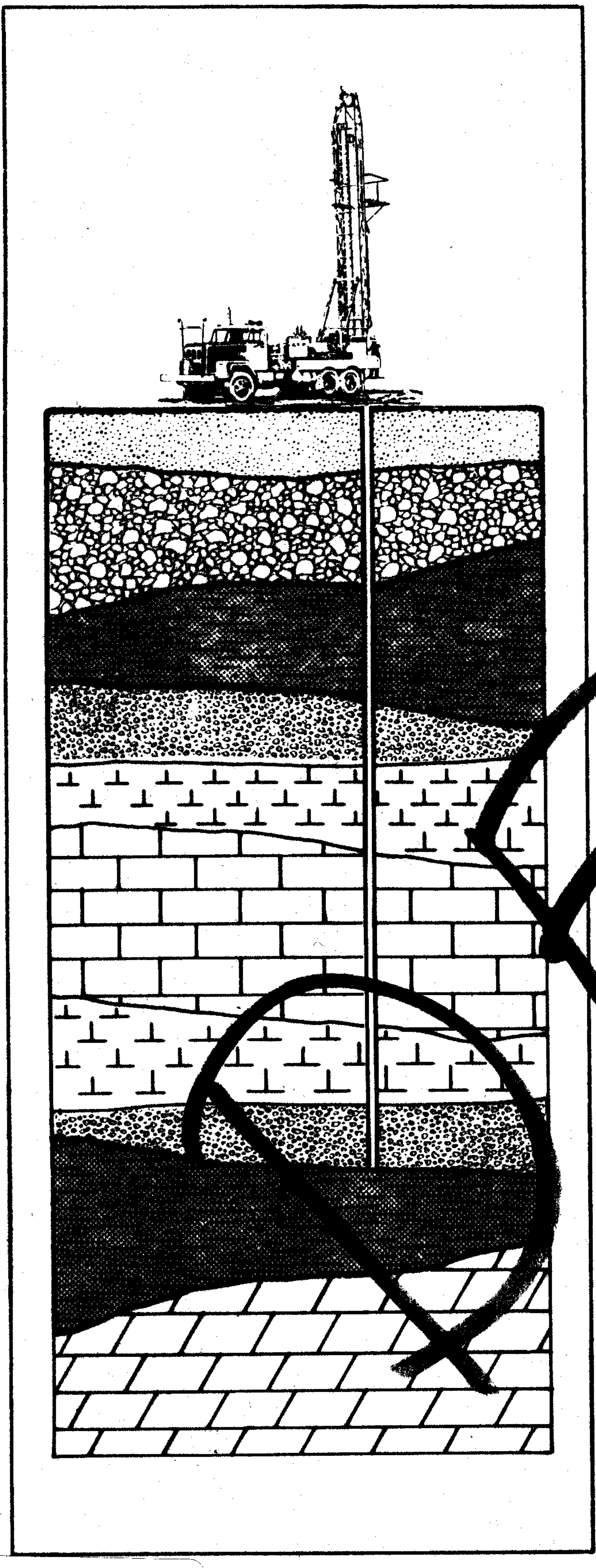
GROUNDWATER RESOURCES OF HENRY COUNTY, VIRGINIA



by

James W. Dawson
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WEST CENTRAL REGIONAL OFFICE

COMMONWEALTH OF VIRGINIA

STATE WATER CONTROL BOARD

BUREAU OF WATER CONTROL MANAGEMENT

Richmond, Virginia

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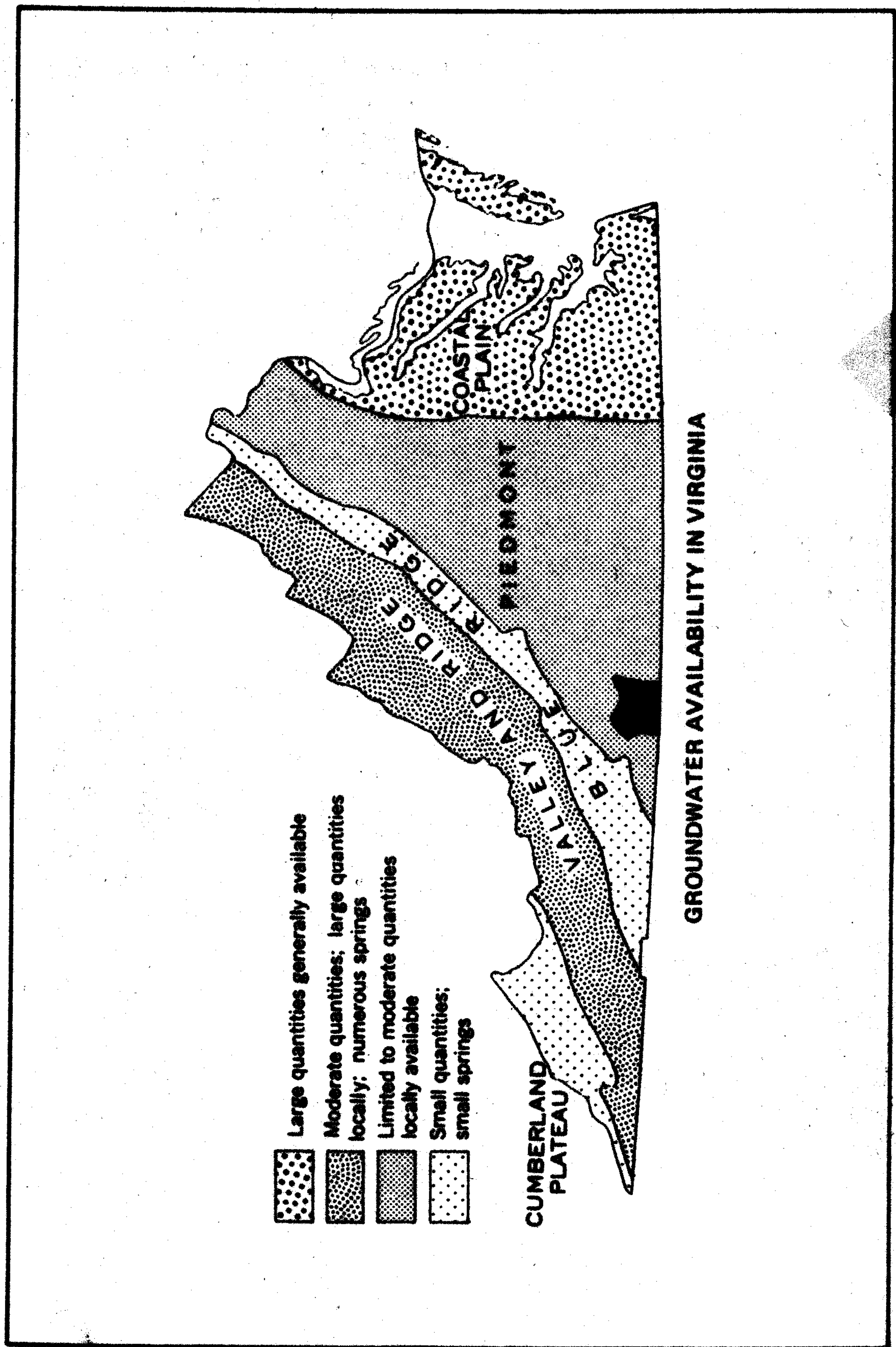


GROUNDWATER AVAILABILITY IN VIRGINIA

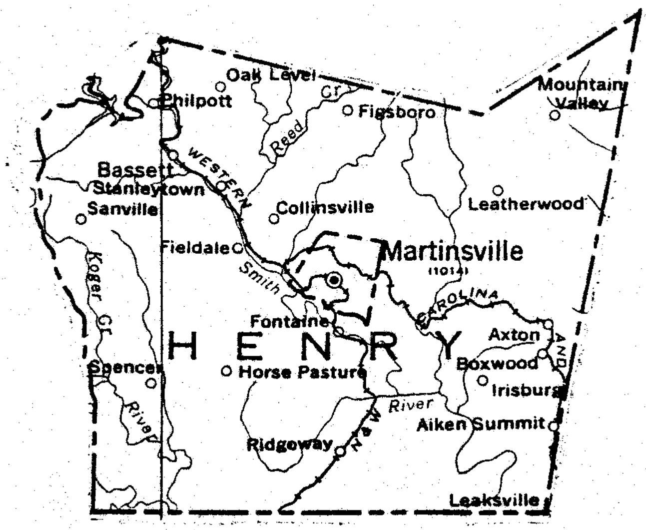
Source: Virginia State Water Control Board – BWCM

Frontispiece

GROUNDWATER RESOURCES

OF

HENRY COUNTY, VIRGINIA



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ACKNOWLEDGMENTS

Appreciation is expressed to the citizens of Henry County who furnished information on their wells and who permitted water quality samples to be taken. Officials of Henry County, numerous industries and private water companies were most cooperative in supplying information on their wells and water systems, as was the State Department of Health in furnishing copies of chemical analyses of these wells. Several water well contractors who operate in the County deserve thanks for supplying valuable information on construction characteristics and well data. Appreciation is also extended to the Virginia Division of Mineral Resources and the U.S. Soil Conservation Service for information on the geology and soils of Henry County.

FOREWORD

This report is part of a series intended to cover the entire State, to provide private citizens, industries, municipalities, well drilling contractors, consultants and professionals with a general evaluation of the groundwater resources in each of the counties in Virginia.

This current report provides sufficient information for prospective users or developers to assess the suitability of groundwater resources within Henry County and the City of Martinsville in fulfilling their water supply needs. Professional hydrogeological consultation should be obtained for detailed evaluation of groundwater resources in specific areas of Henry County, although this report provides necessary background information for such evaluations. Continual updating of information on the groundwater resources of Henry County is provided through State Water Control Board programs. This Agency may be contacted for additional information concerning groundwater resource problems.

GROUNDWATER RESOURCES OF HENRY COUNTY, VIRGINIA

ABSTRACT

Henry County lies within the Piedmont and Blue Ridge Physiographic Provinces and is characterized by a very complex geology. Bedrock consists predominantly of igneous and metamorphic rocks, with some sedimentary rocks in the southeastern portion of the County. Three hydrogeologic units have been identified in Henry County: 1.) Soil Mantle, Colluvial and Terrace Deposits; 2.) Alluvial Deposits; and, 3.) Bedrock Material.

Soil Mantle, Colluvial and Terrace Deposits typically provide low well yields which are suitable for many small domestic applications. Water quality in these deposits can be highly variable, depending upon the physical and chemical characteristics of these deposits. Pollution susceptibility for wells developed in these deposits is relatively high.

Alluvial Deposits, which occur along streams and rivers and occupy valley floors, can provide tremendous well yields if conditions are favorable. Water quality in these deposits is somewhat dependent upon the physical and chemical characteristics of the deposits and is influenced by the water quality of adjacent streams or rivers. Pollution susceptibility for wells developed in these deposits is somewhat variable; dependent upon the characteristics of the deposits and adjacent land use.

Bedrock Material can permit development of wells with high yields (on the order of 300 gallons per minute or greater), if these wells are properly located; however, most well yields are substantially lower (in the range of 5 to 50 gallons per minute). Different rock types do vary somewhat in their capacities to store and transmit water, but well yield

is more dependent upon intersecting fractures in the bedrock. Water quality is generally very high, although instances of excessive iron and manganese concentrations have been reported. Pollution susceptibility of properly constructed wells is minimal, although cases of contamination of inadequately constructed wells have been recorded in Henry County.

The preponderance of groundwater development has occurred along the Smith River Corridor, although more development in this area is possible. On a countywide basis, the potential for additional groundwater withdrawal and use is very high, but adequate hydrogeological studies should be performed to accurately evaluate the resource in specific areas of interest.

Groundwater quality is generally very good and water treatment is not required for most domestic, industrial and municipal applications. However, excessive concentrations of iron and manganese have been recorded in the schist formations in Henry County. Lithology does affect water quality to a certain extent, although drastic changes in water quality are possible in the same formation at different locations and consequently, water quality analyses of wells in a particular area of interest are necessary to ascertain the groundwater quality for that specified area.

This report provides a general evaluation of the quantity and quality of the groundwater resources of Henry County, including the City of Martinsville. It should be noted that this evaluation is based primarily on information contained in State Water Control Board files which do not contain all information regarding the resource. These files indicate a total of 493 wells in the County, which supply 11.6 million gallons of groundwater per day, or approximately 63 percent of the total water use in Henry County. Without detailed hydrogeologic studies, it is impossible to accurately predict how much additional groundwater withdrawal could be developed without adversely affecting the groundwater regime, but a conservative estimate would be approximately 30 million gallons per day.

CHAPTER I

INTRODUCTION

Background

Henry County, with two-thirds of its 385 square miles forested, is located in south central Virginia in the upper Piedmont Plateau (Plate 1). It is bounded on the south by Rockingham County, North Carolina, with the Virginia counties of Pittsylvania, Franklin and Patrick making the east, north and west boundaries respectively.

Sawmilling and the manufacture of wood products have stimulated the growth of related industries to such a degree that Henry County has become a national furniture center. Other important industries in the County include the manufacture of textiles and chemical products.

Over one-half (213 square miles) of the County is in farmland, but much of this is forested, with only 44 square miles in cropland. Tobacco and livestock are the main agricultural products.

The major urban area of the County extends along the Smith River Corridor from the City of Martinsville northwestward to Bassett, including Collinsville, Fieldale, Stanleytown and Villa Heights. This area accounts for 60 percent of the population within Henry County. The total estimated population of the County in July 1977 was 55,440, while the City of Martinsville was 18,600. Population growth for the County is projected to be 60,600 by 1980, 70,100 by 1990 and 77,300 by the year 2000, while the City of Martinsville is not expected to have any significant increase.

At the present time groundwater supplies about 11.6 million gallons per day (mgd), which is 63 percent of the total water use in Henry County.

Available information indicates that approximately 14.9 mgd of groundwater could be obtained from existing wells, if so desired. Surface water withdrawals from the Smith River, Beaver Creek Reservoir and Marrowbone Creek amount to about 6.9 mgd. An additional 2 mgd will be taken from the Smith River by the Henry County Public Service Authority by the year 1980.

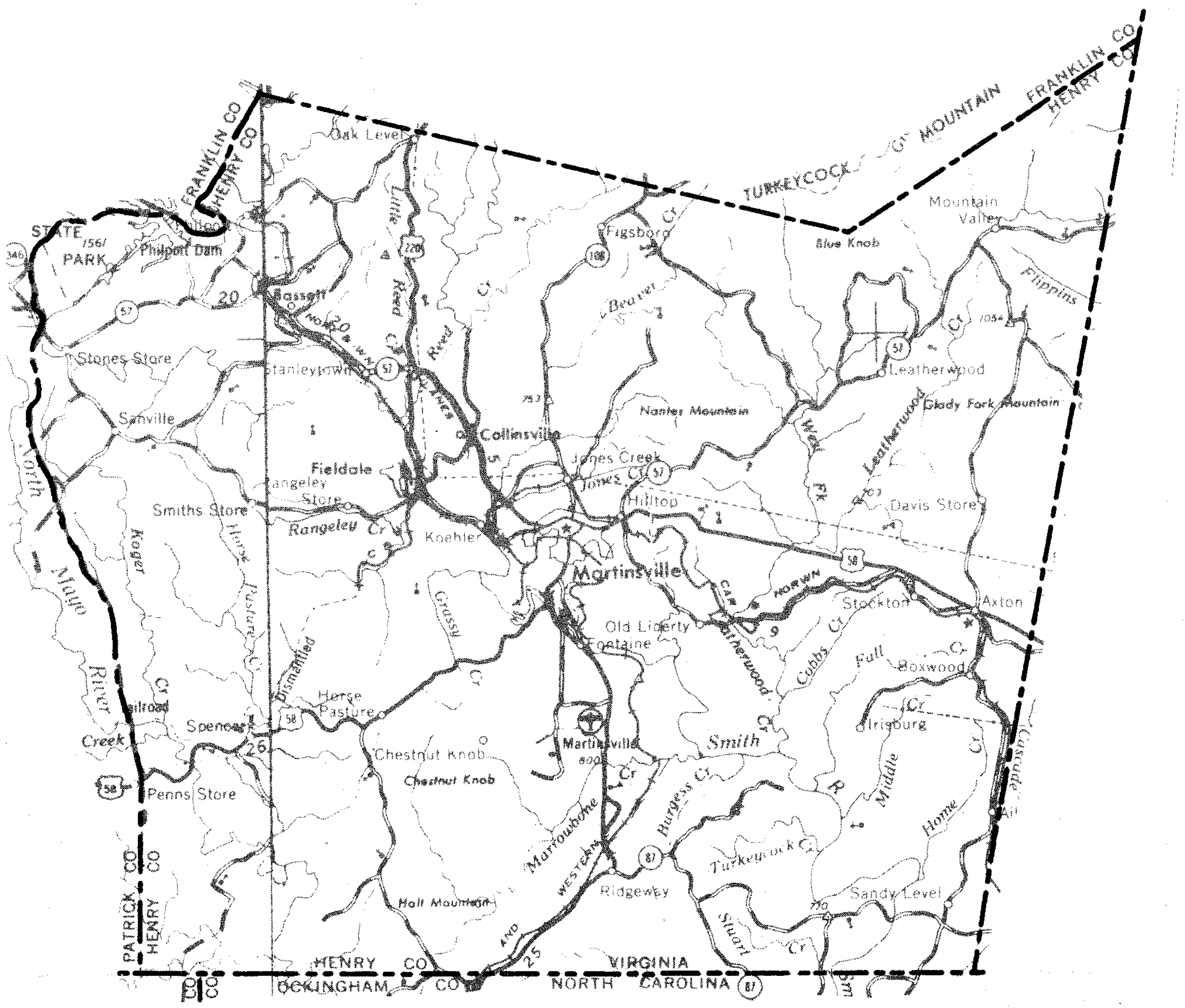
Present groundwater supplies are adequate to meet existing demand and the future demand, based on the present rate of development, can be met without problems, if appropriate development, management and protection of this resource are practiced.

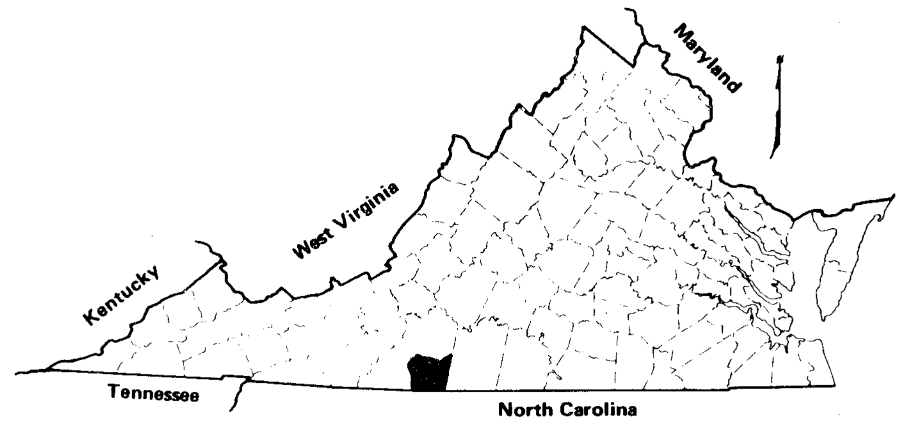
Purpose and Scope

The purpose of this report is to consolidate available information on the groundwater in Henry County and to provide individuals, industries and municipalities with an accurate inventory of the groundwater resources, and how these resources may be developed and protected to meet present and future needs of the County. This report, although directed towards laymen, should provide valuable information for the more professionally-oriented readers, as much of the information contained within has not been previously published.

To appreciate groundwater as a resource, one must understand the relationships between physical setting (climate, precipitation, soils, vegetation), geology (formations, faults, fractures, aquifer systems), water quality, development and management of the resource. In the following chapters, these subjects are discussed in a generalized fashion to give the reader an understanding of the complexities affecting groundwater quality and availability.

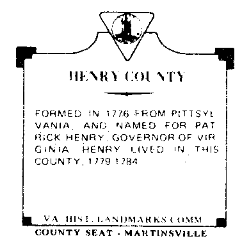
INDEX MAP OF HENRY COUNTY

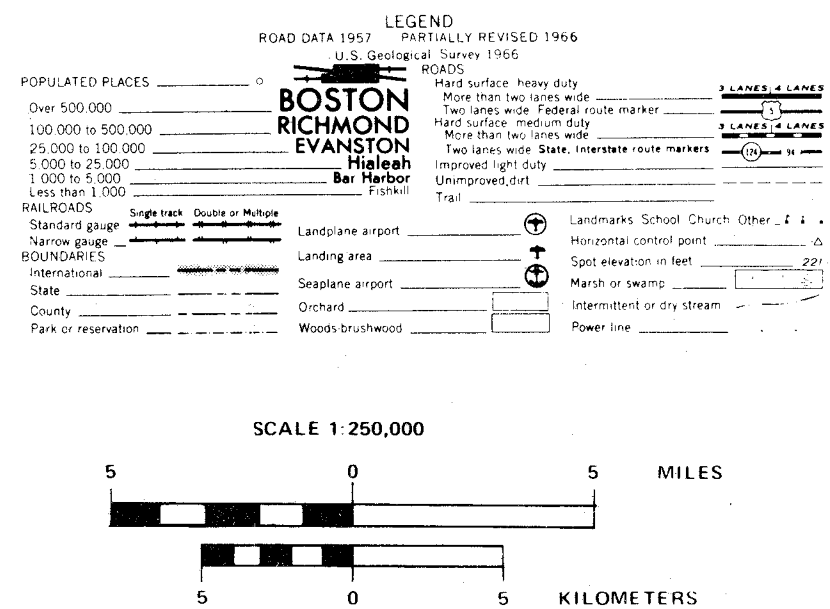




POPULATION (1977 estimation)
County: 55,440
Martinsville: 18,600

AREA
385 Square Miles





Methods of Investigation

Most of the general background and geologic information appearing in this report is a summary or compilation of previous work. Some of the information on water well construction and groundwater quality has been obtained from other State Agencies, although the bulk of it has been collected by the State Water Control Board.

Much of the previously unpublished information on individual well construction data and quality analyses has been collected as a result of the Groundwater Act of 1973. This Act requires that any person completing a water well submit to the Virginia State Water Control Board (Board) a Water Well Completion Report (Form GW-2) and that owners of industrial and public water supplies submit quarterly reports (Form GW-6, Groundwater Pumpage and Use) detailing groundwater withdrawal. In addition, the Board requires that drill-cutting samples be collected at ten-foot intervals on all water wells, unless prior exemption is received from the Board.

A concentrated effort over the past year has been made to collect and chemically analyze groundwater samples at selected sites in Henry County to establish the relationship between geology and groundwater quality. In addition to specific sampling areas, groundwater quality information is obtained from regular monthly sampling runs made by the Board. Domestic supplies are sampled generally, although small industrial and commercial supplies are checked occasionally.

Another source of quality information is the Pollution Response Program (PReP), maintained by the Board for the sole purpose of investigating citizen reports of water pollution of any type. This includes pollution of both groundwater and surface water by accidental or intentional spills of hazardous chemicals, oil, gasoline, refuse and industrial wastes.

All well information, well completion reports and records of ground-water quality analyses cited in this report are on permanent file at the Board's Headquarters Office in Richmond and the West Central Regional Office in Roanoke and are available for public inspection. These data are computerized for storage and retrieval, and were used to compile Appendices A and B.

Previous Investigations

Numerous detailed geologic reports have been made of the Henry County area by the Virginia Division of Mineral Resources, with a map scale of 1:24,000. Reports include the Martinsville West (Conley and Toewe, 1968), Philpott Reservoir (Conley and Henika, 1970), Bassett (Henika, 1971), and Snow Creek, Martinsville East, Price and Spray (Conley and Henika, 1973) 7.5-minute quadrangles. These reports were used extensively in preparing the geological section of this publication.

In Geology and Ground-Water Resources of Pittsylvania and Halifax Counties (Virginia Department of Mineral Resources, 1960), H. E. LeGrand discusses aquifer and well characteristics in the geologically similar Piedmont of nearby Pittsylvania and Halifax counties.

Water Well Numbering System

The State Water Control Board maintains water well information such as well size and depth, yield, water quality, water level changes and other pertinent data in a computerized system at the Board's Richmond Headquarters. Retrieval of this information for specific wells is possible by the water well number system.

This system comprises two numbers: the first one is a county identity number, (Henry County is 144), and the second number is a sequential listing of wells in the county. For example, well number 144-237 refers to a specific well in Henry County. At the time of this reporting, 493 wells are listed in the file for this County, although it is known that the total number of wells in the County is substantially higher.

