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LOW FLOW OF STREAMS IN FAIRFAX COUNTY, VIRGINIA

by E. H. Mohler, Jr. and G. F. Hagan

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ABSTRACT

A frequency analysis of annual minimum 7-day average flows was made for long-term gaging stations in and near Fairfax County to determine low-flow discharge for selected recurrence intervals. Base-flow discharge measurements made at 35 other sites were plotted against concurrent daily discharge data from the gaging stations. The resulting curves of relation were used to estimate 7-day 2-year and 7-day 10-year minimum discharges at ungaged sites.

Low-flow characteristics of streams in Fairfax County are influenced by several factors, principally drainage basin size, geology, and land use. Zero flow to very low base flows occur in streams that drain sedimentary rocks in the Triassic Lowland in western Fairfax County. Higher base flows are sustained by weathered crystalline rocks and by coastal plain sediments in the central and eastern parts of the county, respectively. As land-use changes take place--primarily the conversion of forested and agricultural lands to residential and commercial areas --base flows tend to decrease. Water that would normally

recharge the ground-water system, the source of base flow, runs off rapidly over impervious surfaces or through storm drains. Streamflow may be augmented, however, by discharge of treated sewage effluent or by releases from artificial lakes.

The Occoquan and Potomac Rivers, which form, respectively, the southern and northern boundaries of the County are important to the water supplies of the area. The Occoquan River is developed as a water supply source using reservoir storage, thus low-flow data presented in this report are not applicable to evaluation of the water supply potential of the river. However, low-flow frequency data for the Potomac River are useful in assessing water supply potential as there is little storage within the basin.

Introduction

This report is one of a series that describe geologic and hydrologic conditions in Fairfax County; it is intended for use by planners, engineers, hydrologists, and other citizens concerned with the effect of land use on water resources. The objectives of the report are to present low-flow frequency characteristics, derived from existing streamflow data, for selected sites on Fairfax County streams; to describe a method for estimating low-flow frequency characteristics from base-flow discharge measurements; and to explain the effects of geologic conditions, drainage basins characteristics, and urban development on the low flow of streams.

Streamflow is abundant in Fairfax County. It averages about 33 million cubic feet per year for each square mile of area. There are, however, extreme seasonal variations in flow. At times, streams that drain areas of several square miles may have flows greater than 1,000 cubic feet per second per square mile [$(ft^3/s)/mi^2$]. But during periods of little or no rainfall, particularly in the late summer and fall, those same streams may go completely dry. The variation of daily flow and precipitation for a Fairfax County stream is shown in figure 1.

The adequacy of streamflow to meet requirements for pollution abatement projects, and water supply projects where storage is not provided, and to maintain conditions

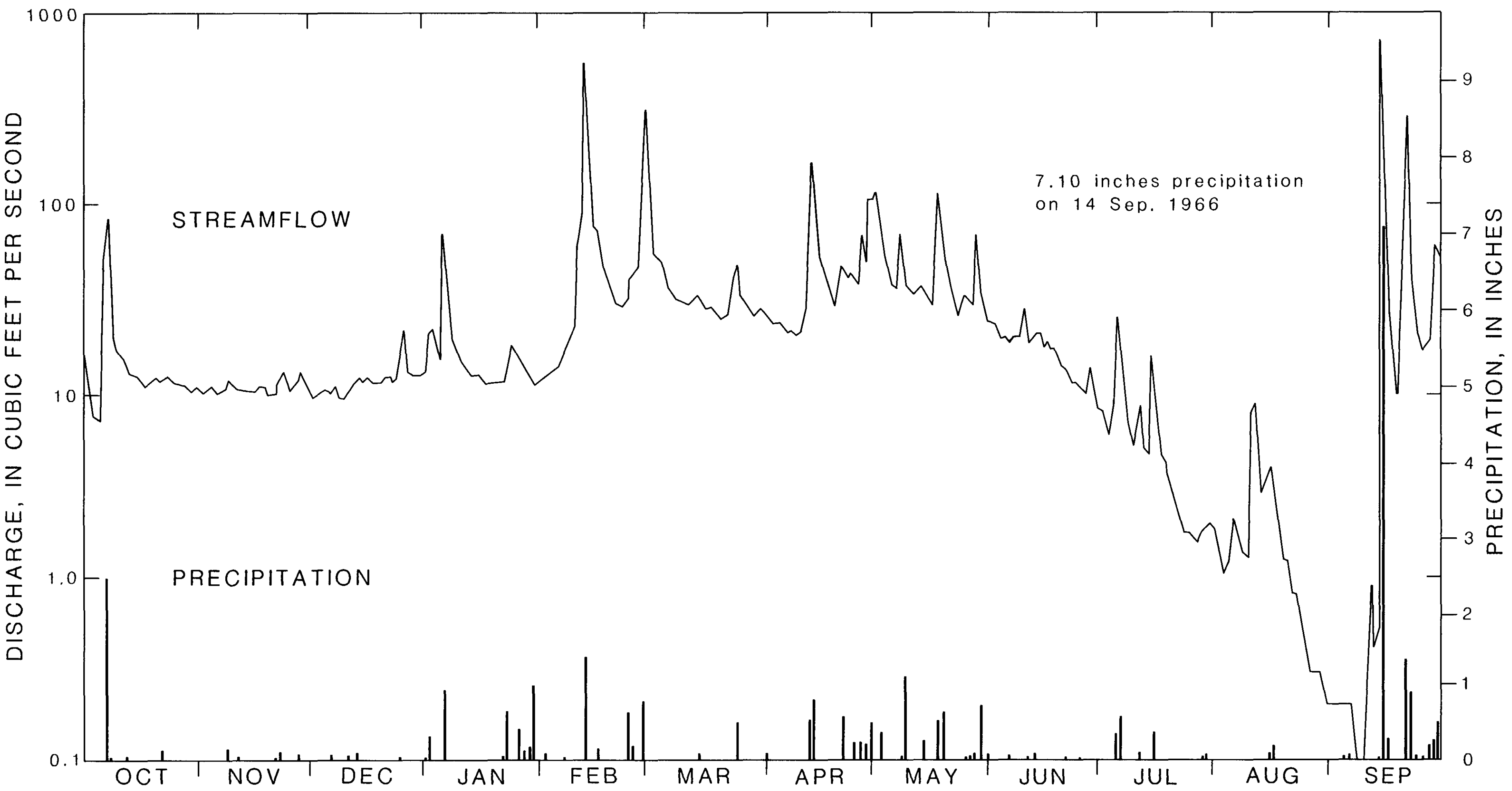

FIGURE 1. -- Daily streamflow, Difficult Run near Great Falls, Va., and daily precipitation at Vienna, Va., 1965-1966.

favorable to aquatic life is commonly evaluated in terms of low-flow characteristics. Low-flow characteristics at a stream gaging station, where data are collected continuously, may be described by duration curves, base-flow recession curves, and low-flow frequency curves (Riggs, 1972). The duration curve shows the percentage of time that a specific discharge has been equalled or exceeded during the period of record at a gaging station. Base-flow recession curves derived from gaging station records represent streamflow after subtracting direct surface runoff, and can be used to estimate future streamflow. Low-flow frequency curves are particularly valuable for planning; they show the probability of occurence of annual low flows.

