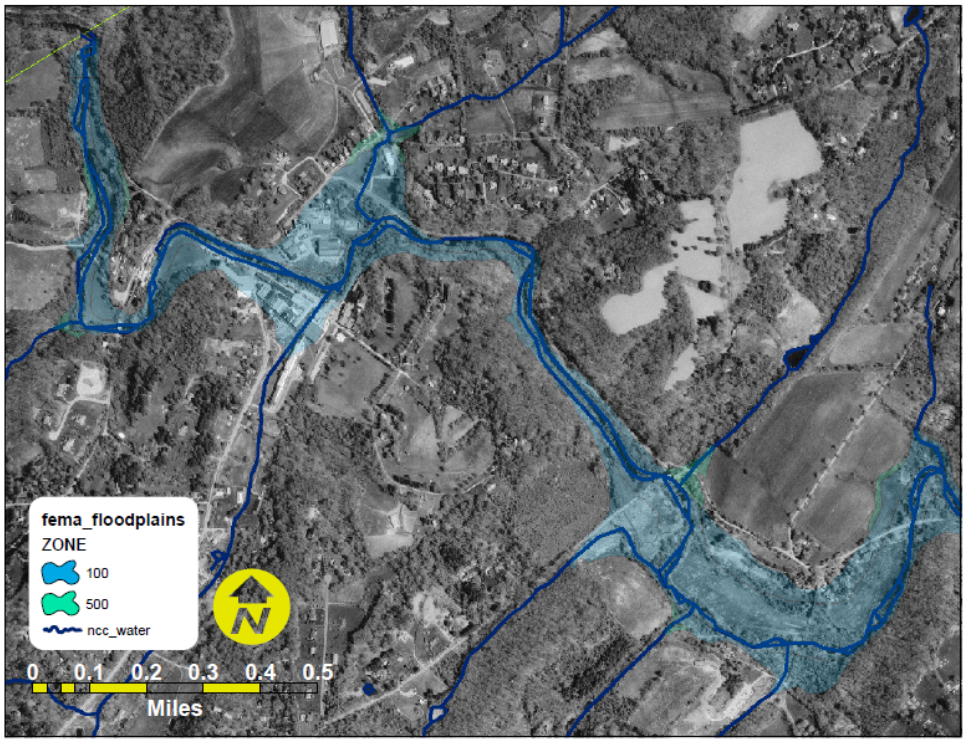
The Delaware Floodplain

Final Draft Report
September 2011



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Introduction

Situated on the Delmarva Peninsula between the Delaware Bay and Chesapeake Bay, Delaware is the lowest state in the United States, with a mean elevation of just 60 feet above sea level. Vulnerable to flooding from rising sea levels and ocean-fueled tropical storm systems, coastal Delaware is one of only three states located on a peninsula. Delaware floods originate along the hilly, rocky Piedmont streams in northern New Castle County and from the tidal bay and Atlantic Ocean.

The 100-year Floodplain

More than 331 square miles, or 17 percent of Delaware's landmass, lie within a mapped 100-year floodplain. The distribution of floodplains in the three Delaware counties is similar, ranging from 16 percent to 18 percent of the land.

Table 1. Area of the 100-year Floodplain in Delaware

County	100-year Floodplain (sq mi)	Portion of County Landmass
New Castle	67	16%
Kent	94	16%
Sussex	170	18%

Road Miles in Floodplain

Approximately 621 road miles are in the 100-year floodplain in Delaware. New Castle, Kent, and Sussex Counties contain 128, 75, and 418 road miles in the 100-year floodplain, respectively. Watersheds with the largest mileage of floodplain roads include the Christina River in New Castle County (44 miles), Murderkill in Kent County (16 miles), and Indian River Bay (106 miles).

Structures in Floodplain

More than 18,000 structures exist in the 100-year floodplain in Delaware—2,431 in New Castle County, 1,853 in Kent County, and 13,760 in Sussex County. Watersheds with the most structures in the 100-year floodplain include the Christina River in New Castle County (1,007 structures), St. Jones River in Kent County (567 structures), and Indian River Bay in Sussex County (3,856 structures).

Flood Discharge

Watersheds with the largest FEMA 100-year-flood flow per drainage area include Shellpot Creek in New Castle County (1,161 cfs/sq mi), Duck Creek in Kent County (327 cfs/sq mi), and Indian River in Sussex County (52 cfs/sq mi). Some of the largest recorded floods occurred on July 8, 1989 (July 4th storm), September 16, 1999 (Hurricane Floyd), Sept. 15, 2003 (Tropical Storm Henri), and Hurricane Irene (August 28-29, 2011).