CHAPTER II

PHYSICAL SETTING

Physiography

Henry County lies entirely within the Piedmont Physiographic Province and is characterized by topographic features ranging from narrow V-shaped valleys with steep-sided elongate ridges to more subdued ridges and wide alluvium-filled valleys.

Turkeycock Mountain (1,850 feet) is the largest topographic feature in Henry County, with its crest marking the northeastern boundary between Henry and Franklin counties for over 13 miles. Smaller prominent landforms include Chestnut Knob (1,520 feet), Nantes Mountain (1,320 feet) and Holt Mountain (1,212 feet). A maximum of 1,310 feet of relief is found in the County between Turkeycock Mountain and the Smith River where it crosses the Virginia-North Carolina border (540 feet)(Plate 2).

Hydrology

Henry County lies entirely within the Roanoke River Basin and is drained by five major rivers. The Smith River drains most of the northern, central and southern parts of the County with a drainage area of 294 square miles. The north and south forks of the Mayo River drain the western and southwestern sections of the County (57 square miles). The Pigg River drains the extreme northeastern tip of the County (22 square miles) and the Dan River drains a small part of eastern Henry County (12 square miles).

Beaver Creek is impounded about two miles north of Martinsville to form the Martinsville Reservoir and has a storage capacity of 1,250 million gallons. This reservoir furnishes all of the potable water to the City of Martinsville. The Smith River is impounded in the extreme northwest section of the County to form Philpott Reservoir, a 3,000 acre lake used for recreational activities, hydroelectric power and flood control. Philpott Reservoir is by far the largest impoundment in Henry County even though most of it is in Patrick and Franklin counties. At this time it is not being used as a source of potable water.

Several streamflow gaging stations are maintained throughout Henry and adjacent counties. The data from these are published annually by the U.S. Geological Survey in "Water Resources Data for Virginia". Table 1 presents the extremes of discharge values for the water year 1976, along with the maximum recorded flow during the period of record (October 1939 to September 1976):

TABLE 1

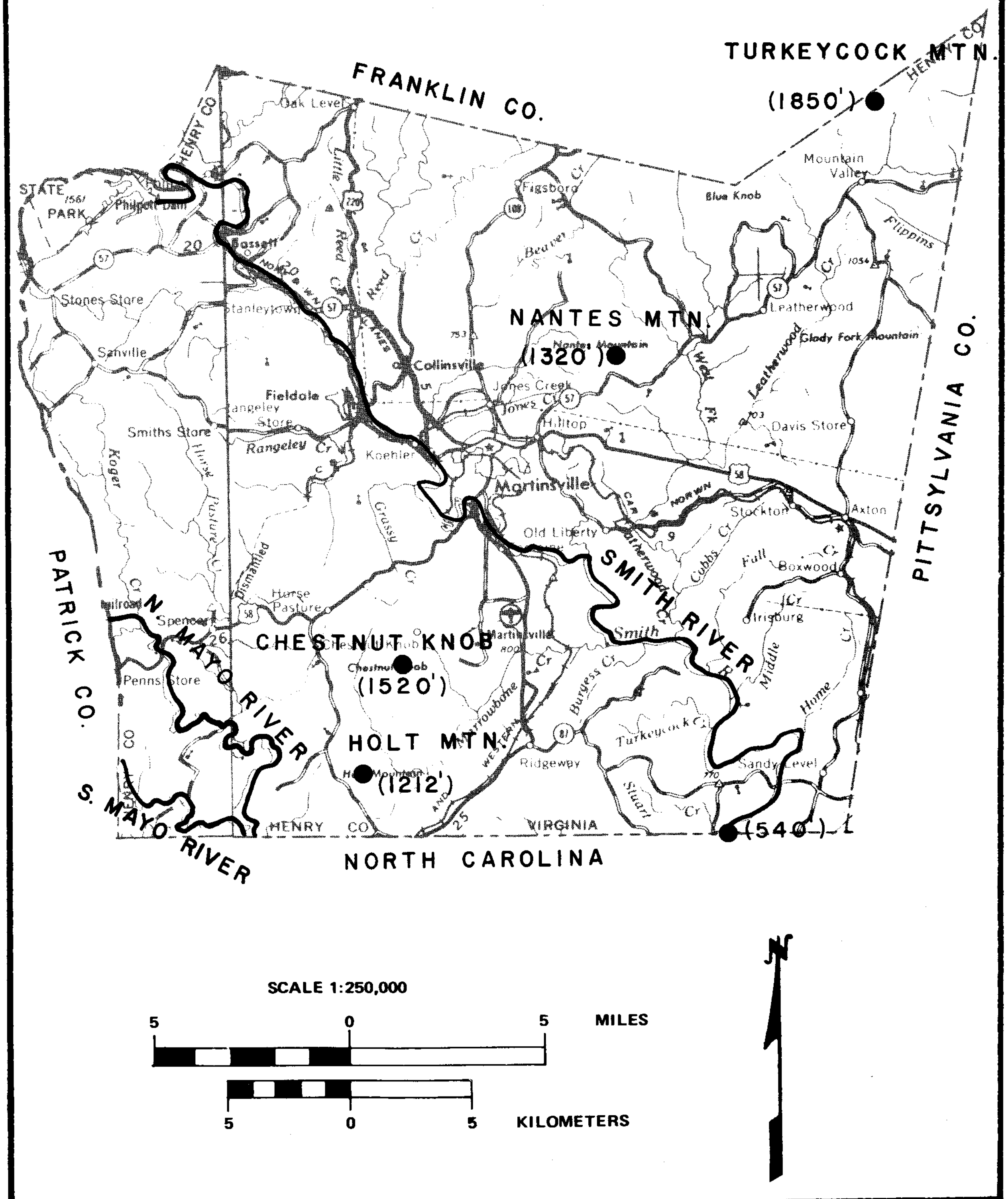
EXTREMES VALUES FOR DISCHARGE IN CUBIC FEET PER SECOND

Station	Period of Record Maximum	Maximum (1976)	Minimum (1976)
Smith River at Philpott, Va.	17,000 $ft.^3/S$ 1949	1,380 $ft.^3/S$	10 $ft.^3/S$
Smith River at Martinsville, Va.	39,000 $ft.^3/S$ 1937	4,620 $ft.^3/S$	7.8 $ft.^3/S$
Smith River at Eden, N.C.	45,600 $ft.^3/S$ 1940	5,700 $ft.^3/S$	59 $ft.^3/S$
North Mayo River near Spencer, Va.	17,200 $ft.^3/S$ 1947	1,460 $ft.^3/S$	30 $ft.^3/S$

Climate and Precipitation

Henry County's climate is typical for south-central Virginia: hot, humid summers and cool rainy winters with some snow. The average annual

PHYSICAL SETTING
OF
HENRY COUNTY



Source: Virginia State Water Control Board - WCRO

PLATE NO. 2

temperature is about 56 degrees Fahrenheit: July being the warmest month, averaging 76 degrees Fahrenheit, and January being the coldest, averaging 37 degrees Fahrenheit. The average annual precipitation is about 44 inches; the summer months (June-September) getting the greatest precipitation, due mainly to showers and thunderstorms (Table 2).

TABLE 2

WEATHER DATA RECORDED AT
THE MARTINSVILLE FILTRATION PLANT
(Averaged Over The Period of Record)

Month	Total Precipitation+ (Inches)		Average Temperature* (Degrees Fahrenheit)
January	3.12		37.1
February	3.35		39.0
March	3.99		46.2
April	3.46		57.0
May	3.84		65.4
June	3.79		72.4
July	4.73		75.6
August	4.23		74.4
September	4.11		67.7
October	3.08		57.2
November	2.86		46.5
December	3.34		37.8
Totals	43.90	Yearly Average	56.4

Source: National Oceanic and Atmospheric Administration
+ Period of Record - 1945 thru 1978
* Period of Record - 1937 thru 1978

Soils and Vegetation

The amount of precipitation that reaches the water table depends on numerous factors: character and thickness of the soil, topography, land use, vegetal cover, soil moisture content, depth to water table, and the intensity, duration and seasonal distribution of precipitation. It is obvious that the precipitation factors are of primary importance, but the percentage of precipitation that reaches the water table is greatly dependent on the overlying soil characteristics and the presence and nature of the vegetation.

Soil conditions that affect groundwater recharge include depth, permeability and slope. Deep, permeable soils with gentle slopes allow greater infiltration than shallow, slowly permeable soils with steep slopes.

The soils in Henry County are formed by both chemical and physical weathering in situ or by physical transportation and deposition. The soils of the granitic and metamorphic rocks are formed by the former process. These soils grade downward into saprolite, a soft, earthy, clay-rich, thoroughly decomposed rock formed by chemical weathering of igneous and metamorphic rocks. The thickness and nature of the saprolite influences groundwater recharge in a similar manner as the overlying soil. A deep, permeable saprolite acts as a sponge, allowing water to recharge the groundwater system over long periods of time.

Alluvial and colluvial soils are formed by the transportation and deposition of materials by water and/or gravity. Alluvial soils are formed on flood plain and terrace deposits, and colluvial soils are formed on material deposited near the base of a slope by unconcentrated surface runoff (sheet erosion) or gravity. These soils, although variable in nature and extent, allow abundant recharge to the groundwater.

Most of the soils in Henry County are relatively deep and permeable enough to offer favorable conditions for groundwater recharge. More detailed soil descriptions are given in Chapter III along with the geological formations.

Vegetation has a protective action towards soil. Roots bind soil so that it remains porous and able to absorb water without being washed away. Forested areas actually break the force of the rain and slow the melting of snow, thus, increasing infiltration and preventing rapid runoff and erosion.

Henry County has about 257 square miles of forest lands, with both deciduous and evergreen species. Approximately 44 square miles of the County are used as croplands, with the remaining 84 square miles being pastures, urban areas and surface waters. The major forest areas provide ideal watersheds to inhibit excess surface runoff and permit greater groundwater recharge. Sound land management programs should be followed to prevent excess runoff and the resulting decrease of groundwater recharge.

CHAPTER III

HYDROGEOLOGY

Introduction

The occurrence, movement and quality of groundwater is strongly influenced by the geologic structure and lithology. For bedrock aquifers, well yield is dependent upon the borehole intersecting fractures within the bedrock, the degree of interconnection of these fractures and the ability of these fractures to transmit water.

Henry County is underlain by igneous and metamorphic rocks which have undergone chemical and physical alteration during their geologic history. The groundwater resources of the County reflect the geologic differences of the bedrock material with regard to both well yield and water quality.

A cursory description of the different lithologies present in Henry County is presented below. The geology and geologic history of Henry County are very complex and are beyond the scope of this report. Reports of the area have been prepared by Meyertons (1963), Conley & Toewe (1968), Conley & Henika (1970), Henika (1971) and Conley & Henika (1973) for the Virginia Division of Mineral Resources. The reports present very comprehensive and in-depth geological studies of portions of the County. The lithologic descriptions and geologic map of Henry County (Plate 3) represent a very brief summary of some of the information contained in the reports cited above. The geologic boundaries, formations and structure represented in Plate 3 were derived primarily from the Conley & Henika (1973) report and the "Geologic Map of Virginia", Virginia Division of Mineral Resources (1963). Interpretative work, for unmapped portions of the County, was performed by State Water Control Board personnel.

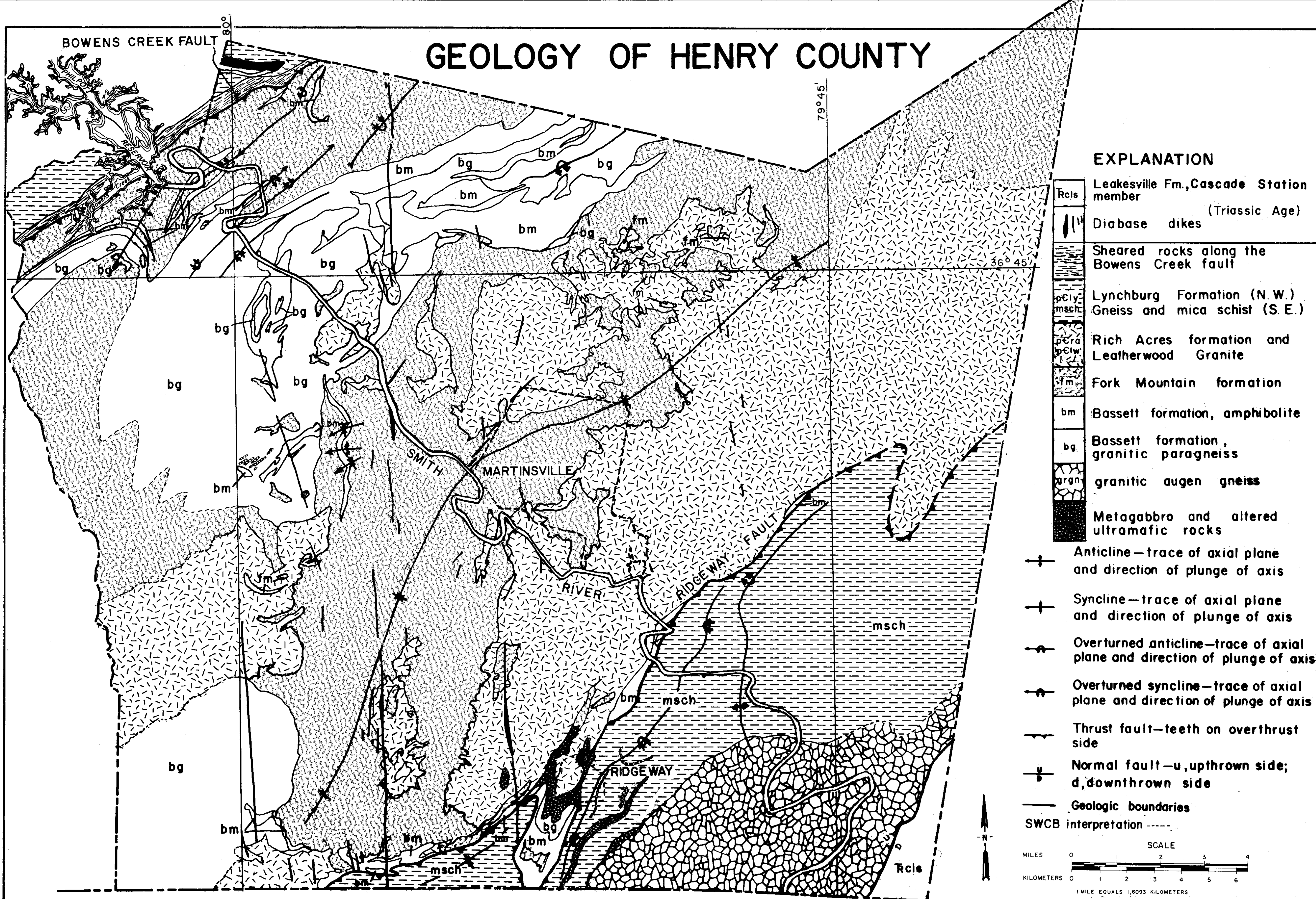
The interpretative work is confined to the eastern and western portions of the map and can be recognized by the use of dashed lines to indicate geologic boundaries and structure. These representations were not verified in the field and represent only approximate locations for these features, which the reader must take into account when referring to the map. The scale for the map on Plate 3 is the same as the Henry County General Highway Map as published by the Virginia Department of Highways and Transportation. Utilization of these two maps should facilitate fairly accurate locations of bedrock geology. However, it should be emphasized that actual field location of specific geologic features may not exactly coincide with the map locations for these features.

Geologic Formations

Henry County is located in the Piedmont Physiographic Province and is underlain by igneous, metaigneous and metasedimentary rocks, plus Triassic sedimentary rocks. Plate 3 is a generalized geologic map of Henry County delineating areas of major lithologic differences and significant geologic structures. Individual formation names and descriptions are presented to assist the reader in identifying particular rock types. General groundwater conditions for each formation are summarized in Table 3, while more detailed information for specific rock types is presented in Chapter IV (page 41) and Chapter V (page 63).

Precambrian Rocks

Granite Gneiss (Map Symbol:grgn). Light gray color, medium-grained, rudely foliated and inequigranular; develops reddish-brown saprolite and light reddish sandy soil.



Source: Virginia Division of Mineral Resources
State Water Control Board — WCRO

PLATE NO. 3

Granitic Augen Gneiss (Map Symbol: grgn) - Composed of coarse-grained granitic augen gneiss, granitic flaser gneiss, biotite schist, hornblende schist and gneiss, banded mica gneiss and foliated leucocratic granite.

Bassett Formation (Map Symbol: bg, bm) - Composed of a medium-grained, light to medium gray, equigranular, leucocratic biotite gneiss overlain by a gneissic to schistose, dark green to black amphibolite, with some epidote rich layers and pyroxene granofels bodies. A deep, reddish-brown saprolite and a tan to light brown, quartz-rich soil develop over the leucocratic biotite gneiss, while a shallow, red-brown, clay-rich, spongy saprolite and dark-red and dark reddish-brown, clay soils develop on the amphibolite.

Fork Mountain Formation (Map Symbol: fm) - Composed primarily of mica schist with thin, discontinuous lenses of quartzite and mica gneiss. Soils are generally thin, light reddish brown with a large amount of mica schist chips and quartz. Saprolites tend to be red or reddish brown, very micaceous, with weathered garnets.

Leatherwood Granite (Map Symbol: pGlw) - Composed of a coarse-grained, light gray, porphyritic biotite granite which can grade into leucogranite and pegmatitic leucogranite. A light tan to red, sandy soil and pinkish saprolite is developed on this formation.

Rich Acres Formation (Map Symbol: pGra) - Composed predominantly of fine- to medium -grained gabbro and hornblende metagabbro, with medium- to coarse-grained, medium grayish-green diorite and dark gray to black, medium- to coarse -grained norite members. Massive, tan to brown, deep saprolite and thick, dark-brown to maroon soils, rich in iron oxides and clay, are developed over this formation.

TABLE 3

GEOLOGIC FORMATIONS AND THEIR HYDROGEOLOGIC CHARACTERISTICS IN HENRY COUNTY

SYSTEM AND AGE	FORMATION OR ROCK TYPE (MAP SYMBOL)	HYDROGEOLOGIC CHARACTERISTICS
Quaternary	Soil Mantle - not mapped Colluvium - not mapped Terrace Deposits - not mapped	**Water Bearing Properties:** Poor to fair, depends on extent, thickness and continuity of deposits; well yields usually low (0-2.5 gpm); wells may go dry during periods of scanty precipitation. **Water Quality:** Can be highly variable, but generally good; high contamination susceptibility from surface or near surface sources (eg., septic tank fields, landfills, accidental spills, etc.)
0-70 million years	Alluvial Deposits - not mapped	**Water Bearing Properties:** Good to excellent, depends upon physical properties of deposits and size of adjacent stream or river; high well yields can be developed (100-700 gpm). **Water Quality:** Can be highly variable; represents intermixing of surface and groundwater; high contamination susceptibility from surface or near surface sources.
Triassic 180-225 million years	Leakesville Formation, Cascade Station Member (Map symbol - T_R cls) Diabase Dikes	**Water Bearing Properties:** Poor to fair; well yields generally low to moderate (0-5 gpm); Higher yields can be realized from wells developed in fault and fracture zones. **Water Quality:** No data available.
Precambrian Rocks greater than 600 million years	Gneiss and Mica Schist (Map symbol - msch) Lynchburg Formation (Map symbol- p-€ly) Rich Acres Formation (Map symbol - p-€ra) Leatherwood Granite (Map symbol - p-€lw) Fork Mountain Formation (Map symbol - fm) Bassett Formation (Map symbol - bg, bm) Granitic Augen Gneiss and Granite Gneiss (Map symbol - grgn)	**Water Bearing Properties:** Poor to excellent; well yields can be highly variable (0-300 gpm), depending upon fracture configuration intersected by borehole; good well location techniques must be employed for development of adequate yields. **Water Quality:** May be variable, although generally quite good; isolated problems, with excessive iron concentrations have been noted in the Lynchburg and Gneiss and Mica Schist Formations; dependent, in part, upon geochemical properties of the individual formations in the area where the well is constructed.
Precambrian (?) Rocks	Altered Metapyroxenite and Talc Schist; Metagabbro	

Lynchburg Formation (Map Symbol: p€ly) - Composed of silvery gray muscovite-sericite gneiss with some graphite schist, metagraywacke, metagraywacke conglomerate and quartzite and metagabbro.

Gneiss and Mica Schist (Map Symbol: msch) - Possibly correlative of the Lynchburg Formation, these rocks consist of garnet mica schist which contains some kyanite and staurolite; muscovite and muscovite-biotite gneiss with interlayered mica schist and dark-green to black garnet-hornblende schist and garnetiferous amphibolite.

Precambrian (?) Rocks

Altered Metapyroxenite and Talc Schist - Composed of altered ultramafic rocks with light gray to light green schist and dark, grayish green, granular rocks as the two predominant lithologies.

Triassic Rocks

Diabase Dikes - Intrusive bodies with a trend of either N.-N.10^{o}W. or N.20-30^{o}W.; generally fine-grained, metanocratic, olivine-pyroxene diabase. Develop deep, dark to reddish-brown, clay rich soils.

Leakesville Formation (Cascade Station Member) (Map Symbol: T_{R}cls) - Composed of red, brown and maroon claystone, shale, siltstone and fine- to coarse-grained sandstone, with some conglomerate.

Quaternary Deposits

Colluvium - Unsorted, angular rock fragments, sand, silt and clay, deep-red color, present on flanks of hills.

Alluvial-Terrace Deposits - Thin remnants of fluvial sediments, exposed on incised meanders of the Smith River, preserved as terraces on slopes or flat topped hills; consists of rounded cobbles and pebbles.

Alluvium - Occurs on valley floors, variable in extent and continuity, usually poorly sorted pebbles and gravel, with sand and clay intermixed; may have gray clay or silty clay near bottom of deposits.

Geologic Structure

The significant geologic structures within Henry County are indicated on Plate 3. Associated with these structures are fracture zones and lineaments. Plate 4 indicates major fracture zones, lineaments and joint patterns within Henry County. The significance of these structures will be discussed in a later section.

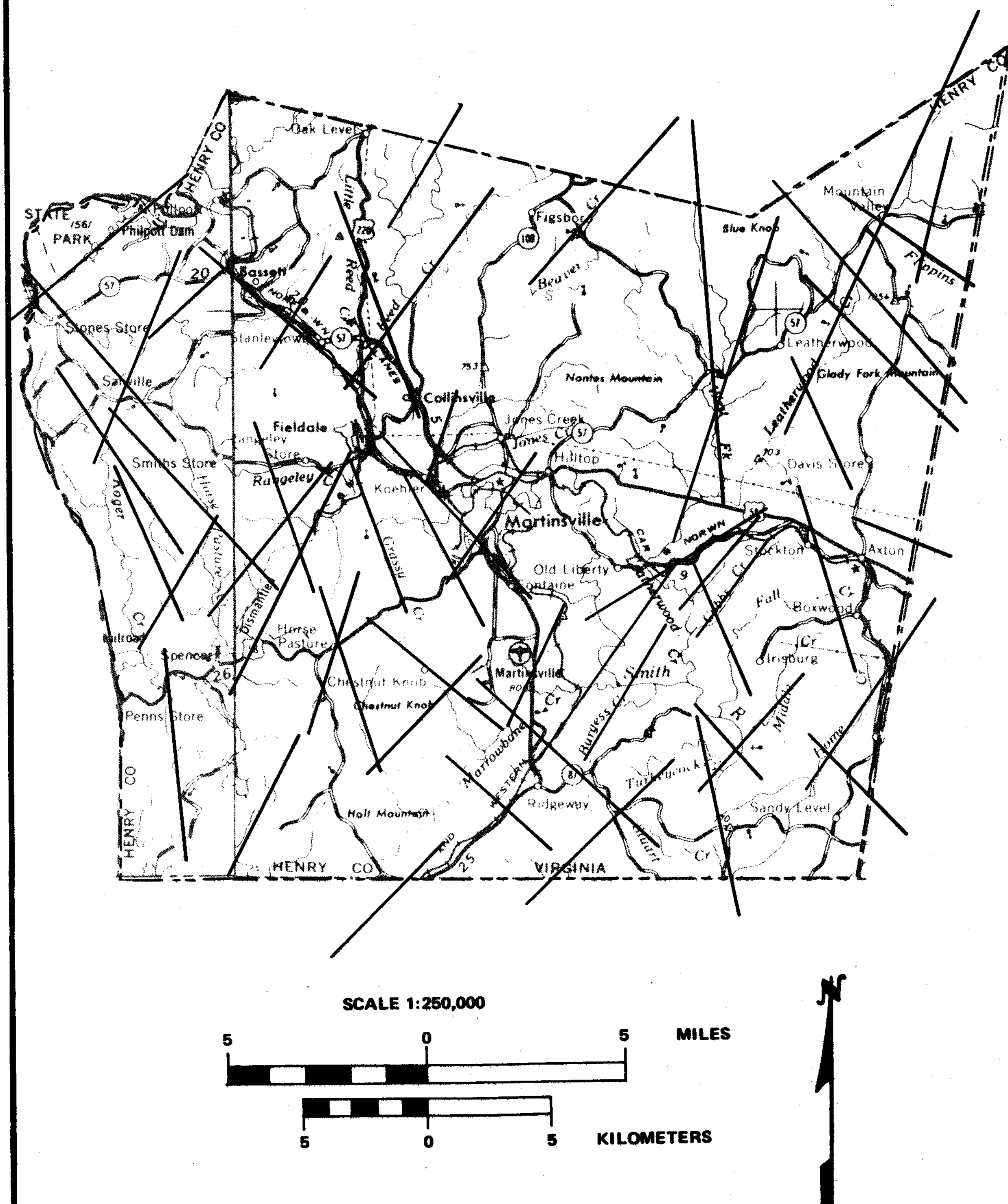
Groundwater Resources: Occurrence

Groundwater is that water which occurs below the zone of permanent saturation, whose upper surface is usually described as the water table. Water table elevations usually fluctuate throughout the year in response to changing climatic conditions. For the purposes of this report, three hydrogeologic units have been delineated for discussion of the groundwater resources: 1.) soil mantle, colluvial and terrace deposits; 2.) alluvial deposits; and 3.) bedrock material.