Water pollution commonly results from land-use practices, and wnen streamflow is less than the minimum required to adequately dilute pollutants, the aquatic environment is adversely affected. The Commonwealth of Virginia has adopted the 7-day 10-year low-flow discharge as the critical discharge in this regard. The 7-day 10-year low flow is the discharge at the 10-year recurrence interval taken from a frequency curve of annual values of the lowest mean discharge for 7 consecutive days. This means that the probability is 1/10 that the 7-day low flow in any one year will be equal to or less than the 7-day 10-year low flow. It is not an extremely rare flow, but neither is it a common one (see Cushing and others, 1973, p. 26).

The results of a low-flow frequency analysis of streamflow data in an area undergoing urban development should be used with caution. During the period of recorded flows, development may alter the pattern of stream flow. A frequency analysis of such a non-homogeneous record could differ significantly from one based on constant basin conditions. Care should also be exercised in extrapolating the results given here to points for which no discharge data are available. Low-flow characteristics for a particular site may be estimated with some degree of confidence if low-flow data are available from a nearby point on the same stream. However, estimating low-flow values at ungaged sites is best done by obtaining several discharge measurements during periods of low flow and relating them to concurrent data at a long-term gaging station preferably on a stream that has similar drainage basin characteristics.

The areal variation and frequency characteristics of annual minimum 7-day average flows at selected sites on Fairfax County streams are shown on the accompanying map, graphs, and tables, and are discussed in the remainder of this text.

Low-Flow Frequency

Frequency curves of annual minimum 7-day average flows at 5 long-term gaging stations in and near Fairfax County were derived both graphically and by fitting a log Pearson Type III theoretical frequency distribution of the data

(Riggs, 1968, p. 4). The two methods gave virtually the same results. Frequency curves for two streams are shown in figure 2. Discharges for recurrence intervals of 2, 5, 10, and 20-years for those streams and others are given in table 1.

Daily discharge records for the station on Accotink Creek were significantly affected by sewage inflows for the years 1957-71. Records for the affected years were not used in the frequency analysis; therefore the data shown in table 1 represent unregulated conditions. Records for the station on Bull Run include sewage inflows after 1962--these records were not used in the frequency analysis. Thus, data in table 1 for Bull Run represent unregulated but not present conditions. The length of usable record for these two stations does not warrant the presentation of a 20-year discharge.

Discharge measurements made at 35 miscellaneous measuring sites on streams in Fairfax County during periods of no surface runoff were used in conjunction with daily records from long-term stations to define low-flow characteristics for the ungaged streams. For example, in figure 3, base-flow measurements of Scott Run near McLean, Va., a low-flow measuring site, are plotted against concurrent daily mean flows of Difficult Run near Great Falls, Va., a long-term gaging station. The 2-year and 10-year low-flow values for Scott Run can be estimated from those

