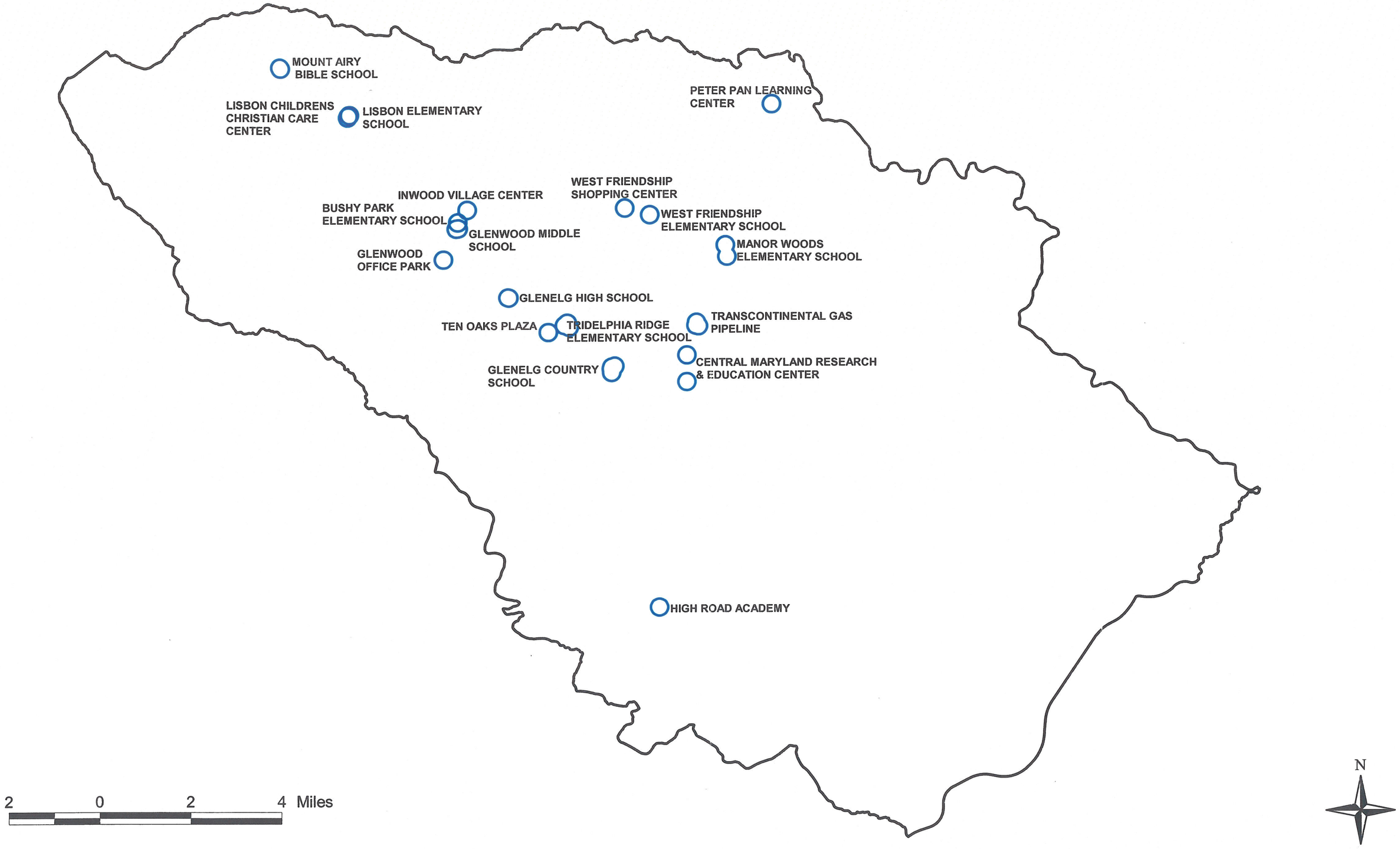

Figure 1. Wellhead Protection Areas for Small Water Systems in Howard County

