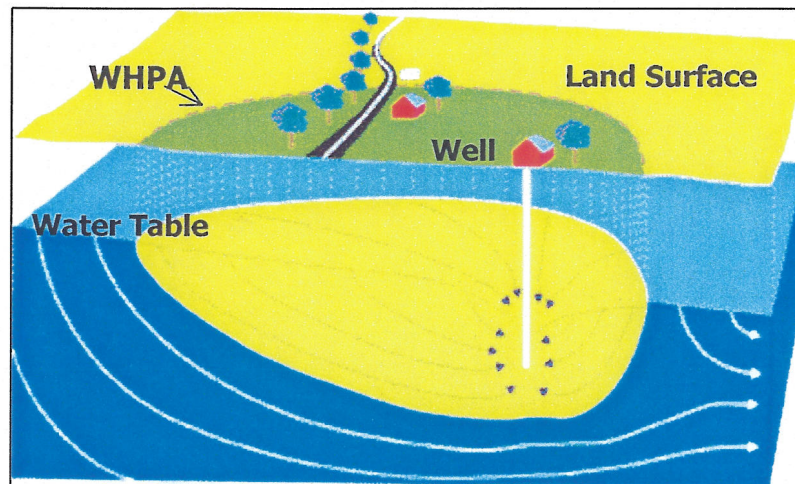


SOURCE WATER ASSESSMENT
For
CITY OF BRUNSWICK YOURTEE SPRINGS
Frederick County, MD



Prepared By
Water Management Administration
Water Supply Program
June, 2005



Robert L. Ehrlich
Governor

Michael S. Steele
Lt. Governor

Kendl P. Philbrick
Secretary

Jonas A. Jacobson
Deputy Secretary

TABLE OF CONTENTS

	Page
Summary	2
Introduction.....	3
Source Information	3
Hydrogeology.....	3
Source Water Assessment Area Delineation	4
Potential Sources of Contamination.....	4
Table 1. Land Use Summary for the SPA	
Water Quality Data	5
Table 2. Summary of Water Quality Samples for City of Brunswick's Yourtee Springs Water Supply	
Susceptibility Analysis.....	6
Table 3. Susceptibility Chart for City of Brunswick's Yourtee Springs (Upper or Large Spring) Water Supply	
Management of the Source Protection Area	9
References.....	10
Other Sources of Data.....	11
Figures	12
Figure 1. Location Map of City of Brunswick Yourtee Springs	
Figure 2. City of Brunswick Yourtee Springs Source Protection Area with Potential Contaminant Sources	
Figure 3. Land Uses of the Yourtee Springs Area	
Figure 4. Photos of Yourtee Springs	

SUMMARY

The Maryland Department of the Environment's Water Supply Program (WSP) has conducted a Source Water Assessment for the City of Brunswick's Yourtee Springs. The required components of this report as described in Maryland's Source Water Assessment Plan (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 source of City of Brunswick's Yourtee Springs water supply is an unconfined fractured rock aquifer, known as the Harpers Formation. The Water Supply Program using U.S. EPA approved methods specifically designed for each source delineated the Source Water Assessment Area.

Potential sources of contamination within the assessment area were identified based on site visits, database reviews and land use maps. Well information and water quality data were also reviewed. Figures showing land uses and potential contaminant sources within the Source Water Assessment Area and an aerial photograph of the well locations are enclosed at the end of the report.

The susceptibility analysis for City of Brunswick's Yourtee Springs water supply is based on a review of the water quality data, potential sources of contamination, aquifer characteristics, and spring integrity. It was determined that the City of Brunswick's Yourtee Springs water supply is not susceptible to contamination by inorganic compounds, volatile organic compounds, synthetic organic compounds, radionuclides, or microbiological contaminants. The recharge area above the springs is nearly 100% forested and is the primary reason for the excellent water quality from the spring. Continued preservation of this forested land is critical for maintaining the excellent water quality from this source.