Floodplain Mapping

Using ArcMap GIS, the University of Delaware's Water Resources Agency prepared interactive floodplain mapping posted at http://brandywine.dgs.udel.edu/flood. The mapping overlays FEMA 100- and 500-year floodplains with 2007 state of Delaware orthophotography. Delaware citizens and governments can access the mapping to determine flood insurance, flood warning, and flood response needs.

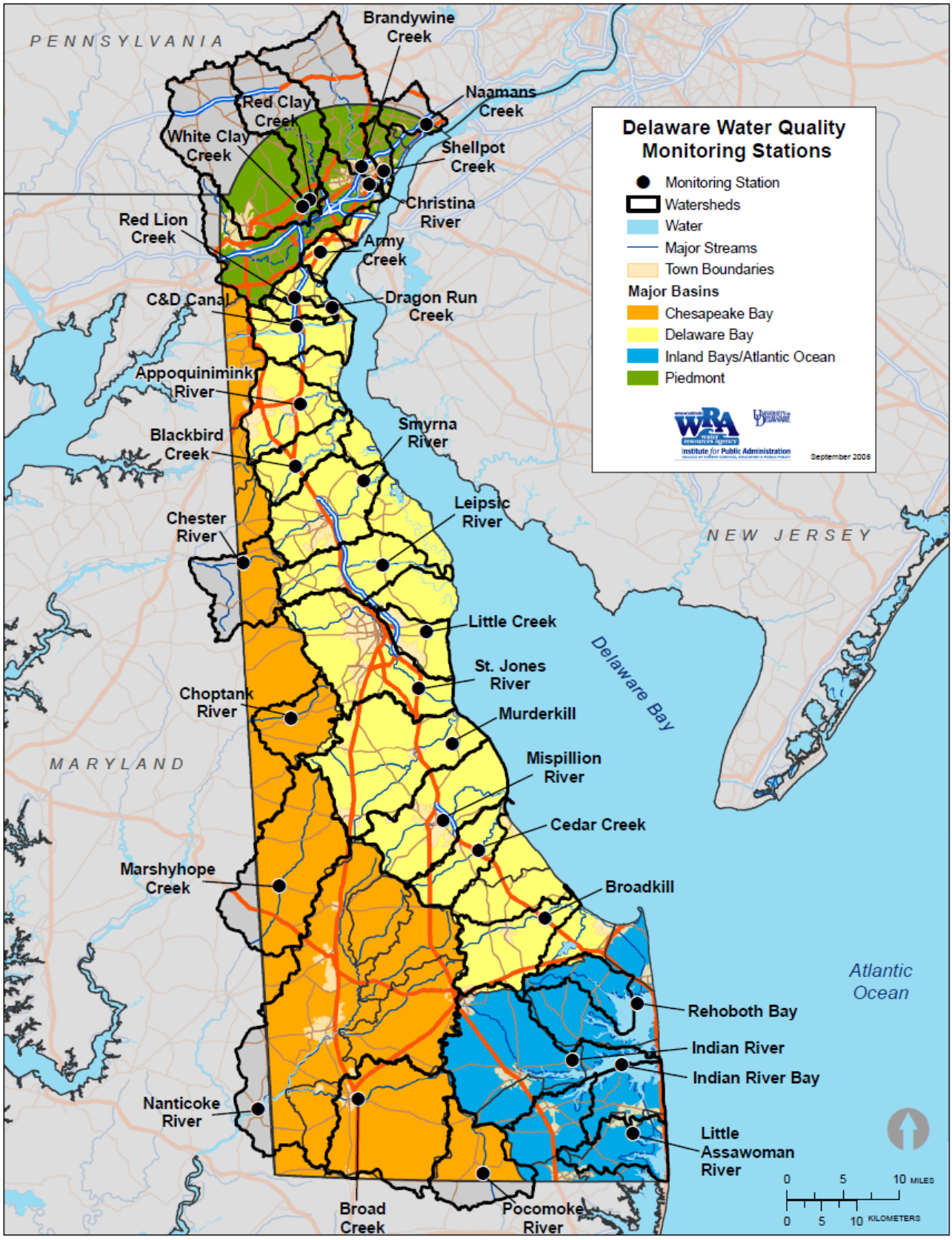


Figure 1. Watersheds in Delaware

Table 2. Area, roads, and structures in the 100-year floodplain in Delaware

County/Whole Basin	Watershed	Area (sq mi)	Roads (mi)	Structures (#)
New Castle County				
Chesapeake Bay	Bohemia Creek	0.2	0	0
	C & D Canal West	0.6	1	0
	Chester River	1.4	1	4
	Elk Creek	0.0	0	0
	Perch Creek	0.0	0	0
	Sassafras River	0.4	0	4
Delaware Bay	Appoquinimink R.	7.8	4	21
	Army Creek	1.3	1	6
	Blackbird Creek	6.8	2	7
	C & D Canal East	13.3	16	301
	Delaware Bay	6.9	2	4
	Delaware River	1.7	10	193
	Dragon Run Creek	1.5	3	111
	Red Lion Creek	1.8	1	17
	Smyrna River	5.7	4	10
Piedmont	Brandywine Creek	1.3	13	70
	Christina River	9.5	44	1,007
	Naamans Creek	0.6	3	73
	Red Clay Creek	1.3	5	142
	Shellpot Creek	1.3	6	180
	White Clay Creek	3.8	12	281
Subtotal		**67.2**	**128**	**2,431**
Kent County				
Chesapeake Bay	Choptank River	5.4	5	209
Delaware Bay	Leipsic River	28.9	12	193
	Little Creek	3.7	8	226
	Mispillion River	19.9	16	167
	Murderkill River	17.0	16	453
	Smyrna River	5.0	3	38
	St. Jones River	14.1	15	567
Subtotal		**94.0**	**75**	**1,853**
Sussex County				
Chesapeake Bay	Broad Creek	6.2	8	252
	Deep Creek	8.7	5	122
	Gravelly Branch	3.1	2	68
	Gum Branch	6.4	8	126
	Marshyhope Creek	10.3	14	184
	Nanticoke River	16.2	20	800
	Pocomoke River	0.0	0	0
	Wicomico	0.0	0	0
Delaware Bay	Broadkill River	26.0	39	957
	Cedar Creek	16.7	20	350
	Mispillion River	19.9	16	126
Atlantic Ocean	Assawoman	0.2	1	84
	Buntings Branch	0.4	3	63
	Indian River	4.9	3	131
	Indian River Bay	17.4	106	3,856
	Iron Branch	1.1	1	46
	Lewes-Rehoboth Canal	6.2	24	662
	Little Assawoman	12.6	89	3,680
	Rehoboth Bay	14.1	59	2,253
Subtotal		**170.4**	**418**	**13,760**
Total Delaware		**331.6**	**621**	**18,044**