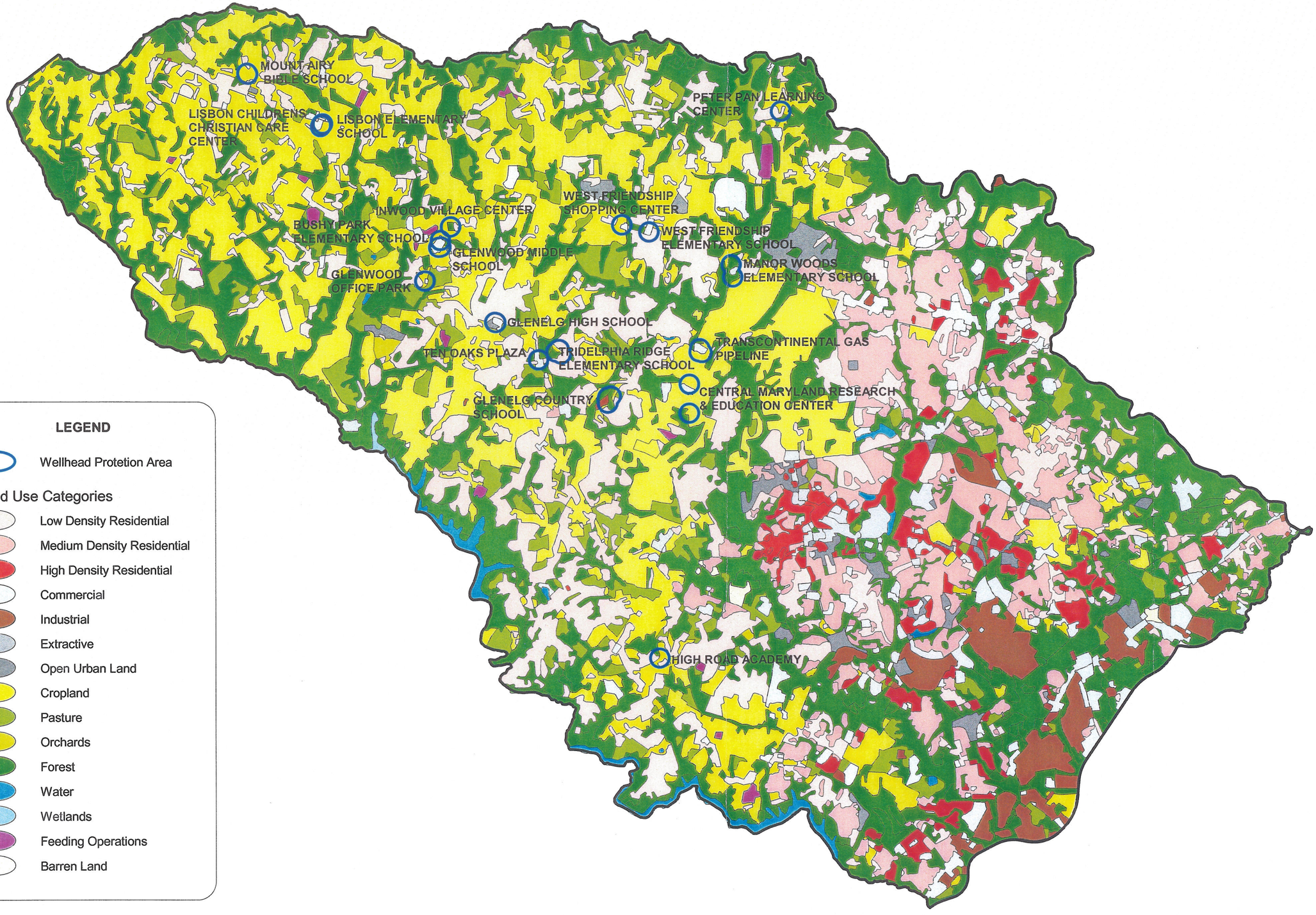

Figure 3. Land Use Map of Howard County

Source: Maryland Office of Planning 1997 Howard County Land Use Map