INTRODUCTION

The City of Brunswick is located in Frederick County, along the Potomac River. The City water supply system serves a population of approximately 6400 people with about 2100 connections and obtains its water supply from two sources: the Potomac River (surface water) and Yourtee Springs (ground water). This report only addresses the water obtained from the Yourtee Springs. Yourtee Springs are located in Washington County on the west side of South Mountain, east of Route 67 approximately nine miles south of the Town of Boonsboro (Washington County) and approximately four miles northwest of the City of Brunswick (Frederick County) (Figure 1). A separate assessment has already been completed for the surface water supply.

SOURCE INFORMATION

Source information was obtained from the Water Supply Program's database, site visits, sanitary survey inspection reports, and published reports. Yourtee Springs is comprised of two springs, located approximately 100 feet apart. Prior to 2000 both springs fed into a single collecting chamber that flows by gravity to the City of Brunswick, with connections along the line between the springs and the City to a school and approximately a dozen residential homes. Since approximately March 2000 only one of the two springs (the upper spring) has been used by the City. These springs were first inventoried by Slaughter in 1958 (Slaughter, 1962, Table 3).

The City of Brunswick has a Water Appropriation Permit for water use from the springs that allows it to use an average of 350,000 gallons per day (gpd) and 500,000 gpd in the month of maximum use. Based on the reported pumpage the annual average water use for the past five years has been approximately 167,000 gpd and the maximum monthly use during this period was approximately 200,000 gpd.

HYDROGEOLOGY

Yourtee Springs lie in the Blue Ridge physiographic province. This province is underlain by highly metamorphosed granitic gneiss and metabasalt, and metamorphosed shale and sandstone. The principal feature in this area is the South Mountain anticline. The segment of the Blue Ridge province lying within Washington County is known as the South Mountain-Elk Ridge province. In this province, springs are commonly of the contact type, fracture type, or a combination of both types. The ground water may collect in and move through several different formations before emerging as a spring. Contact springs occur where the permeable weathered zone, composed of soil, boulders and decomposed rock, overlies relatively impermeable fresh rock. The weathered zone, where permeable, constitutes a major zone of ground water storage. Fracture springs issue openings associated with joints, bedding planes, faults, and openings resulting from slaty cleavage and schistosity. Yourtee Spring is a contact-fracture spring located at the base of South Mountain near the contact of the Catoclin Metabasalt and Harpers

Formation. The Weverton quartzite at the top of South Mountain is probably the principal intake area for the ground water that discharges from Yourtee Springs. The ground water moves downward through the Harpers formation and discharges into a stone-walled collection basin. (Slaughter, 1962).

SOURCE WATER ASSESSMENT AREA DELINEATION

For ground water systems, Source Protection Area (SPA) is considered to be the source water assessment area for the system. The SPA for the City of Brunswick Yourtee Springs' water supply was delineated by the WSP. Hydrogeologic mapping was the method used for the delineation. This is the methodology recommended for fractured rock aquifers in the EPA approved Maryland's Source Water Assessment Plan (1999) for systems using an average of greater than 10,000 gpd from fractured rock aquifers.

The delineated SPA represents the recharge area for Yourtee Springs (Figure 2). The SPA is the watershed drainage area that contributes to the springs. The boundary of the SPA is based on the ground water flow direction and ground water divides inferred from topography, ground water discharge areas hydrogeologic boundaries and permitted withdrawal rates. The total area of the Yourtee Springs SPA is about 194 acres.

POTENTIAL SOURCES OF CONTAMINATION

For this assessment, MDE Waste and Water Management databases and Washington County's database were reviewed, and staff consulted, to identify potential sources of contamination in and around the SPA. WSP staff conducted a field survey of the SPA in April 2005.

Onsite septic systems were the only potential contaminant sources identified in and around the SPA (Figure 2).

The Maryland Department of Planning's (MDP) 2002 digital land use map for Washington County and Frederick County were used to determine the predominant types of land use in the SPA (Figure 3). According to MDP data the entire SPA is made of forested land. While MDP's land use map shows the entire area to be forested, the aerial photo (Figure 1) shows a few residential dwellings within the SPA.