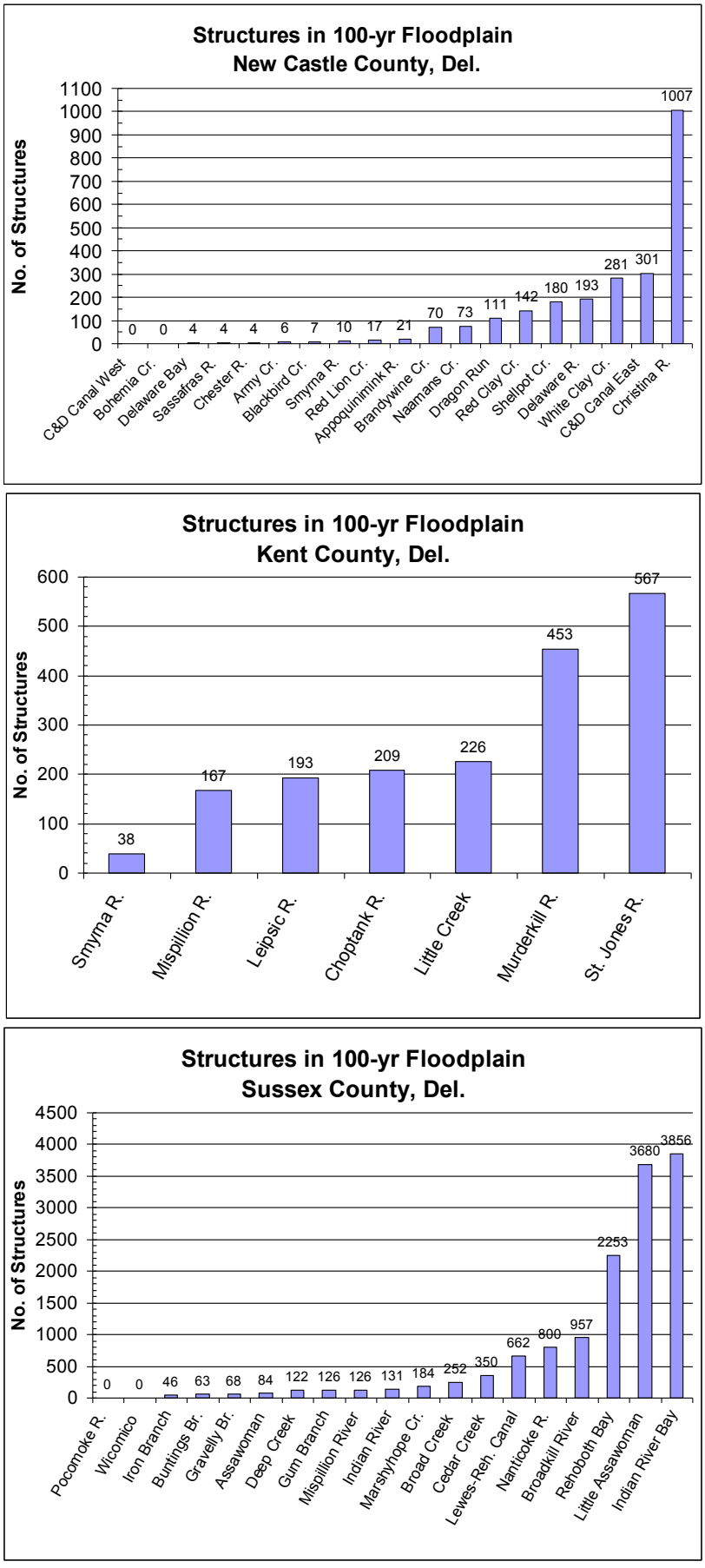
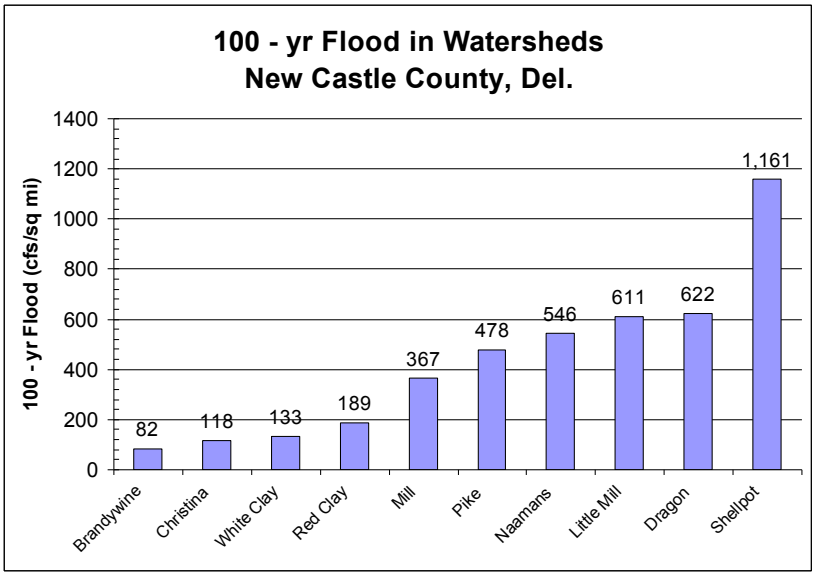


