Base-Flow Yields of Watersheds in the Berkeley County Area, West Virginia

By Ronald D. Evaldi and Katherine S. Paybins

Prepared in cooperation with the Berkeley County Commission

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Figure

1.	Map showing base-flow yields of watershed in the Berkeley County area,	
	West Virginia	.separate file

Table

 Discharge measurements of streams in the Berkeley County area, 	
West Virginia, July 25–28, 2005, and May 4, 20064	

Conversion Factors and Datums

Multiply	Ву	To obtain		
inch (in.)	2.54	centimeter (cm)		
foot (ft)	0.3048	meter (m)		
mile (mi)	1.609	kilometer (km)		
	Area			
acre	0.4047	square hectometer (hm ²)		
square mile (mi ²)	259.0	square hectometer (hm ²)		
	Rate			
inch per year (in/yr)	2.54	centimeter per year (cm/yr)		
cubic foot per second (ft ³ /s)	0.02832	cubic meter per second (m ³ /s)		
gallon per minute (gal/min)	0.06309	liter per second (L/s)		
gallon per day (gal/d)	0.003785	cubic meter per day (m ³ /d)		
gallon per day per acre [(gal/d)/acre]	0.000935	cubic meter per day per square hectometer [(m³/d)/hm²]		

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$^{\circ}C = (^{\circ}F-32)/1.8$

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Vertical control information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). Altitude, as used in this report, refers to distance above the vertical datum.

Base-Flow Yields of Watersheds in the Berkeley County Area, West Virginia

By Ronald D. Evaldi and Katherine S. Paybins

Abstract

Base-flow yields at approximately 50 percent of the annual mean ground-water recharge rate were estimated for watersheds in the Berkeley County area, W.Va. These base-flow yields were determined from two sets of discharge measurements made July 25–28, 2005, and May 4, 2006. Two sections of channel along Opequon Creek had net flow losses that are expressed as negative base-flow watershed yields; these and other base-flow watershed yields in the eastern half of the study area ranged from -940 to 2,280 gallons per day per acre ((gal/d)/acre) and averaged 395 (gal/d)/acre. The base-flow yields for watersheds in the western half of the study area ranged from 275 to 482 (gal/d)/acre and averaged 376 (gal/d)/acre.

Introduction

Berkeley County, W.Va., is in the Eastern Panhandle of the State, about 65 mi northwest of Washington, D.C. The 2004 population of Berkeley County was 89,400 and had increased about 50 percent since 1990 (U.S. Census Bureau, 2006). The primary source of water for most domestic and community water-supply systems in Berkeley County is ground water (Shultz and others, 1995). State and local officials are concerned about the effects that the escalating demands for water are having on the ground-water resources of the county. Should long-term use of ground water exceed its rate of replenishment, water shortages could result. Estimates of ground-water-recharge rates throughout the county are needed for resource management planning. Ground-water recharge is a function of precipitation, temperature, runoff, infiltration rates, geology, topography, and vegetative cover. These factors are difficult to quantify by direct measurement and, as a surrogate, ground-water recharge can be estimated from stream-discharge data obtained during base-flow conditions. The base flow of streams is derived from ground-water outflow and, except for possible outflow differences caused by interbasin water transfers, the relative rates of base-flow yields from watersheds are assumed to be proportional to recharge.

Discharges of streams and a wastewater-treatment-plant outfall in the Opequon Creek Watershed in Berkeley County were measured during base-flow conditions in July 25–28, 2005 (Evaldi and Paybins, 2006). In order to extend the study area to describe the base flow of streams throughout the county, additional stream-discharge measurements were made during base-flow conditions on May 4, 2006. These included stream-discharge measurements in the Opequon Creek Watershed, in the Back Creek Watershed, and on small tributary streams that drain directly to the Potomac River (table 1, at back of report; fig. 1). Presentation of these measurements herein is the result of a cooperative effort by the U.S. Geological Survey (USGS) and the Berkeley County Commission.

Description of the Study Area

Berkeley County, which encompasses a land area of 325 mi², is bounded by Jefferson County, W.Va., to the east; Morgan County, W.Va., to the west; the State of Virginia to the south; and the Potomac River to the north (fig. 1). As reported by Shultz and others (1995), the eastern half of Berkeley County is characterized by gently rolling topography, with altitudes ranging from about 310 to 800 ft. The western half of the county is characterized by northeastward-trending parallel ridges and valleys, with altitudes ranging from about 310 to 2,200 ft.

The Potomac River drains all of Berkeley County. The principal tributaries to the Potomac River are Meadow Branch, Cherry Run, Back Creek, Harlan Run, Opequon Creek, and Rockymarsh Run. Four tributaries of Opequon Creek are of significant size: Tuscarora Creek, Evans Run, Middle Creek, and Mill Creek. The base-flow discharges of all of these streams were measured, except for that of Meadow Branch (which flows through the Sleepy Creek Public Hunting and Fishing Area). Some tributaries to Opequon Creek that are entirely within Jefferson County are shown in this report because their flow contributions were used in the base-flow yield calculations for Berkeley County watersheds.

Hydrologic Conditions

This study is based on stream discharge measurements obtained during similar base-flow conditions during July 25–28, 2005, and on May 4, 2006. During these periods, the base-flow discharge provided by ground-water outflow to streams in the study area was approximately half of the long-term mean annual ground-water recharge rate estimated by Kozar and Mathes (2001).

Streamflow at USGS gaging station 01616500 Opequon Creek near Martinsburg, W.Va. (site 37, table 1, fig. 1), averaged 106 ft³/s (47,600 gal/min) during July 25-28, 2005 a value that is approximately equivalent to the 40-percent duration (flow equaled or exceeded 40 percent of the time) of summer flows reported by Wiley (2006). The station recorded a hydrograph rise to 210 ft³/s (94,300 gal/min) on July 22; however, this rise in flow is believed to reflect runoff from that part of the 273-mi² drainage area that is upstream from the study area because rainfall totaled only 0.02 in. during July 16–24 at Martinsburg (National Climatic Data Center, 2005). Therefore, streamflows measured July 25–28, 2005, were assumed to be derived from base flow rather than from surface runoff. Although 0.12 in. of rain fell in Martinsburg on July 25 and 0.13 in. fell on July 27, most of this precipitation was believed to have been evapotranspired as a result of high temperatures (62 to 97°F) during July 25-28 in the Martinsburg area (National Climatic Data Center, 2005).

Streamflow at USGS gaging station 01616500 Opequon Creek near Martinsburg averaged 100 ft³/s (44,900 gal/min) on May 4, 2006, a value that is approximately equivalent to the 45-percent duration of summer flows reported by Wiley (2006). Streamflow at USGS gaging station 01614000 Back Creek near Jones Springs (site 5; table 1, fig. 1) averaged 71 ft³/s (31,900 gal/min) on May 4, 2006, a value approximately equivalent to the 70-percent duration of summer flows.

Streams were considered at base flow on May 4, 2006, because no measurable rainfall was reported at Martinsburg during April 26 through May 4, 2006 (National Climatic Data Center, 2006).

It was not possible to define all of the hydrologic factors affecting the results of this study. Pumps were noted as running July 25–28, 2005, at Kilmer Spring and at Lefevre Spring, but outflow measurements were not adjusted because the amount of diversion was unknown (Evaldi and Paybins, 2006). Other unknown diversions or interbasin transfers of water could have occurred during the study.