Soil Mantle, Colluvial and Terrace Deposits. The nature and depth of the soil mantle can strongly influence groundwater recharge potential. Relatively deep soil, with moderate permeability, will permit greater infiltration and storage of water than shallow and/or less permeable soils. As water percolates downward through the soil mantle to the bedrock/soil interface, it will tend to collect at the interface.

Many shallow bored and hand-dug wells are constructed in the soil mantle and utilize the soil/rock interface water in Henry County. Although yields from such wells are generally low (0.5 to 2.5 gpm) they can

MAJOR FRACTURE TRACES AND LINEAMENTS IN HENRY COUNTY



Source: Virginia State Water Control Board - WCRO

PLATE NO. 4

provide a quite adequate water supply for domestic use. The primary problems with development of the soil/rock interface water are the high susceptibility for contamination from surface or near-surface sources (e.g. accidental spills, septic tank drainfield, etc.) and the fact that these are the wells that tend to go dry first during drought periods.

Wells developed in colluvial and terrace deposits have essentially the same characteristics as those developed within the soil mantle. Colluvial deposits, especially, have the potential for collecting and holding vast amounts of water for relatively short periods of time, since they are located along the bases of mountain slopes and collect runoff from precipitation events. Terrace deposits will also store large amounts of water and make it available for groundwater recharge. The colluvial and terrace deposits are too thin and irregular to be a significant source of groundwater supply in Henry County; however, they may prove adequate for individual domestic applications.

Alluvial Deposits. These deposits occur along the streams and rivers within Henry County and usually occupy most, or all, of the valley floors. In most cases, these deposits represent a recharge-discharge interface between groundwater and surface water. During drier parts of the year, groundwater will be discharging through these deposits into the adjacent watercourse, as evidenced by stream and river baseflow data. During the wetter seasons, groundwater recharge occurs into these deposits from the abundant water being carried in the adjacent stream or river.

Wells developed in these deposits can have tremendous yields, although the water being withdrawn is essentially a mixture of surface water and groundwater. The contamination potential for wells developed in these deposits is greatly dependent upon the extent, thickness, grain size and other physical properties of the deposits. Utilization of these deposits is more appropriate when high quantities of water are required with less concern for quality.

Bedrock Material. The bedrock geology as delineated in Plate 3 consists of igneous and metamorphic rocks which have different hydrogeologic properties. The amount of fracturing and degree of fracture interconnection and fracture zone permeability strongly influence the yield that can be developed from a well. Plate 5 depicts several fracture configurations that may occur in Henry County.

The extent of fracturing varies according to the nature of bedrock material. In general, metamorphic rocks that are less competent (e.g., schists) do not have as extensively developed fractures as do the more competent igneous and metamorphic rocks (e.g., granite, gneiss, quartzite, etc.).

Other factors also influence well yield. Analysis of water well data (see Appendix A) indicates that topographic position, bedrock material, geologic structural position, bedding planes, joints and cleavage planes all affect well yield to some degree.

In general, higher well yield is favored by lower topographic position because the upland recharge area around the well is greater than for wells of higher topographic position. Bedrock material can influence well yield due to the fracturing of the bedrock and degree of fracture interconnection is different, to some extent, for different kinds of bedrock. Geologic structural position can influence well yield because groundwater movement occurs preferentially along structural lows (i.e., synclines), rather than structural highs (i.e., anticlines). Bedding planes, joints and cleavage planes can have an appreciable effect on well yield since these

FRACTURE CONFIGURATIONS

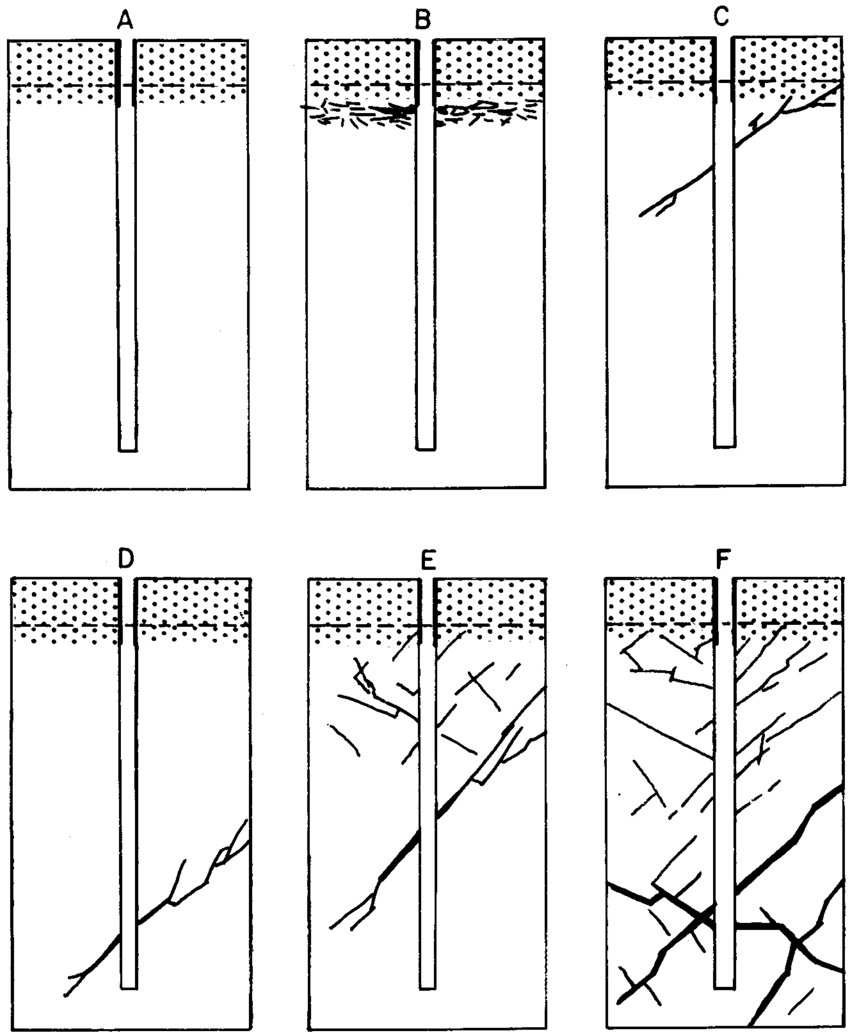


Diagram showing six types of fracture-configurations that influence the yield of wells. Stippled pattern represents soil and soft, decomposed rock. Dashed line represents the water table. Each well is 250 feet deep and is cased to about 50 feet.

A - Dry hole
B - Low yield-may go dry during drought
C - Low to moderate yield-may go dry during drought
D - Moderate yield
E - Moderate to high yield
F - High yield

Source: LeGrand, 1960

PLATE NO. 5

planes act as "pipes" for transmission of groundwater. The permeability of a formation can be significantly higher in the direction of these planes, than perpendicular to them.

Hydrologic Budget

The hydrologic budget represents a quantitative assessment of the balance between recharge and discharge for a certain interval of time in a defined area, and is expressed mathematically as follows:

$$P = R_s + R_g + ET \pm U \pm S$$

where,

P = total precipitation,

R_s = surface runoff,

R_g = groundwater runoff or baseflow,

$R_g + R_s = R_T$ = total runoff

ET = evapotranspiration,

U = subsurface underflow into or out of a basin, and

S = change in storage (surface, soil moisture, groundwater).

For this report, total precipitation and total runoff were measured directly by the use of climatological and stream gauge stations, while evapotranspiration, surface runoff and groundwater runoff were determined indirectly. Subsurface underflow was considered negligible as were changes in storage since the budget was computed on an annual basis. Therefore,

$$P = R_s + R_g + ET$$

The groundwater component of runoff was estimated from stream gauge records by assuming that the monthly minimum is a measure of baseflow.

Evapotranspiration was estimated by two different methods. Potential evapotranspiration was calculated by the Thornthwaite Method which is an empirical method based on an exponential relationship between mean monthly consumptive use and mean monthly temperature. An indirect method of evapotranspiration estimation can be derived by solving the simplified water balance equation:

$$ET = P - R_T$$

The results of hydrologic budget analyses for the Smith River Basin in Henry County are presented in Table 4, while similar analyses for the North Mayo River Basin north of Spencer, Virginia, are presented in Table 5. It was not possible to estimate budgets for the entire Mayo River Basin within the County, due to the lack of necessary climatological and stream gauge data for the basin. In comparing evapotranspiration figures, it will be noticed that a difference exists between the Thornthwaite and Indirect Methods. This difference is a result of cumulative errors inherent in estimation of various components of the budget and also in net changes in subsurface underflow and storage, both of which were assumed to be negligible. The estimated annual hydrologic budgets presented in Tables 4 and 5 do not consider all of the factors that affect the water resources of the County; however, they do represent valid approximations and should be considered as such.

The average estimated baseflow (i.e., groundwater runoff) for the period 1971-1976 is 9.51 inches (see Table 4) and 12.26 inches (see Table 5) for the Smith River and North Mayo River Basins, respectively. This is equivalent to a discharge of approximately 151,891 acre-feet of water per year for the Smith River Basin and approximately 67,320 acre-feet per year for the North Mayo River Basin (north of Spencer, Virginia; includes a portion of eastern Patrick County) for a total of approximately 219,212 acre-feet of water per year for these two river basins. Current usage

TABLE 4

ESTIMATED ANNUAL HYDROLOGIC BUDGET FOR THE
SMITH RIVER BASIN IN HENRY COUNTY, VIRGINIA
1971-72 THRU 1975-76

Water Year+	Precipitation* In. (cm)	Temperature °F (°C)	Total Runoff In. (cm)	Estimated Baseflow In. (cm)	Baseflow As Percent Of Total Runoff
1971-72	59.29 (150.60)E	56.75 (13.76)	21.00 (53.34)	10.59 (26.90)	50.4
1972-73	53.28 (135.33)E	57.20 (14.01)	21.79 (55.35)	13.83 (35.13)	63.5
1973-74	51.47 (130.73)	56.88 (13.83)	17.70 (44.96)	10.26 (26.06)	58.0
1974-75	48.28 (122.63)E	55.36 (12.99)	19.35 (49.15)	8.06 (20.47)	41.7
1975-76	33.26 (84.48)E	55.85 (13.26)	11.30 (28.7)	4.80 (12.19)	42.5
Average(5 Yrs)	49.12 (124.77)	56.41 (13.57)	18.23 (46.30)	9.51 (24.15)	51.2

POTENTIAL EVAPOTRANSPIRATION

Water Year	Baseflow As Percent Of Precipitation	Thornthwaite Method In. (cm)	Indirect Method In. (cm)
1971-72	17.9	33.12 (84.13)	38.29 (97.26)
1972-73	26.0	31.57 (80.19)	31.49 (79.99)
1973-74	20.0	31.63 (80.34)	33.77 (85.78)
1974-75	16.7	30.47 (77.39)	28.93 (73.48)
1975-76	14.4	30.89 (78.46)	21.96 (55.78)
Average (5 Yrs.)	19.0	31.54 (80.10)	30.89 (78.46)

*Average for Martinsville, Va. and Eden, N.C.
E = Estimated Value
+October-September inclusive

TABLE 5

ESTIMATED ANNUAL HYDROLOGIC BUDGET FOR THE
NORTH MAYO RIVER BASIN IN HENRY COUNTY, VIRGINIA+
1971-72 THRU 1975-76

Water Year++	Precipitation* In. (cm)	Temperature °F (°C)	Total Runoff In. (cm)	Estimated Baseflow In. (cm)	Baseflow As Percent Of Total Runoff
1971-72	59.29 (150.60)E	56.75 (13.76)	24.89 (63.22)	12.56 (31.90)	50.5
1972-73	53.28 (135.33)E	57.20 (14.01)	24.02 (61.01)	15.21 (38.63)	63.3
1973-74	51.47 (130.73)	56.88 (13.83)	20.12 (51.11)	11.94 (30.33)	59.3
1974-75	48.28 (122.63)E	55.36 (12.99)	21.49 (54.59)	12.06 (30.63)	56.1
1975-76	32.41 (82.32)	55.85 (13.26)	13.83 (35.13)	9.55 (24.26)	69.1
Average(5 Yrs)	48.95 (124.32)	56.41 (13.57)	20.87 (53.01)	12.26 (31.15)	59.7

POTENTIAL EVAPOTRANSPIRATION

Water Year	Baseflow As Percent Of Precipitation	Thornthwaite Method In. (cm)	Indirect Method In. (cm)
1971-72	21.2	33.12 (84.13)	34.40 (87.38)
1972-73	28.6	31.57 (80.19)	29.26 (74.32)
1973-74	23.2	31.63 (80.34)	31.35 (79.63)
1974-75	25.0	30.47 (77.39)	26.78 (68.02)
1975-76	29.5	30.89 (78.46)	18.58 (47.19)
Average (5 Yrs.)	25.5	31.54 (80.10)	28.07 (71.31)

+ Includes a portion of eastern Patrick County
++ October-September inclusive
* Average for Martinsville, Va. and Eden, N.C.
E = Estimated Value

(see Table 7, Page 50), based on State Water Control Board records, is approximately 11.6 mgd, or 12,994 acre-feet per year. Though it is difficult to predict how much additional groundwater withdrawal is possible, the hydrologic budget analyses (as presented in Tables 4 and 5) clearly indicate that only a small amount of the groundwater resources of Henry County is currently utilized and that tremendous additional withdrawal is possible.

For any specific area of the County, a more detailed and extensive hydrologic budget analysis should be conducted to accurately assess the groundwater resources within that area.

CHAPTER IV

GROUNDWATER DEVELOPMENT AND POTENTIAL

Introduction

Historically, groundwater resources have been developed primarily for individual domestic applications, privately-owned public water supply systems and industrial needs when no other acceptable water supply was readily available. Municipal water supply systems, however, have relied predominantly on development of surface water resources to meet their needs. Explanation of this phenomenon is somewhat elusive, if one considers the following items: 1.) approximately 97 percent of the fresh water resources of the earth occurs underground; 2.) development and treatment costs are approximately five times and three to five times, respectively, more for surface water than for groundwater; 3.) groundwater quality is generally higher and more consistent than surface water; and, 4.) properly developed groundwater resources are more reliable than are surface water supplies, since they are not as rapidly affected by drought conditions. Emphasis must be placed on the proper development of groundwater resources, which includes adequate management, if groundwater is to be considered as a reliable water supply source for municipal and industrial applications. For individual domestic supplies, proper development is not as crucial; however, owners who have had wells go dry could blame inadequate development in most instances.

Well Development

Appendix A presents a summary of water well data for Henry County. Plate 6 shows the relationships between: (a) percent of wells intersecting fractures and number of fractures intersected by a well versus yield; (b) yield of producing zones (fractures) versus depth; (c) percent wells within a certain depth range and yield of these wells versus depth; and, (d) groundwater yield from different rock types versus depth. From these graphical representations of well data, several general statements concerning wells within Henry County can be made:

1.) Average well yield for wells intersecting one, two and three or more fractures is approximately 15, 52 and 58 gallons per minute (gpm), respectively.

2.) Approximately 42%, 39% and 19% of the wells intersect one, two and three or more fractures, respectively.

3.) Well yield increases as the number of fractures intersected increases.

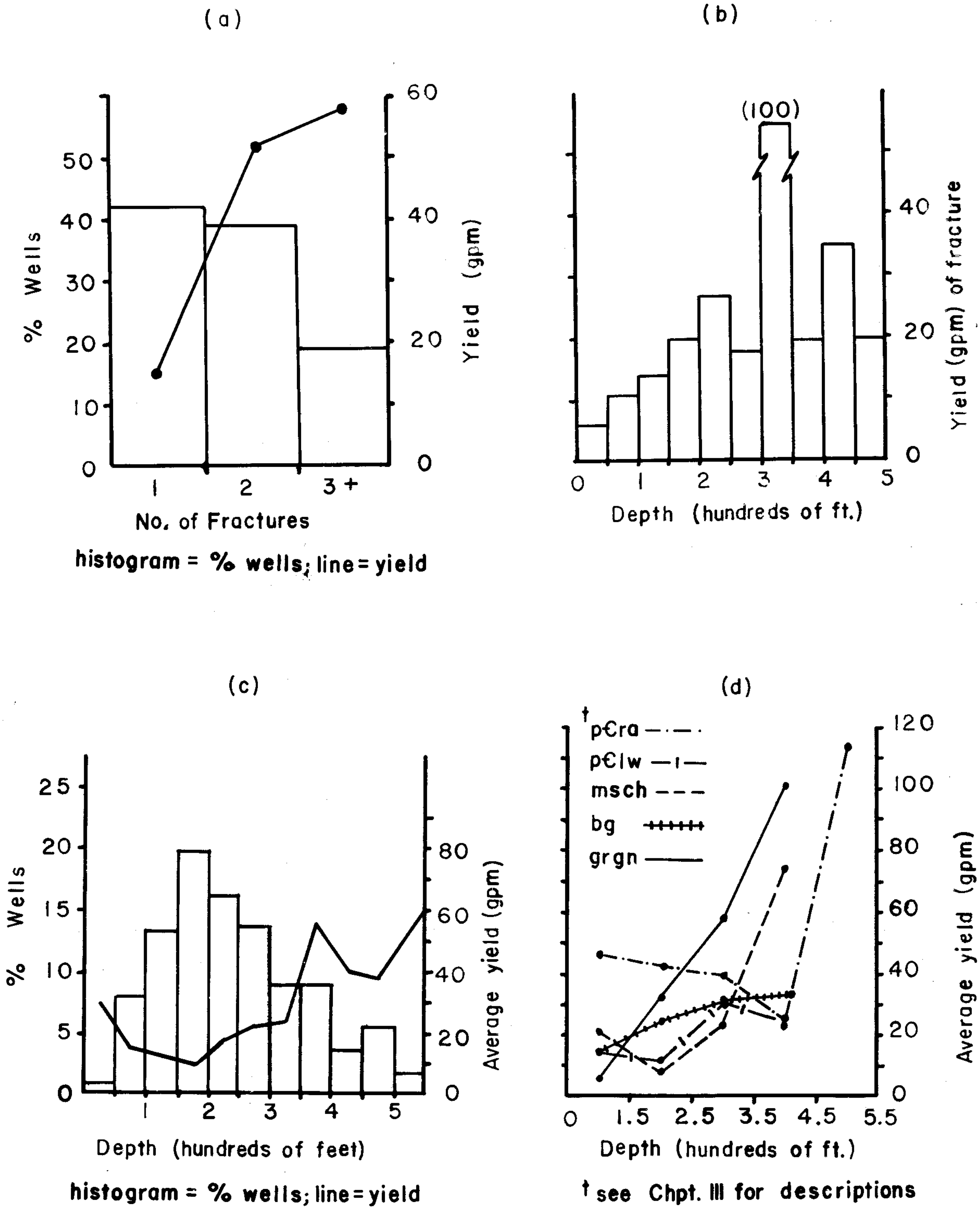
4.) Producing zone (fracture) yields increase with depth to a maximum at an approximate depth of 300 to 350 feet and then decline, with no reported producing zones at a depth greater than 500 feet.

5.) A greater number of wells within the County (19%) are constructed to a depth of 150 to 200 feet, with an average yield of approximately 13 gpm; however, greater yields are realized from deeper wells.

(NOTE: In Plate 6(c), the relatively high yield expressed for wells less than 50 feet deep is due to the fact that many of these wells are developed in alluvium along the channels of streams and rivers and the high yields are a result of induced flow from the river to the well through the alluvium. In contrast, Plate 6(b) indicates the yield from a fracture at the same depth to be substantially lower.)

6.) Certain rock types have a greater probability of supplying adequate amounts of groundwater than others. Plate 6(d) is a plot of average well yields within specific depth ranges for a particular rock type.

COMPARISON OF WATER WELL AND HYDROGEOLOGIC DATA



Source: Virginia State Water Control Board - WCRO

PLATE NO. 6

Other factors governing well yield (e.g., topographic position, number of fractures intersected, proximity to fracture or fault zones, etc.) were not taken into consideration in preparation of the graph. However, the plot does give an indication of the water-bearing characteristics for different rock types with depth. The plot indicates that granite gneiss and the Rich Acres Formation are the most productive at depths of 350 to 550 feet. For relatively shallow well applications, one could expect increased well yield with increased depth for wells constructed in granite gneiss and biotite gneiss. For the other rock types in Plate 6(d), the probability of encountering greater yields with depth is not as great as it is for the gneisses, until one goes to the depth range in which the plots reflect increased average yield. This plot does not mean that one can construct a well in the Rich Acres Formation (for example) and drill to 500 feet and expect to develop a yield of 118 gallons per minute. Adequate hydrogeologic investigation must be conducted if well yields of that magnitude are to be realized. It should also be emphasized that the yields plotted are average yields, thus indicating that well yields both above and below the average have been developed in the specific rock types plotted in Plate 6(d).

Scrutiny of the water well data in Appendix A also indicates that, in general, well yield is somewhat dependent upon topographic setting, with higher well yields, and increased probability of encountering water, favored by lower topographic positions. Valleys are developed along fractures in the bedrock, while hills remain in areas where the bedrock is not fractured or otherwise weakened; additionally, the upland areas around a valley constitute a recharge area for an individual well. Upland well locations, on the other hand, are somewhat removed from fault or fracture zones and have a limited recharge area above them. These factors contribute to the differences in well yields noted between wells for different topographic position.

As indicated in Plate 6(a), well yield increases with the number of fractures the borehole intersects. In order to develop a dependable groundwater supply, the well must be constructed to an adequate depth and must intersect a fracture or producing zone. When well yield is compared with well location proximity to a fracture trace, it becomes evident that the amount of fracturing of the bedrock material and degree of fracture interconnection strongly influence well yield.

Table 6 depicts average well depth and yield for wells in different elevation ranges and developed in different rock types. These values indicate that, on the average, wells developed in the Rich Acres Formation have greater yield than wells developed in other rock types; further, higher well yield is favored by lower topographic position.

As mentioned previously, proper well development (i.e., adequate cleaning and sanitation of the borehole), in conjunction with satisfactory well construction (i.e., proper site selection, borehole alignment, casing placement and grouting), is crucial if groundwater is to be considered a reliable water source. For most public and industrial water supply systems, the requirements of proper development are met; however, for individual domestic wells, these requirements are often times not followed.

Inadequately constructed wells can provide a rapid vehicle for groundwater contamination. Water well casing performs two important functions: 1.) it prevents the sides of the borehole from collapsing when the well passes through soil material or unstable bedrock; and, 2.) it prevents the introduction of surface water and/or contaminants into the well (and thus into the groundwater). However, satisfactory placement of the casing is necessary if this protective function is to be obtained. In many cases the casing is not properly set into the bedrock or inadequate sealing (grouting) around the casing will permit contaminants to flow down the sides of the casing and into the well. Plate 7 depicts well construction factors that can affect contamination susceptibility.