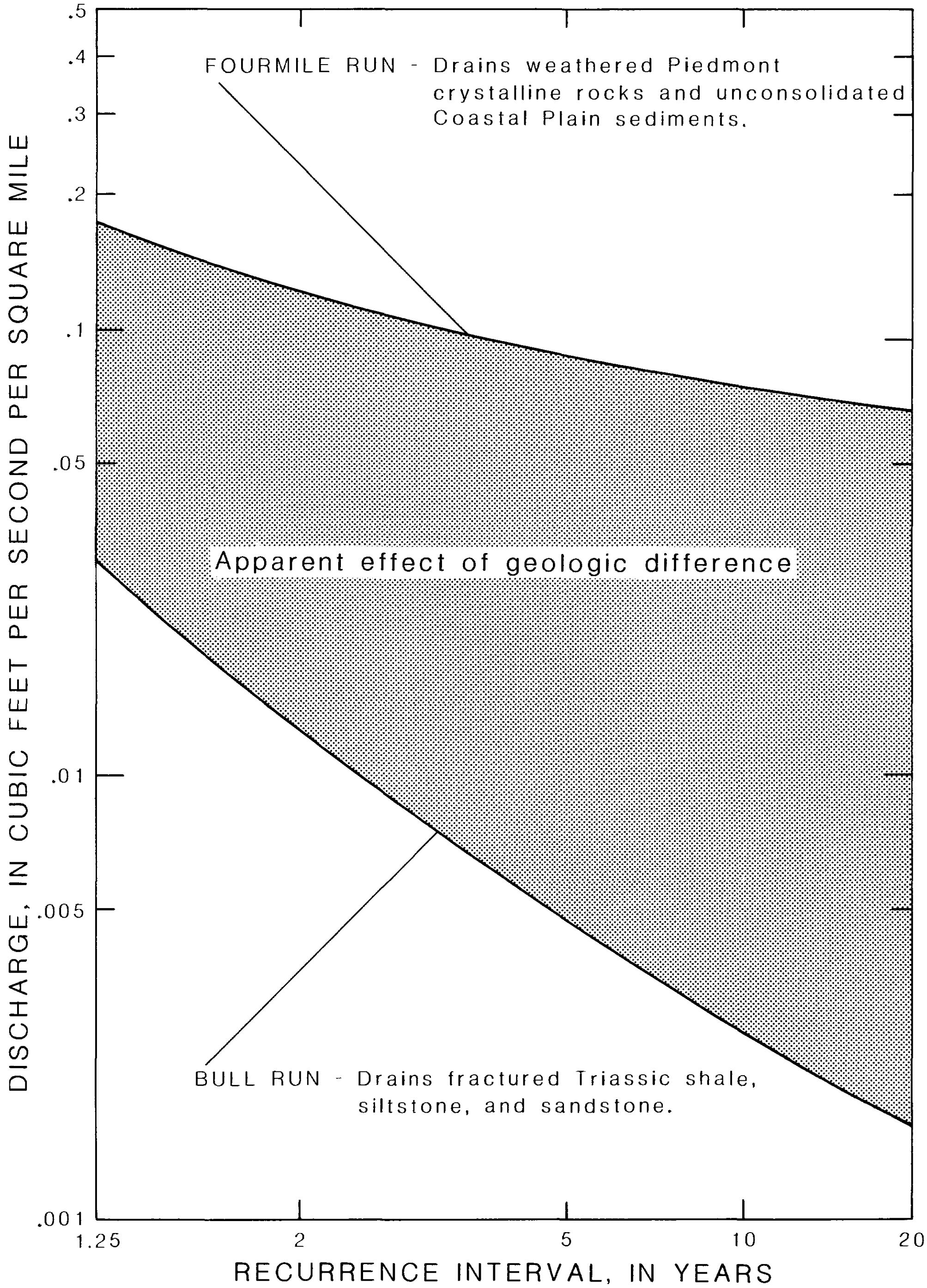

FIGURE 2. -- Frequency curves for annual lowest mean discharge for 7 consecutive days for two streams that drain different rock types.

Table 1.--Magnitude and frequency of annual low flow for 7 consecutive days at long-term daily-record gaging stations in Fairfax County, Va. Annual low flow in cubic feet per second and (cubic feet per second per square mile).

Period of record Climatic years ending March 31 (years)	Drainage area (mi^2)	Annual low flow, for indicated recurrence interval			
		2-year	5-year	10-year	20-year
	01646000 Difficult Run near Great Falls (Piedmont - Rural/Suburban)				
1936-76 (41)	57.9	12.4 (.21)	5.4 (.093)	2.7 (.047)	1.4 (.024)
	01652500 Fourmile Run at Alexandria (Piedmont and Coastal Plain - Urbanized)				
1953-69, 1975 (18)	14.4	1.7 (.12)	1.2 (.083)	1.0 (.069)	0.9 (.063)
	01653000 Cameron Run at Alexandria [1] (Piedmont and Coastal Plain - Urbanized)				
1957-76 (20)	33.7	3.2 (.095)	2.1 (.062)	1.7 (.050)	1.5 (.045)
	01654000 Accotink Creek near Annandale (Piedmont - Rural/Suburban)				
1949-56, 1972-78 (15)	23.5	3.0 (.13)	1.1 (.046)	0.56 (.024)	--
	01657000 Bull Run near Manassas (Triassic Lowland - Rural)				
1952-62 (11)	148	0.99 (.007)	0.37 (.003)	0.21 (.0014)	--

1 Low flow affected by Lake Barcroft.

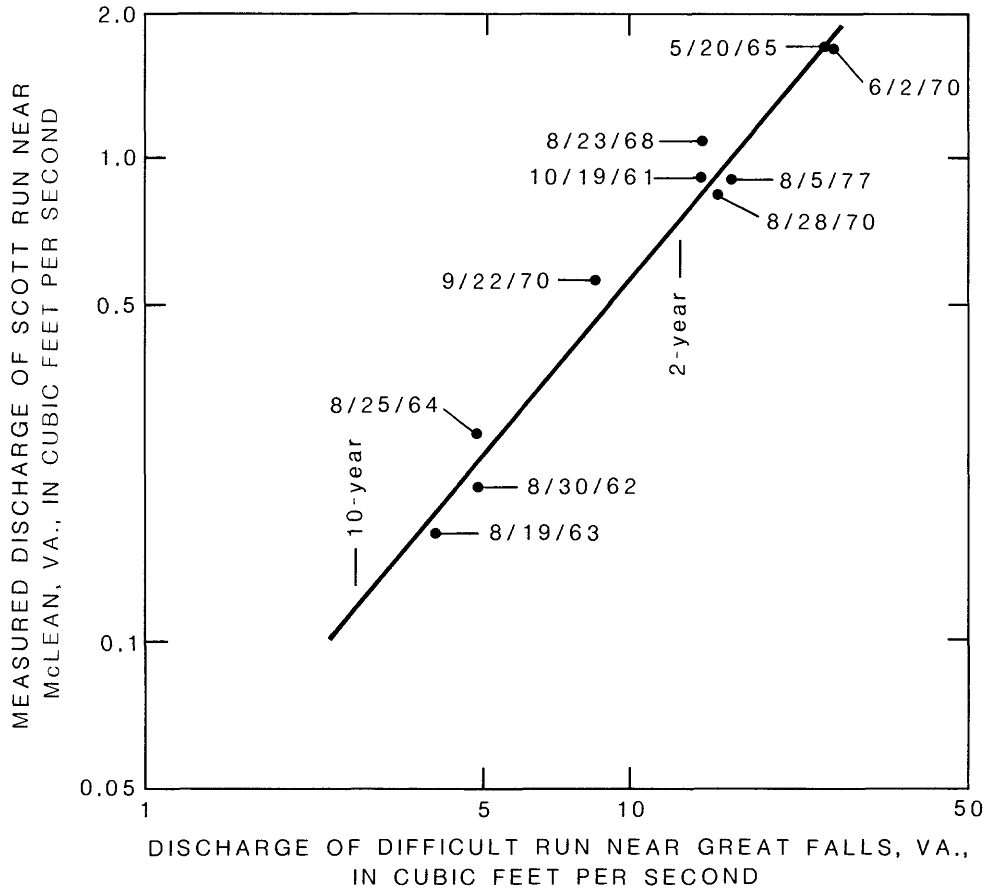

FIGURE 3. -- Relation of base-flow measurements of Scott Run to concurrent daily mean flows of Difficult Run (gaged).

values for Difficult Run using the curve of relation plotted in figure 3. The accuracy of the relation derived in this way does not warrant definition of a complete frequency curve for the low-flow measurement site (Riggs, 1972; Hardison and Moss, 1972). Thus, the annual minimum 7-day average flows estimated by this method for the ungaged streams are shown in table 2 only for the 2-year (50 percent chance) and 10-year (10 percent chance) recurrence intervals. The 7-day 10-year low-flow values for both the gaged and ungaged sites in Fairfax County are shown on Plate 1.

Factors Affecting Low Flows

Various factors in a drainage basin control the low-flow characteristics of streams. Natural factors that affect low flows are drainage basin size; geology, including the nature and thickness of soil or weathered surface materials; and topographic features such as land slope and surface roughness. Climatic and meteorologic factors such as evapotranspiration rates and seasonal distribution of precipitation also affect low flows, but they would probably have a similar effect on all streams in an area no larger than Fairfax County.