Residential areas may be a source of nitrates and SOC's if fertilizers and pesticides are not used carefully for lawns and gardens. A review of the MDP's 2002 Washington County Sewer Map indicates that the entire SPA has no planned sewer service. Onsite septic systems may be potential sources of nitrates and microbiological contaminants to the springs.

WATER QUALITY DATA

Water Quality data was reviewed from the Water Supply Program's database and system files for Safe Drinking Water Act contaminants. The State's SWAP defines a threshold for reporting water quality data as 50% of the Maximum Contaminant Level (MCL). If a monitoring result is at or greater than 50% of a MCL, this assessment will describe the sources of such a contaminant and, if possible, locate the specific sources which are the cause of the elevated contaminant level. All data reported is from the finished (treated) water unless otherwise noted. The treatment that the City of Brunswick currently uses at Yourtee Springs is gaseous chlorination (post) for disinfection.

A review of the monitoring data since 1990 for Brunswick's Yourtee Springs water supply indicates that it meets the current drinking water standards. The water quality sampling results are summarized in Table 4. It must be noted that the radionuclide numbers used in this table include detections of radon-222 using proposed lower MCL of 300 picoCuries/Liter (pCi/L).

	Nitrate		SOCs		VOCs		IOCs (except nitrate)		Radionuclides	
PLANT NO	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL	No. of Samples Collected	No. of samples > 50% MCL
02	13	0	1	0	16	0	7	0	2	0

Table 2. Summary of Water Quality Samples for City of Brunswick's Yourtee Springs Water Supply.

Inorganic Compounds (IOCs)

No IOCs above 50% of the MCL have been detected in Brunswick's Yourtee Springs water supply. Nitrates have been detected at levels below the MCL. Detected levels range from 0.002 to 0.9 parts per million (ppm). Natural background levels are below 0.4 ppm. (Hamilton & others, 1993). The MCL for nitrate is 10 ppm. Other IOCs detected in the water supply include nitrite, sulfate, sodium, and fluoride. Nitrite and sulfate were detected in May 1995 at 0.2 ppm and 5.1 ppm, respectively. The MCL for nitrite is 1 ppm. There is no MCL for sulfate. Fluoride was detected in May 2003 at 0.1 ppm. The MCL for fluoride is 4 ppm. And, sodium has been detected in August 1998, May 2003, and August 2003 at 2.3 ppm, 0.8 ppm, and 1.94 ppm. There is no MCL for sodium. The levels detected of all inorganic contaminants represent natural background conditions.

Volatile Organic Compounds (VOCs)

No VOCs above 50% of the MCL have been detected in Brunswick's Yourtee Springs water supply. There are three VOCs that have been detected since 1990. Bromodichloromethane and chloroform were detected in December 1990 (6 parts per billion (ppb) and 14 ppb), in August 1996 (0.8 ppb and 5.3 ppb), and in April 1998 (0.9 ppb and 1.1 ppb). Chloroform was detected in May 1997 (0.7 ppb).

These compounds are formed as a result of chlorine reacting with natural organic compounds in the water during disinfection and are known as trihalomethanes. The maximum contaminate level for total trihalomethanes is 80 ppb.

Synthetic Organic Compounds (SOCs)

No SOC's above 50% of the MCL have been detected in Brunswick's Yourtee Springs water supply. Dalapon was detected in May 1995 at 0.52 ppb. The MCL for dalapon is 200 ppb. Also detected in May 1995, di (2-ethylhexyl) phthalate (also known as DEHP) at 0.87 ppb. DEHP was detected in the laboratory blank analyzed concurrently with this sample, and therefore the reported levels are not believed actually present in the water supply. Subsequent samples had not detectable levels of SOC's.

Radionuclides

No radionuclides above 50% of the MCL have been detected in Brunswick's Yourtee Springs water supply. Gross beta was detected in December 1999 at 3 picoCuries/Liter (pCi/L). The MCL for gross beta is 50 pCi/L.