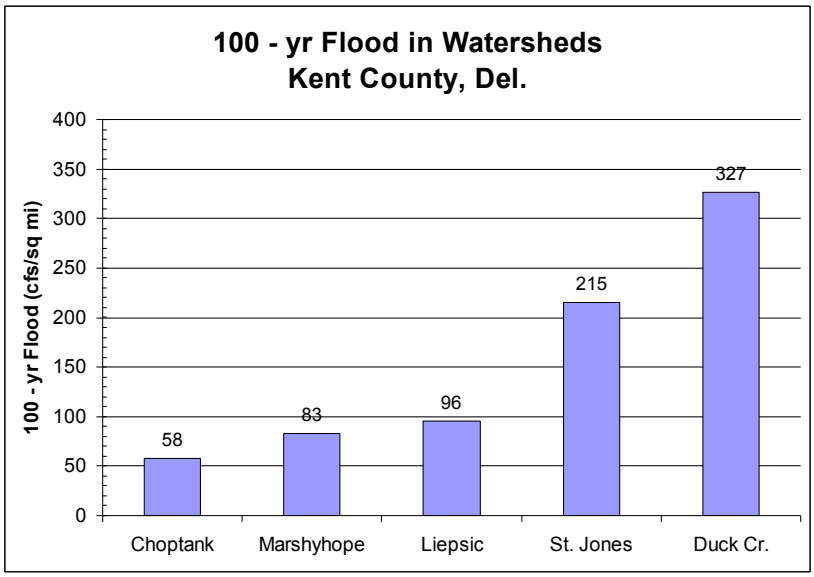
Figure 2. Number of structures in the 100-year floodplain in Delaware