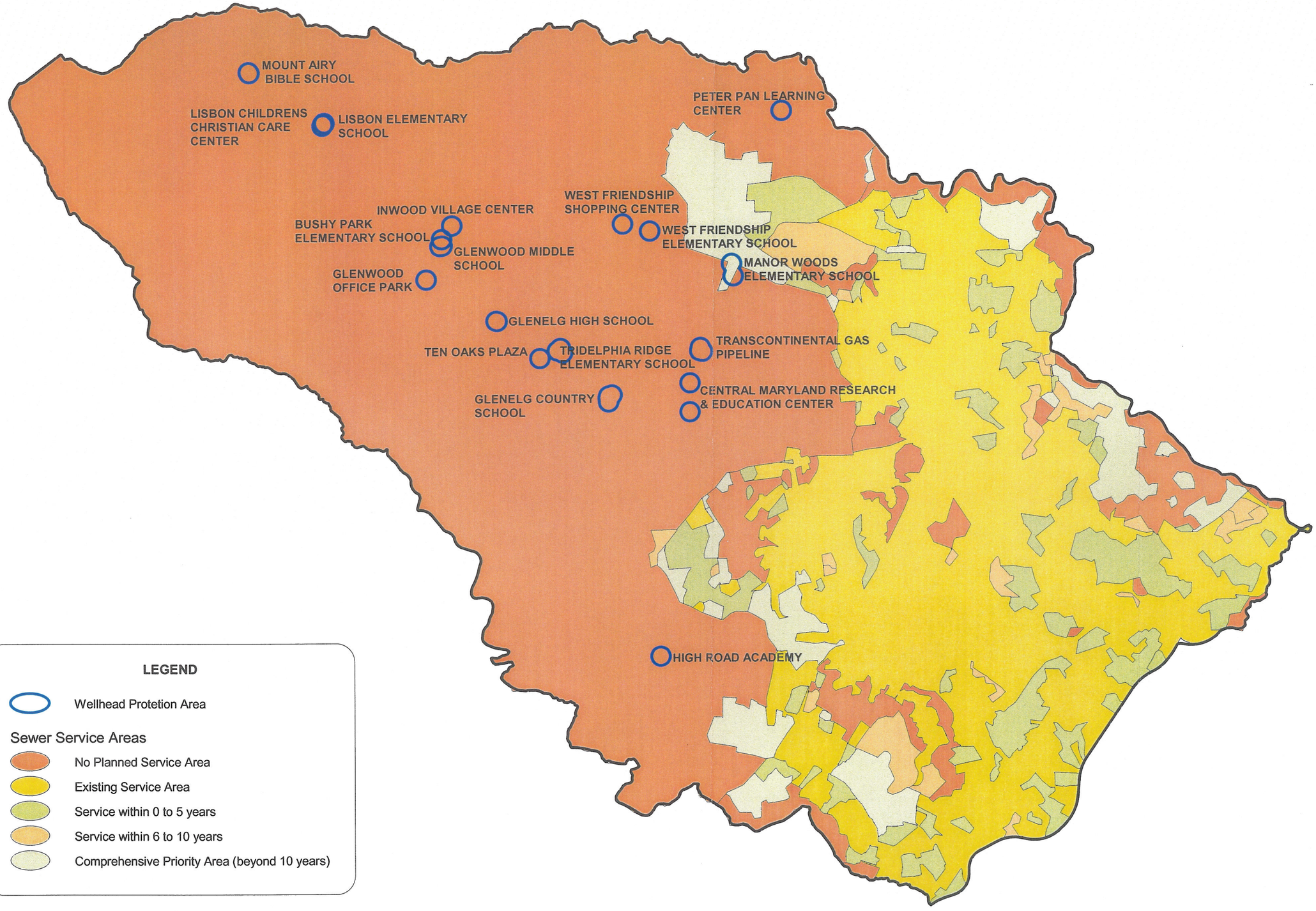

Figure 4. Sewer Service Map of Howard County

Source : Howard County 1994 Sewer Map