Discharge Measurements

Discharge information was obtained during July 25–28, 2005, at 69 stream sites, 31 springs, and 1 wastewater-treatment-plant outfall in the Opequon Creek Watershed (Evaldi and Paybins, 2006). The wastewater-treatment-plant outfall measurement and 17 of the stream measurements were used in this study. Discharge measurements were made at 32 additional stream sites on May 4, 2006.

All sites during both time periods were measured by wading with current meters. Observations of width, depth, and velocity were made at intervals in a cross section of the stream or outflow. Measured discharge is the summation of the products of the subsection areas of the cross sections and their respective average velocities (Rantz and others, 1982). Equipment used for measuring flow was checked for accuracy before and after data collection and was within acceptable operational limits. The accuracy of individual discharge measurements was dependent on channel or outflow conditions, and error generally was estimated to be less than 10 percent.

A means of adjusting the measurements to similar conditions was employed because the stream-discharge measurements were obtained during slightly different flow conditions. The measurement adjustments were based on comparison of streamflow-gaging-station records for the dates of the Berkeley County discharge measurements to a flow statistic estimated from the long-term gaging-station records. The flow statistic chosen as the basis for the adjustments was the mean ground-water recharge rate estimates for USGS gaging stations 01616500 Opequon Creek near Martinsburg (9.8 in/yr) and 0161700 Back Creek near Jones Springs (8.5 in/yr) (Kozar and Mathes, 2001). These ground-water recharge rates can be expressed as mean watershed outflow rates, which for Opequon Creek near Martinsburg is 197 ft³/s and for Back Creek near Jones Springs is 147 ft³/s.

The measurement adjustment factor used for Opequon Creek and other streams in the eastern half of the study area (sites 9-40, and 42-50) was the ratio of 50 percent of the longterm mean watershed outflow rate (98.5 ft³/s) to the flow of Opequon Creek near Martinsburg at the time of data collection. The flow of Opequon Creek near Martinsburg averaged 106 ft³/s July 25–28, 2005, and 100 ft³/s on May 4, 2006. Discharge measurements of streams in the eastern half of the study area during July 25–28, 2005, were adjusted by a factor of 0.929, and measurements on May 4, 2006, were adjusted by a factor of 0.985. The measurement adjustment factor used for Back Creek and other streams in the western half of study area (sites 1-8) was the ratio of 50 percent of the long-term mean watershed outflow rate (73.5 ft³/s) to the flow of Back Creek near Jones Springs at the time of data collection. The flow of Back Creek near Jones Springs averaged 71 ft³/s on May 4, 2006. Stream discharge measurements of Back Creek and other streams in the western half of the study area for May 4, 2006, were adjusted by a factor of 1.035.

Base-Flow Yields

Base-flow yields equivalent to approximately 50 percent of the annual mean ground-water recharge rate were estimated for watersheds in Berkeley County (table 1, fig. 1). For headwater-channel sites, the base-flow yields were computed as the measured outflow divided by the watershed drainage area. Base-flow yields for other stream-channel sections were computed as the change in channel discharge between measurement sites divided by the amount of intervening drainage area between them. The base-flow yields were expressed in gallons per day per acre (gal/d)/acre) of intervening drainage area. For computation of change in discharge between measurement sites along a channel, all tributary inflows to the channel reach and known wastewater-treatment-plant discharges were subtracted. Flow losses of -332 and -940 (gal/d)/acre were thus determined for two subwatersheds along Opequon Creek (sites 15 and 37, respectively). These negative watershed yields might indicate flow losses to the ground-water system, channel underflow, or possible discharge-measurement errors. The base-flow yield of watersheds in the eastern half of the study area, based on measurement sites 9-50, ranged from -940 to 2,280 (gal/d)/acre and averaged 395 (gal/d)/acre. The base-flow yield of watersheds in the western half of the study area, based on measurement sites 1-8, ranged from 275 to 482 (gal/d)/acre and averaged 376 (gal/d)/acre.

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4 Base-Flow Yields of Watersheds in the Berkeley County Area, West Virginia

Table 1. Discharge measurements of streams in the Berkeley County area, West Virginia, July 25–28, 2005, and May 4, 2006.

[---; unknown; ft³/s, cubic feet per second; gal/d, gallon per day. Horizontal coordinates are referenced to North American Datum of 1983 (NAD 83)]