Man's modification of the natural physical environment can have a profound effect on the low flow of streams. In Fairfax County, such modifications are expressed principally by a conversion of forest and agricultural lands to residen-

Table 2.--Estimated annual low flow for 7 consecutive days at low-flow measuring sites on streams in Fairfax County, Va. Annual low flow in cubic feet per second and (cubic feet per second per square mile).

Station No.	Station name	Period of record (water years)	Drainage area (mi^2)	Annual low flow for indicated recurrence interval 2-year	10-year	Remarks
			TRIASSIC BASINS			
01644291	Stave Run near Reston	1971-78	0.08	0	---	---
01644295	Smilax Branch at Reston	1967-78	.32	0	---	---
01644300	Sugarland Run at Herndon	1965-74, 77	3.36	0	---	---
01656800	Cub Run near Chantilly	1962, 1964-69, 77	7.13	0	---	---
			PIEDMONT BASINS			
01645750	South Fork Little Difficult Run near Fairfax	1966-74, 77	1.59	0.19 (.12)	.03 (.02)	---
01645784	Snakeden Branch at Reston	1974-78	.79	.22 (.28)	.06 (.08)	Drains old lake bed.
01645800	Piney Branch at Vienna	1962-74, 77	.29	.001 (.003)	0	Highly urbanized.[1]
01645900	Colvin Run at Reston	1962-70, 1972-74, 77	5.09	.78 (.15)	.13 (.026)	---
01645950	Piney Run at Reston	1965-66, 77	2.06	.17 (.083)	.004 (.002)	---
01646200	Scott Run near McLean	1961-70, 77	4.69	.73 (.16)	.12 (.026)	---
01646600	Pimmit Run near Falls Church	1960, 1962-74, 77	2.87	.09 (.03)	.002 (.001)	Highly urbanized.
01646700	Pimmit Run at Arlington	1960, 1962-74, 77	8.12	1.1 (.14)	.07 (.009)	Do.
01652400	Long Branch at Arlington	1960-63, 77	.94	.11 (.12)	.06 (.06)	Do.
01652600	Holmes Run at Merrifield	1960-70 1972-74, 77	2.70	.15 (.056)	.01 (.004)	Urbanized.

Table 2 (continued).--Estimated annual low flow for 7 consecutive days at low-flow measuring sites on streams in Fairfax County, Va. Annual low flow in cubic feet per second and (cubic feet per second per square mile).

Station No.	Station name	Period of record (water years)	Drainage area (mi^2)	Annual low flow for indicated recurrence interval 2-year	10-year	Remarks
			PIEDMONT BASINS (continued)			
01652610	Holmes Run near Annandale	1960-74, 77	7.10	0.38 (.054)	0.01 (.001)	Urbanized.
01652620	Tripps Run at Falls Church	1960, 62 1964-74, 77	1.78	.10 (.056)	.01 (.006)	Do.
01652645	Tripps Run Tributary near Falls Church	1962-67, 77	.50	0	---	Do.
01652650	Tripps Run near Falls Church	1960, 62-74 1977	4.55	.34 (.075)	.01 (.002)	Do.
01652710	Backlick Run at Springfield	1960-70 1972-74, 77	2.02	0	---	Do.
01653900	Accotink Creek at Fairfax	1960-64 1966-74, 77	6.80	.45 (.066)	.06 (.009)	Do.
01653950	Long Branch at Vienna	1964-74, 77	1.18	.04 (.034)	.002 (.002)	Do.
01654500	Long Branch near Annandale	1960-74, 77	3.71	.79 (.21)	.13 (.035)	Do.
01655310	Rabbit Branch near Burke	1960, 62 1964-74, 77	3.81	.58 (.15)	.10 (.026)	---
01655350	Pohick Creek near Springfield	1960, 62-70 1972-74, 77	15.0	1.3 (.087)	.04 (.003)	---
01655370	Middle Run near Lorton	1960, 62-74 1977	3.56	.10 (.028)	0	---
01655380	South Run near Lorton	1960, 62-74 1977	6.54	.20 (.031)	0	---
01655390	Pohick Creek at Lorton	1960, 62-74 1977	31.0	3.0 (.097)	.06 (.002)	Downstream 20 percent of basin in Coastal Plain.
01657300	Popes Head Creek At Fairfax Station	1964, 65, 77	3.88	.48 (.12)	.07 (.02)	
01657400	Popes Head Creek at Clifton	1964, 65, 77	17.2	1.2 (.070)	.11 (.0064)	
01657435	Wolf Run near Clifton	1973, 74, 77	5.39	.13 (.024)	.006 (.001)	---
01657600	Sandy Run near Fairfax Station	1965-74, 77	2.35	.12 (.051)	.003 (.001)	---

Table 2 (continued).--Estimated annual low flow for 7 consecutive days at low-flow measuring sites on streams in Fairfax County, Va. Annual low flow in cubic feet per second and (cubic feet per second per square mile).

Station No.	Station name	Period of record (water years)	Drainage area (mi^2)	Annual low flow for indicated recurrence interval 2-year	10-year	Remarks
			COASTAL PLAIN BASINS			
01652910	Backlick Run at Alexandria	1960-74, 77	13.4	1.7 (.13)	0.32 (.024)	Gravel plant operations augment low flow.
01653210	Pike Branch at Alexandria	1960-66, 77	2.65	.16 (.060)	0	Urbanized.
01653447	Penn Daw Outfall at Alexandria	1960-74, 77	0.82	.06 (.07)	.03 (.04)	Do.
01653700	Little Hunting Creek at Gum Springs	1960, 62 1963, 77	1.78	--- (2)	---	Lowest observed flow: 0.05 ft/s, 0.028 (ft^3/s)/mi^2. August 1962.
01653800	Dogue Creek near Accotink	1960-63, 77	10.6	--- (2)	---	Lowest observed flow: 0.1 ft^3/s, 0.01 (ft^3/s)/mi^2, August 1962.
01657800	Giles Run near Woodbridge	1964-74, 77	4.54	.60 (.13)	.12 (.026)	Upstream 40 percent of basin in Piedmont.

(1) The terms "urbanized and "highly urbanized" are used to indicate relative degree of development within the basin, no quantitative evaluation is implied.

(2) Insufficient data to make estimate.

tial and commercial areas--one definition of urban development.