Table 3. 100-year FEMA flood flow per area in Delaware watersheds

Watershed	100-yr Flow (cfs)	Watershed (sq mi)	Flow per area (cfs/sq mi)
New Castle County			
Brandywine Creek	30,400	314.0	82
Christina River	27,600	234.0	118
White Clay Creek	21,500	162.0	133
Red Clay Creek	10,200	54.1	189
Mill Creek	4,400	12.0	367
Pike Creek	3,010	6.3	478
Naamans Creek	7,640	14.0	546
Little Mill Creek	5,800	9.5	611
Dragon Creek	2,817	4.5	622
Shellpot Creek	8,590	7.4	1,161
Kent County			
Choptank River	5,486	94.7	58
Marshyhope Creek	5,312	63.8	83
Liepsic River	3,752	39.1	96
St. Jones River	8,201	38.1	215
Duck Creek (Smyrna River)	7,400	22.6	327
Sussex County			
Nanticoke River	211	5,120	24
Broadkill River	1,283	45.4	28
Mispillion River	1,110	39.3	28
Broad Creek	3,900	116.1	34
Indian River	5,360	102.0	52

FEMA Flood Insurance Studies, New Castle (2007), Kent (2008), and Sussex counties (2005)





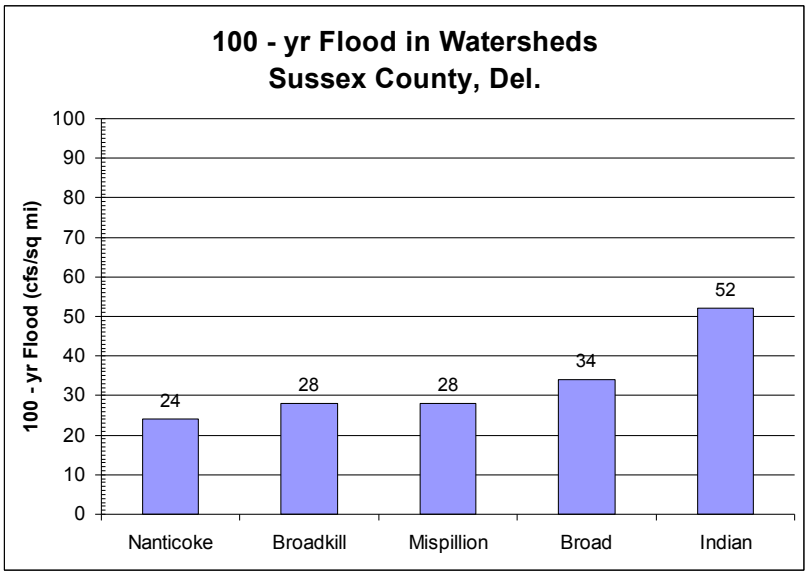


Figure 3. 100-year FEMA flood flow per area in Delaware watersheds
FEMA Flood Insurance Studies, New Castle (2007), Kent (2008), and Sussex counties (2005)