Proper well development includes such procedures as well cleaning and sanitation after construction is completed, in order to provide maximum yield and non-contaminated water. Furthermore, an accurate well-yield test should be conducted to prevent over-pumping of the well, which could result in pumping the well dry, pump damage and interruption of water supply.

In numerous instances, particularly for individual domestic wells with low yields, adequate well yield tests are not performed. While a yield test of some sort is conducted, it is usually not of sufficient duration for an accurate determination of well yield. Yield tests are performed to determine what the constant yield of a well is. Public and industrial water supply systems have extensive well yield tests performed, since pumping is performed on a more continuous basis than for individual domestic systems. While tests for domestic systems need not be as comprehensive (since pumping is generally not on a continuous basis), such tests should be accurate enough to prevent development of pump problems, as mentioned above.

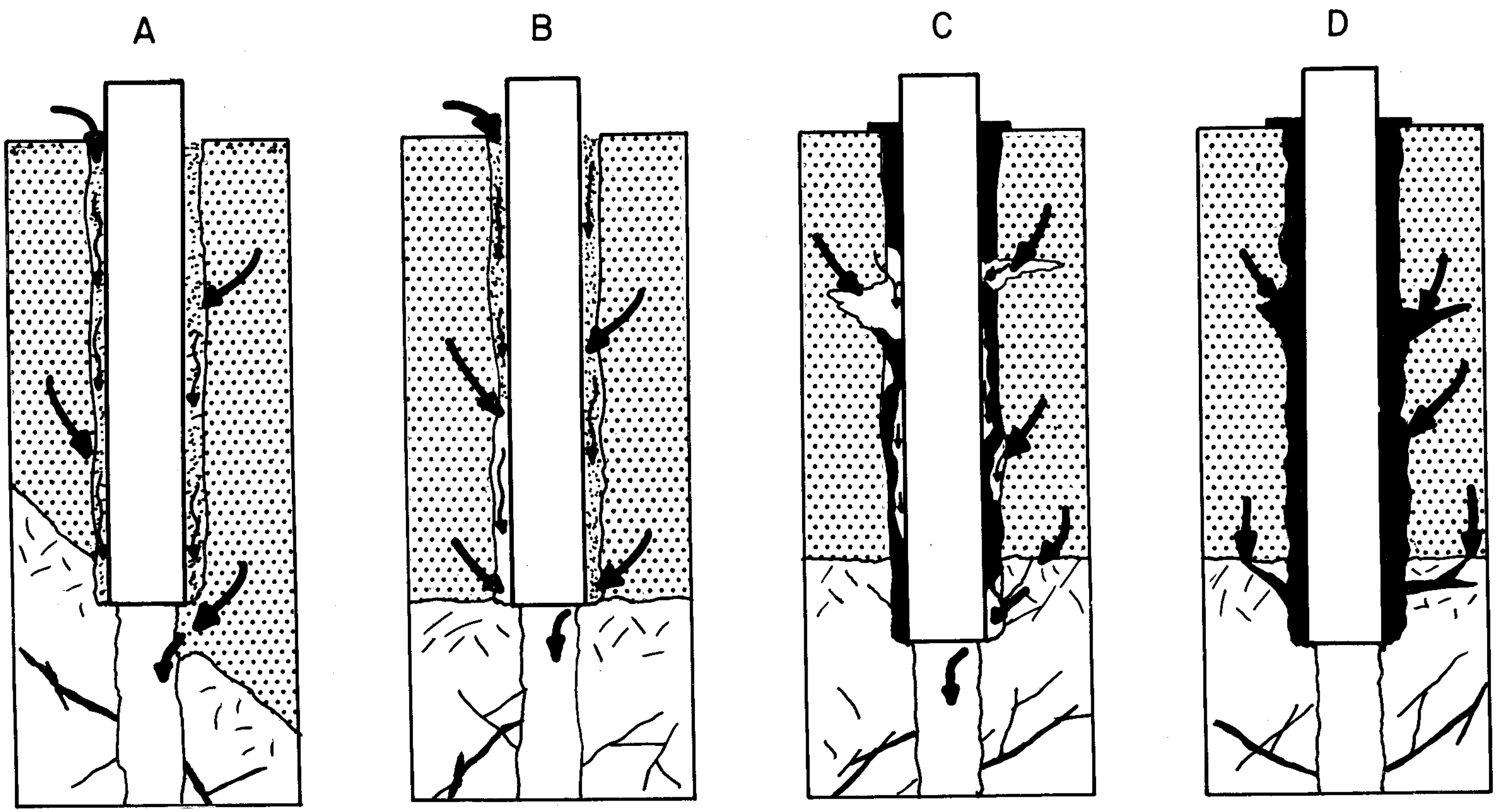
An example of the use of well-yield tests to calculate true yield is: A domestic well was constructed to a depth of 250 feet; a half-hour test conducted during completion of the well indicated a yield of five gallons per minute. The pump is set at 245 feet and the static water level is at 50 feet below land surface. Approximately 1.5 gallons of water per foot of

TABLE 6

AVERAGE WELL DEPTH AND YIELD ACCORDING
TO
ROCK TYPE AND ELEVATION
IN HENRY COUNTY, VIRGINIA

Rock Type or Formation	Elevation (Ft.)	Number of Wells	Average Depth (Ft.)	Average Yield (gpm)
-	800	96	286	54
-	800-900	100	293	40
-	900-1000	57	238	20
-	1000	60	245	19
Leatherwood Granite	-	25	275	26
Rich Acres Formation	-	77	295	45
Gneiss, Amphibolite	-	87	269	27
Schist	-	41	288	22

EFFECTS OF WELL CONSTRUCTION ON CONTAMINATION SUSCEPTIBILITY



A - casing improperly set on sloping bedrock surface; grout with drill cuttings; extreme susceptibility
B - casing improperly set on flat bedrock surface; grout with drill cuttings; high susceptibility
C - casing properly set; poured cement grout, leaves openings sometimes; low to moderate susceptibility
D - casing properly set; pressure cement grout, all openings sealed; minimal susceptibility

Stippled Area - Soil and decomposed rock

Arrows - Indicate travel path of contaminants

Source: State Water Control Board - WCRO

PLATE NO. 7

borehole (for a six-inch diameter well), times 195 feet of water above the pump intake, amounts to about 293 gallons of water in storage in the well. The owner has a 5 gpm pump installed in the well and the system functions properly for a while. However, during periods of extensive water use, the well goes dry and pump damage occurs. The half-hour yield test, at 5 gpm, was not of sufficient duration to pump out the water which was in storage in the well, and thus, the true yield of the well was not determined. Since most domestic pumps are not operating on a continuous basis, problems with the well did not develop until pumping continued for an extended period. Water level recovery data after the well went dry, indicated that a period of five hours was required for the water level to return to the static water level of 50 feet below land surface. Therefore, the actual, continuous yield of the well was lower than the 5 gpm indicated in the first test (5 hours = 300 minutes to recharge approximately the 300 gallons in storage, which is a flow to the well of about 1 gpm). If the first yield test had been conducted for a long enough period, it would have become evident that the yield of the well was substantially lower than originally determined.

Groundwater Development

Within Henry County, the major area of urban and industrial development has occurred along the Smith River Corridor, which extends from just below Philpott Dam, southeastward to the Virginia-North Carolina border. The remaining areas of the County have experienced much less development and are predominantly rural in nature. Table 7 indicates estimated groundwater baseflow (i.e., groundwater runoff to surface streams), groundwater development (i.e., combined yield of all wells as determined by well-yield tests).

TABLE 7

ESTIMATED GROUNDWATER BASEFLOW, DEVELOPMENT, USAGE AND POTENTIAL FOR PORTIONS OF HENRY COUNTY, VIRGINIA

Sub-Basin	Baseflow* (mgd)	Development** (mgd)	Usage+ (mgd)	Potential++ (mgd)
Smith River Corridor	87.5	6.6	9.4	78.1
Smith River Basin (excludes corridor)	58.3	0.8	.8	57.5
North Mayo River (includes part of Patrick County)	62.9	2.8	1.4	60.1
Unlocated Wells	-	4.7	-	-
Total for Henry County	208.7	14.9 (7%)	11.6	193.8

* Average value computed for the 5-year interval 1971-1976.

** From SWCB file records only, does not include all wells, computed from well-yield tests submitted with Water Well Completion Reports.

\+ Computed from SWCB file records and assuming per capita water use of 125 gpd.

++ Refers to amount of groundwater resources present, not the amount which can be extracted.

usage (actual groundwater withdrawal as determined by State Water Control Board file records and per capita water use figures) and potential (amount of groundwater remaining under the surface, but not the amount that could be withdrawn for different areas of the County). When the development of groundwater is being considered, adequate hydrogeological evaluation is necessary to ensure a reliable water supply. Many factors affect groundwater occurrence, movement, availability and quality, and these factors should be investigated when consideration is given to groundwater development to meet the needs of large water users. For individual domestic application, extensive hydrogeologic investigation is not required; however, individuals should engage professional consultation services to facilitate development of an adequate water supply.

In Table 7, a significant difference is present between figures for groundwater development and usage. Development refers to the volume of water that could be extracted from wells within the County or Sub-basin, while usage refers to the volume of groundwater actually withdrawn. It should be recognized that calculation of the development figures in Table 7 are based on well yield tests as conducted by water well contractors, which do not necessarily reflect the actual yields that can be developed. Further, State Water Control Board file data does not include a record of all wells constructed in Henry County, and thus, the development values should be considered as an approximation of actual development figures.

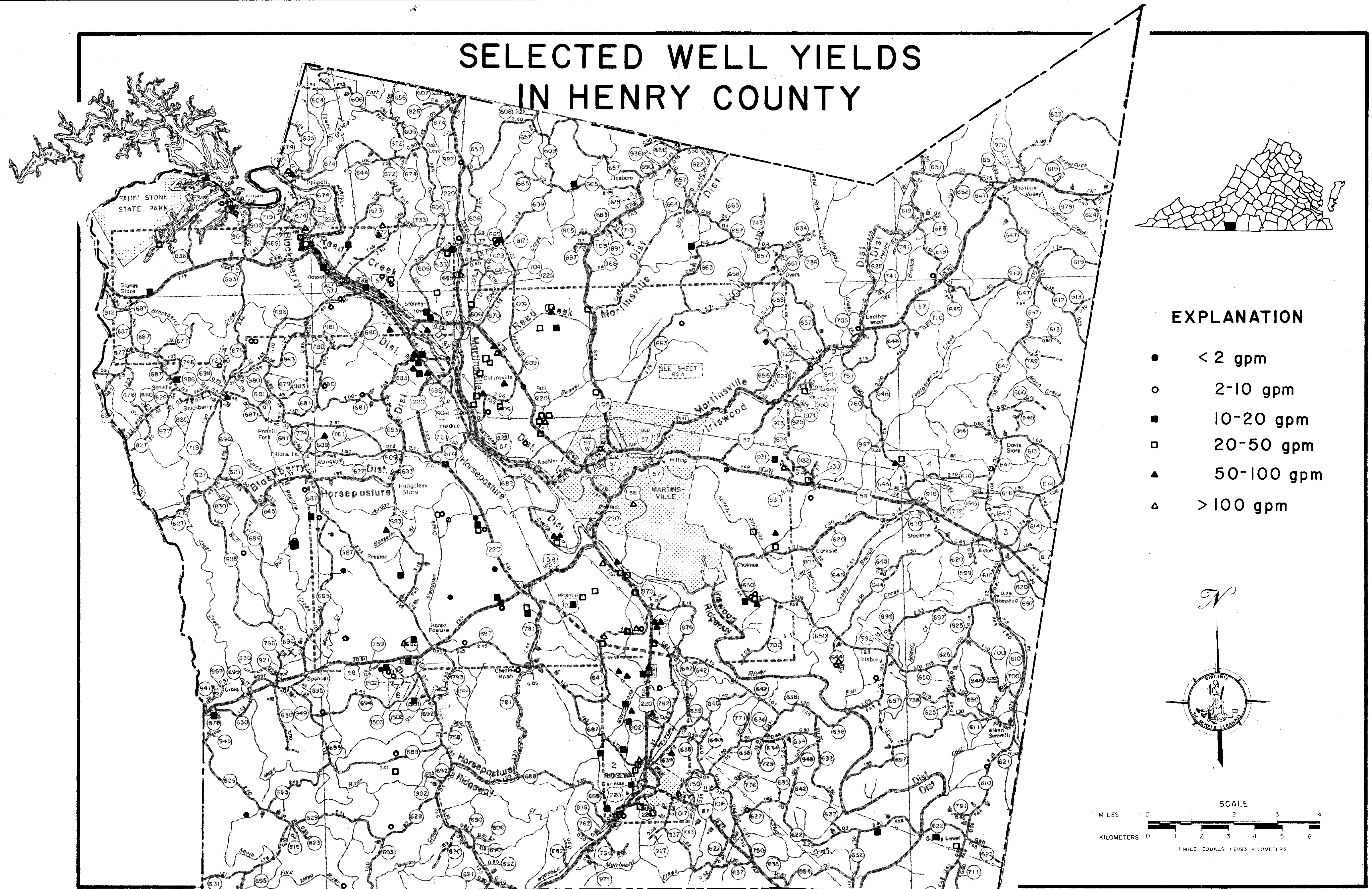
Proper development also implies management of the resource, not only from the standpoint of protection (i.e., from surface activities that may pollute groundwater), but also from a usage standpoint. In other words, competitive uses of groundwater in a particular area must be considered to ensure that overuse of the resourc, with resultant aquifer damage and severe interference problems, does not occur.

Plate 8 is a plot of selected well yields in Henry County, while Plate 9 depicts wells intersecting one, two or three or more fractures (producing zones). In Plate 9, numerals adjacent to the fracture symbol indicate the yield of the well, which emphasizes the importance of intersecting fractures within the bedrock to assure development of an adequate and reliable groundwater source. Major fracture traces and lineaments in Henry County are represented in Plate 4. Scrutiny of the Water Well Data Summary for Henry County (Appendix A) reveals that many of the higher production wells are located on or very close to major fractures and lineaments. Wells developed in bedrock must intersect producing zones (fractures) where secondary porosity and permeability permit development of sufficient well yields.

Groundwater Potential

Table 7 indicates that an estimated seven percent of the groundwater resources of Henry County have been developed, with a potential of 193.8 mgd still available for development. It must be emphasized that this figure for groundwater potential is an estimate of the amount of groundwater remaining that has not been developed and does not indicate that the volume represented could be extracted or pumped. The actual amount of groundwater that could be withdrawn would be lower than the indicated amount, although it would be extremely difficult to predict what that exact amount would be. However, the values in Table 7 do indicate that a significant potential for groundwater development is present in Henry County.

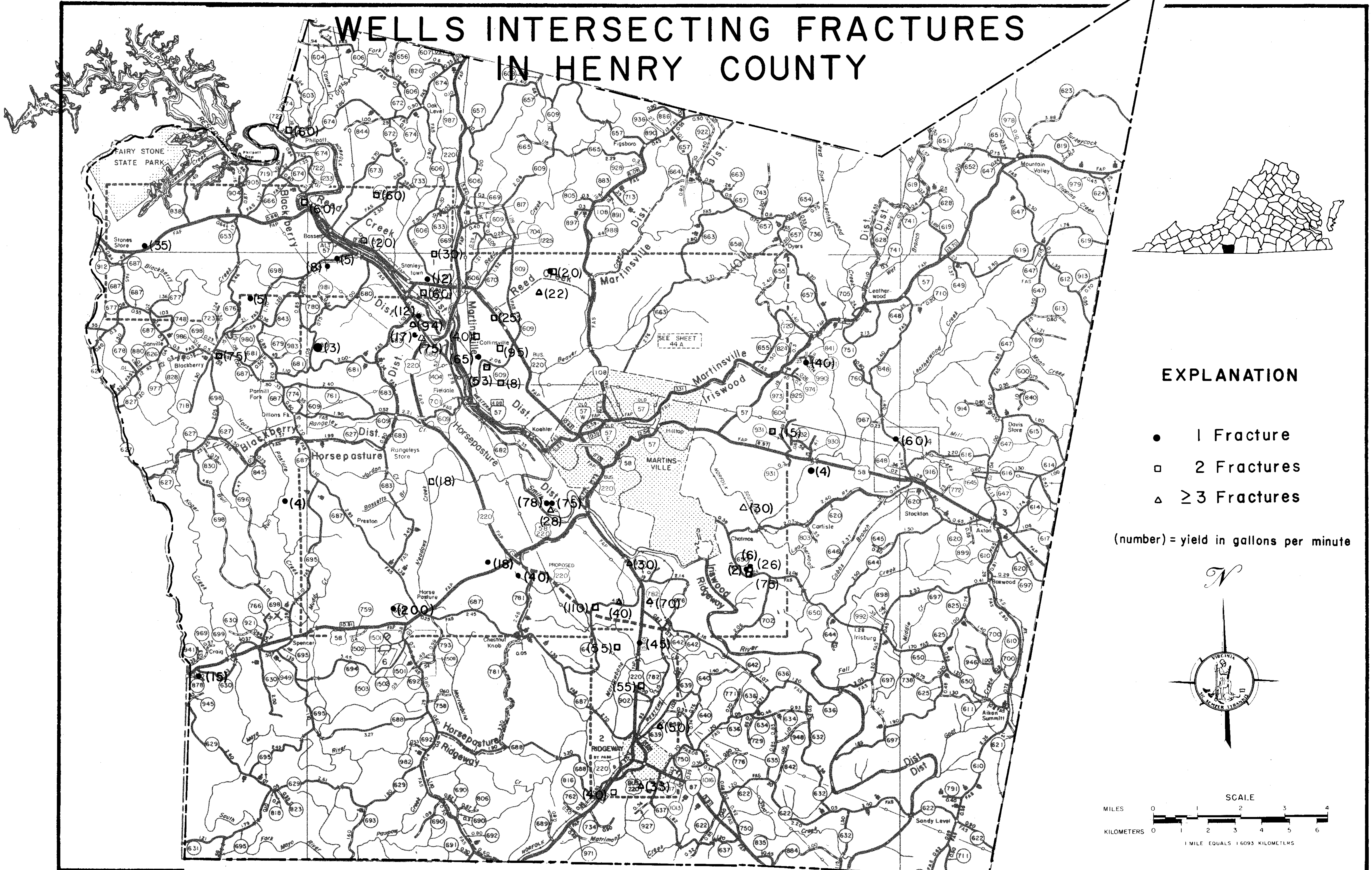
Greater development of groundwater resources has occurred in the



Source: Virginia State Water Control Board - WCRO

PLATE NO. 8

WELLS INTERSECTING FRACTURES IN HENRY COUNTY



Source: Virginia State Water Control Board - WCRO

PLATE NO. 9

Smith River Corridor and the potential for future development is not as great in this portion of the County as it is outside of the Corridor. Plate 4 indicates major fracture traces and lineaments and Plate 3 depicts major geologic structures, faults and bedrock geology. Development of high production wells must, out of necessity, be undertaken in areas that have favorable geologic conditions. While the aforementioned plates indicate general areas where development of large groundwater supplies may be possible, detailed hydrogeological investigations are necessary for an accurate delineation of the groundwater potential in specific areas of the County. Another area of vast potential, is development of relatively shallow wells in alluvium, which could provide from one to several million gallons a day depending on the extent, thickness and hydrological characteristics of the alluvial deposits.

CHAPTER V

GROUNDWATER QUALITY

Introduction

Dissolved chemical constituents in groundwater are a reflection of the soil and bedrock material in which the water occurs and these constituents affect its overall quality and usefulness. Consequently, chemical groundwater quality will vary from place to place, as do the soil and bedrock materials. The presence of other quality parameters (such as bacteria, hydrocarbons, nitrates, excessive chlorides, certain heavy metals, etc.) are, for the most part, a result of man's activities, which introduce contaminants to the subsurface environment.

General Groundwater Quality

Generally, groundwater is colorless, clean and has a constant temperature equivalent to the average yearly temperature of the area where it occurs (in Henry County, about 15.5^{o}C or 60^{o}F). Numerous properties can be determined by detailed water-analysis techniques; however, the parameters discussed in Table 8 are sufficient for an overall assessment of groundwater quality. Results of these analyses are expressed in the metric system as milligrams per liter (mg/l). Although not precisely equivalent, milligrams per liter (mg/l) is often times used interchangeably with parts per million (ppm).

The parameters discussed in Table 8 constitute routine analysis as conducted by the State Water Control Board, and are sufficient for an overall assessment of groundwater quality. However, for a more specific assessment, a detailed groundwater quality analysis should be conducted.

TABLE 8

SOURCE AND SIGNIFICANCE OF SELECTED GROUND WATER QUALITY PARAMETERS

CONSTITUENT OR PROPERTY	SOURCE OR CAUSE	SIGNIFICANCE
Hydrogen ion concentration (pH)	Acids, acid-producing salts, and free carbon dioxide lower the pH. Phosphates, silicates, carbonates and bicarbonates raise the pH.	Measurement of pH gives an indication of whether the water will act as a weak acid or as an alkaline solution. A pH value of 7.0 is considered neutral with values below 7.0 being acidic, and above 7.0 as alkaline. Generally, water with decreasing pH values is increasingly corrosive, although extremely alkaline waters will also be corrosive. In areas with acid mine drainage, improper chemical waste disposal and other activities that may contaminate ground water quality, measurement of pH values may indicate contamination.
Specific conductivity (micromhos per cubic centimeter at $25^{o}C$)	Dissolved mineral content of water.	Specific conductance is a measure of the capacity of the water to transmit an electric current. The value varies directly as does the concentration of dissolved mineral constituents.
+ Total Dissolved Solids (500 mg/l)	Primarily from mineral constituents dissolved from soil and rocks.	A general indication of the overall suitability of water for many uses. Water with concentrations less than 500 mg/l is generally satisfactory for domestic use and for many industrial applications. Water with concentrations greater than 500 mg/l is frequently unsuitable for many purposes, having a disagreeable taste and potential corrosiveness to well casings & pumping apparatus.
Hardness	Primarily derived from dissolved calcium and magnesium, although other constituents contribute to the total hardness value.	Most commonly evidenced by the amount of soap required to produce suds. Familiar bathtub ring is the result of soap combining with dissolved minerals. When hard water undergoes drastic temperature change (e.g. boilers, hot water tanks, coffee pots, etc.), it will form a hard scale. Water hardness is somewhat relative between different areas. Water with hardness values up to 80 mg/l is considered soft; 80 to 120 mg/l, moderately hard; 120 to 180 mg/l, hard; and greater than 180 mg/l, very hard.
+ Iron (Fe) (0.3 mg/l) + Manganese (Mn) (0.05 mg/l)	Dissolved from practically all rocks and soils. Additional iron may be contributed by iron pipes, pumps and other equipment.	Both iron and manganese are present in practically all water supplies and when present in even small amounts, may cause problems with staining and odor. Manganese problems occur at much lower concentrations than iron does. When ground water containing these dissolved minerals is aerated, a precipitate is formed: iron dioxide-FeO_2(common rust); and, manganese dioxide-MnO_2. Concentrations in excess of the standard will result in taste and odor problems, staining of laundry and plumbing fixtures, and may favor the growth of slime-forming bacteria which have been known to clog pipes, pumps, fixtures and pores in water bearing formations.
Calcium (Ca) and Magnesium (Mg)	Dissolved from practically all soils and rocks but especially from limestone, dolomite and gypsum.	Causes most of the hardness and scale-forming problems with water; major "hardness" constituents of hard water (see hardness). Water with low concentration is more desireable for many commercial, industrial and dommestic applications.
Sodium (Na) and Potasium (K)	Dissolved from practically all rocks and soils. Also found in sea water, brines and sewage.	When present in high concentrations with chlorides will impart salty taste to water. Does not have appreciable affect as to usefulness of water when present in moderate amounts.
Alkalinity	Carbonate and bicarbonate ions in water contribute to alkalinity	Ability of water to neutralize acid. Water does not have to have a pH above 7.0 to possess alkalinity. Some ground water with a pH value below 7.0 may have some salts that will neutralize acids and, consequently, will have a measureable alkalinity.
+ Chloride (Cl) (250 mg/l)	Dissolved from soils and rocks. Present in sewage, sea water and industrial brines.	When combined with sodium in large concentrations, will give water a salty taste. Will increase corrosiveness of water when present in large amounts. Water with concentration greater than 500 mg/l will have disagreeable taste; studies indicate that some livestock can consume water with as much as 3,000 or 4,000 mg/l with no ill effects. High concentrations in ground water usually indicate contamination by sea water (coastal areas), industrial brines or by some of man's surface activities such as highway deicing or salt storage areas.
+ Sulfate (SO_4) (250 mg/l)	Principally derived from gypsum (calcium sulfate) or oxidation of pyrite (iron sulfide) or soils and rocks containing other sulfur compounds. Present also in some industrial wastes.	Drinking water standard based primarily on esthetic considerations. Will form hard scale in boilers when combined with calcium; will give water a bitter taste when present in large concentrations; if Epsom salt (magnesium sulfate) or Glauber's salt (sodium sulfate) are present, infrequent users may notice a laxative effect.
* Nitrate (NO_3) (10 mg/l as Nitrogen or 45 mg/l as NO_3)	Derived from decaying organic matter, fertilizer, sewage and nitrogen in soil.	Concentrations vary from area to area and appear unrelated to geology. Levels in excess of local background levels, may indicate pollution. Drinking water standard based on possible toxicity to infants, knowns as cyanosis (Johnson, 1972), in which baby becomes listless and drowsy with skin taking on a blue color and therefore, should not be used in formula preparation. Older children and adults are not affected, however, excessive nitrate levels may indicate contamination from sewage or manure, which may harbor harmful bacteria. High nitrate levels encourage the growth of algae and other organisms which impart disagreeable odor and taste to the water.
* Fluoride (F) (1.4 mg/l)	Present in minute quantities in most rocks and soils. Added to many municipal water supplies by fluoridation.	Reduces incidence of tooth decay when consumed during the period of enamel calcification during childhood. However, excessive concentration may cause tooth mottling depending on age of child, amount consumed and individual susceptibility.