Average discharge increases with increasing drainage basin area for the five long-term gaging stations in Fairfax County (fig. 4). A plot of 7-day annual low-flow values vs drainage areas for these same sites (fig. 5) shows a similar trend for 4 stations, but the position of data points for Bull Run near Manassas indicates that factors other than basin size must be controlling low flows. The 148-square mile Bull Run basin is primarily a rural, agricultural area underlain by fractured sedimentary rocks. The other four smaller drainage areas are in various stages of urban/suburban development and are underlain by either crystalline rocks or interbedded sand and clay.

The calculated low-flow values for ungaged Piedmont basins (table 2) are plotted against drainage area in figures 6 and 7. The data are shown on two graphs because streams tributary to the Potomac River (fig. 6) maintain slightly higher base flows than those which drain southward to the Occoquan River (fig. 7). The 7-day 2-year recurrence interval low flows display, with a few exceptions, a fairly consistent relation to drainage basin size. The 7-day 10-year values, however, show a wide scatter, which reflects the control of other basin factors on streamflow during extreme drought conditions.

The geology of a drainage basin is a major influence on

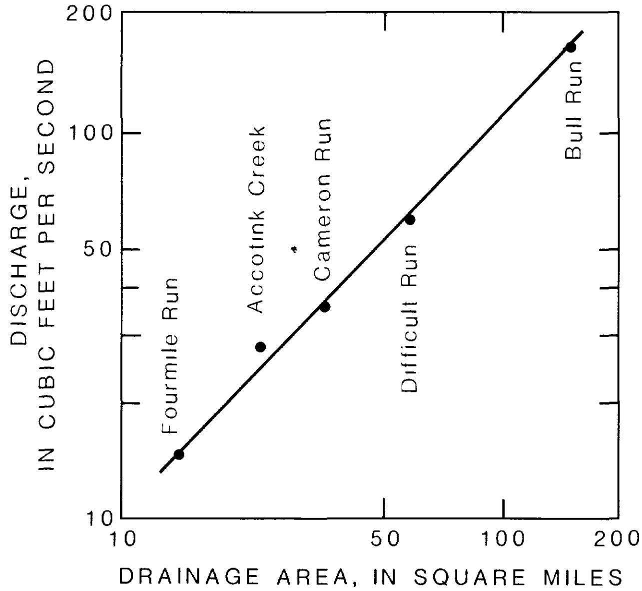

FIGURE 4. -- Relation of average discharge to drainage area for 5 long-term gaging stations in Fairfax County, Va.

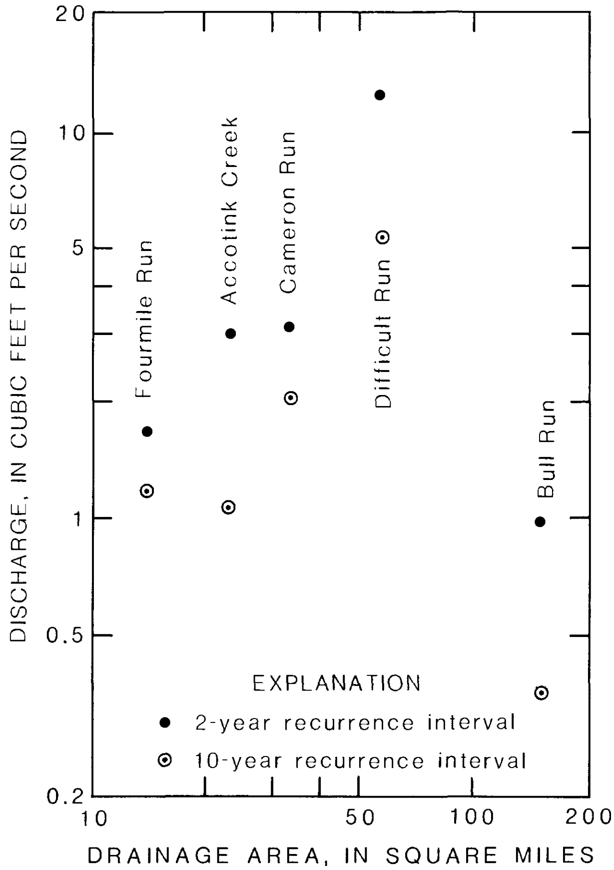

FIGURE 5. -- Plot of 7-day annual low flows vs. drainage area for 2-year and 10-year recurrence intervals for sites shown in figure 4.