Microbiological Contaminants

Raw water samples were collected and tested for bacteria from the upper spring and the lower spring. As a result of these samples, improvements to the cover over the upper spring were performed to protect the spring from small mammals, birds and other critters (See Photos Figure 4). The lower spring was to be taken off-line due to the lack of integrity in the structure and positive fecal coliform organisms. In addition, the overflow water level in the upper spring was raised to reduce the entrance velocity and enhance the filtration of the aquifer under the spring. These improvements resulted in improved water quality in the upper spring.

SUSCEPTIBILITY ANALYSIS

Brunswick's Yourtee Springs obtain water from an unconfined fractured-rock aquifer. Unconfined aquifers are generally vulnerable to any activity on the land surface that occurs within the SPA. Therefore, managing this area to minimize the risk to the supply and continued routine monitoring of contaminants is essential in assuring a safe drinking water supply. The susceptibility of the spring to contamination was determined for each group of contaminants based on the following criteria: (1) available water quality data, (2) presence of potential contaminant sources in the SPA, (3) aquifer characteristics, (4) spring integrity, and (5) the likelihood of changes to the natural conditions.

The susceptibility of the water supply to the various types of contaminants is summarized in Table 6.

Inorganic Compounds (IOCs)

No IOCs above 50% of an MCL have been detected in Brunswick's Yourtee Springs water supply. Nitrates have been detected from 0.002 to 0.9 parts per million (ppm). The MCL for nitrate is 10 ppm. These levels indicate that a relatively small source of nitrate is present in the SPA, which is consistent with the land use (see page 4). Other IOCs detected in the water supply include nitrite, sulfate, sodium, and fluoride. Sulfate, fluoride, and sodium can occur naturally in water.

Based on the above analysis, Brunswick's Yourtee Springs water supply is **not** susceptible to nitrate or other inorganic compounds.

Volatile Organic Compounds (VOCs)

No VOCs have been detected in Brunswick's Yourtee Springs water supply above the 50% of the MCL. No significant sources of volatile compounds were identified within the source protection area.

Based on the above analysis, Brunswick's Yourtee Springs water supply is **not** susceptible to VOC contamination.

Synthetic Organic Compounds (SOCs)

No SOCs have been detected in Brunswick's Yourtee Springs water supply above the 50% of the MCL. The detection of di (2-ethylhexyl) phthalate in one sample can be attributed to its presence in the laboratory environment. Given the forested nature of the recharge area there is little chance of SOCs being present in the water supply.

Based on the above analysis, Brunswick's Yourtee Springs water supply is **not** susceptible to SOC contamination.

Radionuclides

No radionuclides above 50% of the MCLs have been detected in Brunswick's Yourtee Springs water supply.

Based on the above analysis, Brunswick's Yourtee Springs water supply is **not** susceptible to radionuclides.

Microbiological Contaminants

Based on raw water bacteriological data the upper spring was determined not to be under the direct influence of surface water. The smaller or lower spring was taken off-line as a result of microbiological contamination. Hence this upper spring is **not** susceptible to fecal contamination or protozoan including *Giardia* and *Cryptosporidium*.

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. It is imperative that the integrity of the spring construction be maintained to

keep small mammals, birds, and other critters out of the water supply. It would not be unexpected for total coliform organisms to be present in some raw water samples, given the size of the spray and the ability of insects to enter very small openings. Insects can transport coliform bacteria, which are ubiquitous in soil, into the large spring area. If at some time in the future the City decides to use the smaller or lower spring a rehab of the foundation and structure is needed prior to its reuse (letter by B. Grove, 1999).

CONTAMINANT TYPE	Are Contaminant Sources present in the SPA?	Are Contaminants detected in WQ samples at 50% of the MCL	Is Spring Integrity a Factor?	Is the Aquifer Vulnerable?	Is the System Susceptible to the Contaminant
Nitrate	YES	NO	NO	YES	NO
Inorganic Compounds (except nitrate)	NO	NO	NO	NO	NO
Volatile Organic Compounds	NO	NO	NO	NO	NO
Synthetic Organic Compounds	NO	NO	NO	NO	NO
Radionuclides	NO	NO	NO	NO	NO
Microbiological Contaminants	YES	NO	YES	NO	NO

Table 3. Susceptibility Summary for City of Brunswick's Yourtee Springs (Upper or Large Spring) Water Supply.