*Standard based on health considerations.
+Standard based on aesthetic considerations.

Source: Klemt, et al, 1976 and Virginia State Health Department.

The Virginia Department of Health (Waterworks Regulation, 1974) has adopted public drinking water standards that are quite comprehensive and require testing for chemical, bacteriological and radiological constituents before a source can be approved as a public drinking water supply. The public drinking water standards for the parameters discussed in Table 8 are given when applicable, with an asterisk (*) indicating those based on health considerations. Although not discussed in Table 8, public drinking water standards also delineate concentrations for heavy metals, such as arsenic (0.1 mg/l), barium (1 mg/l), cadmium (0.01 mg/l), chromium (0.05 mg/l), copper (1 mg/l), cyanide (0.2 mg/l), lead (0.05 mg/l), mercury (0.002 mg/l), silver (0.05 mg/l) and zinc (5 mg/l). With the exception of copper and zinc (which are established for aesthetic reasons), the limits are based upon the toxicity of the various metals and provide a reasonable safety factor for human consumption. For the most part, groundwater quality within Henry County is well within the abovementioned limits, although some isolated cases of excessive concentrations have been noted.

Groundwater Quality Within Henry County

A generalized summary of groundwater quality for the different rock types is presented in Table 9, which presents minimum, maximum and mean values for the various parameters listed. As can be seen from Table 9, groundwater quality varies somewhat according to rock type, but the overall quality is quite good. Appendix B is a water quality printout for all wells in Henry County for which reliable information is available.

Man's Influence on Groundwater Quality

Surface water exists in a fairly "open" system, that is, factors influencing water quality usually result in immediate detection and, although the effects may vary in their degree of severity, they are usually short-lived in a particular area because the movement and dissipation of pollutants takes place quickly. Groundwater, however, exists in a system where input and output occur at a much slower rate than for surface water. Consequently, a considerable interval may develop between the time contaminants are placed on the land surface (or in the soil mantle) and the time these contaminants are noticed in the groundwater. After groundwater contamination has been detected (e.g., well contamination), the problem will normally remain in the affected area for an extensive time period, since groundwater flow velocities are relatively slow, compared with surface water velocities.

Contamination of groundwater is not as immediately apparent as for surface water. Man's surface activities can proceed for years with no noticeable effects on groundwater quality and suddenly appear as a relatively severe pollution problem. For example, an automotive garage may dispose of its waste oil by dumping it out back of the facility for years, with no groundwater quality problems evident. It may take years for the oil to slowly percolate down through the overlying soil cover and through the bedrock, to appear, quite suddenly, in a neighbor's well. When something like this occurs, it is very difficult, if not impossible, to correct the situation and the problem can continue for quite some time after the source has been eliminated.

Man's activities may result in a much swifter impairment of groundwater quality than the above example, but practically all activities have

TABLE 9

GROUNDWATER QUALITY IN HENRY COUNTY

Parameter[1]	Gneiss (Map Symbol:grgn,bg,bm)			Schist (Map Symbol:msch p€ly,fm)			Rich Acres Fm. (Map Symbol:p€ra)			Leatherwood Granite (Map Symbol:p€lw)		
	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean
pH	6.0	8.0	6.9	6.3	8.1	6.8	6.0	7.6	6.8	5.8	6.5	6.2
Specific Conductance	56	510	199	84	250	142	53	280	163	54	580	237
TDS[2]	13	389	143	100	168	120	75	215	136	64	66	65
Hardness	28	232	90	49	116	66	27	143	77	12	22	17
Iron	0.0	0.4	0.1	0.0	24.0	3.5	0.0	9.2	1.2	-	-	-
Manganese	0.0	0.2	0.03	0.01	0.44	0.12	0.0	0.2	0.04	0.0	0.01	0.01
Calcium	0.0	49.0	15	14.0	31.0	20.5	3.0	45.0	17.4	4.0	7.0	5.7
Magnesium	0.7	6.5	3.7	1.7	3.3	2.1	.09	19.0	5.7	1.2	1.2	1.2
Sodium	1.0	16.0	7.7	5.0	16.0	6.8	1.0	94.0	11.7	1.0	7.0	4.3
Potassium	0.3	7.9	2.3	0.6	1.0	0.9	0.2	5.0	2.5	0.9	2.0	1.8
Chloride	1.0	28.0	9.1	9.0	16.3	11.3	0.4	30.8	9.1	0.0	10.0	3.7
Sulfate	0.0	18.0	5.7	1.0	5.0	2.8	1.0	15.0	4.0	2.0	3.0	2.7
Nitrate	0.0	5.8	2.2	-	-	-	0.0	19.0	3.7	-	-	-
Number of Wells Sampled		15			9			21			3	

1. All values expressed as milligrams per liter, except for pH (dimensionless) and specific conductance(micromhos)
2. Total Dissolved Solids

Source: State Water Control Board, West Central Regional Office

the potential for adversely affecting groundwater quality. Poorly constructed wells may permit rapid contamination of groundwater by permitting polluted surface water to flow down the well casing and into the groundwater regime.

The capacity of soils for filtering and treating wastes is generally good; however, if careful consideration is not given to the planning, design and construction of land disposal areas, groundwater contamination may result. Sanitary landfills, chemical waste disposal areas, sludge disposal areas and land application of sewage treatment plant effluents, to mention a few, all require sufficient planning, design and operation to assure that groundwater quality in the area is maintained. Many cases throughout the country have been documented where groundwater contamination has occurred 25 to 50 years after a land disposal site has been abandoned. Experience has shown that with present technology, rehabilitation of contaminated aquifers is physically very difficult and monetarily prohibitive.

In addition to land disposal of wastes, other surface activities can seriously affect groundwater quality in a particular area. The improper or excessive use of fertilizers, pesticides, herbicides and de-icing salts or accidental spilling of petroleum or chemical liquids can have a severe and long-lasting potential for groundwater contamination. It must be recognized that prevention of groundwater contamination is the key to maintaining groundwater quality and that rehabilitation of contaminated groundwater resources is very difficult, if not impossible, to accomplish.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Three major hydrogeologic units have been identified in Henry County:

1. Soil Mantle, Colluvial and Terrace Deposits can provide adequate groundwater supplies for small domestic applications, although wells developed in these deposits do have a relatively high susceptibility for contamination from surface and near-surface sources. Wells constructed in these deposits are typically shallow, bored or hand dug, with low yields (0.5 to 2.5 gpm).

2. Alluvial Deposits can permit development of wells with very high yields, depending on the physical characteristics of the deposits. These deposits occur along streams and rivers in Henry County and usually occupy most, or all, of the valley floors. Pollution susceptibility is highly dependent upon the physical nature of the deposits and water withdrawn from the deposits can be considered a mixture of surface and groundwater.

3. Bedrock Material permits development of high quality and reliable groundwater supplies with minimum pollution susceptibility, if good well construction and development is employed. The natural groundwater quality varies somewhat, depending upon the nature of the bedrock in which the water occurs, and well yield is dependent upon intersecting fractures in the bedrock material. Wells developed in the Rich Acres Formation have a higher average well yield than wells developed in other formations or rock types.

The primary porosity and permeability of the bedrock material within Henry County is relatively low and development of high production wells must occur in areas of folding, faulting and fracturing where these phenomena result in higher secondary porosity and permeability. The majority of groundwater development has occurred along the Smith River Corridor to meet the needs of industrial and commercial enterprises, but a large potential remains for future development. Development of relatively shallow wells in alluvial deposits, which could provide from one to several million gallons a day, is a potential groundwater source, which warrants careful consideration.

Groundwater quality within Henry County is relatively high, although a few cases of poor quality have been reported. In general, the Leatherwood Granite has a higher water quality than the other formations or rock types, although exceptions to this may be encountered. Water quality in the Soil Mantle, Colluvial and Terrace Deposits can be highly variable depending on the chemical composition of those deposits. Alluvial Deposits have a variable water quality depending on the characteristics of those deposits and, in part, upon the water quality of adjacent rivers and streams.

Recommendations

Prospective large-scale users of groundwater should obtain adequate professional hydrogeological consultation to accurately delineate the groundwater conditions in specific areas of interest.

Groundwater is a valuable and vulnerable natural resource which requires adequate protection in both the quality (preventing contamination) and quantity (resource management) aspects.

Groundwater and surface water are not separate entities. Comprehensive water resource planning and management must address both of these phases of the hydrologic cycle in order to assure that sufficient, high quality water sources are available for future domestic, commercial and industrial development in Henry County.

Prospective groundwater users and developers, water well contractors and professionals should comply with all applicable aspects of the Groundwater Act of 1973. This Act, in part, requires submission of reports to the State Water Control Board concerning water well construction (Water Well Completion Report, Form GW-2) and groundwater pumpage and use (Ground Water Pumpage and Use Report, Form GW-6). Information contained in these reports aids this Agency in developing a more realistic inventory of the groundwater resources of the State and thus, better delineation of the role of groundwater in meeting future water needs will be realized.

APPENDIX A

SUMMARY OF WATER WELL DATA FOR HENRY COUNTY

The computer printout on the following pages lists basic well data for wells in Henry County. This printout is updated frequently to include information from new Water Well Completion Reports which are constantly being submitted by water well drillers. The information under the heading "Aquifer" may be cross-referenced with Table 3, Chapter III.

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   W A T E R   C O N T R O L   M A N A G E M E N T

SUMMARY OF WATER WELL DATA FOR HENRY COUNTY

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THE FOLLOWING LIST OF WELL DATA SUMMARIZES BASIC DATA OBTAINED FROM WATER WELL COMPLETION REPORTS WHICH ARE ON PERMANENT FILE IN THE OFFICES OF THE VIRGINIA STATE WATER CONTROL BOARD. ADDITIONAL INFORMATION FOR MANY OF THE WELLS IS AVAILABLE AND CAN BE OBTAINED BY CONTACTING THE APPROPRIATE REGIONAL OFFICE OR THE BUREAU OF WATER CONTROL MANAGEMENT AT THE AGENCY HEADQUARTERS IN RICHMOND.

************ EXPLANATION OF PARAMETERS ************

SWCB NO: STATE WATER CONTROL BOARD NUMBER - A SEQUENTIAL NUMBERING SYSTEM USED WITHIN A COUNTY; WHEN REFERRING TO A SPECIFIC WELL USE THIS NUMBER

OWNER AND/OR PLACE: IDENTIFIES ORIGINAL OR CURRENT WELL OWNER AND/OR LOCATION OF WELL

YEAR COMP: YEAR IN WHICH WELL CONSTRUCTION WAS COMPLETED

LOG: TYPE OF LOG ON FILE FOR WELL; D = DRILLERS, E = ELECTRIC, G = GEOLOGIC

ELEV: ELEVATION - MEASURED IN FEET ABOVE MEAN SEA LEVEL

TOTAL DEPTH: TOTAL DEPTH DRILLED, IN FEET, WITH RESPECT TO LAND SURFACE

BEDROCK: DEPTH TO BEDROCK, IN FEET, WITH RESPECT TO LAND SURFACE

CASING: MAXIMUM AND MINIMUM DIAMETER OF CASING, IN INCHES, USED IN WELL

DEVEL ZONE: DEVELOPED ZONE - INTERVALS, IN FEET, WHERE AQUIFERS TAPPED AND/OR SCREENED

AQUIFER: WATER-BEARING UNIT; ABBREVIATIONS USED INDICATE GEOLOGIC AGE OF UNIT AND ARE CONSISTENT WITH "GEOLOGIC MAP OF VIRGINIA" (DIVISION OF MINERAL RESOURCES - 1963)

STATIC LEVEL: DEPTH, IN FEET, TO WATER WITH RESPECT TO LAND SURFACE; MEASUREMENTS TAKEN WHEN WELL IS NOT PUMPED AND ARE GENERALLY THOSE RECORDED ON COMPLETION DATE

YIELD: REPORTED OR MEASURED PRODUCTION, IN GALLONS PER MINUTE

DRAWDOWN: DIFFERENCE, IN FEET, BETWEEN STATIC LEVEL AND PUMPING LEVEL; I.E., REPORTED OR MEASURED DROP, IN FEET, IN WATER LEVEL DUE TO PUMPING

SPEC CAPAC: SPECIFIC CAPACITY - YIELD PER UNIT OF DRAWDOWN EXPRESSED AS GALLONS PER MINUTE PER FOOT OF DRAWDOWN

HRS: HOURS - DURATION OF PUMP TEST, IN HOURS, FROM WHICH THE PRECEDING THREE ITEMS WERE DERIVED

USE: USE OF WATER OR WELL UNDER CONSIDERATION; DOM = DOMESTIC, PUB = PUBLIC, GOV = GOVERNMENT, IND = INDUSTRIAL, COM = COMMERCIAL, INS = INSTITUTIONAL, ABD = ABANDONED, DST = DESTROYED, IRR = IRRIGATION, RCH = ARTIFICIAL RECHARGE

VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF WATER CONTROL MANAGEMENT

SUMMARY OF WATER WELL DATA FOR HENRY COUNTY

SWCB NO	OWNER AND/OR PLACE	YEAR COMP	LOG	ELEV	TOTAL DEPTH	BED-ROCK	CASING MAX MIN	DEVEL FROM	ZONE TO	AQUIFER	STATIC LEVEL	YIELD	DRAW DOWN	SPEC CAPAC	HRS	USE
1	SHANNON HILLS #2	65		780	218	55	6			PCRA	38	50	6	8.33	2	PUB
2	HENRY CO PSA			990	490	110	8	125	140		100	3				PUB
	CARVER ESTATES #3															
3	HNRY CO.PSA DANIEL#10	68		860	690	67	6	140	142	PCRA	87	8	210	.03	48	PUB
4	DU PONT	70	D	750	280	48	6	59	61	BGN	14	78	63	1.23	8	IND
5	DU PONT	68	D	740	360	63	6	74	75	BGN	52	28	126	.22	8	IND
6	HNRY CO.PSA CARVER #2	68	D	1040	480	105	6	414	415	SMS	40	8	375	.02	8	ABD
7	HNRY CO.PSA LITHIA	68	D	840	302	34	6	90	100	MSCH	45	50				PUB
8	PSA TANGLEWOOD TERR#2	68		825	265	65	6	94	95	PCLW	40	110	260	.42	3	PUB
9	BASSETT MNF #1	51		770	65	41	6	17	65	BG	17	21	4	5.25	1	PUB
10	L.O.F.PLASTICS	69		440	395		8			PCV	42	120			12	IND
11	PSA ARLINGTON HTS #2	69	D	740	160	55	6	63	64	PCRA	40	30	105	.28	8	PUB
12	HBC WATER CO.HOLIDAY	69	K	825	350	90	6	125	135	PCLW	90	40	400	.10	24	PUB
					350	90	6				90			.40	24	
13	HENRY CO PSA				325	80	6				100	3				
	CARVER ESTATES															
14	USA CORPS,PHILPOTT #3	68	D	1130	122	38	6			MSCH	45	35			2	GOV
15	PHILPOTT RESERVOIR	68	D	1100	200	89	6			MSCH	93	6			1	GOV
18	PATRICK HENRY COLLEGE	68	G	770	400		6			PCV						INS
19	PATRICK HENRY COLLEGE		G	770	400		6			PCV		30				INS
20	CARLISLE WATER CO.#4	64		805	250	88	6	95	125	PCLW	50	15	200	.07	3	PUB
21	CARLISLE WATER CO.#5	65	D	760	250	58	6	65		PCLW	53	4				PUB
22	CARLISLE WATER CO. #6	65	D	740	250	55	6	65		PCRA	40	30				PUB
23	HENRY CO.SOCIAL SERV.		D	940	200	40	6	90	100	PZLW	50	20			1	PUB
24	HENRY CO PSA			940	212	20	6	55	75		60	12			12	PUB
	CARVER ESTATES #1															
25	HENRY CO PSA			980	125	20	6	50	75		60	20	75	.26	12	PUB
	CARVER ESTATES #2															
26	HENRY CO PSA				325	30		125	130		125	1				PUB
	CARVER ESTATES #4															
27	HENRY CO PSA			980	165	60		60	61			1				PUB
	CARVER ESTATES															
28	BOB ANTHONY,WESTWOOD	70	D	1180	320	80	6	180	181	MSCH	40	10	141	.07	10	PUB
29	BOB ANTHONY,FAIR #1	70	D	1245	320	160	6	280	281	GN	50	30	280	.10	8	PUB
30	BASSETT KNITTING CO.	70		790	340	35	6	98	100	GRGN	20	35				IND
31	REED CREEK,EASTWOOD#3	69	D	800	360	57	6	130	132	PCRA	40	6	310	.01	10	PUB
32	MTN VIEW ESTATES #2	70	D	860	320	63	6	90	91	BG	50	5	260	.01	10	PUB
33	MTN VIEW ESTATES #1	70	D	920	320	40	6	160	163	BG	60	8	250	.03	10	PUB
34	HNRY CO.PSA DANIEL#11	70	D	800	500	96	6	200	225	FG	45	35	167	.20	48	PUB
35	BASSETT-WALKER KNIT	71	D	790	360	58	8	85	87	GRGN	40	300	210	1.42	10	IND
36	HNRY CO.PSA CARVER #3	71	D	1030	325	90	6	210	225	SMS	50	8	325	.02	2	PUB
37	BASSET WAREHOUSE LOT	70		750	187	51	6	150	153	QT	19	20				IND
38	HNRY CO.PSA MEDOGRDN2	71	D	840	225	118	6	135	225	PCRA	65	40	40	1.00	1	PUB
39	CHARLES FINNEY	71	D		425	20	6				60	100	295	.33	10	PUB

VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF WATER CONTROL MANAGEMENT

SUMMARY OF WATER WELL DATA FOR HENRY COUNTY

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SWCB NO	OWNER AND/OR PLACE	YEAR COMP	LOG	ELEV	TOTAL DEPTH	BED-ROCK	CASING MAX MIN	DEVEL FROM	ZONE TO	AQUIFER	STATIC LEVEL	YIELD	DRAW DOWN	SPEC CAPAC	HRS	USE
40	LAUREL PARK WATER WKS	72	D	730	285	62	6	225	285	PCRA	60	25	20	1.25	3	PUB
41	HENRY CO PSA CARVER ESTATES			920	225	80	6	105	108		40	25			74	PUB
42	CHARLIE M FINNEY	72	D		412	50	6				60	42	60	.70	10	PUB
43	REED CR.EASTWOOD #1	67		790	300	62	6			PCRA	40	10	280	.03	2	ABD
44	REED CR.EASTWOOD #2	68	D	730	262		6	54	55	PCRA	40	26				PUB
45	CARLISLE WATER CO. #2	59	D	660	230	9	10			PCRA	14	60	66	.90	45	PUB
46	CARLISLE WATER CO. #3	61	D	7002	50	10	8			PCRA	20	45	70	.64	24	PUB
47	HNRY CO.PSA WHITBY #1	58	D	740	361	59	6	63	85	FM	10	50	37	1.35	1	DST
48	HNRY CO.PSA WHITBY #2	58	D	760	315	59	8	65	85	FM	10	75	20	3.75	1	PUB
49	GRAVELY FURNITUR CO#2	66		830	215		6			PCRA	35	47				IND
50	GRAVELY FURNITUR CO#1	50		840	280		6			QT	30	30				IND
51	OLD DOMINION BOX CO.	60		665	265	100	7			AL	19	170				ABD
52	SKYLINE FOREST WILSON	60		1400			6					10				PUB
53	VA GLASS PRODUCTS	57		810	785		8			PCRA		250			20	IND
54	HENRY COUNTY PLYWOOD	76	D	800	110		8			PCRA	30	75				IND
55	AMERICAN TRUCK BODY C	55			100		6				50					IND
56	BLUE RIDGE TALC CO	65		920	105	33	6	95	100	MS	10	200				IND
57	MARTINSVILLE STONE CO	57		730	200	30	6			BGN		15			45	IND
58	AMERICAN FURNITURE #1	32		750	460	20	6			PCRA	75	60				ABD
59	AMERICAN FURNITURE #2	59		750	200	20	8			PCRA	50	30	20	1.50	72	IND
60	AMERICAN FURNITURE #3	63		750	200	20	6			PCRA	50					IND
61	BASSET MIRROR	50		760	464	60	8			QT	30	300	24	12.50	24	IND
62	FIELDALE CEMENT PRODU				30		24			PZLW	14	6	4	1.50		IND
63	HNRY CO.PSA SHRWOOD#1			900	300		6	65		GRGN		6				PUB
64	HNRY CO.PSA SHRWOOD#2			900	230		6			GRGN		6				PUB
65	HNRY CO.PSA SHRWOOD#3			960	359		6			GRGN		20				PUB
66	CARVER HEIGHTS WTR CO	69			350					MSCH						DST
67	RIDGEWOOD WTR SUPPLY	34		750	112		5			AM						PUB
69	USA CORPS PHILPOTT #1	65		1060	250	20	5			MSCH		1			1	ABD
70	USA CORPS.PHILPOTT #2	65		1130	180	41	5			MSCH	37	8			12	ABD
71	USA CORPS.PARK GROUP	66		1100	124	50	6			MSCH	96	6			2	GOV
72	USA CORPS.BOWENS CR	66		1000	80	60	6			AMPH	29	20			2	GOV
73	BASSETT IND.KENNYS	72	D	750	200	45	6	60	61	BG	20	60	160	.37	2	COM
74	WILLARD D HOLLAND	72	D		270	60	6	58	65	PCLW	60	5	210	.02	2	PUB
75	BASSETT FURNITURE CO.	50		770	750					QT		350				IND
76	R.L.WRIGHT BASSET HTS			1060						AM						PUB
77	BASSET IND MAIN OFFIC	64		750	300					BG						PUB
79	HNRY CO.PSA CARVER #1	62		1000	247		6	110	125	SMS	100	18	40	.45		PUB
80	HNRY CO.PSA,GLEN CT#1			810	350		8			PCRA		55				PUB
81	HNRY CO.PSA.DANIEL #9	66		845	340	92	6	110		PCRA	48	31	134	.23	48	PUB
82	HNRY CO.PSA,DANIEL #7	65		840	492	74	7	74	110	PCLW	63	25	327	.07	48	PUB
83	HNRY CO.PSA.EDGWOOD#2			980						PCLW						PUB
84	HNRY CO.PSA,ENG.VLLAG			760						PCRA						ABD

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   W A T E R   C O N T R O L   M A N A G E M E N T