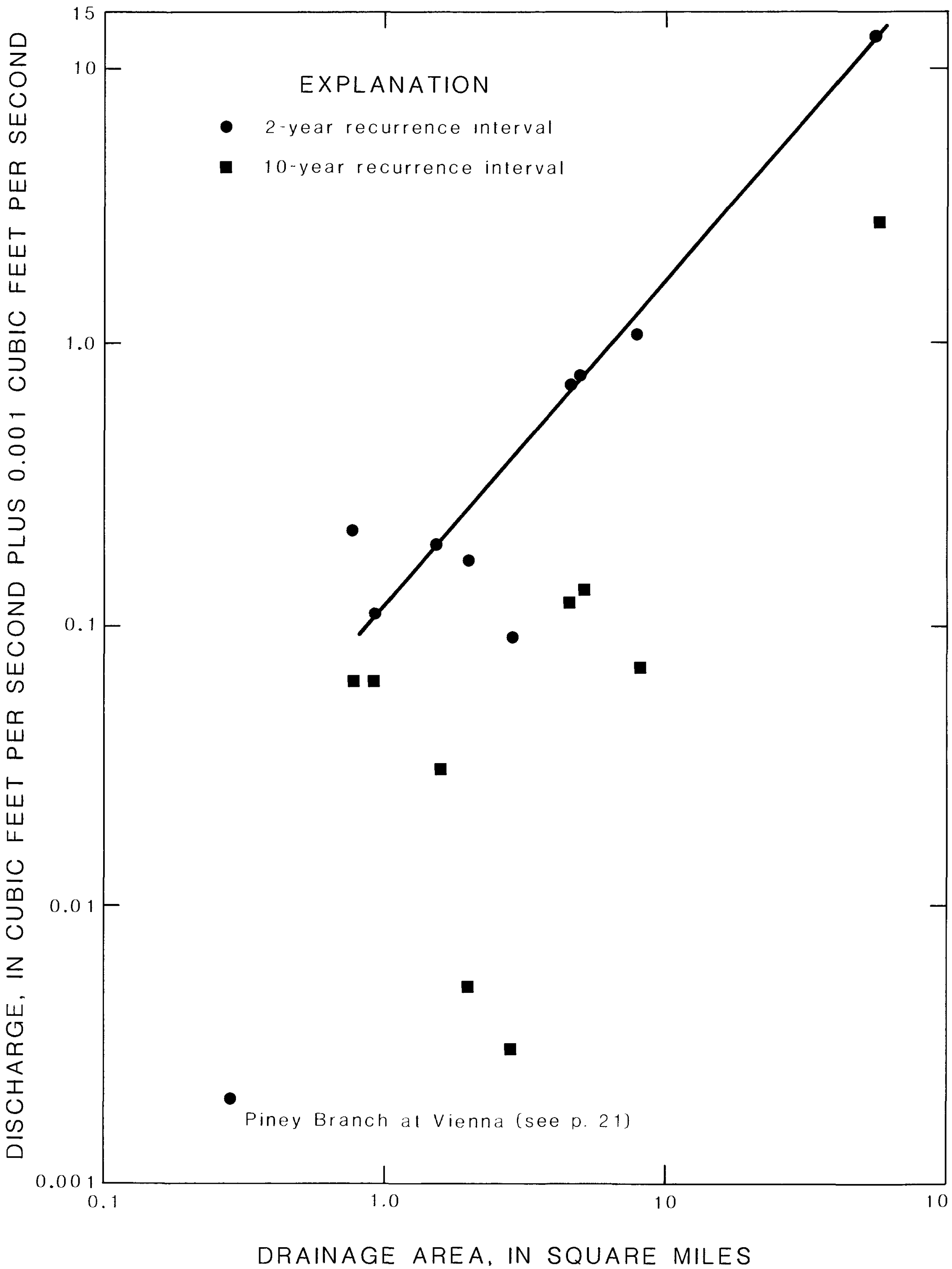

FIGURE 6. -- Relation of 7-day annual minimum flows to drainage area for streams draining crystalline rocks in the Difficult Run, Scott Run, Pimmit Run, and Fourmile Run basins, Fairfax County, Va.

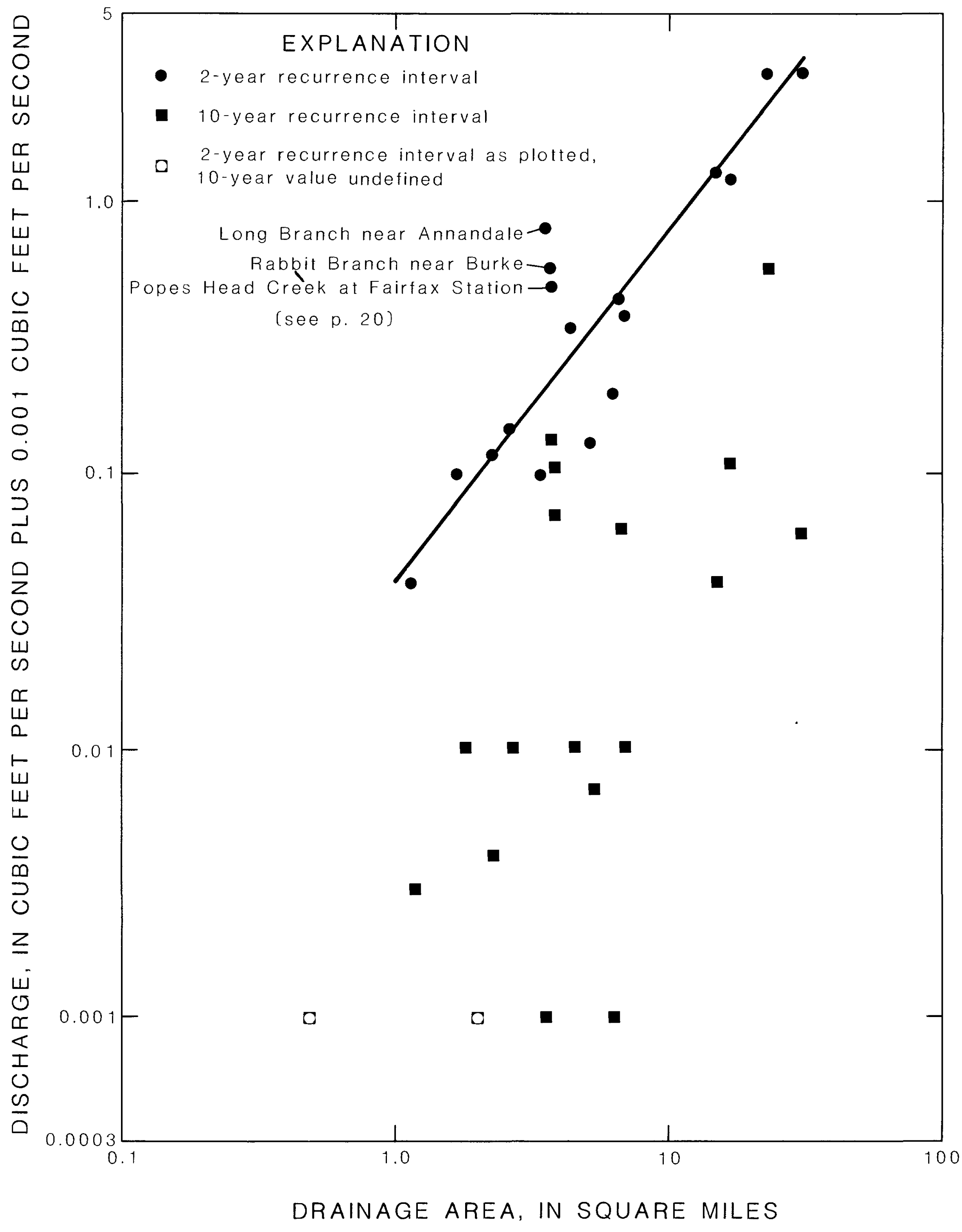

FIGURE 7. -- Relation of 7-day annual minimum flows to drainage area for streams draining crystalline rocks in the Occoquan, Pohick, Accotink, and Cameron Run basins, Fairfax County, Va.

low flow. The type and structure of the rocks present and the thickness and physical characteristics of the weathered overburden, including soil, determine the capacity of those materials to accept water and their ability to transmit it. These properties affect the amount of and rate at which precipitation enters the ground-water system and is later released to sustain streamflow. Differences in the parent bedrock and in the thickness and nature of the weathered overburden contribute to the wide range in low flows of streams in Fairfax County. The relation of these geologic factors to low flows is summarized in the following table.

