DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN FILE MAP 78-267

JOHNSTON--PROBABLE YIELDS OF WELLS IN THE BEDROCK AQUIFERS OF FAIRFAX CO., VA.

NAMES APPLIED TO ROCKS IN FAIRFAX COUNTY

Map units shown here	Drillers' terms	Map units shown on bedrock geologic map by Drake and Froelich (1977)
1-SILTSTONE	Red shale or slate	SILTSTONE (S1) interbedded with shale and sandstone
2-SANDSTONE	Red sandstone	SANDSTONE (S2) interbedded with siltstone
3-SCHIST	Mica rock, blue shale, or blue stone	SCHIST (B) interbedded with metagraywacke, gneiss, phyllite, and phyllonite
4-PHYLLITE	Soft shale, soapstone, yellow shale, or gray rock	PHYLLITE (A) interbedded with metasiltstone and slate
5-GNEISS	Mica and flint rock or granite	GNEISS (D) including granofels and migmatite
6-METAGRAYWACKE	Slaty rock, blue stone, or sandy shale	METAGRAYWACKE (C) interbedded with quartzite, schist, and granofels
7-GRANITE	Granite	GRANITOID ROCKS (F) including gneissic granite, adamellite, granodiorite, pegmatite, and related rocks
8-CONGLOMERATE	Hard, red or white sandstone	CONGLOMERATE (S3) interbedded with sandstone and siltstone
9-GREENSTONE	Greenstone or dark rock	MAFIC ROCKS (G) including amphibolite gabbro, chloritic schist and greenstone. ULTRAMAFIC ROCKS (H) including serpentinite and chloritic schist
10-DIABASE	Trap rock, blackjack, or black granite	DIABASE (J)
11-HORNFELS	Hard shale, lavender rock, gray shale, or gray rock	HORNFELS (E) including thermally metamorphosed (baked) shale, siltstone, sandstone, and conglomerate

HYDROGEOLOGIC CHARACTERISTICS OF THREE PRINCIPAL AQUIFERS AS RELATED TO WELL YIELDS

AQUIFER	LITHOLOGIC DESCRIPTION	HYDRAULIC CHARACTERISTICS	OPTIMUM SITES FOR HIGH-YIELDING WELLS
1-SILTSTONE	Red to brown siltstone, and interbedded shale and sandstone	Fractured aquifer, with transmissivities in the range of 1000 to 2000 ft²/day. Initial well yields of 300 to 1000 gal/min have been obtained at Dulles Airport. Very hard water of marginal quality is found in some deep wells (Johnston, 1960).	Anywhere except in vicinity of the hornfels (Unit 11 on map). Identification of fracture zones from linear traces on satellite imagery may be helpful.
2-SANDSTONE	Reddish-brown arkosic sandstone, and interbedded, siltstone and shale	Fractured aquifer, with greatest permeability associated with bedding-plane partings. Transmissivity for a 300-foot section near base of unit is 250 to 300 ft²/day, suggesting average hydraulic conductivity is 1 ft/day. Thick sections of aquifer are untested, but transmissivities up to to 1000 ft²/day are a reasonable expectation and well yields of a few hundred gallons per minute from 500 to 1000 ft. wells are likely.	Avoid areas close to hornfels (Unit 11). Underlying conglomerate (Unit 8) has lower transmissivity, and well sites should be as far west of this unit as possible. Identification of fracture zones from linear traces on satellite imagery may be helpful.
3-SCHIST	Pelitic schist interbedded with graywacke, gneiss, and phyllite that has been intensely refolded and faulted.	Fractured aquifer, with joints and partings parallel to the generally steep-dipping foliation. Highly anisotropic and nonhomogeneous aquifer, with greatest transmissivity apparently associated with shear zones adjacent to more massive rock units. Estimated transmissivity ranges from 10 to 100 ft²/day. Overlying saprolite acts as a leaky confining bed and, where underlain by fractured schist, should contribute significantly to well yields.	Proximity to contact with more competent rock units, such as gneiss (5), metagraywacke (6), and granite (7). (Note most high-yielding wells on map are close to contact with these units). Identification of fracture zones from satellite imagery may be helpful.