Site ber Latitude (arcrs) Uranitage (arcrs) Uranitage (arcrs) Uranitage (arcrs) Uranitage (arcrs) Adjusted (arcr) Tow (arcr) 1 54/406 3937140 7801420 5.570 2.82 1.885,000 3.9 Cherry Run near Cherry Run 2 54/406 3921240 7811160 110.00 47.7 5.838,000 3.9710,00 37.8 Back Crock near Shanghai 5 5.4406 3921240 780710.0 8.100 3.352,000 3.9870,000 37.8 Back Crock near Jones Springs 5 5.4406 393450.0 78001.0 7.10 4.5890,000 5.67,30,000 468 Back Crock near Johnsontrown 8 5.4406 393452.0 775351.4 9.60 0 0 0 Unmander inburgy near Margove 9 5.4408 393452.1 775351.9 7.73 7.731.1 10.00 6.570 9.1 Hardan Run at Lindic Geogetown 11 5.4406 39178.7 780153.8 90.900 52.4 3.3870000 -3.22	0.4			l e se de de				² Base-		
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5 54/06 39352.0 780014.0 72.00 7.2 4.66 0.00 4.780,000 4.78 Tibuarce Creek near Johnsontown 8 5/4/06 39355.0 780014.0 1.2.000 7.2.2 4.666.000 4.61 2.980,000 2.953,000 4.68 Back Creek near Johnsontown 8 5/4/06 393557.2 775215.1 0.0 0 0 Unnamed tributary near Marlowe 11 5/4/06 393557.2 775207.9 703 0.103 66.75 0.5.70 9.3 Jordan Rom near Marlowe 12 5/4/06 393557.9 79512.9 703 0.103 66.75 0.5.70 9.3 Jordan Rom near Marlowe 15 5/4/06 391751.3 780159.8 90.00 52.4 3.360.000 Opequon Creek arc artidgeway 15 5/4/06 391718.3 781115.1 1.330 0.167 107.900 106.300 80 Silver Spring Run near Marlowe 17 75/4/06 391182.7 780110.0 10.200	4	5/4/06	392711.0	780701.0	8,100	3.33	2,152,000	2,228,000	275	Elk Branch near Shanghai
6 544/06 3935360 780014.0 12,800 7.2 4,666,000 4,830,000 376 Tilhance Creek near Johnsontown 7 544/06 3935367.3 775713.1 10,500 4,61 2,980,000 2,935,000 280 Hardan Run at Little Georgetown 9 544/06 393582.2 775515.4 9.26 0 0 0 Unnamed tributary near Prospect Hill 10 544/06 39358.2 77521.0 703 0.103 6,6570 93 Jordan Run near Marlowe 12 544/06 391578.1 77520.7 703 0.103 6,6570 93 Jordan Run near Marlowe 13 544/06 391718.3 780115.0 1530 0.067 6,170 16,300 80 Silver Spring Run near Ridgeway 15 544/06 391718.3 78011.5 1,330 0.167 107,900 166,300 23 Opequon Creek at Carters Ford 15 544/06 391178.3 78011.5 1,330 0.167 107,900 166,3	5	5/4/06	393046.0	780212.0	150,000	71.0	45,890,000	47,490,000	482	Back Creek near Jones Springs
7 5/4/06 393507.3 77513.1 10.500 4.61 2.980.000 2.93 Back Creek near Johnsontown 9 5/4/06 393567.3 77513.1 10.500 4.61 2.980.000 2.935.000 280 Harlan Rum ant Little Georgetown 10 5/4/06 393547.9 775207.9 703 0.103 66.570 65.570 93 Jordan meart Marlowe 12 5/4/06 393584.0 77512.3 607 0.117 114.400 112.700 186 Magruder Run neart Marlowe 15 5/4/06 391515.1 780159.8 90.00 52.4 33.86,000 Opequon Creek at Criters Ford 15 5/4/06 391718.3 780118.0 94.00 51.2 33.90.00 32.50.00 312 Opequon Creek near Kidgeway 15 5/4/06 39178.3 780118.0 94.00 51.2 33.90.00 72.4 73.90.0 73.90 10.7 Tarkey Run near Kidgeway 17 5/4/06 391808.7 780110.0 <td< td=""><td>6</td><td>5/4/06</td><td>393522.0</td><td>780014.0</td><td>12,800</td><td>7.22</td><td>4,666,000</td><td>4,830,000</td><td>376</td><td>Tilhance Creek near Johnsontown</td></td<>	6	5/4/06	393522.0	780014.0	12,800	7.22	4,666,000	4,830,000	376	Tilhance Creek near Johnsontown
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11 5/406 393580 7751230 607 0.117 11.400 11.2700 186 Magruder Run near Marlowe 12 5/406 391551.5 780159.8 90,000 52.4 33,870,000 33,360,000 Opequon Creek at Carters Ford 14 5/406 391718.3 780113.0 1.53 0.096 62.050 61.120 40 Dunean Run near Ridgeway 15 5/406 391718.3 780115.1 1.330 0.167 107,900 106,300 80 Silver Spring Run near Ridgeway 16 5/406 39178.8 778021.2 1,730 0.122 778,600 2.294,000 107 Tarkey Run near Marlowe 19 712,505 391808.2 778021.5 1,730 0.122 72,800 2.0500 205 Mill Creek At Burker Hill 21 72,6005 392018.7 78032.6 0,200 3.49 2.256,000 2.055 Mill Creek At Burker Hill 21 72,6005 391946.8 78022.5 2,200 0.6	10	5/4/06	393632.6	775216.1		0	0	0	0	Unnamed tributary near Marlowe
12 5/4/06 391351.5 780159.8 90,900 52.4 33.870.000 33.360.000 Opequon Creek at Carters Ford 15 5/4/06 391707.8 780310.2 1.530 0.096 62.059 61.120 40 Duemar Run near Ridgeway 15 5/4/06 391707.8 780115.1 1.330 0.167 107900 10.6300 80 Siver Spring Run near Ridgeway 16 5/4/06 391705.7 780115.1 1.330 0.167 107900 10.6300 80 Siver Spring Run near Ridgeway 17 5/4/06 391808.7 780010.0 10.200 3.82 2.469.000 2.294.000 107 Turkey Run near mouth near Middleway 20 7/2/6/05 39218.7 78035.64 10.200 3.49 2.256.000 2.095.000 2.095 Mill Creek at Bunker Hill 21 7/2/6/05 39184.8 78025.7 19,700 14.0 9.048.000 4,74.3000 1.80 Mill Creek hear mouth near Middleway 24 5/4/06 39184.43 780057.7 19,700 14.0 9.048.000 4,814.000	11	5/4/06	393547.9	775207.9	703	0.103	66,570	65,570	93	Jordan Run near Marlowe
13 5/4/06 39151.5 780159.8 90.900 52.4 33.870.000 33.360.000	12	5/4/06	393358.0	775123.0	607	0.177	114,400	112,700	186	Magruder Run near Marlowe
14 5/4/06 391707.8 780116.0 91.2 33.090.000 32.560.000 -332 Opequon Creek near Ridgeway 15 5/4/06 3917125.7 780115.1 1.330 0.167 107.900 106.300 80 Silver Spring Run near Ridgeway 17 5/4/06 391808.7 78012.5 1.730 0.122 78.850 77.670 45 Specks Run near Ridgeway 18 725/05 391808.7 780012.5 1.730 0.122 78.850 107 Turkey Run near Ridgeway 20 725/05 39180.7 780010.0 10.200 3.42 2.246,000 2.095,000 205 Mill Creek at Bunker Hill 21 77.6/05 39200.3 780325.5 2.200 0.688 444,700 413.100 1.86 Torytow Run at Bunker Hill 23 77.6/05 39184.3 78005.7 19.700 13.000 47.43,000 4.660.00 651 Mill Creek near Middleway 25 54/06 391214.9 77559.2 13.600 9.21.60.00 54.300 2.48 0.600 7.48,032 Middle Creek near Darkewille	13	5/4/06	391551.5	780159.8	90,900	52.4	33,870,000	33,360,000		Opequon Creek at Carters Ford