SUMMARY OF WATER WELL DATA FOR HENRY COUNTY

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SWCB NO	OWNER AND/OR PLACE	YEAR COMP	LOG	ELEV	TOTAL DEPTH	BED-ROCK	CASING MAX	CASING MIN	DEVEL FROM	ZONE TO	AQUIFER	STATIC LEVEL	YIELD	DRAW DOWN	SPEC CAPAC	HRS	USE
85	HNRY CO.PSA,GAYNORHTS	60		820	240		6				BGN						PUB
86	HNRY CO.PSA,HLCRESTPK	61		840	275	61	6		110	115	PCRA	50	30	150	.20	8	PUB
87	REED CR WTR,KMBRLYHLS	64		840	168	104	6				BG	67	30				PUB
88	REED CR LAKEWOOD FR#3			1060	300	40	5				FG		7	280	.02		ABD
91	MARROWBONE HTS #2	60		780	250		6				PCRA	50	15	200	.07	3	PUB
92	HNRY CO,PSA,MEADOWG#1	67		850	315	55	6				PCRA						PUB
93	REED CR,EAGLE LANE #1			960	240		6				PZLW	40	13	200	.06		PUB
94	REED CR,GREENBRIAR #2	65		940	130	73	5				BGN	50	12	110	.10		PUB
95	S.B.TERRY,RICH ACRE#1	49		805	172		6		42		PCRA	42	27	10	2.70		PUB
96	MARROWBON HTS,SHNON#1	62		760	294		6		110	125	PCRA	110	55	30	1.83	4	PUB
97	HNRY CO,PSA,SHEFLD #2	64		780	250		6		60	75	PCRA	60	55			12	PUB
98	HNRY CO,PSA,SHRWOOD#4			960							GRGN						PUB
99	MONTA VISTA WATER CO	64		920	114	62	6				GRGN	49	30				PUB
	MONTE VISTA																
100	TOWN OF RIDGEWAY #1	35		830	154		6				PCRA		40				PUB
101	MART'VL FINANCE&INVES	64			147		6						100				PUB
	SKYLINE FOREST																
102	HNRY CO,PSA,TNGLWD #1	67		740			6				PCRA		30				ABD
103	HNRY CO,PSA,VILLA HTS	41		810	300		6				PCRA		30				PUB
104	HNRY CO,PSA,VILLA HTS	48		820	692		8				PCRA		100				PUB
105	I.E.CAHILL,WALNUT ACR	64		880	204	53	6				GRGN	20	60	40	1.50		PUB
109	REED,CR,PIEDMONT #2			795	300		6				PCRA		35				PUB
110	REED CR,PINE FOREST	66		980	300		6				TRD	50	8				PUB
111	DALE MCGHEE,WILDWOOD	72	D	1065	250	130	6		142	143	GRGN	40	75	195	.38	10	PUB
112	WILLARD D. HOLLAND	72			225		7		60	65	PCLW	60	4	220	.01	2	ABD
113	HNRY CO,PSA,DANIEL#12	72		920	423	81	6		95	110	AMPH	95	40	264	.15	48	PUB
114	HNRY CO,PSA,DANIEL #1			900	278						BGN	56	4	210	.01		ABD
115	HNRY CO,PSA,DANIEL#2			860	348						PCLW	60	49	200	.24	48	PUB
116	HNRY CO,PSA,DANIEL #4			850	306						PCRA	24	84	188	.44	48	PUB
117	HNRY CO,PSA,DANIEL#6			920	350						BGN	115		26		294	PUB
118	HNRY CO,PSA DANIEL #8			840	404						PCRA						PUB
119	HNRY CO,PSA,DANIEL#13	72		810	447	118	6		150	400	MS	40	65	257	.25	48	PUB
120	HNRY CO,PSA,DANIEL#14	72		820	368	58	6		98	125	PCRA	14	95	82	1.15	48	PUB
121	REED CR,GREENBRIER #3	68	D	920	250	54	6		60		BGN	40	8	200	.04	10	PUB
122	REED CR,GREENBRIER #4	68	D	910	132	50	6		50	60	BGN	35	18	40	.45	72	PUB
123	REED CR,STONELEIGH #1	68	D	840	300	76			89	90	PCRA	40	60	200	.30	9	PUB
124	REED CR,STONELEIGH #2	70	D	845	320	88	6		119	120	PCRA	60	12	290	.04	10	PUB
125	REED CR,EAGLE LANE #2	69	D	990	308	43	6		53	54	PZLW		4	43	.09	10	PUB
126	REED CR,LAKEWOOD FR#6	70	D	1040	200	20					FG	25	12	160	.07	10	PUB
127	REED CR,EASTWOOD #4	70	D	720	305	70			80	81	PCRA	60	2	235		9	ABD
128	REED CR, EASTWOOD #5	71	D	780	260	65			70	72	PCRA	40	75	30	2.50	10	PUB
129	REA-PRIL,CARDINAL EST	71	D	920	290	70	6		80	81	BG	55	60	225	.26	9	PUB
130	HNRY CO,PSA,SPENCERS	70		1180	252		6	28	90	92	SHS	63		15		2	PUB
131	REED CR,HANOVER PLACE	76		1080	300	67	6		110	112	SMS	40	40	60	.66	72	PUB

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132	HNRY CO,PSA,WHITBY #0	72		750	347	51	6		60	125	BG	9	17				PUB
135	DU PONT	69	D	740	300	62	6		90	92	BGN	35	75	57	1.31	8	IND
137	PIG CITY DEVELOPMENT	72	D	860	330	50	6				PCLW		5				PUB
138	HENRY CO,JAIL	73	D	940	400	54	6		280	285	PZLW	60	53	40	1.32	5	GOV
139	MARTIN PROCESSING	73		735	40	55	6		240	245	GRGN	20	65	320	.20	72	IND
140	BASSETT MIRROR CO.	73	D	790	400	35	6		150	155	FM	10	60	230	.26	10	IND
141	BASSETT-WALKER KNIT	73	D	790	360	58			110	200	GRGN	109	100	200	.50	8	IND
142	TOWN OF RIDGEWAY #8	74	D	910	400	38	6		142	145	PCRA	57	40	263	.15	72	PUB
143	AMERICAN FURNITURE #5	74	D	750	450	55	6		234	235	PCRA	80	35	190	.18	10	IND
144	AMERICAN FURNITURE CO	74	D		470	45	6					470	50	320	.15	10	IND
145	PRILLAMAN & PAGE	74	D	860	300	24	6		135	136	PCRA	30	100	250	.40	10	IND
146	HCA-MARTIN INC	74	D	940	420	18	6		183	185	GRGN	15	5	335	.01	10	IND
147	TOWN OF RIDGEWAY #7	74	D	960	400	46	8		70	71	GN	60	33			4	PUB
					400	35	8					60					
148	LESTER GROUP CO	74	D	940	420	18	6		183	185	FM	15	5	335	.01	10	IND
149	BLUE RIDGE TRUCKING COMPANY	72			365		6					30	30			2	IND
150	TOWN OF RIDGEWAY	74	D		300							40	100	50	2.00	10	PUB
150	TOWN OF RIDGEWAY #9	74	D	865	300	47	8	12	98	102	TTS	40	5	50	.10	10	PUB
152	HCA-MARTIN INC	74	D	740	450	34	6				GRGN		12	450	.02	2	IND
153	HCA-MARTIN INC	74	D	745	500	82	6		118	120	GRGN		4	500		1	IND
154	ANTHONY,FAIRWAY ACR#2	74	D	1250	400	120	6		155	158	GN	65	50	325	.15	10	PUB
155	FAITH CONSTRUCTION CO	74	D		45	220	6					60	75	140	.53	10	IND
156	HCA-MARTIN #4	74	D	720	500	85	6		94	96	AL	60	12	440	.02	1	DOM
157	HCA-MARTIN #5	75	D	740	380	58	6		65	66	PCRA	49	94	292	.32	43	IND
158	HNRY CO,PSA,GAYNOR #2	62		800	398						PCRA						ABD
159	HNRY CO,PSA,BEAVER #1	63		740	229		6				BGN		30				PUB
160	HNRY CO,PSA,BEAVER #2	65		750	260		6				BGN		30				PUB
161	HNRY CO,PSA,PAWERLINE	66		830	250		6				PCRA		30				PUB
162	HCPSA,HOLIDAY INN			820							SMS						ABD
164	STATE PRISON CAMP #28	75		1090	235	52	6		35		FM	30	16	170	.09	4	INS
165	STANLEY FURNITURE #1			780	337	20	8				GRGN						IND
166	STANLEY FURNITURE #2			780	615	20	8				GRGN						IND
167	STANLEY FURNITURE #3			760	297	20	6				PCRA						IND
168	STANLEY FURNITURE #4			760	160	25	6				GRGN						IND
169	STANLEY FURNITURE #5			840	292	35	6				PCRA						IND
170	STANLEY FURNITURE #6			850	120	30	6				PCRA						IND
171	STANLEY FURNITURE #7			800			6				GRGN						IND
172	STANLEY FURNITURE #8			760	227	15	6				PCRA						IND
173	STANLEY FURNITURE #9			850		25	6				GRGN						IND
174	STANLEY FURNITURE #10			860		25	6				GRGN						IND
175	CLYDE RICHARDSON #1				100								10				IND

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177	HCPSA,SHEFFIELD TER#1			800	250		6				PCRA						PUB
178	SHEFFIELD TERRACE #2 WATER SUPPLY INCORP	61			250		6										PUB
179	REED CR,PIEDMONT ESTI	66		865	180	90	6		120	140	PCRA	45	60	25	2.40	3	PUB
180	REED BARKER	59		740	152		6						25				PUB
181	HNRY CO,PSA,GLEN CT#2	67		760	307		6				PCRA		18				PUB
182	HNRY CO,PSA,GLEN CT#3	66		805	257	50		6			PCRA		18				PUB
183	HNRY CO,PSA,DANIEL CR	75	D	840	505	72	8	6	80		BGN		37			10	PUB
184	GEORGE REYNOLDS	75	D		200	86	6					40	50			1	DOM
185	PRILLIAM & THOMAS	75	D	1110	500	100	6		379	380	GRGN	160		8		1	DOM
186	WARREN RICHARSON	75	D	810	320	63	6		318	319	PCRA	80		4		1	DOM
187	ARCHIE TAYLOR	75	D		260	41	6					50	2			1	DOM
188	G W GROGAN	75	D		180	59	6					60	5			1	DOM
189	EMORY M DAVIS	75	D		160	67	6					30	1			1	DOM
190	G W GROGAN	75	D		180	79	6					50	4			1	DOM
191	RIVERSIDE PLAZA			760							PCRA						COM
201	PRILLIAM&THOMAS CONST	75	D		500	48	6					160	8			1	PUB
202	HENRY CO.PSA,DANIEL	75	D	875	470	60	6		225	226	MSCH	95	22	362	.06	144	PUB
203	REED CR,PRESTON GDN#2	75	D	1105	360	78	6		358	360	SMS	60	200			1	PUB
206	THOMAS TAYLOR	75	D	1030	300	60	6		170	171	FG	60	2			1	DOM
207	MARTINSVILLE SPDWY #4	75	D	740	320	63	6		133	134	PCRA	40	70			1	PUB
208	JOE BEANER	75	D	910	300	37	6		190	191	GRGN	40	2			1	DOM
209	DILLON INSURANCE CO	75	D	760	120	18	6		90	91	GRGN	15	2			1	COM
210	DEWEY COOK	75	D	960	120	72	6		111	112	FG	6	7			1	DOM
211	CARL WOOD	75	D		160	94	6					70	1			1	DOM
212	G W GROGAN	75	D	1050	140	75	6		130	135	FG	45	10			1	DOM
213	CHARLIE STROUT	75	D		65	63	6					20	12			1	DOM
214	MARTHA WHITE	75	D	1020	240	62	6		208	209	BG	60	3			1	DOM
215	JUNIOR WIDENER	75	D	870	160	54	6		152	153	GRGN	60	5			1	DOM
216	FRANK LEPPAWER	75	D		300	98	6					60	5			1	DOM
217	HOLMES MEM PRES CH	75	D	1150	130	102	6		123	124	FG	60	2			1	PUB
218	JERRY HYLTON	75	D	940	95	70	6		81	82	GRGN	50	10			1	DOM
219	JACKIE GEORGE	75	D	850	100	63			92	93	PCLW	40	15			1	DOM
220	THOMAS PURGAM	75	D	820	100	42	6		96	97	PCRA	40	15			1	DOM
221	C H JAMESON	75	D		160	62	6					50	50			1	DOM
222	US ARMY JAMISON #5	76		990	160	24	6		140	145	PCLY	16	4	150	.02	24	GOV
223	WILBUR TURNER	75	D		160	49	6					40	1			1	DOM
224	SHIRLEY P FRYE	75	D		180	74	6					60	4			1	DOM
225	ELMER P HORSELY	76	D	1070	200	98	6		174	175	FM		8			1	DOM
226	FRED T MARTIN JR	76	D	860	450	41	6		69	70	PCRA	60	1			1	DOM
227	REED CREEK WATER CO	75	D		360	55	6					60	200			1	COM
228	REED CREEK WATER CO	75	D		360	55	6					60	200			1	COM
229	US ARMY JAMISON #4	76		990	250	22	6		200	205	PCLY	16	10	224	.04	24	COM
230	CHARLIE STANT	76	D		280	87	6					60	2			1	DOM

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   W A T E R   C O N T R O L   M A N A G E M E N T

SUMMARY OF WATER WELL DATA FOR HENRY COUNTY

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SWCB NO	OWNER AND/OR PLACE	YEAR COMP	LOG	ELEV	TOTAL DEPTH	BED-ROCK	CASING MAX	CASING MIN	DEVEL FROM	ZONE TO	AQUIFER	STATIC LEVEL	YIELD	DRAW DOWN	SPEC CAPAC	HRS	USE
231	CHARLIE FINNEY REALTY	76	D		200	89	6					80	8			1	DOM
232	J R PURCELL	76	D		250	75	6					80	3			1	DOM
233	C H JAMESON	76	D		125	78	6					70	8			1	DOM
234	GARY ROBERTS	76	D		70	63	6					50	15			1	DOM
235	BILL EANES	76	D		300	63	6					50	2			1	DOM
236	WILLIAM HEADDY	76	D		80	61	6					40	4			1	DOM
237	CLAUDE JARRETT	76	D		150	84	6					30	25			1	DOM
238	GARY ROBERTS	76	D		300	69	6					60	1			1	DOM
239	CARROLL R SIMMONS	76	D		240	62	6					80	2			1	DOM
240	GARY ROBERTS		D		180	59	6					60	15			1	DOM
241	JAMIE & CAMPBELL	76	D		220	41	6					60	4			1	DOM
242	FRED ROACH	76	D	850	320	69	6		92	93	PCRA	60	1			1	DOM
243	LARRY BAHAMON	76	D		125	63	6					50	10			1	DOM
244	ANDREW HODGE CONST	76	D		100	42	6					50	12			1	DOM
245	PATRICK HENRY BANK	76	D	750	125	35	6		116	117	GRGN	20	12			1	COM
246	DANIEL BAYER	76	D		240	62	6					60	2			1	DOM
247	HENRY CO. PLYWOOD	76	D	800	300	9	6		296	297	PCRA	40	45			1	IND
248	HORSEPASTURE CHURCH	76	D	1040	140	66	6		137	138	FG	50	12			1	PUB
249	DANIEL CREEK WATER CO	76	D		505	52	8					140	25			3	PUB
250	HENRY CO PSA DANL CRK	76	D	900	485	95	6		103	104	SMS		20			8	PUB
251	DAVID MOHAN	76	D	1010	150	70	6				FG	50	7			1	DOM
252	CARLIE STANT	76	D		130	50	6					50	5			1	DOM
253	ROBERT NEAL	76	D		200	72	6					60	4			1	DOM
254	R S REYNOLDS	76	D	850	75	40	6				PCLW	20	50			1	DOM
255	RAYMOND WARD	76	D	970	400	90	6				PCLW	80	1			1	DOM
256	MARTHA DICKERSON	76	D	860	100	40	6				GRGN	20	8			1	DOM
257	LLOYD TURNER	76	D	1030	200	75	6				GRGN	75	6			1	DOM
258	JOHNNIE MILLER	76	D		300	40	6					80	15			1	DOM
259	WILLIAM L. STEWART	76	D	1100	125	84	6				GRGN	60	5			1	DOM
260	HENRY COOK	76	D		200	105	6					50	2			1	DOM
261	CHARLIE FINNEY	76	D		300	228	6					60	10			1	DOM
262	J C O'DELL	76	D		250	52	6					50	12			1	DOM
263	LEE DILLARD	76	D		350	100	6					50	1			1	DOM
264	W A SINGLETON	76	D	920	105	75	6				TRD	45	5			1	DOM
265	MONTA VISTA WATER CO	76	D	890	400	90	6				GRGN	80	8			1	DOM
266	HOWARD M WALKER	76	D		375	84	6					80	1			1	DOM
267	JAMES A HARDY	76	D		225	100	6					40	3			1	DOM
268	ROBERT HARRIS	76	D		225	58	6					20	3			1	DOM
269	JESSIE MANNS	76	D	1020	200	89	6				SMS	70	15			1	DOM
270	JOHN BROWN	76	D		220	139	6					100	6			1	DOM
271	TOM BUMPASS & SON	76	D		300	35	6					30	1			1	DOM
272	W D CAMPBELL	76	D		250	83	6					80	1			1	DOM
273	SPENCER PURITAN CLUB	76	D		180	109	6					70	4			1	DOM
274	GRADY BRIMMER	76	D		160	75	6					70	15			1	DOM

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275	ANDREW D HODGE CONST	76	D		160	62	6					70	8			1	DOM
276	WILLIAM C SMITH	76	D		500	84	6					60	15			1	DOM
277	C H JAMISON	76	D		125	78	6					70	8			1	DOM
278	L D WITT	76	D		370	132	6					100	3			1	DOM
279	ANTHONY HOMES	76	D		225	50	6					50	50			1	DOM
280	BUMPASS & SON LUMBER	76	D		240	83	6					70	1			1	DOM
281	J E OLIVER CONSTR CO	76	D		140	41	6					40	20			1	DOM
282	CLARENCE HUFF			940													DOM
283	MAX KENDALL LUMBER CO			1080													IND
284	OSWALD HAIRFIELD			1000													DOM
285	HARRY HANKINS			970	30		30					25					DOM
286	J N HOLLAND			1020	125												DOM
287	R E GRAVELY	36		1000	40							20					DOM
288	CHARLES HARIFIELD			980													DOM
289	JOSEPH J WILSON			1000	45							8					DOM
290	JAMES ASHWORTH	72		930	100												DOM
291	ANDREW J HAISLIP	62		980	187								5				DOM
292	DELMA G YOUNG	70		1260	300		6										DOM
293	C WOODY YOUNG	64		1240	125						PRE-CA						DOM
294	P L PRILLAMAN	58		940	107		6				PRE-CA	37					DOM
295	BUFORD A MULLIN			1020							PRE-CA						DOM
296	W E COLSTON			780							QUAD						DOM
297	MARY R GRAIG			980							PCBA						DOM
298	FERA KOGER	41		880	15		2				PFBG	4					DOM
299	W P SPENCER	66		880	60		6				PRE-CA	12	22				DOM
300	M L BARLEY	50		840	70						PFRA						DOM
302	HUNTINGTON HILLS																DOM
303	NATIONWIDE MANUFACT	77	D	760	385	35	6		374	375	GN		8			3	IND
304	NATIONWIDE MANUFACT	77	D	760	332	35	6		80	81	GN		100			3	IND
305	THOMAS BATEMAN	77	D		300		6					60	2			1	DOM
306	HARRY STONE	77	D		65		6					40	30			1	DOM
307	JOHN L.SMITH	77	D		200		6					50	1			1	DOM
308	H.W. SCOTT	77	D		180		6					70	5			1	DOM
309	ROBERT WILLIAMS	77	D	1010	250	100	6				FG	60	2			1	DOM
310	LAWRENCE JONES	77	D		230		6					70	1			1	DOM
311	I L WOOD	72	D	870	200	42	6				BA	60	12			1	DOM
312	JAE MARSHALL	77	D		200		6					80	12			1	DOM
313	HOWARD BOWER	77	D		160		6					90	10			1	DOM
314	ROBERTS BODY SHOP	77	D		120	120	6					15	4			1	DOM
315	BILLY NANCE	77	D		180		6					50	3			1	DOM
316	BILLY MARSHALL	77	D		120		6					10	20			1	DOM
317	ALLEN ADAMS	77	D	1010	160	79	6				PCLW	30	10			1	DOM
318	JAMES KALLAN	77	D		125		6					40	40			1	DOM
319	GRADY GILLESPIE	77	D		150		6					60	8			1	DOM

VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF WATER CONTROL MANAGEMENT

SUMMARY OF WATER WELL DATA FOR HENRY COUNTY

****

SWCB NO	OWNER AND/OR PLACE	YEAR COMP	LOG	ELEV	TOTAL DEPTH	BED-ROCK	CASING MAX MIN	DEVEL FROM	ZONE TO	AQUIFER	STATIC LEVEL	YIELD	DRAW DOWN	SPEC CAPAC	HRS	USE
320	WALTER PARSON	77	D		100		6				40	25			1	DOM
321	RICHARD SHULER	76	D		150		6				40	8			1	DOM
322	ANTHONY HOMES	76	D		150		6				50	40			1	DOM
323	ANTHONY HOMES	76	D		100		6				50	25			1	DOM
324	JACK FOLEY	76	D		425		6				60	1			1	DOM
325	CHARLIE STANT CONST	76	D		230		6				40	1			1	DOM
326	JAMES TAYLOR	76	D		250		6				60	2			1	DOM
327	J.H. JAMESON	76	D		300		6				70	1			1	DOM
328	J.H.JAMESON	76	D		200		6				60	1			1	DOM
329	CLARENCE SMITH	76	D		250		6				60	1			1	DOM
330	BILL EANES	76	D	950	250	42	6			MS	50	2			1	DOM
331	RAY LAWLESS	76	D	890	120	22	6			AGN	18	3			1	DOM
332	BILLY JORDAN	76	D		200		6				60	5			1	DOM
333	K.G.WALKER	76	D		220		6				60	1			1	DOM
334	ROGER LEON CLARK	76	D		125	41	6				25	3			1	DOM
335	JESSIE FAIN	76	D	690	100	25	6			PCRA	20	6			1	DOM
336	ARTHUR HILL	76	D		160		6				60	1			1	DOM
337	VIOLA PENN	76	D	810	150	30	6			PCRA	50	4			1	DOM
338	ROGER D. MORGAN	76	D		300		6				50	2			1	DOM
339	GROVER A HARRISON	77	D	960	248	8	6	219	220	AM	75	15			1	DOM
340	ROGER M JOHNSON	72	D		125	15	6	115	116	AM		10			1	DOM
341	R M ANTHONY CONST CO	76	D	1030	335		6				50	75			1	PUB
342	B R FAIN	77	D		200		6				60	7			1	PUB
343	CHARLIE STOUT	77	D		200	600	6					2			1	DOM
344	DWAYNE L NYCAMP	77	D		100		6				40	8			1	DOM
345	MT BAPTIST METHODIST	77	D		250		6				50	11			1	DOM
346	D L COMPTON	77	D		175		6				50	3			1	DOM
347	GRAVELY FURNITURE CO	77	D		225		6				30	15			1	DOM
348	FRANKE TUGGLE	77	D		200		6				50	3			1	DOM
349	MADELAINE BARBOUR	77	D		300		6				50	1			1	DOM
350	MILLIE AHERON	77	D		300		6				70	3			1	DOM
351	CHARLIE STOUT CONSTR	77	D		125		6				60	10			1	DOM
352	ROBERT WARD	77	D		150		6				50	40			1	DOM
352	TOWN & COUNTRY REALTY	77	D		250		6				30	1			1	DOM
353	TOWN & COUNTRY REALTY	77	D		250		6				70	30			1	DOM
354	RAYMOND ELLIOTT	77	D		180		6				60	1			1	DOM
355	CENTRAL HOME BUILDERS	77	D		200		6				60	6			1	DOM
356	ROBERT H SPILMAN	77	D		250		6				40	12			1	DOM
357	RALPH L VAUGHN	77	D		500		6				80	1			1	DOM
358	CLAY EARL			735	300					PCRA		70				IND
359	CLAY EARL			740	360					PCRA		70				IND
360	CLAY EARL			700	300					PCRA		70				IND
361	TOWN OF RIDGEWAY #2			810	250					PCRA	20					PUB
362	TOWN OF RIDGEWAY #3			805	300					PCRA		30				PUB

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   W A T E R   C O N T R O L   M A N A G E M E N T