MANAGEMENT OF THE SPA

As evidenced by the aerial photo (Figure 1), the great majority of the SPA is forested. It is recommended that the City of Brunswick review the zoning governing this land and determine if conservation easements or other protective measures are present to protect this area from future development. Ensuring the natural forested landscape is the most important action to ensure a high quality of water from the Yourtee Springs. The Department of the Environment has funding to make loans available for the purchase of property or easements for the protection of the water supply. Eligible property must lie within the designated SPA. Loans are currently being offered at zero percent interest and zero points. Contact the WSP for more information. In addition, the City should ensure the continued integrity of the springhouse and perform regular inspections and maintenance as needed. The City should keep up-to-date its plan for providing a safe and adequate drinking water supply under emergency conditions in accordance with COMAR 26.04.01.22. The City shall continue to monitor for all Safe Drinking Water Act contaminants as required by MDE.

REFERENCES

- Bolton, David W., 1996, Network Description and Initial Water-Quality Data from a Statewide Ground-Water Quality Network in Maryland: Maryland Geological Survey Report of Investigations No. 60, 167 p.
- Duigon, Mark T., 1994, Sykesville Quadrangle, Maryland Geological Survey, Quadrangle Atlas No. 24.
- Cleaves, E. T., Edwards, Jr., J., and Glaser, J. D., 1968, Geology Map of Maryland, Maryland Geological Survey.
- 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, 87p.
- Maryland Department of the Environment, Water Supply Program, 1999, Maryland's Source Water Assessment Plan, 36 p.
- Meyer, G., and Beall, R. M., 1958, The Water Resources of Carroll and Frederick Counties: Department of Geology, Mines and Water Resources Bulletin 22, 355p.
- Nutter, L. J., and Otton, E. G., 1969, Ground-Water Occurrence in the Maryland Piedmont: Maryland Geological Survey Report of Investigations No. 10, 56p.
- Slaughter, T. H., 1962, The Ground-Water Resources, in The water resources of Allegany and Washington Counties: Maryland Department of Geology, Mines, and Water Resources Bulletin 24, 1-244pp.
- U.S. Environmental Protection Agency, 1991, Delineation of Source Protection Areas in Fractured Rocks: Office of Water and Drinking Water, EPA/570/9-91-009, 144 p.

OTHER SOURCES OF DATA

Water Appropriation and Use Permit: WA1983G012

Public Water Supply Inspection Reports

MDE Water Supply Program Oracle Database

MDE Waste Management Sites Database

Washington County and Frederick County WHP Database

Department of Natural Resources Digital Orthophoto Quarter Quadrangles: Keedysville
SE and Harpers Ferry NE