15 5/4/06 391718.3 780118.1 1,330 0,167 107,900 106,300 80 Silver Spring Run near Ridgeway 16 5/4/06 391708.7 780112.1 1,330 0,167 107,900 106,300 80 Silver Spring Run near Ridgeway 18 7725/05 391808.2 775924.7 3,960 2,71 1,752,000 1,627,000 1411 Turkey Run art Middeway 20 7726/05 392018.7 780326.4 10,200 3.82 2,266,000 2,095,000 205 Mill Creek hear Bunker Hill 21 7726/05 392018.7 780325.5 2,200 0.688 444,700 413,100 1,88 Torytown Run at Bunker Hill 23 726/05 391948.8 780225.7 1,900 14,00 9,048,000 8,406,000 2,280 Opequon Creek near Middleway 24 5/4/06 39184.8 775949.0 130,000 7.71 49,80,000 2,480 40 Goose Creek near Middleway 25 5/4/06 392114.9 77559.2 16,61,000 1,543,000 248 Middle Creek near Darkesville </td <td>14</td> <td>5/4/06</td> <td>391707.8</td> <td>780310.2</td> <td>1,530</td> <td>0.096</td> <td>62,050</td> <td>61,120</td> <td>40</td> <td>Dunean Run near Ridgeway</td>	14	5/4/06	391707.8	780310.2	1,530	0.096	62,050	61,120	40	Dunean Run near Ridgeway
16 5/4/06 39125.7 780115.1 1.330 0.167 107,900 106,300 80 Silver Spring Run near Ridgeway 17 5/4/06 391808.7 780212.5 1.730 0.122 78,850 77,670 45 Specks Run near Ridgeway 18 7/25/05 391808.7 780010.0 10.200 3.82 2,469,000 2.294,000 107 Turkey Run at Middleway 20 7/26/05 39200.3 780325.5 2,200 0.688 444,700 13.100 188 Torytown Run at Bunker Hill 21 7/26/05 391946.8 780325.5 1,4100 7.90 5,106,000 4,743,000 1,360 Mill Creek hear Worth near Middleway 23 7/26/05 391840.8 775949.0 130,000 77.1 49,830,000 49,080,000 2,280 Opequon Creek near Middleway 25 5/4/06 392114.9 77597.2 16,600 9.31 60,170,000 59,270,000 455 Middle Creek near Meksevile 27 7/26/05 39214.3 77581.8 9,440 4.92 3,180,000 2,544,000 445	15	5/4/06	391718.3	780118.0	94,900	51.2	33,090,000	32,560,000	-332	Opequon Creek near Ridgeway
17 5/4/06 391808.7 780212.5 1,730 0.122 78,850 77,670 45 Specks Run near Ridgeway 18 7/25/05 391830.7 780010.0 10,200 3.82 2,246,000 2,294,000 107 Turkey Run near mouth near Middleway 20 7/26/05 392018.7 780326.4 10,200 3.42 2,256,000 2,095,000 205 Mill Creek at Bunker Hill 21 7/26/05 392103.7 780325.5 2,200 0.688 444,700 413,100 1.88 Torytown Run at Bunker Hill 22 7/26/05 39184.3 780037.7 19,700 14.0 9,048,000 8,406,000 651 Mill Creek near mouth near Middleway 25 5/4/06 391814.8 77599.2 136,000 93.1 60,170,000 592,70,000 1,660 Opequon Creek near Moldheway 25 5/4/06 39214.9 775808.8 1,200 0.080 51,700 48,030 40 Goose Creek near mouth near Egypt 726/05 392115.5 775801.3 1,760 2.06 1,331,000 1,237,000 701 East Branch Hopewe	16	5/4/06	391725.7	780115.1	1,330	0.167	107,900	106,300	80	Silver Spring Run near Ridgeway
18 7/25/05 391808.2 775924.7 3.960 2.71 1.752,000 1.61 Turkey Run at Middleway 19 7/25/05 392018.7 780010.0 10,200 3.82 2.469,000 2.294,000 107 Turkey Run at Middleway 20 7/26/05 392010.3 780325.5 2.200 0.688 444,700 413.100 188 Torytown Run at Bunker Hill 21 7/26/05 391840.8 780325.5 14,100 7.90 5,106,000 4,743,000 1.860 Mill Creek at must Middleway 23 726/05 391840.8 775949.0 130,000 77.1 49,830,000 42,080,000 2.280 Opequon Creek near Middleway 25 5/4/06 391840.8 77592.2 136,000 9.21 1.661,000 1.543,000 2.49 Midale Creek near Darkesville 27 7/26/05 392123.1 775813.8 9,440 4.92 3.180,000 1.237,000 716 East Branch Hopewell Run near Legypt 28 7/26/05 392115.5 <td< td=""><td>17</td><td>5/4/06</td><td>391808.7</td><td>780212.5</td><td>1,730</td><td>0.122</td><td>78,850</td><td>77,670</td><td>45</td><td>Specks Run near Ridgeway</td></td<>	17	5/4/06	391808.7	780212.5	1,730	0.122	78,850	77,670	45	Specks Run near Ridgeway
19 7/25/05 391830.7 780010.0 10.200 3.82 2.469,000 2.294,000 107 Turkey Run near mouth near Middleway 20 7/26/05 392018.7 780326.4 10,200 3.49 2.256,000 2.095,000 205 Mill Creek at Bunker Hill 21 7/26/05 39200.3 780325.5 2.200 0.688 444,700 413,100 1.86 Torytown Run at Bunker Hill 23 7/26/05 391854.3 78037.7 19,700 14.0 9,048,000 8,060.00 651 Mill Creek near Middleway 24 5/4/06 391840.8 77579.2 136,000 77.1 49,830,000 2.280 Opequon Creek near Middleway 25 5/4/06 392114.9 775759.2 136,000 2.957 1.661,000 1,450,00 449 Middle Creek near mouth near Egypt 26 7/26/05 392115.9 77580.8 1,200 0.80 51,700 48,030 40 Goose Creek near mouth near Leetown 27 702/6/05 392115.4	18	7/25/05	391808.2	775924.7	3,960	2.71	1,752,000	1,627,000	411	Turkey Run at Middleway
20 7/26/05 392018.7 780326.4 10,200 3.49 2,256,000 2,095,000 205 Mill Creek at Bunker Hill 21 7/26/05 391946.8 780225.9 14,100 7.96 5,106,000 4,743,000 1,860 Mill Creek below Bunker Hill 23 7/26/05 391854.3 780057.7 19,700 14.0 9,048,000 4,060,000 651 Mill Creek hear Middleway 24 5/4/06 392114.9 77579.2 136,000 93.1 6,0170,000 5,9270,000 1,660 Opequon Creek near Egypt 25 7/26/05 392115.9 775801.8 9,440 4.92 3,180,000 2,954,000 435 Middle Creek near mouth near Egypt 28 7/26/05 392115.9 775801.8 1,700 4.8030 40 Goose Creek near mouth near Egypt 29 7/26/05 392115.4 775601.6 3,900 2.06 1,331,000 1,237,000 701 East Branch Hopewell Run near Leetown 31 7/26/05 3922115.5 775601.3 <td>19</td> <td>7/25/05</td> <td>391830.7</td> <td>780010.0</td> <td>10,200</td> <td>3.82</td> <td>2,469,000</td> <td>2,294,000</td> <td>107</td> <td>Turkey Run near mouth near Middleway</td>	19	7/25/05	391830.7	780010.0	10,200	3.82	2,469,000	2,294,000	107	Turkey Run near mouth near Middleway