SUMMARY OF WATER WELL DATA FOR HENRY COUNTY

****

SWCB NO	OWNER AND/OR PLACE	YEAR COMP	LOG	ELEV	TOTAL DEPTH	BED-ROCK	CASING MAX	CASING MIN	DEVEL FROM	ZONE TO	AQUIFER	STATIC LEVEL	YIELD	DRAW DOWN	SPEC CAPAC	HRS	USE
363	TOWN OF RIDGEWAY #4			860	210								15				PUB
364	TOWN OF RIDGEWAY #5			960	400								25				PUB
365	TOWN OF RIDGEWAY #6	65		860	300						PCRA		20				PUB
366	BASSET INDUSTRIES #21			770													IND
367	BASSET INDUSTRIES #2			770													IND
368	BASSET INDUSTRIES #20			770													IND
370	BASSET INDUSTRIES #25	64		830							BG						PUB
371	BASSET INDUSTRIES #R3	66		760	140												PUB
372	BASSET INDUSTRIES #R4	66			140												PUB
373	BASSET INDUSTRIES #5	66		750	140												PUB
374	BASSET INDUSTRIES #9	73		840	140								10				DOM
375	BASSET INDUSTRIES #29			760													DOM
376	JOE ROGERS	66		800	135												DOM
377	J. E. BASSETT WELL#31			845	165						BASSET						DOM
378	J. E. BASSETT WELL#23			810	200						BASSET						DOM
379	BASSET INDUSTRIES #15			765													IND
380	BASSET INDUSTRIES #24	60		760							BASSET						PUB
381	BASSET INDUSTRIES #14			740													IND
382	BASSET INDUSTRIES #13	70		740									12				IND
383	R. H. SPILMAN #22			865	250						PCLW		12				DOM
384	BASSET INDUSTRIES #32			845													DOM
385	W. M. BASSETT #30	65		835	800								60				DOM
386	BASSET INDUSTRIES	50		880	750								250				DOM
387	BASSET HTS WTR CO #8			780													DOM
388	BASSETT HTS WTR CO#10			870													PUB
389	MIKE HARRIS			740													PUB
390	ARNOLD TESTOR			730													PUB
391	ROY SLAUGHTER			735													DOM
392	L. M. SLAUGHTER			730													DOM
393	LESSIE PRYOR #1			710													DOM
394	LESSIE PRYOR #2			710													DOM
395	CHARLIE SLAUGHTER			720	80												DOM
396	EVERETT COBBLER			710													DOM
397	B. B. SMITH			715	90							80					DOM
398	JOHN WRIGHT	67		700	131							67	13				DOM
399	EARL COOK			840													DOM
400	AUBREY COLE			840													DOM
401	CLYDE MARTIN	58		840	140							68	9				DOM
402	JAMES C. HARRIS			835													DOM
403	JAMES NEAVES			920									1				DOM
404	JOSEPH SCALES JR.			685													DOM
405	MARROWBONE HTS CORP#1	54		780	309			6			PCRA						PUB
406	S.B.TERRY RICH ACRE#2	64		820	274		6				PCLW		24				PUB
407	HENRY CO. PSA FAGGWTR			825							PCRA						PUB

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   W A T E R   C O N T R O L   M A N A G E M E N T

SUMMARY OF WATER WELL DATA FOR HENRY COUNTY

****

SWCB NO	OWNER AND/OR PLACE	YEAR COMP	LOG	ELEV	TOTAL DEPTH	BED-ROCK	CASING MAX MIN	DEVEL FROM	ZONE TO	AQUIFER	STATIC LEVEL	YIELD	DRAW DOWN	SPEC CAPAC	HRS	USE
408	HENRY CO PSA ANDRIA#2			800	226					PCRA		12				PUB
409	HENRY CO PSA ANDRIA#1			800	250					PCRA						ABD
410	GLEN JARRETT			1090						BASSET						ABD
411	RANGELY UNION 76			820												COM
412	DOYLE LUMBER CO.	58		1085												COM
413	REED CR. WTR.CO. LF#5			1090	150						60	6				PUB
414	REED CR.WTC.CO. LF #4			1005	300					FG						ABD
415	REED CR.WTR.CO. GB #1				300							2				ABD
416	REED CR.WTR.CO. PG #1			1080						BGN						ABD
417	USA CORPS OF ENG-MIZE	62		1010	100		5					55			12	GOV
418	CARLISLE WTR CORP. #1			805						PCLW	46	125				PUB
419	S.B.TERRY RICH ACRE#3	66		860	305		6			PZLW	40	13			12	PUB
420	HENRY CO. PSA AXTON															PUB
421	HENRY CO.PSA.EDGWD #1			860						TRT						PUB
422	HENRY CO.PSA. EDGWD#3			980						FG						PUB
423	HENRY CO.PSA.WNFRDHLS									GRGN						PUB
424	HENRY CO.PSA.SHRWD#5									GRGN						PUB
425	HENRY CO.PSA.VILLAHTS	76		740	525					PCRA		3				ABD
426	HENRY CO.PSA.ARLNGTN1			735						PCRA		20				PUB
427	HENRY CO.PSA. -X			1050						SMS						PUB
428	HENRY CO. PSA.-X2			1100						SMS						PUB
429	A. D. CARTER			1100						M						DOM
430	RALPH LESTER			1060						BG						DOM
431	BILLY DONAVANT			1000						FG						DOM
437	HENRY CO PSA SHERWOOD FOREST #6			880	440	64	6	250	251			4			8	DOM
438	HENRY CO PSA CLARENCE WRIGHT #2			970	505	57	8	70	135			60			5	DOM
439	HENRY CO PSA PIONEER TRAIL #2			900	505	83	6	135	136			12			4	DOM
440	PRILLAMAN & PACE INC	77	D		500		6				20	43			1	PUB
441	SAM S GUSLER	77	D	940	225	46	6			AM	10	12			1	DOM
442	RICKY STONE JR	77	D	990	150	56	6			AM	50	4			1	DOM
443	LON B TATUM	77	D		300		6				60	1			1	DOM
444	BRAMMER CONSTR CO	77	D		125		6				40	40			1	DOM
445	BETHEL METHODIST CH	77	D	730	165	60	6	160	165	AGN	60	10			1	PUB
446	JANE W BARRETT	77	D	970	200	84	6			BGN	50	1			1	DOM
447	BOBBY M CRADDOCK	77	D		250		6				40	1			1	DOM
448	JIMMY HENSLEY	77	D		200		6				40	4			1	DOM
449	D M COURTNEY	77	D		225		6				60	5			1	DOM
450	DONALD GUINN	77	D	870	200	67	6				60	4			1	DOM
451	CARLO D SMITH	72	D		200		6			BG	60	4			1	DOM
452	JAMES A MARTIN	77	D		150		6				40	40			1	DOM
453	BUCK K BARROW	77	D	920	200	54	6			GN	50	2			1	DOM

SUMMARY OF WATER WELL DATA FOR HENRY COUNTY

SWCB NO	OWNER AND/OR PLACE	YEAR COMP	LOG	ELEV	TOTAL DEPTH	BED-ROCK	CASING MAX	CASING MIN	DEVEL FROM	ZONE TO	AQUIFER	STATIC LEVEL	YIELD	DRAW DOWN	SPEC CAPAC	HRS	USE
454	JAMES KING	76	D	1060	250	100	6				SMS	70	2			1	DOM
455	MRS GEORGE RAMSEY	77	D	870	200	78	6				PCRA	80	125			1	DOM
456	ROGER C WINEBERGER	77	D		250		6					60	1			1	DOM
457	E L COBLE	77	D		125		6					40	12			1	DOM
458	CENT HOME BUILDERS	77	D		200		6					60	20			1	DOM
459	CENT HOME BUILDERS	77	D		275		6					60	4			1	DOM
460	JAMES NICHOLS	77	D		300		6					50	1			1	DOM
462	H B C WATER CO #3	77			275		6		100	105		55					PUB
463	H B C WATER CO #2	77															PUB
464	BASSETT MIRROR CO #1	73		790	150	50	6		60	62	GRGN	25	100	110	.90	10	IND
465	HENRY CO SCHOOL BOARD			1125													IND
	SANVILLE SCHOOL																
466	HENRY CO SCHOOL BOARD			1050													IND
	S H HAIRSTON SCHOOL																
467	BOBBY Y PRUIT	78	D	1010	300	14	6				PCLW	70	2			1	DOM
468	GRAVELY FURN CO	77		830	285		6				PCRA		150				IND
469	PRILLAMAN & REAVIS			760	250		6						3				IND
	DISCO DRUG																
470	LAUREL PARK WATER WKS	74	D	760	300	50	6		80	100	PCRA	60	2	252		1	PUB
471	JOSEPH A EANES	78	D		175	75	6					50	8			1	DOM
472	TOWN & COUNTRY REALTY	78	D		125	52	6					60	6			1	DOM
473	TOWN & COUNTRY REALTY	78	D		100	68	6					20	12			1	DOM
474	J R CUNDIFF	78	D		200	110	6					60	3			1	DOM
475	J R CUNDIFF			1130	375	63	6					60	15			1	DOM
	SANVILLE ESTATES																
476	H C HALL	78	D	820	200	51	6				PCRA	60	3			1	DOM
477	PAUL J CLIFTON	78	D		200	27	6					25	3			1	DOM
478	DONALD EMIS	78	D	1100	225	93	6				SMS	80	15			1	DOM
479	BILL SMITH	78	D	1100	225	75	6				SMS	60	4			1	DOM
480	LEWIS BAAZ	78	D		200	39	6					40	7			1	DOM
481	CHARLES ANTHONY	78	D		200	84	6					70	8			1	DOM
482	PRILLAMAN & THOMPSON	78	D		225	56	6					60	2			1	DOM
483	PRILLAMAN & THOMPSON	78	D		100	52	6					50	20			1	DOM
484	PRILLAMAN & THOMPSON	78	D		200	69	6					50	2			1	DOM
485	DAN EDWARDS	78	D		150	54	6					15	12			1	DOM
486	CHARLIE STANT CON CO	78	D		200	123	6					40	2			1	DOM
487	SAM GUSLER	78	D	1010	150	59	6				AM	60	12			1	DOM
488	SAM GUSLER & SONS	78	D	1010	175	60	6				AM	60	3			1	DOM
489	MR PEATROSS	78	D	850	200	44	6				GN	50	6			1	DOM
490	J A MORRIS	78	D		200	86	6					86	4			1	DOM
491	MARVIN F WEINBUSH	78	D	990	200	65	6				GRGN	50	6			1	DOM
492	JACK R FOLEY	78	D	1030	500	27	6				MS	40	1			1	DOM
493	BILL SMITH	78	D	1100	500	100	6				SMS	90	2			1	DOM
494	REEDY CREEK WATER CO	76	D		425	70		6			PZLW	60	10			1	PUB

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   W A T E R   C O N T R O L   M A N A G E M E N T

SUMMARY OF WATER WELL DATA FOR HENRY COUNTY

****

SWCB NO	OWNER AND/OR PLACE	YEAR COMP	LOG	ELEV	TOTAL DEPTH	BED-ROCK	CASING MAX	CASING MIN	DEVEL ZONE FROM	DEVEL ZONE TO	AQUIFER	STATIC LEVEL	YIELD	DRAW DOWN	SPEC CAPAC	HRS	USE
495	L G WALDAN CONTR	77			100		6					20	15			1	DOM
496	RIVERVIEW APARTMENTS	77			400		6					50	1			1	DOM
497	JOSEPH G GEORGE	77			400		6					60	3			1	DOM
498	TONY COX	30			250		6					50	40			1	DOM
499	WAYA BAPTIST CHURCH	77			200		6					40	75			1	DOM
500	R J DANDRIGE	77			125		6					30	12			1	DOM
501	CHARLIE STONE	77			150		6					20	10			1	DOM
502	HARRY NOLEN	77			400		6					10	10			1	DOM
503	ELIZABETH FOSTER	77			175		6					60	7			1	DOM
504	EDWARD JOYCE	77			125		6					40	12			1	DOM
505	OSCAR L NUNLEY	77			300		6					50	8			1	DOM
506	CLYDE HENSLEY	77			325		6					60	4			1	DOM
507	CHARLIE STOUT CONSTR	77			125		6					50	3			1	DOM
508	WALTER B HALL	77			125		6					40	5			1	DOM
509	ANTHONY HANES	77			250		6					50	8			1	DOM
510	ANTHONY HANES	77			150		6					50	3			1	DOM
511	GAIL COMPTON	77			300		6					60	3			1	DOM
512	GROGAN SMITH	77			225		6					50	3			1	DOM
513	KITTY MYERS	77			125		6					50	4			1	DOM
514	G E BOAZ	77			235		6					50	50			1	DOM
515	G W GROGAN	77			125		6					40	10			1	DOM
516	THOMAS PEGRAM	77	AIR		175		6					60	5			1	DOM
517	FREY RAY	77			250		6					60	2			1	DOM

APPENDIX B

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR HENRY COUNTY

The computer printout on the following pages lists basic groundwater quality data available for many of the wells listed in the water well data summary (Appendix A). There are some quality analyses listed for wells not included in Appendix A; however, well data is available for these wells and may be obtained by contacting the State Water Control Board's West Central Regional Office in Roanoke or the Headquarters Office in Richmond.

VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF SURVEILLANCE AND FIELD STUDIES

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR ROCKINGHAM COUNTY

****

THE FOLLOWING LIST OF GROUNDWATER QUALITY DATA SUMMARIZES BASIC DATA OBTAINED FROM ANALYSES OF GROUNDWATER, COLLECTED FROM WELLS AND SPRINGS, WHICH ARE ON PERMANENT FILE IN THE OFFICES OF THE VIRGINIA STATE WATER CONTROL BOARD. ADDITIONAL GROUNDWATER QUALITY INFORMATION FOR MANY OF THESE WELLS AND SPRINGS IS AVAILABLE AND CAN BE OBTAINED BY CONTACTING THE APPROPRIATE REGIONAL OFFICE OR THE BUREAU OF SURVEILLANCE AND FIELD STUDIES AT THE AGENCY HEADQUARTERS IN RICHMOND.

************ EXPLANATION OF PARAMETERS ************

SWCB NO: STATE WATER CONTROL BOARD NUMBER - A SEQUENTIAL NUMBERING SYSTEM USED WITHIN A COUNTY; WHEN REFERRING TO A SPECIFIC WELL USE THIS NUMBER

OWNER AND/OR PLACE: IDENTIFIES ORIGINAL OR CURRENT WELL OWNER AND/OR LOCATION OF WELL.

DATE SAMP: DATE SAMPLED - MONTH AND YEAR IN WHICH WATER SAMPLE WAS COLLECTED.

PH: HYDROGEN ION CONCENTRATION - BASED ON A SCALE OF 1 THROUGH 14. WATER WITH A PH GREATER THAN 7.0 IS CONSIDERED TO BE BASIC OR ALKALINE; THE LARGER THE PH VALUE, THE MORE ALKALINE THE WATER. WATER WITH A PH LESS THAN 7.0 IS CONSIDERED TO BE ACIDIC; THE SMALLER THE PH VALUE, THE MORE ACIDIC THE WATER.

SPEC COND: SPECIFIC CONDUCTIVITY - AN INDICATOR OF THE RELATIVE AMOUNT OF DISSOLVED MINERALS IN WATER; HIGHER VALUES INDICATE GREATER AMOUNTS OF DISSOLVED MINERALS; UNIT OF MEASUREMENT IS MICROMHO

T-DIS SOLID: TOTAL DISSOLVED SOLIDS - INDICATES TOTAL AMOUNT OF DISSOLVED MINERALS IN WATER; UNIT OF MEASUREMENT IS MILLIGRAMS PER LITER

HARDNESS TOTAL: TOTAL HARDNESS - CAUSED BY THE PRESENCE OF CALCIUM, MAGNESIUM, IRON, ZINC , AND OTHER TRACE METALS. UNIT OF MEASURE IS MILLIGRAMS PER LITER.

HARDNESS CA,MG: CALCIUM-MAGNESIUM HARDNESS - INDICATES THAT PORTION OF TOTAL HARDNESS CAUSED BY CALCIUM AND MAGNESIUM, WHICH ARE GENERALLY RESPONSIBLE FOR ALMOST ALL HARDNESS IN WATER. UNIT OF MEASURE IS MILLIGRAMS PER LITER.

THE AMOUNT OF HARDNESS IN WATER WILL AFFECT THE ABILITY OF SOAP TO LATHER OR CLEANSE BECAUSE OF THE TENDENCY OF THE IONS CAUSING HARDNESS TO REACT WITH SOAP. THE HIGHER THE HARDNESS OF WATER, THE MORE DIFFICULT IT IS FOR SOAP TO LATHER.

NOTE: TOTAL HARDNESS IS GENERALLY DETERMINED BY CHEMICAL TITRATION WHEREAS CALCIUM-MAGNESIUM HARDNESS IS GENERALLY DETERMINED BY MATHEMATICAL CALCULATION FROM CHEMICALLY-DETERMINED VALUES FOR CALCIUM AND MAGNESIUM. BECAUSE OF THIS DIFFERENCE IN DETERMINATION, THE CALCIUM-MAGNESIUM HARDNESS VALUES FOR SOME ANALYSES WILL BE LARGER THAN THE TOTAL HARDNESS VALUE.

******** PARAMETERS LISTED BELOW ARE MEASURED IN MILLIGRAMS PER LITER ********

FE: IRON	MN: MANGANESE	CA: CALCIUM
MG: MAGNESIUM	NA: SODIUM	K: POTASSIUM
HCO3: BICARBONATE	SO4: SULFATE	CL: CHLORIDE
	NO3: NITRATE (AS NO3)	

VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF SURVEILLANCE AND FIELD STUDIES

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR HENRY COUNTY

****

SWCB NO	OWNER AND/OR PLACE	DATE SAMP	PH	SPEC COND	T-DIS SOLID	HARDNESS TOTAL	CA,MG	FE	MN	CA	MG	NA	K	ALK	SO4	CL	NO3
4	DUPONT	10 75	6.6	87		36	36	0.30	0.00	9.0	3.3	1.0	0.3	31	0.0	7.0	3.
14	PHILPOTT DAM	1 77	6.7	84	100	58	41	24.00	0.44	14.0	1.7	16.0	0.8	28	16.3	5.0	0.
18		10 75	7.3	260		116	120	0.00	0.01	35.0	8.1	4.0	4.1	124	15.5		0.
19	PATRICK HENRY COLLEGE	7 78	7.6	202	136	84	86			28.0	4.0	7.0	4.0	92	8.0	1.0	
19	PATRICK HENRY COLLEGE	4 78	8.0		176	96	117		0.01	34.0	8.0	10.0	4.0	124	18.0	1.0	
19	PATRICK HENRY COLLEGE	1 78	6.7		190	119	146	0.10		44.0	9.0	11.0	5.0	131	19.0	1.5	
19	PATRICK HENRY COLLEGE	10 77	6.7	260	165	118	121			34.0	9.0	11.0	5.0	124	17.0		
19	PATRICK HENRY COLLEGE	7 77	7.7	290	250	137	120			35.0	8.0	9.0	5.0	96	12.0	19.0	
19	PATRICK HENRY COM. COL	4 77	7.6	255	213	126	145			45.0	8.0	10.0	5.0	120	14.0	4.0	
19	PATRICK HENRY COLLEGE	1 77	7.7	240	215	128	113	0.00	0.01	32.0	8.1	28.0	3.9	124	15.4	2.0	0.
23	HEMRY CO. SOCIAL SERVI	6 77	6.5	580	66	12				4.0		7.0	2.0	35	10.0	2.0	
30	BASSETT KNITTING	9 75	7.6	330		126	144	0.00	0.01	49.0	5.5	9.0	3.3	117	21.6		5.
30	BASSETT KNITTING #2	9 75	7.3	317		134	134	0.00	0.00	47.0	4.3	9.0	3.0	108	28.0		0.
32	BASSETT FURNITURE	9 75	7.0	230		92	101	0.10	0.00	30.0	6.5	9.0	3.3	95	11.1		0.
33	BASSETT FURNITURE	9 75	6.7	395		142	158	0.30	0.00	41.0	13.7	18.0	3.6	85	29.6		50.
50	TOWN OF RIDGEWAY	4 77	7.0	260	389	144	144		0.02	25.0	20.0	9.0	2.0	85	12.0	18.0	
50	GRAULLY FURNITURE	10 75	8.0	510		232	263	0.40	0.20	58.0	29.0	12.0	7.9	228	23.6		0.
54	HCPC	10 75	6.8	280		128	129	0.30	0.20	31.0	12.8	1.0	4.2	122	16.5		3.
56	BLUERIDGE TALC CO	9 75	7.3	349		18	12	0.50	0.10	3.0	1.3	94.0	2.5	145	30.8		0.
57	MARTINSVILLE STORE COR	10 75	6.6	56		28	20	0.00	0.00	5.0	2.0	1.0	0.4	29	1.5	2.0	0.
58	AMERICAN FURNITURE	7 78	7.8	250	177	106	120			35.0	8.0	9.0	5.0	117	17.0	2.0	
58	AMERICAN FURNITURE	4 78	7.0		118	54			5.00	16.0		0.9	7.0	58	14.0	2.0	
58	AMERICAN FURNITURE	1 78	6.4		122	59	104	9.20	0.14	27.0	9.0	7.0	5.0	61	15.0	2.5	
58	AMERICAN FURNITURE	10 77	6.4	150	109	60	62	1.30	0.01	17.0	5.0	7.0	3.0	58	10.0	2.0	
58	AMERICAN FURNITURE	7 77	7.0	140	110	58	60	5.00	0.04	16.0	5.0	6.0	4.0	63	7.9	2.0	
58	AMERICAN FURNITURE	4 77	6.9	180	187	102	62	4.40	0.03	17.0	5.0	7.0	4.0	89	8.4	8.0	
58	AMERICAN FURNITURE	1 77	7.1	170	165	60	55	1.40	0.03	14.0	5.0	44.0	3.0	93	8.8	3.0	0.
58	AMERICAN FURNITURE	10 75	7.0	180		84	82	0.40	0.03	25.0	5.0	1.0	3.4	86	7.1		0.
59	AMERICAN FURNITURE	10 75	6.9	120		58	51	0.10	0.00	15.0	3.5	1.0	2.6	60			0.
63	SHERWOOD FOREST	7 76	6.9	310		145	121	0.00	0.02	39.0	5.9	16.0	3.1	157		8.0	2.
69	PHILPOTT RESERVOIR	1 78	6.6		111	63	85	1.40	0.20	31.0	2.0	5.0	1.0	63	12.0	2.5	

NOTE--ALL ZEROS (00.00) - ANALYSED, NOT DETECTED; ALL NINES (99.99) - COULD NOT BE STORED, REFER TO ANALYSIS

V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   S U R V E I L L A N C E   A N D   F I E L D   S T U D I E S

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR HENRY COUNTY

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SWCB NO	OWNER AND/OR PLACE	DATE SAMP	PH	SPEC COND	T-DIS SOLID	HARDNESS TOTAL	CA,MG	FE	MN	CA	MG	NA	K	ALK	SO4	CL	NO3
69	PHILPOTT DAM	7 78	5.9	66	58	24	25		0.15	7.0	2.0	3.0	1.0	11	15.0	4.0	
69	PHILPOTT DAM	4 78	7.1		114	62		1.90	2.00	22.0		3.4	5.0	66	11.0	1.0	
69	PHILPOTT RESERVOIR	10 77	6.3	132	105	63	58	0.40		20.0	2.0	5.0	1.0	60	9.0	1.0	
69	PHILPOTT RESERVOIR	7 77	8.1	250	168	116	55	1.80	0.06	19.0	2.0	5.0	1.0	21	15.0	2.0	
69	PHILPOTT RESERVOIR	4 77	6.8	150	133	86	68	1.60	0.09	24.0	2.0	5.0	1.0	64	9.1	4.0	
69	PHILPOT RES. OFFICE #1	7 76	6.7	130		59	65	2.07	0.06	23.0	1.9	5.0	0.7	65		4.0	0.
71	PHILPOTT RESERVOIR	7 76	6.7	140		55	64	0.02	0.01	23.0	1.8	7.0	0.6	68		2.0	0.
72	PHILPOTT RES.BOWENS CR	7 76	6.4	80		41	32	0.00	0.00	8.0	3.1	4.0	0.7	36	3.1	3.0	2.
100	TOWN OF RIDGEWAY	7 78	7.2	208	148	88	94	0.10		23.0	9.0	8.0	5.0	98	12.0	2.0	
100	TOWN OF RIDGEWAY	4 78	7.6		175	110	115		0.04	25.0	13.0	9.0	2.0	97		11.0	
100	TOWN OF RIDGEWAY	1 78	6.8		188	143	190	0.30		45.0	19.0	11.0	3.0	128	20.0	15.0	
100	TOWN OF RIDGEWAY	10 77	6.7	280	215	136	139	0.10		33.0	14.0	8.0	3.0	106	14.0	14.0	
100	TOWN OF RIDGEWAY	7 77	7.6	140	117	58	114			21.0	15.0	9.0	2.0	58	10.0	2.0	
100	TOWN OF RIDGEWAY	5 60	7.5				31	0.12	0.00	9.3	1.9	2.3			0.4	1.6	
101	SKYLINE FOREST	11 64	7.2				25	0.25	0.03	6.6	2.1				3.0	1.6	
101	SKYLINE FOREST	10 64	7.2				18	0.08	0.25	4.6	1.7				2.2		
102	TANGLEWOOD TERRACE	1 67	6.0				32	0.04	0.03	8.0	3.0	9.4			1.5	2.3	
103	VILLA HEIGHTS #4	4 63	7.6				49	0.05	0.00	14.2	3.4	2.5			2.1	1.0	
104	VILLA HEIGHTS #5	4 63	6.7				39	0.02	0.05	10.8	3.1	4.2			1.2	1.3	
105	WALNUT ACRES	5 64	7.3					0.10	0.04						0.7	5.4	
106	V-C FR LINES	7 65	7.6					0.05	0.02						3.5	1.0	
107	R H CLARK ELEM SCH	1 65	7.3				24	0.07	0.05	8.7	0.6				1.1		
108	MASON SUBDIVISION	12 65	6.8					0.21	0.10						1.9	1.5	
109	PIEDMONT ESTATES	12 67	6.0				13	0.01	0.02	4.0	0.9	5.6	1.1		0.5	2.0	
110	PINE FOREST SUB	3 68	6.2				25	0.21	0.01	8.0	1.4	4.2	0.6		1.0	1.5	
133	DANIEL CREEK WATER CO	8 76	6.6	180	124	77	81	0.00	0.10	26.0	4.1	6.0	1.4	78	8.0	2.0	0.
116	DANIEL CREEK WATER CO	7 76	7.4	170		74	91	0.00	0.00	24.0	7.7	5.0	4.3	89	7.1	3.0	1.
121	REED CREEK WATER CO	8 76	6.5	72	85	27	32	0.00	0.00	12.0	0.7	3.0	0.6	34	2.6	1.0	0.
123	REED CREEK WATER CO	8 76	6.6	64	75	32	32	0.00	0.00	8.0	3.0	2.0	0.3	37	2.4	2.0	2.