USGS Topographic 7.5 Minute Shepardtown Quadrangle

Maryland Office of Planning 2002 Washington County Land Use Map

Maryland Office of Planning 2002 Frederick County Land Use Map

Maryland Office of Planning 2002 Washington County Sewer Map

Maryland Office of Planning 2002 Frederick County Sewer Map

FIGURES

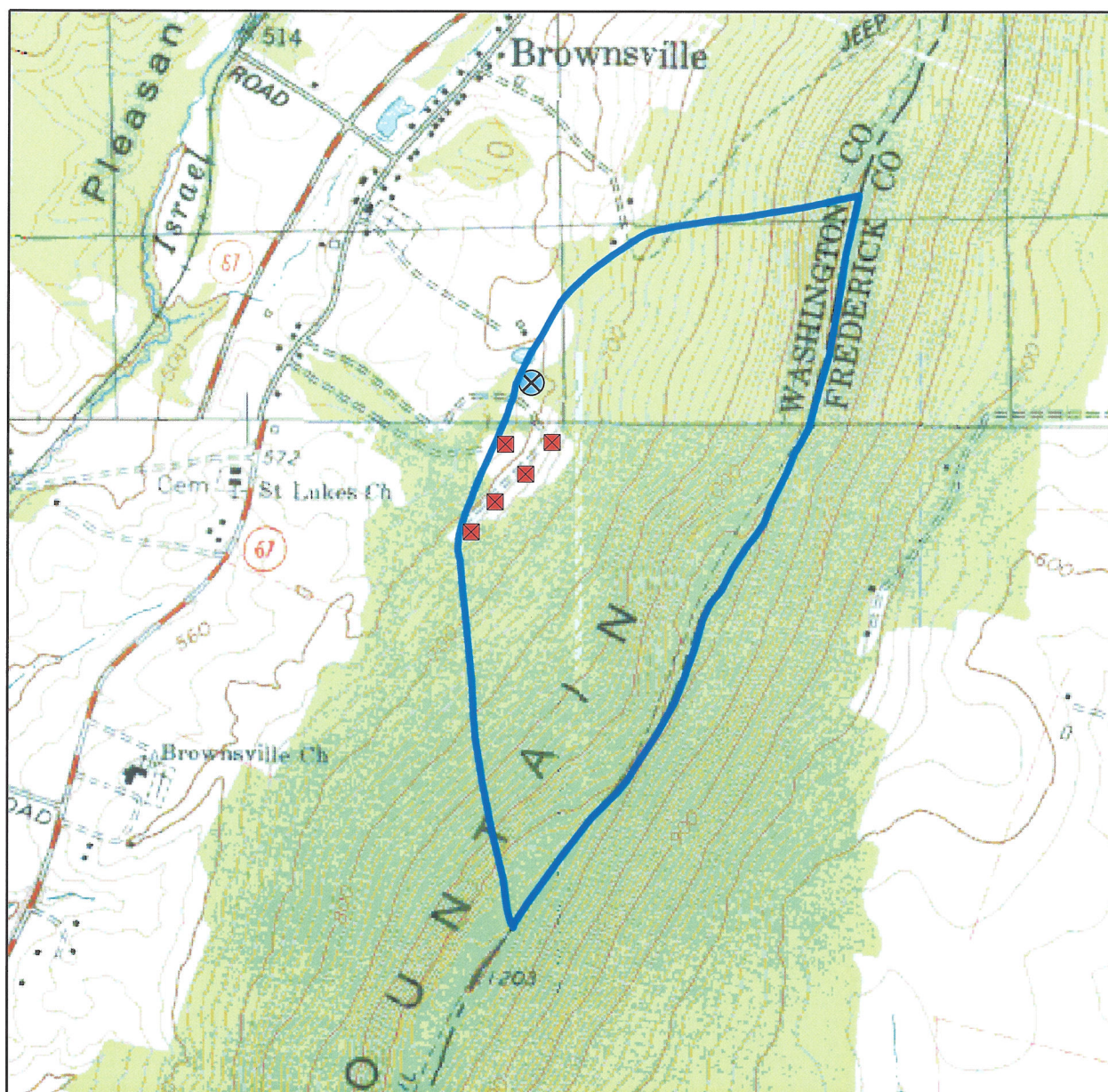
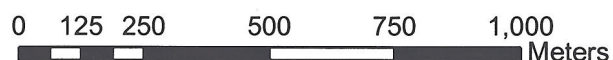
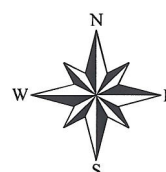
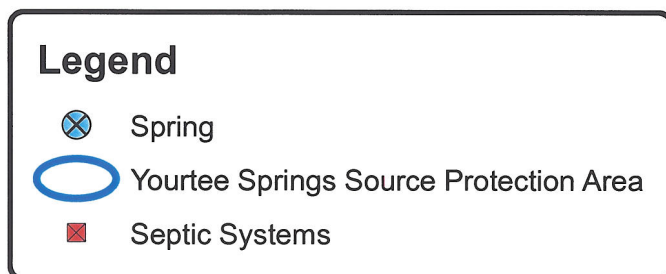


Figure 2. City of Brunswick Yourtee Springs Source Protection Area with Potential Contaminant Sources



Base Map: USGS 7.5 minute Topographic Quadrangle - Shepardtown



Figure 3. Land Uses of the Yourtee Springs Area