21 7/26/05 392000.3 780325.5 2,200 0.688 444,700 413,100 1.88 Torytown Run at Bunker Hill 22 7/26/05 391854.3 780025.7 19,700 14,00 9,048,000 8,406,000 651 Mill Creek hear mouth near Middleway 24 5/4/06 391840.8 775949.0 130,000 77.1 49,830,000 49,080,000 2,280 Opequon Creek near Middleway 25 5/4/06 392114.9 77559.2 136,000 9.2.1 6,0170,000 5,9270,000 1,660 Opequon Creek near Egypt 26 7/26/05 392123.1 775813.8 9,440 4.92 3,180,000 2,954,000 435 Middle Creek near mouth near Egypt 27 7/26/05 392115.4 775601.3 1,760 2.06 1,331,000 1,237,000 318 South Branch Hopewell Run near Leetown 30 7/26/05 392115.4 775606.6 3.900 2.06 1,331,000 1,237,000 318 South Branch Hopewell Run near Leetown 31 7/26/05 392115.4 775606.6 891 0.523 338,000	20	7/26/05	392018.7	780326.4	10,200	3.49	2,256,000	2,095,000	205	Mill Creek at Bunker Hill
22 7/26/05 391946.8 780225.9 14,100 7.90 5,106,000 4,743,000 1,360 Mill Creek below Bunker Hill 23 7/26/05 391854.3 780057.7 19,700 14.0 9,048,000 4,743,000 0,280 Opequon Creek near mouth near Middleway 25 5/4/06 391814.8 77559.2 136,000 93.1 60,170,000 59,270,000 1,660 Opequon Creek near Middleway 26 7/26/05 392115.9 775808.8 1,200 0.080 51,700 48,030 40 Goose Creek near mouth near Egypt 27 7/26/05 392115.9 775601.3 1,760 2.06 1,331,000 1,237,000 701 East Branch Hopewell Run near Lectown 30 7/26/05 392115.4 77560.6 3.900 2.06 1,331,000 1,237,000 318 Suth Branch Hopewell Run near Lectown 32 5/4/06 392312.4 775653.3 2,880 0.523 338,000 3333,000 115 Burzard Run near Vanville 33 <t< td=""><td>21</td><td>7/26/05</td><td>392000.3</td><td>780325.5</td><td>2,200</td><td>0.688</td><td>444,700</td><td>413,100</td><td>188</td><td>Torytown Run at Bunker Hill</td></t<>	21	7/26/05	392000.3	780325.5	2,200	0.688	444,700	413,100	188	Torytown Run at Bunker Hill
23 7/26/05 391854.3 780057.7 19,700 14.0 9,048,000 451 Mill Creek near mouth near Middleway 24 5/4/06 391840.8 775949.0 130,000 77.1 49,830,000 49,080,000 2,280 Opequon Creek near Middleway 25 5/4/06 39214.0 780227.3 6,200 2.57 1,661,000 1,543,000 249 Middle Creek near Darkesville 27 7/26/05 392123.1 775813.8 9,440 4.92 3,180,000 2,954,000 435 Middle Creek near mouth near Egypt 28 7/26/05 392115.5 775601.3 1,760 2.06 1,331,000 1,237,000 701 East Branch Hopewell Run near Lectown 30 7/26/05 392115.4 775653.3 2,880 0.523 338,000 3330,000 115 Buzzard Run near Maville 31 5/4/06 392312.4 775653.3 2,880 0.523 338,000 333,000 115 Buzzard Run near Vanville 33 5/4/06 392312.4	22	7/26/05	391946.8	780225.9	14,100	7.90	5,106,000	4,743,000	1,360	Mill Creek below Bunker Hill
24 5/4/06 391840.8 77594.0 130,000 77.1 49,830,000 2,280 Opequon Creek near Middleway 25 5/4/06 392114.9 775759.2 136,000 93.1 60,170,000 59,270,000 1.660 Opequon Creek near Egypt 26 7/26/05 392123.1 775813.8 9,440 4.92 3,180,000 2,954,000 435 Middle Creek near mouth near Egypt 28 7/26/05 392115.5 775601.3 1,760 2.06 1,331,000 1,237,000 701 East Branch Hopewell Run near Lectown 30 7/26/05 392115.4 775500.6 3,900 2.06 1,331,000 1,237,000 318 South Branch Hopewell Run near Lectown 31 7/26/05 392112.4 775506.6 891 0.254 164,200 1161,700 18 Sulphur Spring Branch near Vanville 33 5/4/06 392312.4 775547.1 4,950 3.32 2,146,000 1,993,000 403 Shaw Run near Mouth near Grubbs Corner 35 5/4/06	23	7/26/05	391854.3	780057.7	19,700	14.0	9,048,000	8,406,000	651	Mill Creek near mouth near Middleway
25 5/4/06 392114.9 775759.2 136,000 93.1 60,170,000 59,270,000 1,660 Opequon Creek near Egypt 26 7/26/05 392234.0 780227.3 6,200 2.57 1,661,000 1,543,000 249 Middle Creek near Darkesville 27 7/26/05 392115.9 775808.8 1,200 0.080 51,700 48,030 40 Goose Creek near mouth near Egypt 29 7/26/05 392115.5 775601.3 1,760 2.06 1,331,000 1,237,000 701 East Branch Hopewell Run near Leetown 30 7/26/05 392115.4 775625.0 7,090 5.56 3,594,000 3,338,000 604 Hopewell Run near Mouth near Leetown 32 5/4/06 392312.4 775653.3 2.880 0.523 338,000 1331.000 141 Buzzard Run near Vanville 33 5/4/06 392312.4 775628.8 518 0.128 82,730 81,490 157 Unnamed tributary near Grubbs Corner 35 5/4/06	24	5/4/06	391840.8	775949.0	130,000	77.1	49,830,000	49,080,000	2,280	Opequon Creek near Middleway
26 7/26/05 392234.0 780227.3 6,200 2.57 1,661,000 1,543,000 249 Middle Creek near Darkesville 27 7/26/05 392123.1 775813.8 9,440 4.92 3,180,000 2,954,000 435 Middle Creek near mouth near Egypt 28 7/26/05 392115.5 775601.3 1,760 2.06 1,331,000 1,237,000 701 East Branch Hopewell Run near Leetown 30 7/26/05 392115.4 775605.3 3,900 2.06 1,331,000 1,237,000 318 South Branch Hopewell Run near Leetown 31 7/26/05 392115.4 775625.0 7.090 5.56 3,594,000 333,000 604 Hopewell Run near Mouth lear Leetown 32 5/4/06 39232.8 775706.6 891 0.254 164,200 161,700 181 Sulphur Spring Branch near Vanville 34 7/27/05 392445.5 775644.2 3.230 0.168 108,600 107,000 33 Cold Spring Run near Doughas Grove 37	25	5/4/06	392114.9	775759.2	136,000	93.1	60,170,000	59,270,000	1,660	Opequon Creek near Egypt
27 7/26/05 392123.1 775813.8 9,440 4.92 3,180,000 2,954,000 435 Middle Creek near mouth near Egypt 28 7/26/05 392115.5 775801.3 1,760 2.06 1,331,000 1,237,000 701 East Branch Hopewell Run near Leetown 30 7/26/05 392115.4 775601.3 1,760 2.06 1,331,000 1,237,000 318 South Branch Hopewell Run near Leetown 31 7/26/05 392115.4 77560.6 3,900 2.06 1,331,000 1,237,000 318 South Branch Hopewell Run near Leetown 32 5/4/06 392312.4 77565.3 2,880 0.523 338,000 333,000 115 Buzzard Run near Vanville 33 5/4/06 39232.8 77576.6 891 0.254 164,200 161,700 181 Sulphur Spring Branch near Vanville 34 7/27/05 392416.4 77564.2 3,230 0.168 108,600 107,000 33 Cold Spring Run near Douglas Grove 35 5/4/06 392452.5 77564.2 3,230 0.168 108,600 107	26	7/26/05	392234.0	780227.3	6,200	2.57	1,661,000	1,543,000	249	Middle Creek near Darkesville