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V I R G I N I A   S T A T E   W A T E R   C O N T R O L   B O A R D

B U R E A U   O F   S U R V E I L L A N C E   A N D   F I E L D   S T U D I E S

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR HENRY COUNTY

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SWCB NO	OWNER AND/OR PLACE	DATE SAMP	PH	SPEC COND	T-DIS SOLID	HARDNESS TOTAL	CA,MG	FE	MN	CA	MG	NA	K	ALK	SO4	CL	NO3
124	REED CREEK WATER CO	8 76	6.6	53	102	27	23	0.00	0.00	6.0	2.0	3.0	0.2	22	2.6	2.0	4.
125	REED CREEK WATER CO	8 76	5.8	54	64	18	22	0.00	0.01	7.0	1.2	5.0	0.9	22	0.0	3.0	5.
126	REED CREEK WATER CO	8 76	6.9	120	107	53	57	0.10	0.04	20.0	1.8	11.0	1.0	56	7.1	2.0	0.
131	HANOVER SERVICES INC	8 76	6.6	120	100	49	48	0.20	0.07	14.0	3.3	7.0	1.0	43	10.9	2.0	0.
133	DANIEL CREEK WATER CO	7 76	6.8	120		45	56	0.00	0.00	14.0	5.3	7.0	2.2	61	4.5	3.0	0.
134	DANIEL CREEK WATER CO	7 76	7.2	190		74	90	0.00	0.00	22.0	8.7	11.0	4.3	93	5.8	3.0	2.
138	HENRY CO JAIL	10 75	6.4	76		22	19	0.00	0.00	6.0	1.2	1.0	2.4	40	1.1	3.0	0.
149	BLUE RIDGE TRUCKING	1 75	6.5	110		38	43	0.20		11.0	4.0	7.7	1.3	54	2.8		7.
150	TOWN OF RIDGEWAY	1 77	7.2	250	214	114	111	0.00	0.00	21.0	14.3	0.0	1.0	82	14.3	19.0	15.
156	HCA-MARTIN INC	7 76	6.6	170		76	82	0.90	0.03	24.0	5.6	9.0	2.1	73	9.6	4.0	1.
157	HCA-MARTIN INC	7 76	6.7	250		98	115	0.00	0.02	37.0	5.7	9.0	2.4	108	22.8	5.0	0.
160	HENRY CO PSA #6	8 76	6.9	130	13	65	63	0.00	0.01	18.0	4.5	8.0	1.2	71	2.5	4.0	2.
161	HENRY CO PSA #7	8 76	6.6	110	106	49	44	0.20	0.00	11.0	4.1	4.0	0.8	58	7.5	2.0	0.
203	REED CREEK WATER CO	8 76	6.6	130	121	49	52	0.00	0.03	17.0	2.4	7.0	1.0	51	6.9	3.0	0.
282	AXTON	8 76		950													33.
283	KENDALL LUMBER CO	8 76		68													0.
285	H HANKINS	8 76		24													4.
285	H HANKINS	8 76															4.
287	R E GRAVELY	8 76		230													0.
289	J J WILSON	8 76		44													0.
290	J ASHWORTH	8 76		38													0.
291	A J HAISLIP	8 76		165													0.
292	DELMA G YOUNG	9 76	5.2	19	51	8	7	0.00	0.01	2.0	0.6	5.0	0.6	10	1.7	1.5	

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VIRGINIA STATE WATER CONTROL BOARD

BUREAU OF SURVEILLANCE AND FIELD STUDIES

SUMMARY OF GROUNDWATER QUALITY ANALYSES FOR HENRY COUNTY

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SWCB NO	OWNER AND/OR PLACE	DATE SAMP	PH	SPEC COND	T-DIS SOLID	HARDNESS TOTAL	CA,MG	FE	MN	CA	MG	NA	K	ALK	SO4	CL	NO3
293	C WOODY YOUNG	9 76	6.8	125	136	56	58	0.60	0.10	19.0	2.6	9.0	2.0	57	9.4	4.0	0.
294	P L PRILLAMAN	9 76	6.2	66	81	28	29	0.30	0.01	6.0	3.6	2.0	1.2	29	4.1	4.0	1.
295	B A M	9 76	6.3	121	120	68	69	0.00	0.02	16.0	7.2	2.0	0.4	52	3.8	5.0	4.
296	W E COLSTON	9 76	6.3	96	143	38	46	0.00	0.00	11.0	4.6	8.0	1.5	41	2.5	4.0	2.
298	FERA KOGER	9 76	6.2	72	100	10	38	0.10	0.00	9.0	3.8	3.0	1.2	27	10.1	4.0	3.
299	W P SPENCER	9 76	6.1	75	108	34	22	0.00	0.00	6.0	1.9	8.0	0.5	33	0.0	1.5	6.
300	M L BARLEY	9 76	6.2	104	180	34	41	0.00	0.00	12.0	2.8	9.0	1.2	32	0.0	8.0	16.
410	GLEN JARRETT	7 77	6.2	110	99	56	35	0.10		11.0	2.0	9.0	3.0	40	2.5	7.0	
411	FANGLEY UNION	7 77	6.3	72	76	26	29	0.10		7.0	3.0	5.0	1.0	28	2.6	4.0	
412	DOYLE LUMBER CO.	7 77	5.5	16	14	26			0.01			1.0		5	2.6	4.0	
429	MR A D CARTER	8 77	6.2	90	103	46			2.00	8.0		0.0	9.0	35	3.0	5.0	
430	RANDOLPH LESTER	8 77	6.0	95	198	56	36			8.0	4.0	6.0	2.0	30	4.0	5.0	
431	BILLY DONAVANT	8 77	6.2	67	67	38	23			6.0	2.0	6.0	2.0	18	3.0	5.0	

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APPENDIX C

GLOSSARY

GLOSSARY

Alluvium	A general term for sediments deposited in recent geological time by a stream or other body of water.
Amphibole	A group of dark, rock-forming, ferromagnesian silicate minerals.
Amphibolite	Metamorphic rock consisting mainly of amphibole and plagioclase with little or no quartz.
Anticline	An upfold of layered rocks in the form of an arch and having the oldest strata in the center. The reverse of a syncline.
Aquiclude	A geologic formation, group of formations or part of formations, that is capable of absorbing water, but is relatively impermeable, and does not supply appreciable quantities of water to a well or spring.
Aquifer	A geologic formation, group of formations or part of formations, capable of supplying water to wells in usable quantities. An aquifer is unconfined (water table conditions), or confined (artesian conditions) depending on whether the groundwater level is at atmospheric pressure, or greater than atmospheric pressure due to the presence of an overlying confining geologic formation (aquiclude or aquitard).
Augen	In foliate metamorphic rocks, lenticular mineral grains or mineral aggregate having the shape of an eye in cross-section.
Bedding Plane	The division plane in sedimentary or stratified rocks which separates the individual layers, beds or strata.
Bedrock	Any solid rocks exposed at the surface or overlain by unconsolidated materials.
Biotite	Generally black, dark brown or dark green ferromagnesian mineral of the mica group.
Clastic Rock	A consolidated sedimentary rock composed of broken fragments that are derived from pre-existing rocks, e.g., sandstone, conglomerate, or shale, etc.

Colluvium	Loose soil material and/or rock fragments deposited by the action of gravity, usually at the base of a slope or cliff.
Conglomerate	A coarse-grained, clastic sedimentary rock composed of rounded to subangular fragments larger than 2 mm in diameter set in a matrix of sand, silt or any of the natural cementing materials.
Consolidated	A rock that is firm and rigid in nature due to the natural interlocking and/or cementation of its mineral grain components. The reverse is unconsolidated.
Diabase	An intrusive igneous rock composed primarily of labradorite and pyroxene, with ophitic texture.
Dike	Tabular igneous intrusion, cuts across planar structures of surrounding rocks.
Diorite	Group of plutonic rocks; composition intermediate between acidic and basic rocks; characteristically composed of dark-colored amphibole, plagioclase, pyroxene and minor amounts of quartz (sometimes).
Dip	The angle at which a rockbed is inclined from the horizontal.
Drawdown	The difference between static level and pumping level in a wall, i.e., the drop in the water level due to pumping.
Epidote	A yellowish-, pistachio- or blackish-green mineral; occurs in low-grade metamorphic rocks or as an alteration product of ferromagnesian minerals.
Evapotranspiration	The process by which surface water, soils and plants release water vapor to the air.
Flaser	Streaky layers of parallel, scaly aggregates surrounding the lenticular bodies of granular material.
Fault	A fracture or fracture zone along which there has been movement of two rock masses relative to one another parallel to the fracture. The movement may be a few inches or many miles, horizontal or vertical.
Flood Plain	The strip of relatively smooth land adjacent to a river channel and built of alluvium carried by the river during floods. The flood plain is covered by water when the river is in flood.

Fold	A bend in the rock strata.
Formation	A unit of geologic mapping consisting of recognizable rock units.
Fracture	Break in rocks.
Gabbro	Group of basic, dark-colored intrusive igneous rocks consisting of feldspar and pyroxene.
Gneiss	A foliated rock formed by regional metamorphism; bands or lenticles in which minerals with flaky or elongate form predominate; adjective-gneissic.
Granite	A coarse-grained igneous rock consisting of feldspar, quartz and other minerals.
Granofels	Medium- to coarse-grained granitic metamorphic rock with little or no foliation or lineation.
Graywacke	Dark, usually gray or greenish gray, sometimes black, very hard, tough, firmly indurated, coarse-grained sandstone.
Groundwater	Water below the water table, i.e., in the zone of saturation.
Hornblende	Commonly black, dark green or brown mineral of the amphibole group.
Hydrogeology	The science that deals with subsurface waters and related geologic aspects of surface waters; hydrology or flow characteristics of subsurface waters.
Igneous Rocks	Rocks formed by solidification of deep-seated molten silicate materials.
Infiltration	The flow of water through the soil surface into the ground.
Joint	A fracture in rock along which no appreciable movement has occurred. Joints are generally perpendicular to bedding planes.
Kyanite	Blue or light-green aluminosilicate mineral; occurs in long, thin, bladed crystals in schists and gneisses.
Labradorite	Dark, gray, blue, green or brown mineral of the plagioclase feldspar group; common in igneous rocks of intermediate to low silica content.

Leucocratic	Light colored; applied to a light-colored igneous rock relatively poor in mafic minerals.
Lineaments	Straight or gently curved, lengthy features of the Earth's surface, frequently expressed topographically as depressions or lines of depression.
Lithology	The composition and structure of rock. Adjective: Lithologic
Mafic	Igneous rock composed chiefly of one or more ferromagnesian (dark-colored) minerals.
Metamorphic Rocks	Rocks formed within the earth crust by the transformation of a pre-existing rock in the solid state without fusion and without addition of new material, as a result of high temperatures, high pressures or both.
Mica	Group of minerals that vary in color from colorless, silvery white, pale brown or yellow to green or black; readily splits into very thin, tough and somewhat elastic plates, prominent rock-forming constituents in many igneous and metamorphic rocks.
Muscovite	Usually colorless, whitish or pale brown mineral of the mica group; common mineral in metamorphic rocks (gneisses and schists) and most acid igneous rocks (granites and pegmatites).
Norite	A coarse-grained plutonic rock containing basic plagioclase (labrodorite) as the chief component.
Olivine	An olive-green, grayish-green or brown ferromagnesian silicate mineral; common rock-forming mineral of basic, ultrabasic and low-silica igneous rocks.
Ophitic	Refers to texture or an igneous rock (especially diabase) in which lathe-shaped plagioclase crystals are partially or completely included in pyroxene crystals.
Pegmatitic	The texture of an exceptionally, coarsely-crystalline, igneous rock.
Permeability	The capacity of a rock or soil for transmitting water.
Plagioclase	A group of feldspar containing aluminum, calcium and silica; one of the most common rock-forming minerals.

Plutonic Rock	Characteristically medium- to coarse-grained rock, formed at considerable depth by crystallization of magma or by chemical alteration.
Porosity	The spaces or voids in rock and soil materials usually expressed as a percentage of the material.
Porphyritic	Refers to the texture of an igneous rock in which larger crystals are set in a fine groundmass which may be crystalline or glassy or both.
Pyroxene	A group of dark, rock-forming silicate minerals containing aluminum, calcium, sodium, iron and magnesium.
Quartzite	A very hard sandstone composed predominantly of quartz which may be either metamorphosed or not.
Recharge	The addition of water to an aquifer by natural infiltration or artificial means.
Runoff	That part of precipitation that appears in surface streams.
Sandstone	Sedimentary rock consisting predominately of sand-size particles.
Saprolite	A soft, earthy, clay-rich thoroughly decomposed rock formed in place by chemical weathering of igneous and metamorphic rocks.
Schist	A well-foliated metamorphic rock in which the component flaky materials (mica) are distinctly visible.
Sedimentary Rocks	Refers to rocks formed from the consolidation of layered sediments.
Sericite	White, fine-grained potassium mica occurring in small scales and flakes as an alteration product of various aluminosilicate minerals; formed in various metamorphic rocks.
Staurolite	Brownish to black ferromagnesian mineral found in rocks that have undergone medium-grade metamorphism.
Structure	A general disposition, attitude, arrangement or relative position of the rock masses of a region or area, also referred to as "structural geology".

Subsidence	A local mass movement that involves principally the gradual downward settling or sinking of the earth's surface.
Syncline	A downfold with troughlike forms and having youngest rock in the center.
Terrace Deposits	Deposits of alluvium (sand, gravel, cobble or clay) which occurs along the margin and above the level of a body of water, marking a former water level.
Topography	The relief and form of a land surface.
Ultramafic	An igneous rock composed chiefly of mafic minerals.
Water Table	The upper surface of the zone of saturation. The surface in water table aquifer at which the water level stands.
Water Well	An artificial excavation (pit, hole, tunnel) generally cylindrical in form and often walled in, sunk (drilled, dug, driven, bored, jetted) into the ground to such a depth as to penetrate water-yielding rock and to allow water to flow or to be pumped to the surface.

APPENDIX D

BIBLIOGRAPHY

BIBLIOGRAPHY

The following list of references includes all those used in preparing this report, in addition to several others which should provide educational reading on the subjects of ground water and water well drilling.

American Geological Institute, Glossary of Geology and Related Sciences , Washington, D.C., 1972.

Army and Air Force, Departments of the, "Well Drilling Operations", Technical Manual 5-197 and Air Force Manual 85-23, 1965.

Campbell, Michael D. and Lehr, Jay H., Water Well Technology , McGraw-Hill, 1973.

Commonwealth of Virginia, Department of Conservation and Economic Development, "Geologic Map of Virginia", Division of Mineral Resources, 1963.

Commonwealth of Virginia, Department of Health, Bureau of Sanitary Engineering, "Waterworks Regulations", Richmond, Virginia, 1974.

Commonwealth of Virginia, Division of Planning and Community Affairs, "Population Projections, Virginia Counties and Cities, 1980-2000", Richmond, Virginia, 1975.

Commonwealth of Virginia, State Water Control Board, "Groundwater in Virginia: Quality and Withdrawals", Bulletin 38, Richmond, Virginia.

Commonwealth of Virginia, State Water Control Board, "Groundwater in Virginia", Bulletin 502, Richmond, Virginia, Revised 1969.

Commonwealth of Virginia, State Water Control Board, "Rules of the Board and Standards for Water Wells", Richmond, Virginia, May 1974.

Commonwealth of Virginia, State Water Control Board, "State Water Control Law", Richmond, Virginia.

Commonwealth of Virginia, State Water Control Board, "Guide for Water Well Contractors and Groundwater Users", Information Bulletin 508, Richmond, Virginia, October 1974.

Conley, James F. and Toewe, E. Clayton, Geology of the Martinsville West Quadrangle, Virginia, Report of Investigations 16, Virginia Division of Mineral Resources, Charlottesville, Virginia, 1968.

Conley, James F. and Henika, William S., Geology of the Philpott Reservoir Quadrangle, Virginia, Report of Investigations 22, Virginia Division of Mineral Resources, Charlottesville, Virginia, 1970.

Conley, James F. and Henika, William S., Geology of the Snow Creek, Martinsville East, Price and Spray Quadrangles, Virginia, Report of Investigations 33, Virginia Division of Mineral Resources, Charlottesville, Virginia, 1973.

Davis, N. S. and DeWiest, R. M. M., Hydrogeology , John Wiley and Sons, Inc., New York, New York, 1966.

Flawn, Peter T., Environmental Geology: Conservation Land-Use Planning and Resource Management , Harper and Row, New York, New York, 1970.

Gibson, Ulrick P. and Singer, Rexford D., Water Well Manual , Premier Press, 1971.

Hem, John O., "Study and Interpretation of the Chemical Characteristics of Natural Water", United States Geological Survey, Water-Supply Paper 1473, 1970.

Henika, William S., Geology of the Bassett Quadrangle, Virginia, Report of Investigations 26, Virginia Division of Mineral Resources, Charlottesville, Virginia, 1971.

Holmes, Arthur, Principles of Physical Geology , The Ronald Press Company, New York, 1965.

Johnson Division, Universal Oil Products Company, Ground Water and Wells , H. M. Smyth Company, Inc., Saint Paul, Minnesota, 1972.

Lohman, S. W., "Definitions of Selected Ground Water Terms - Revisions and Conceptual Refinements", United States Geological Survey, Water Supply Paper 198B, 1972.

LeGrand, Harry E., Geology and Ground-Water Resources of Pittsylvania and Halifax Counties Bulletin 75, Virginia Division of Mineral Resources, Charlottesville, Virginia, 1960.

McKee, Jack E. and Wolf, Harold W., "Water Quality Criteria", California State Water Resources Control Board, Publication 3-A, 1963.

Meinzer, Oscar E., "Outline of Ground Water Hydrology", United States Geological Survey, Water Supply Paper 494, 1923.

Meyertons, Carl Theile, Triassic Formations of the Danville Basin, Report of Investigations 6, Virginia Division of Mineral Resources, Charlottesville, Virginia, 1963.

National Water Well Association, "Water Well Driller's Beginning Training Manual", published by the National Water Well Association, 1971.

Thomas, H. E., The Conservation of Ground Water , McGraw-Hill Book Co., 1951.

Todd, D. K., Groundwater Hydrology , John Wiley and Sons, Inc., 1959.

Trelease, Frank J., Water Law , West Publishing Company, St. Paul, Minnesota, 1974.

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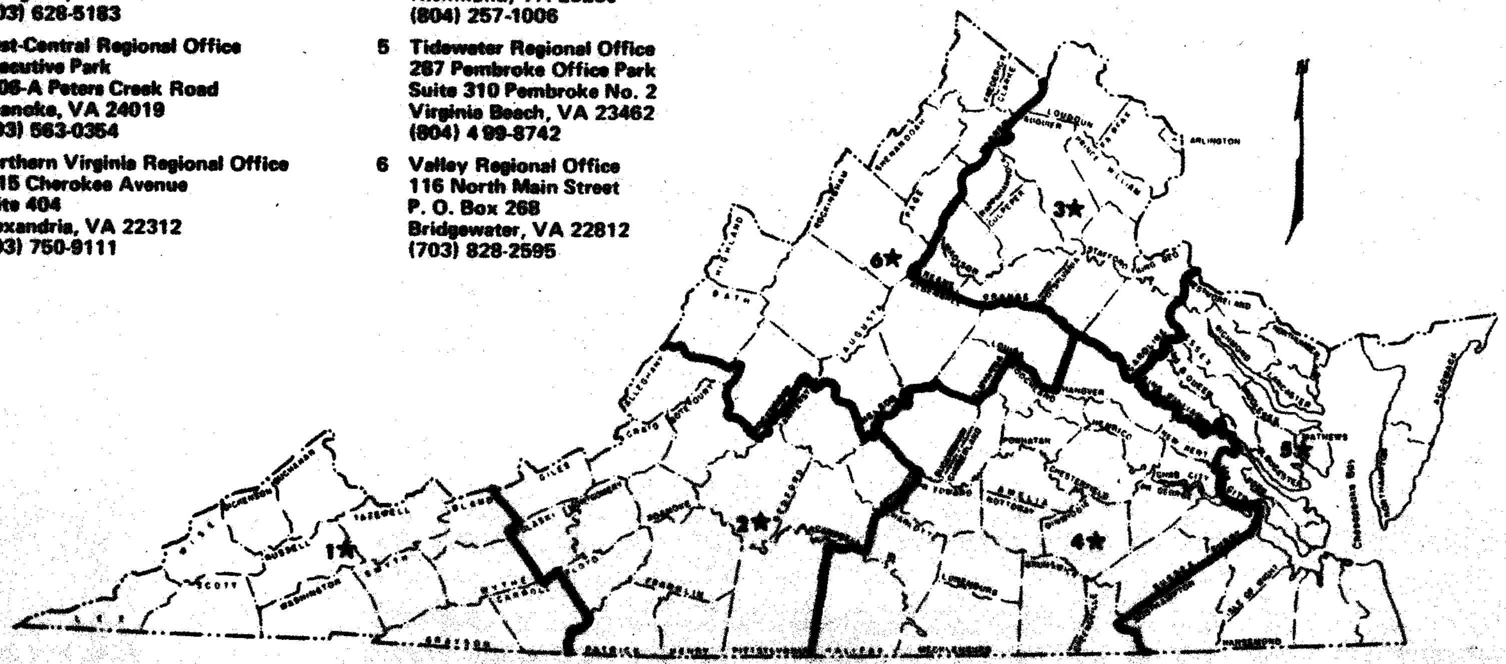

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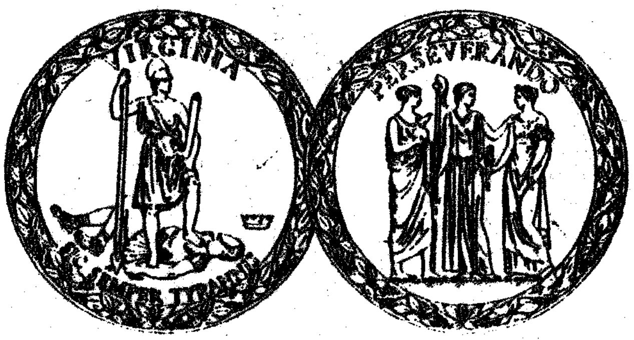
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