PROBABLE WELL YIELDS

Bedrock aquifers (water-bearing formations) are listed below in order of their capability of supplying water to wells. Chances of obtaining a specified well yield are based primarily on yields reported by drillers from more than 1100 wells in Fairfax County. Probable yields for the siltstone and sandstone aquifers were also based on the aquifer transmissivity, as determined from pumping tests. The terms used to describe the percentage chances of obtaining a specified yield from a particular well are derived as follows:

Very unlikely	Poor	Fair	Good	Excellent
0	10	35	65	90 100 percent

For example, 92 percent of all shallow wells in schist yield more than 5 gallons per minute, and therefore chances of obtaining this yield are considered excellent.

Shallow wells are defined as all wells cased to bedrock, with a total depth of less than 200 feet. Most shallow wells are within the 75 to 150 foot depth range. Deep wells include all wells with total depths exceeding 200 feet. Most deep wells are 200 to 500 feet; however, a few wells in the schist and siltstone aquifers have been drilled to depths of 800 to 1000 feet.

DESCRIPTION OF MAP UNITS

SILTSTONE - Chances of obtaining 5 gallons per minute or more in shallow wells are excellent.

Chances of obtaining more than 100 gallons per minute in deep wells are good.

SANDSTONE - Chances of obtaining 5 gallons per minute or more in shallow wells are excellent.

Chances of obtaining more than 100 gallons per minute in deep wells are fair.

SCHIST - Chances of obtaining 5 gallons per minute or more in shallow wells are excellent.

Chances of obtaining more than 50 gallons per minute in deep wells are fair.

Chances of obtaining more than 100 gallons per minute in deep wells are poor.

PHYLLITE - Chances of obtaining 5 gallons per minute or more in shallow wells are excellent.

Chances of obtaining more than 50 gallons per minute in deep wells are very unlikely.

GNEISS - Chances of obtaining 5 gallons per minute or more in shallow wells are good.

Chances of obtaining more than 50 gallons per minute in deep wells are poor.

METAGRAYWACKE - Chances of obtaining 5 gallons per minute or more in shallow wells are good.

Chances of obtaining more than 50 gallons per minute in deep wells are poor.

GRANITE - Chances of obtaining more than 5 gallons per minute in shallow wells are good.

Chances of obtaining more than 50 gallons per minute in deep wells are very unlikely.

CONGLOMERATE - Chances of obtaining more than 5 gallons per minute in shallow wells are good.

Chances of obtaining more than 50 gallons per minute in deep wells are very unlikely.

GREENSTONE - Chances of obtaining 5 gallons per minute or more in shallow wells are fair.

Chances of obtaining more than 25 gallons per minute in deep wells are poor.

DIABASE - Chances of obtaining 5 gallons per minute or more in shallow wells are poor.

Chances of obtaining more than 25 gallons per minute in deep wells are poor.

HORNFELS - Chances of obtaining 5 gallons per minute or more in shallow wells are poor.

Chances of obtaining more than 25 gallons per minute in deep wells are very unlikely.

SYMBOLS

Contact between bedrock units (after Drake and Froelich, 1977).

Contact with overlying Coastal Plain sediments.

Outlier of Coastal Plain sediments.

Well yielding more than 100 gallons per minute.

Well yielding 50 to 100 gallons per minute.

SELECTED REFERENCES

Drake, A. A., and Froelich, A. J., 1977, Bedrock map of Fairfax County, Virginia: U.S. Geol. Survey Open-File Report 77-523.

Johnston, P. M., 1960, Ground-water supplies in shale and sandstone in Fairfax, Loudoun, and Prince William Counties, Virginia: U.S. Geol. Survey Circular 424, 7 p.

Johnston, P. M., 1964, Geology and ground-water resources of Washington, D. C., and vicinity: U.S. Geol. Survey Water-Supply Paper 1776, 97 p. and unpub. Appendix of well records.

Lee, K. Y., 1977, Triassic stratigraphy in the northern part of Culpeper Basin, Virginia and Maryland: U. S. Geol. Survey Bulletin 1422-C, 17 p.

GEOLOGY MODIFIED FROM DRAKE AND FROELICH (1977)

COVERED BY COASTAL PLAIN DEPOSITS

SCALE 1:48 000

CONTOUR INTERVAL 10 FEET

U.S. Geological Survey
OPEN FILE MAP
This map is preliminary and has not been edited for conformity with Geological Survey standards or nomenclature.

PROBABLE YIELDS OF WELLS IN THE BEDROCK AQUIFERS OF FAIRFAX COUNTY, VIRGINIA

By

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