28 7/26/05 392115.9 775808.8 1,200 0.080 51,700 48,030 40 Goose Creek near mouth near Egypt 29 7/26/05 392115.5 775601.3 1,760 2.06 1,331,000 1,237,000 318 South Branch Hopewell Run near Leetown 30 7/26/05 392115.4 775605.0 7,090 5.56 3,594,000 3,338,000 604 Hopewell Run near mouth near Leetown 32 5/4/06 392312.4 775605.3 2,880 0.523 338,000 333,000 115 Buzzard Run near Vanville 33 5/4/06 392416.4 775547.1 4.950 3.32 2,146,00 1,993,000 403 Shaw Run near mouth near Grubbs Corner 36 5/4/06 392445.5 77564.2 3,230 0.168 108,600 107,000 33 Cold Spring Run near Douglas Grove 37 5/4/06 392445.5 775616.1 172,000 100 64,630,000 63,660,000 -940 Opequon Creek near Martinsburg 38 5/4/06 392639.0 775546.3 426 0.044 28,440 28,010 </td <td>27</td> <td>7/26/05</td> <td>392123.1</td> <td>775813.8</td> <td>9,440</td> <td>4.92</td> <td>3,180,000</td> <td>2,954,000</td> <td>435</td> <td>Middle Creek near mouth near Egypt</td>	27	7/26/05	392123.1	775813.8	9,440	4.92	3,180,000	2,954,000	435	Middle Creek near mouth near Egypt
29 7/26/05 392115.5 775601.3 1,760 2.06 1,331,000 1,237,000 701 East Branch Hopewell Run near Leetown 30 7/26/05 392115.4 775601.6 3.900 2.06 1,331,000 1,237,000 318 South Branch Hopewell Run near Leetown 31 7/26/05 392219.5 775625.0 7,090 5.56 3,594,000 3,338,000 604 Hopewell Run near Mouth near Leetown 32 5/4/06 392312.4 775653.3 2,880 0.523 338,000 133,000 115 Buzzard Run near Vanville 33 5/4/06 392343.7 775625.8 518 0.128 82,730 81,490 157 Unnamed tributary near Grubbs Corner 35 5/4/06 392445.5 775644.2 3,230 0.168 108,600 107,000 33 Cold Spring Run near Douglas Grove 37 5/4/06 392453.0 775643.2 3,230 0.168 108,600 107,000 37 Evans Run near mouth near Martinsburg 38 7/27/05 392639.0 775546.3 426 0.044 28,440 28,01	28	7/26/05	392115.9	775808.8	1,200	0.080	51,700	48,030	40	Goose Creek near mouth near Egypt
30 7/26/05 392115.4 775600.6 3,900 2.06 1,331,000 1,237,000 318 South Branch Hopewell Run near Leetown 31 7/26/05 392219.5 775625.0 7,090 5.56 3,594,000 3,338,000 604 Hopewell Run near mouth near Leetown 32 5/4/06 392312.4 775653.3 2,880 0.523 338,000 318 Sulphur Spring Branch near Wanville 33 5/4/06 392416.4 775547.1 4,950 3.32 2,146,000 1,993,000 403 Shaw Run near mouth near Grubbs Corner 35 5/4/06 39243.7 775628.8 518 0.128 82,730 81,490 157 Unnamed tributary near Grubbs Corner 36 5/4/06 39243.5 775644.2 3,230 0.168 108,600 107,000 33 Cold Spring Run near Douglas Grove 37 5/4/06 392459.0 775546.3 426 0.044 28,440 28,010 66 Unnamed tributary near Van Clevesville 38 7/27/05 <td< td=""><td>29</td><td>7/26/05</td><td>392115.5</td><td>775601.3</td><td>1,760</td><td>2.06</td><td>1,331,000</td><td>1,237,000</td><td>701</td><td>East Branch Hopewell Run near Leetown</td></td<>	29	7/26/05	392115.5	775601.3	1,760	2.06	1,331,000	1,237,000	701	East Branch Hopewell Run near Leetown
31 7/26/05 392219.5 775625.0 7,090 5.56 3,594,000 3,338,000 604 Hopewell Run near mouth near Leetown 32 5/4/06 392312.4 775625.3 2,880 0.523 338,000 333,000 115 Buzzard Run near Vanville 33 5/4/06 392332.8 775706.6 891 0.254 164,200 161,700 181 Sulphur Spring Branch near Vanville 34 7/27/05 392416.4 775542.5 77564.8 518 0.128 82,730 81,490 157 Unnamed tributary near Grubbs Corner 36 5/4/06 392434.7 775628.8 518 0.128 82,730 81,490 157 Unnamed tributary near Grubbs Corner 36 5/4/06 392445.5 775616.1 172,000 100 64,630,000 63,660,000 -940 Opequon Creek near Martinsburg 38 7/27/05 392528.8 775608.2 7,590 4.84 3,128,000 2,906,000 383 Tuscarora Creek at Martinsburg 40 7/27/05 392261.9 775808.2 7,590 4.84 3,128,000	30	7/26/05	392115.4	775600.6	3,900	2.06	1,331,000	1,237,000	318	South Branch Hopewell Run near Leetown
32 5/4/06 392312.4 775653.3 2,880 0.523 338,000 333,000 115 Buzzard Run near Vanville 33 5/4/06 392332.8 775706.6 891 0.254 164,200 161,700 181 Sulphur Spring Branch near Vanville 34 7/27/05 392416.4 775547.1 4,950 3.32 2,146,000 1,993,000 403 Shaw Run near mouth near Grubbs Corner 35 5/4/06 392445.5 77564.2 3,230 0.168 108,600 107,000 33 Cold Spring Run near Douglas Grove 37 5/4/06 392527.2 775646.1 172,000 100 64,630,000 63,660,000 -940 Opequon Creek near Martinsburg 39 5/4/06 392639.0 775546.3 426 0.044 28,440 28,010 66 Unnamed tributary near Van Clevesville 40 7/27/05 392801.9 775808.2 7,590 4.84 3,128,000 2,906,000 383 Tuscarora Creek at Martinsburg 41 7/27/05 392654.8 775607.7 16,900 17.0 10,990,000 10,210,000 </td <td>31</td> <td>7/26/05</td> <td>392219.5</td> <td>775625.0</td> <td>7,090</td> <td>5.56</td> <td>3,594,000</td> <td>3,338,000</td> <td>604</td> <td>Hopewell Run near mouth near Leetown</td>	31	7/26/05	392219.5	775625.0	7,090	5.56	3,594,000	3,338,000	604	Hopewell Run near mouth near Leetown
33 5/4/06 39232.8 775706.6 891 0.254 164,200 161,700 181 Sulphur Spring Branch near Vanville 34 7/27/05 392416.4 775547.1 4,950 3.32 2,146,000 1,993,000 403 Shaw Run near mouth near Grubbs Corner 35 5/4/06 392434.7 775628.8 518 0.128 82,730 81,490 157 Unnamed tributary near Grubbs Corner 36 5/4/06 392445.5 775644.2 3,230 0.168 108,600 107,000 33 Cold Spring Run near Douglas Grove 37 5/4/06 392527.2 775616.1 172,000 100 64,630,000 63,660,000 -940 Opequon Creek near Martinsburg 38 7/27/05 392512.8 775546.3 426 0.044 28,010 66 Unnamed tributary near Van Clevesville 40 7/27/05 392801.9 775808.2 7,590 4.84 3,128,000 2,906,000 383 Tuscarora Creek at Martinsburg 41 7/27/05 392654.8 775607.7 16,900 17.0 10,990,000 10,210,000	32	5/4/06	392312.4	775653.3	2,880	0.523	338,000	333,000	115	Buzzard Run near Vanville