Table 3. Relation of geology to low flows of Fairfax County Streams.

Area	Piedmont	Coastal Plain	Triassic Lowland
Geology	Crystalline rocks with thick (as great as 200 feet) overburden	Interbedded sand and clay	Siltstone, sandstone, shale and diabase with thin (0-50 feet, but commonly 5-15 feet) overburden
Ground-water transmission capability	Low to very low	Low to moderately high	Low to moderately high
Ground-water storage capability	High	Moderately high	Very low
Relative base flow	High sustained flow	Moderate sustained flow	Very low or no flow

The effect of geology on low flows is shown by comparing low-flow frequency curves for two streams that drain different rock types (fig. 2). Annual 7-day low flows for Bull Run near Manassas (area of drainage basin equals 148 mi^2) are only a fraction of those for the smaller basin of Fourmile Run at Alexandria (14.4 mi^2). The 7-day 2-year low flows are zero for all 4 Triassic basins listed in table 2. Several Piedmont and Coastal Plain basins which drain smaller areas than the Triassic basins show some base flow at both the 2-year and 10-year recurrence intervals. An example of the local effect of geology on low flows is indicated by data plotted in figure 7. Low flows for Long Branch, Rabbit Branch, and Popes Head Creek, which plot high with respect to the line of relation, drain adjacent subbasins in the headwater areas of the Accotink, Pohick, and Popes Head Creek basins. These streams drain areas of thick (up to 150 feet) weathered overburden that stores and later releases water to sustain the relatively high base flows.

Because most of the available low-flow data are from streams in the Piedmont, and only a few data sites lie entirely within either the Coastal Plain or Triassic Lowland parts of the county, a statistical comparison of low-flow characteristics of the three areas would not be practical. However, a general statement can be made that, due principally to geologic differences, low flows are higher in the eastern and central parts of Fairfax County than in the western part.

Land slope and surface roughness, the latter affected by plant cover, control the rate of surface runoff and therefore the time available for water to infiltrate to the ground-water table. Steep slopes suggest rapid runoff and low infiltration; gentle slopes imply delayed runoff and consequently higher infiltration. The amount of ground water available to sustain future low flows varies directly with the amount of infiltration.

Effects of Urban Development

Urban development in a drainage basin may cause either a decrease or increase in the low flow of streams in the basin. As natural vegetation is replaced by streets, parking lots, houses and commercial buildings and an increasing percentage of precipitation becomes direct runoff, less water is available to replenish the ground-water reservoir. As a result, the ground-water contribution to stream-flow is reduced. In the late stages of urban development, small headwater streams may be obliterated by regrading the land surface or replaced by closed drainage systems, thereby eliminating recharge and resultant low flows. An example is Piney Branch at Vienna (see fig. 6).

The diversion of water from a stream during severe droughts affects already low stream flow. In an area of mixed agriculture and urban land, for example, water may be diverted from streams for livestock or to irrigate crops or golf courses. The steep decline in daily flow of Difficult Run near Great Falls in late August and early September, 1966 (fig. 1), indicates a high rate of evapotranspiration during a record-breaking drought. Withdrawals of water from the stream or its tributaries during such a period would further reduce the naturally occurring low flow.

The construction of lakes on streams can result in an increase in flow downstream. Local government may require the release of minimum flow downstream that would equal or exceed the natural flow of the impounded stream. A local rise in the ground-water table adjacent to a lake can also result in increased flow in the downstream channel due to leakage past the reservoir embankment. Finally, the natural low-flow discharge of a stream can be increased and perhaps stabilized by release of treated effluent from sewage-disposal plants. For example, on August 30, 1977, a discharge of 2.0 ft^3/s was measured on Cub Run near Centreville; eighty-five percent (1.7 ft^3/s) of this flow was being discharged upstream as treated sewage effluent.

No attempt was made in this study to quantify the effect of urbanization on low flows at long-term gaging stations. In an earlier analysis, the Virginia State Water Control Board (1970) estimated, on the basis of 10 years of data through 1962, a 7-day 10-year discharge of 0.9 ft^3/s in the highly urbanized Fourmile Run basin. Using 18 years of data, a value of 1.0 ft^3/s was estimated in the present study. Urban development may have been largely stabilized in this basin by 1953 when data collection began, or the geologic controls may simply overshadow any effects of urban development. At the gaging station on Difficult Run near Great Falls, the 7-day 10-year low flow based on 27 years of data through 1962 is 3.8 ft^3/s (Virginia State Water Control Board, 1970). In the present study, a value of 2.7 ft^3/s was estimated for that station using 41 years of data. The lower discharge value is believed to be the result of the inclusion of 2 years of severe drought (1965 and 1967) rather than a decline in base flows that could be related to urban development.

Low Flows of the Occoquan and Potomac Rivers

The Occoquan River and a tributary stream, Bull Run, form the southern boundary of Fairfax County. The river's flow is affected by tides from its mouth at Belmont Bay upstream to the vicinity of the town of Occoquan. About a mile further upstream, and just upstream from Elkhorn Run, is the Occoquan Dam, which impounds a reservoir with a surface area of approximately 1,720 acres. This reservoir is the major water supply source of the Fairfax County Water Authority (FCWA).

The drainage area at the dam is 592 mi^2, which includes the basins of the major tributaries Bull Run, Broad Run, and

Cedar Run. Approximately 105 mi^2 or 18 percent of the drainage area is in Fairfax County. Geologically, the Occoquan River basin is dominated by the sedimentary rocks of the Triassic Lowland that extend westerly from Fairfax County; low-flow frequency data for Bull Run near Manassas, Va. are shown in table 1. The 7-day 10-year low flows from smaller drainage areas within the basin range from 0.001 to 0.01 $(ft^3/s)/mi^2$, the higher values occurring in the head-water reaches of the major tributaries.

The Potomac River forms the northern boundary of Fairfax County. About 110 mi^2 or 25 percent of the county's land area drains into the Potomac. Water is withdrawn from this reach of the river by the U.S. Corps of Engineers to supply the District of Columbia, Arlington County, the City of Falls Church, and parts of Fairfax County. The Fairfax County Water Authority is now constructing facilities to divert additional water from the Potomac River for public supply.