34 7/27/05 392416.4 775547.1 4,950 3.32 2,146,000 1,993,000 403 Shaw Run near mouth near Grubbs Corner 35 5/4/06 392434.7 775628.8 518 0.128 82,730 81,490 157 Unnamed tributary near Grubbs Corner 36 5/4/06 392445.5 775644.2 3,230 0.168 108,600 107,000 33 Cold Spring Run near Douglas Grove 37 5/4/06 392527.2 775616.1 172,000 100 64,630,000 63,660,000 -940 Opequon Creek near Martinsburg 38 7/27/05 392528.8 775629.3 4,560 2.94 1,900,000 1,765,000 378 Evans Run near mouth near Martinsburg 39 5/4/06 392639.0 775546.3 426 0.044 28,440 28,010 66 Unnamed tributary near Van Clevesville 40 7/27/05 392801.9 7757808.2 7,590 4.84 3,128,000 2,906,000 383 Tuscarora Creek at Martinsburg 41 7/27/05 392651.8 775607.7 16,900 17.0 10,990,000	33	5/4/06	392332.8	775706.6	891	0.254	164,200	161,700	181	Sulphur Spring Branch near Vanville
35 5/4/06 392434.7 775628.8 518 0.128 82,730 81,490 157 Unnamed tributary near Grubbs Corner 36 5/4/06 392445.5 775644.2 3,230 0.168 108,600 107,000 33 Cold Spring Run near Douglas Grove 37 5/4/06 392527.2 775616.1 172,000 100 64,630,000 63,660,000 -940 Opequon Creek near Martinsburg 38 7/27/05 392528.8 775629.3 4,560 2.94 1,900,000 1,765,000 378 Evans Run near mouth near Martinsburg 39 5/4/06 392609.0 775546.3 426 0.044 28,440 28,010 66 Unnamed tributary near Van Clevesville 40 7/27/05 392801.9 775808.2 7,590 4.84 3,128,000 2,906,000 383 Tuscarora Creek at Martinsburg 41 7/27/05 392654.8 775607.7 16,900 17.0 10,990,000 10,210,000 509 Tuscarora Creek near mouth near Blairton 42	34	7/27/05	392416.4	775547.1	4,950	3.32	2,146,000	1,993,000	403	Shaw Run near mouth near Grubbs Corner
36 5/4/06 392445.5 775644.2 3,230 0.168 108,600 107,000 33 Cold Spring Run near Douglas Grove 37 5/4/06 392527.2 775616.1 172,000 100 64,630,000 63,660,000 -940 Opequon Creek near Martinsburg 38 7/27/05 392528.8 775629.3 4,560 2.94 1,900,000 1,765,000 378 Evans Run near mouth near Martinsburg 39 5/4/06 392639.0 775546.3 426 0.044 28,440 28,010 66 Unnamed tributary near Van Clevesville 40 7/27/05 392801.9 775808.2 7,590 4.84 3,128,000 2,906,000 383 Tuscarora Creek at Martinsburg 41 7/27/05 392706.1 775713.6 3.94 2,546,000 2,546,000 Wastewater-treatment-plant outfall 42 7/27/05 392654.8 775607.7 16,900 17.0 10,990,000 10,210,000 509 Tuscarora Creek near mouth near Blairton 43 5/4/06 392735.8 775507.2 3,660 0.306 197,800	35	5/4/06	392434.7	775628.8	518	0.128	82,730	81,490	157	Unnamed tributary near Grubbs Corner
37 5/4/06 392527.2 7/5616.1 17/2,000 100 64,630,000 63,660,000 -940 Opequon Creek near Martinsburg 38 7/27/05 392528.8 775629.3 4,560 2.94 1,900,000 1,765,000 378 Evans Run near mouth near Martinsburg 39 5/4/06 392639.0 775546.3 426 0.044 28,440 28,010 66 Unnamed tributary near Van Clevesville 40 7/27/05 392801.9 775808.2 7,590 4.84 3,128,000 2,906,000 383 Tuscarora Creek at Martinsburg 41 7/27/05 392706.1 775713.6 3.94 2,546,000 2,546,000 Wastewater-treatment-plant outfall 42 7/27/05 392654.8 775607.7 16,900 17.0 10,990,000 10,210,000 509 Tuscarora Creek near mouth near Blairton 43 5/4/06 392735.8 775506.4 1,860 0.809 522,900 515,000 277 Unnamed tributary near Files Crossroad 44 5/4/06 392735.8 775507.2 3,660 0.306 197,80	36	5/4/06	392445.5	775644.2	3,230	0.168	108,600	107,000	33	Cold Spring Run near Douglas Grove
38 7/27/05 392528.8 7/5629.3 4,560 2.94 1,900,000 1,765,000 378 Evans Run near mouth near Martinsburg 39 5/4/06 392639.0 775546.3 426 0.044 28,440 28,010 66 Unnamed tributary near Van Clevesville 40 7/27/05 392801.9 775808.2 7,590 4.84 3,128,000 2,906,000 383 Tuscarora Creek at Martinsburg 41 7/27/05 392706.1 775713.6 3.94 2,546,000 2,546,000 Wastewater-treatment-plant outfall 42 7/27/05 392654.8 775607.7 16,900 17.0 10,990,000 10,210,000 509 Tuscarora Creek near mouth near Blairton 43 5/4/06 392735.8 775506.4 1,860 0.809 522,900 515,000 277 Unnamed tributary near Files Crossroad 44 5/4/06 392735.8 775507.2 3,660 0.306 197,800 194,800 53 Unnamed tributary near Files Crossroad 46 5/4/06 392757.4 775506.1 901 0.414 267,600 <td>37</td> <td>5/4/06</td> <td>392527.2</td> <td>775616.1</td> <td>172,000</td> <td>100</td> <td>64,630,000</td> <td>63,660,000</td> <td>-940</td> <td>Opequon Creek near Martinsburg</td>	37	5/4/06	392527.2	775616.1	172,000	100	64,630,000	63,660,000	-940	Opequon Creek near Martinsburg
39 5/4/06 392639.0 7/5546.3 426 0.044 28,440 28,010 66 Unnamed tributary near Van Clevesville 40 7/27/05 392801.9 775808.2 7,590 4.84 3,128,000 2,906,000 383 Tuscarora Creek at Martinsburg 41 7/27/05 392706.1 775713.6 3.94 2,546,000 2,546,000 Wastewater-treatment-plant outfall 42 7/27/05 392654.8 775607.7 16,900 17.0 10,990,000 10,210,000 509 Tuscarora Creek near mouth near Blairton 43 5/4/06 392655.3 775526.4 1,860 0.809 522,900 515,000 277 Unnamed tributary near Blairton 44 5/4/06 392735.8 775507.2 3,660 0.306 197,800 194,800 53 Unnamed tributary near Files Crossroad 45 5/4/06 392757.4 775506.1 901 0.414 267,600 263,600 293 Eagle Run near Files Crossroad 46 5/4/06 392925.6 775442.3 742 0.335 216,500 213,300<	38	7/27/05	392528.8	775629.3	4,560	2.94	1,900,000	1,765,000	378	Evans Run near mouth near Martinsburg
40 //2//05 392801.9 //3808.2 /,590 4.84 3,128,000 2,906,000 383 Tuscaroa Creek at Martinsburg 41 7/27/05 392706.1 775713.6 3.94 2,546,000 2,546,000 Wastewater-treatment-plant outfall 42 7/27/05 392654.8 775607.7 16,900 17.0 10,990,000 10,210,000 509 Tuscaroa Creek near mouth near Blairton 43 5/4/06 392655.3 775526.4 1,860 0.809 522,900 515,000 277 Unnamed tributary near Blairton 44 5/4/06 392735.8 775507.2 3,660 0.306 197,800 194,800 53 Unnamed tributary near Files Crossroad 45 5/4/06 392757.4 775506.1 901 0.414 267,600 263,600 293 Eagle Run near Files Crossroad 46 5/4/06 392925.6 775442.3 742 0.335 216,500 213,300 287 Unnamed tributary near Berkeley 48 5/4/06	39	5/4/06	392639.0	775546.3	426	0.044	28,440	28,010	66	Unnamed tributary near Van Clevesville
41 //2//05 392/06.1 //5/13.6 3.94 2,346,000 2,346,000 Wastewater-treatment-plant outrail 42 7/27/05 392654.8 775607.7 16,900 17.0 10,990,000 10,210,000 509 Tuscarora Creek near mouth near Blairton 43 5/4/06 392655.3 775526.4 1,860 0.809 522,900 515,000 277 Unnamed tributary near Blairton 44 5/4/06 392735.8 775509.9 198,000 121 78,200,000 77,030,000 372 Opequon Creek near Files Crossroad 45 5/4/06 392757.4 775506.1 901 0.414 267,600 263,600 293 Eagle Run near Files Crossroad 46 5/4/06 392925.6 775442.3 742 0.335 216,500 213,300 287 Unnamed tributary near Berkeley 48 5/4/06 393101.4 775325.4 207,000 126 81,440,000 80,210,000 572 Opequon Creek near Bedington 48 7/28/05 393115.1 775324.2 7,340 9.37 6,056,000 5,626	40	7/27/05	392801.9	775808.2	7,590	4.84	3,128,000	2,906,000	383	Tuscarora Creek at Martinsburg
42 //2//05 392654.8 //5007.7 16,900 17.0 10,990,000 10,210,000 509 Huscarora Creek near mouth near Blairton 43 5/4/06 392655.3 775526.4 1,860 0.809 522,900 515,000 277 Unnamed tributary near Blairton 44 5/4/06 392735.8 775509.9 198,000 121 78,200,000 77,030,000 372 Opequon Creek near Files Crossroad 45 5/4/06 392757.4 775506.1 901 0.414 267,600 263,600 293 Eagle Run near Files Crossroad 46 5/4/06 392925.6 775442.3 742 0.335 216,500 213,300 287 Unnamed tributary near Berkeley 48 5/4/06 393101.4 775325.4 207,000 126 81,440,000 80,210,000 572 Opequon Creek near Bedington 48 7/28/05 393115.1 775324.2 7,340 9.37 6,056,000 5,626,000 767 Hoke Run near mouth near Bedington	41	1121105	392706.1	//5/13.6		3.94	2,546,000	2,546,000		Wastewater-treatment-plant outfall
4.5 5/4/06 392735.8 7/5509.9 198,000 121 78,200,000 77,030,000 372 Opequon Creek near Files Crossroad 45 5/4/06 392735.8 775509.9 198,000 121 78,200,000 77,030,000 372 Opequon Creek near Files Crossroad 45 5/4/06 392748.4 775507.2 3,660 0.306 197,800 194,800 53 Unnamed tributary near Files Crossroad 46 5/4/06 392757.4 775506.1 901 0.414 267,600 263,600 293 Eagle Run near Files Crossroad 47 5/4/06 392925.6 775442.3 742 0.335 216,500 213,300 287 Unnamed tributary near Berkeley 48 5/4/06 393101.4 775325.4 207,000 126 81,440,000 80,210,000 572 Opequon Creek near Bedington 48 7/28/05 393115.1 775324.2 7,340 9.37 6,056,000 5,626,000 767 Hoke Run near mouth near Bedington	42	514105	392034.8	1/300/./	10,900	17.0	10,990,000	10,210,000	509 277	Lunamed tributary near Disister
44 5/4/06 392748.4 775507.2 3,660 0.306 197,800 194,800 53 Unnamed tributary near Files Crossroad 46 5/4/06 392757.4 775506.1 901 0.414 267,600 263,600 293 Eagle Run near Files Crossroad 47 5/4/06 392925.6 775442.3 742 0.335 216,500 213,300 287 Unnamed tributary near Berkeley 48 5/4/06 393101.4 775325.4 207,000 126 81,440,000 80,210,000 572 Opequon Creek near Bedington 48 7/28/05 393115.1 775324.2 7,340 9.37 6,056,000 5,626,000 767 Hoke Run near mouth near Bedington	45	5/4/00	392033.3 202725 0	775500.0	1,800	0.809	522,900	515,000	2//	Onnamed tributary near Blairton
4.5 5/4/06 392757.4 775506.1 901 0.414 267,600 263,600 293 Eagle Run near Files Crossroad 47 5/4/06 392925.6 775442.3 742 0.335 216,500 213,300 287 Unnamed tributary near Berkeley 48 5/4/06 393101.4 775325.4 207,000 126 81,440,000 80,210,000 572 Opequon Creek near Bedington 48 7/28/05 393115.1 775324.2 7,340 9.37 6,056,000 5,626,000 767 Hoke Run near mouth near Bedington	44	5/4/00	2027101	775507.9	198,000	0.206	107 200	104 800	512	Uppequon Creek near Files Crossroad
40 574/06 392925.6 775442.3 742 0.335 216,500 205,000 295 Eagle Run hear Phes Crossroad 47 5/4/06 392925.6 775442.3 742 0.335 216,500 213,300 287 Unnamed tributary near Berkeley 48 5/4/06 393101.4 775325.4 207,000 126 81,440,000 80,210,000 572 Opequon Creek near Bedington 48 7/28/05 393115.1 775324.2 7,340 9.37 6,056,000 5,626,000 767 Hoke Run near mouth near Bedington	43	5/4/06	302757 /	775506.1	3,000	0.300	197,800	262 600	202	Eagle Pup pear Files Crossroad
47 574/06 393101.4 775325.4 207,000 126 81,440,000 80,210,000 572 Opequon Creek near Bedington 48 7/28/05 393115.1 775324.2 7,340 9.37 6,056,000 5,626,000 767 Hoke Run near mouth near Bedington	40 17	5/4/00	392131.4	775442.3	742	0.414	207,000	203,000	293 287	Lagie Kull lical Flics Clossfoad
48 7/28/05 393115.1 775324.2 7,340 9.37 6,056,000 5,626,000 767 Hoke Run near mouth near Bedington	+/ /2	5/4/06	392923.0	775325 1	207.000	126	210,300	213,300	∠01 570	Onequon Creek near Redington
10 1120100 575115.1 115527.2 1,570 7.51 0,050,000 5,020,000 101 Hoke Kun hear indutin hear indutin fear indutin	40	7/28/05	393115.1	775324 2	7 340	9 37	6 056 000	5 626 000	767	Hoke Run near mouth near Redington
50 5/4/06 392913.9 774942.2 10.300 5.88 3.800.000 3.743.000 363 Rockymarsh Run near Scrabble	50	5/4/06	392913.9	774942.2	10,300	5.88	3,800.000	3,743.000	363	Rockymarsh Run near Scrabble

¹ Discharge measurements were adjusted to approximate outflow conditions at 50 percent of the long-term annual mean ground-water recharge rate. Discharge measurements of streams in the eastern half of the study area (sites 9–40, and 42–50) during July 25–28, 2005, were adjusted by a factor of 0.929, and measurements on May 4, 2006, were adjusted by a factor of 0.985. Discharge measurements of streams in the western half of the study area (sites 1–8) made on May 4, 2006, were adjusted by a factor of 1.035.

² Base-flow yields are computed as the change in channel discharge between measurement sites divided by the change in drainage area between the sites. Yields are negative for losing (influent) reaches and positive for gaining (effluent) reaches. See figure 1 for areas associated with the base-flow yield calculations for the indicated measurement sites.