Low-flow frequency data for the Potomac River upstream from Fairfax County are available from an analysis of daily-flow records for the gaging station at Point of Rocks, Md. Annual lowest mean discharge for 7, 14, 30, 60, 90, and 120 consecutive days are shown in table 4. Frequency curves constructed from the values listed in table 4 are shown in figure 8. The curves reflect present conditions within the basin upstream from Point of Rocks. Future upstream diver-

ANNUAL MINIMUM	DISCHARGE, IN CUBIC FEET PER SECOND, FOR INDICATED RECURRENCE INTERVAL, IN YEARS				
	2-YEAR	5-YEAR	10-YEAR	20-YEAR	50-YEAR
7-Day	1,340	998	857	756	656
14-Day	1,430	1,060	910	803	698
30-Day	1,600	1,180	1,020	899	787
60-Day	1,970	1,380	1,160	1,000	853
90-Day	2,350	1,580	1,300	1,100	926
120-Day	2,720	1,820	1,490	1,260	1,040

TABLE 4. -- Magnitude and frequency of annual low flow for indicated number of consecutive days, Potomac River at Point of Rocks, Md. (based on period Apr. 1, 1895 to Mar. 31, 1977).

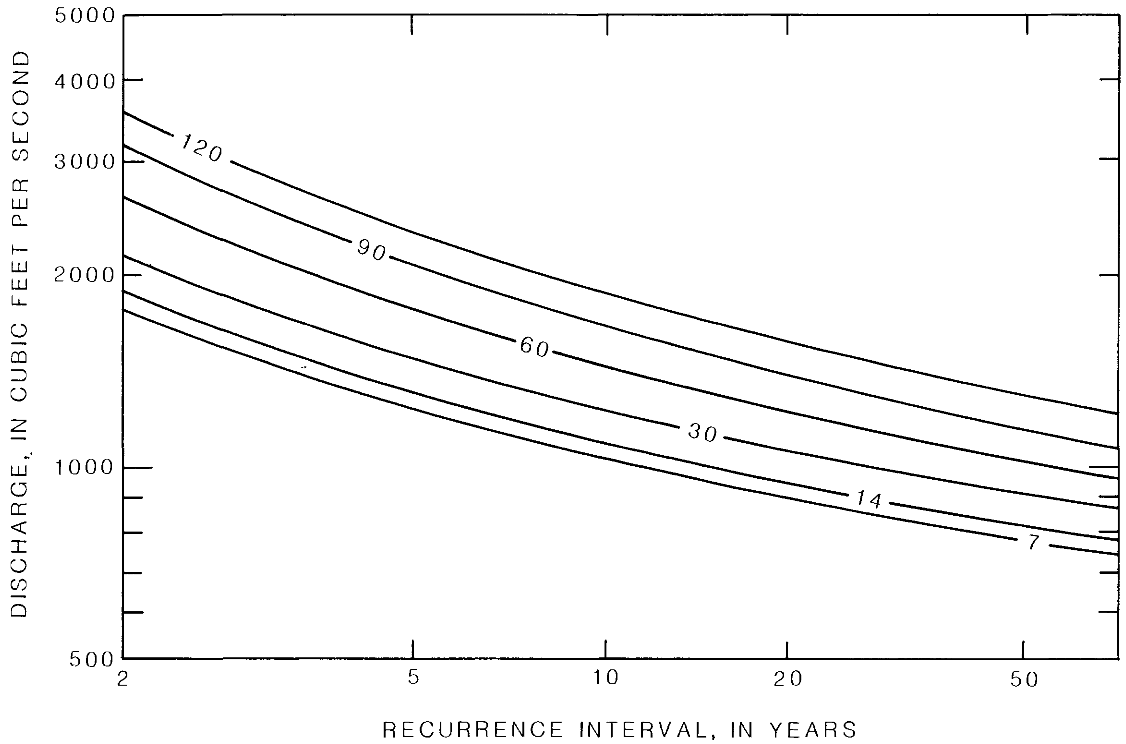

FIGURE 8. -- Frequency curves of annual lowest mean discharge for indicated number of consecutive days, Potomac River at Point of Rocks, Md. (data from Table 4.).

sions and storage projects will change these frequency curves. Application of Potomac River low-flow characteristics at Point of Rocks, Md. to the vicinity of Fairfax County requires the consideration of inflow from the intervening area and large diversions from the river for water supply in the Washington metropolitan area (Walker, 1971, pp. 13, 113, 127, 128). Data on tributary inflow, Potomac River discharge in the vicinity of Fairfax County (Little Falls Dam), and diversions for the river are published annually in U.S. Geological Survey water resources data reports for Virginia, and Maryland-Delaware.

Summary

The 7-day 2-year annual low flow is zero in 4 small basins (less than 8 mi^2) in the western part of Fairfax County. These basins are underlain by fractured sedimentary rocks. Higher base flows are characteristic of streams that drain weathered crystalline rocks and unconsolidated sediments in the central and eastern parts of the county, respectively. At 4 gaging stations in these areas, 7-day 10-year low flows range from 0.024 to 0.069 $(ft^3/s)/mi^2$. However, because of local geologic controls and the effects of urban development, estimated values at selected, ungaged sites on other County streams range from zero flow to 0.08 $(ft^3/s)/mi^2$. In the Piedmont crystalline rock portion of the county, 7-day 2-year low flows generally increase with drainage area, but there is poor agreement between 7-day 10-year low flows and basin size.

The Occoquan River and a major tributary, Bull Run, form the southern boundary of Fairfax County. Fractured sedimentary rocks dominate the basin, and 7-day 10-year low flows range from 0.001 to 0.01 $(ft^3/s)mi^2$. At the gaging station on Bull Run near Manassas, the 7-day 10-year low flow is only 0.21 ft^3/s or 0.0014 $(ft^3/s)/mi^2$. Low flows of the Potomac River in the vicinity of Fairfax County are significantly affected by diversions for water supply in the Washington metropolitan area. Low-flow frequency data are available upstream from Fairfax County at Point of Rocks, Md.

The following table gives the factors used to convert inch-pound units given in this report to International System (SI) units.

Multiply inch-pound units	By	To obtain SI units
Length:		
inches (in)	2.54×10^{1}	millimeters (mm)
	2.54×10^{0}	centimeters (cm)
Area:		
square miles (mi^2)	2.59×10^{0}	square kilometers (km^2)
Flow:		
cubic feet per second (ft^3/s)	2.832×10^{1}	liters per second (L/s)
cubic feet per second per square mile [$(ft^3/s)/mi^2$]	1.093×10^{-2}	cubic meters per second per square kilometer [$(m^3/s)/km^2$]
million gallons per day (Mgal/d)	4.381×10^{-2}	cubic meters per second (m^3/s)

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