Table 4. Top floods in Delaware watersheds

Watershed at USGS Gage	Date	Peak Flow (cfs)	Return Interval	Probability
New Castle County				
Shellpot Creek at Wilmington, Del.	7/05/89	8,040	100-yr	1%
01477800	9/13/71	6,850	50-yr	2%
1945-present	8/27/67	4,650	>10-yr	10%
	9/16/99	4,460	10-yr	10%
	8/28/11	4,400	10-yr	10%
Christina River at Cooches Bridge, Del.	9/16/99	7,050	>100-yr	<1%
01478000	7/05/89	5,530	50-yr	2%
1943-present	9/28/04	5,430	50-yr	2%
	8/28/11	4,990	>25-yr	4%
	5/01/47	4,330	25-yr	4%
White Clay Creek near Newark, Del.	9/16/99	19,500	>100-yr	1%
01479000	8/28/11	16,700	>100-yr	1%
1943-present	9/15/03	13,900	>50-yr	2%
	7/05/89	11,600	25-yr	4%
	1/19/96	9,150	>10-yr	10%
	7/22/72	9,080	>10-yr	10%
Red Clay Creek at Wooddale, Del.	9/15/03	16,000	>500-yr	<0.2%
01480000	9/28/04	8,280	>50-yr	2%
1943-present	8/28/11	7,680	50-yr	2%
	9/16/99	7,650	50-yr	2%
	6/28/06	5,490	25-yr	4%
Brandywine Creek at Wilmington, Del.	6/23/72	29,000	100-yr	1%
01481500	9/17/99	28,700	>50-yr	2%
1946-present	8/28/11	23,000	>25-yr	4%
	1/25/79	22,400	>25-yr	4%
	9/13/71	21,300	25-yr	4%
	9/29/04	20,800	25-yr	4%
Blackbird Creek at Blackbird, Del.	9/16/99	789	100-yr	1%
01483200	6/22/72	712	>50-yr	4%
1956-present	7/12/04	694	50-yr	4%
	8/28/11	669	50-yr	4%
	9/12/60	510	25-yr	4%

Sources: www.usgs.gov and Ries, K. G. and J. A. Dillow, 2006. Magnitude and Frequency of Floods on Nontidal Streams in Delaware. U. S. Geological Survey. Scientific Investigations Report 2006-5146.

Table 4. Top floods in Delaware watersheds (cont'd)

Watershed at USGS Gage	Date	Peak Flow (cfs)	Return Interval	Probability
Kent County				
St. Jones River at Dover, Del.	8/28/11	2,390	>100-yr	1%
01483700	9/13/60	1,900	100-yr	1%
1958-present	2/24/98	1,400	25-yr	4%
	2/26/79	1,340	25-yr	4%
	8/26/58	1,260	>10-yr	10%
	6/23/72	996	5-yr	20%
Choptank River near Greensboro, Md.	8/04/67	6,970	50-yr	<1%
01491000	8/28/11	6,470	>25-yr	4%
1948-present	9/17/99	6,420	>25-yr	4%
	2/26/79	6,110	25-yr	4%
	6/17/01	5,240	>10-yr	10%
Sussex County				
Pocomoke River near Willards, Md.	8/20/89	2,820	>100-yr	1%
01485000	1/29/98	1,970	50-yr	2%
1949-present	2/26/79	1,870	50-yr	2%
	3/23/00	1,480	10-yr	10%
	3/03/94	1,470	10-yr	10%
Nanticoke River near Bridgeville, Del.	2/26/79	3,020	100-yr	1%
01487000	8/05/67	2,360	25 yr	4%
1943-present	8/26/58	2,300	25 yr	4%
	3/03/94	1,970	10 yr	10%
	9/17/99	1,760	10 yr	10%
	8/28/11	1,580	5-yr	20%
Marshyhope Creek near Adamsville, Del.	7/13/75	3,700	25-yr	4%
01488500	8/28/11	3,510	>10-yr	10%
1943-present	9/17/99	3,340	10-yr	10%
	8/05/67	3,060	5-yr	20%
	7/30/84	2,800	5-yr	20%
	8/21/97	2,780	5 yr	20%

Sources: www.usgs.gov and Source: Ries, K. G. and J. A. Dillow, 2006. Magnitude and Frequency of Floods on Nontidal Streams in Delaware. U. S. Geological Survey. Scientific Investigations Report 2006-5146.

Table 5. Flood frequency statistics at USGS gages in and near Delaware

USGS Gage	10-yr (cfs)	25-yr (cfs)	50-yr (cfs)	100-yr (cfs)
Shellpot Creek at Wilmington Del. 01477800	4,320	5,560	6,650	7,880
Christina River at Cooches Bridge, Del. 01478000	3,430	4,410	5,220	6,080
White Clay Creek near Newark, Del. 01479000	7,840	10,400	12,600	15,000
Red Clay Creek at Wooddale, Del. 01480000	4,560	6,170	7,600	9,220
Brandywine Creek at Wilmington, Del. 01481500	16,100	21,300	25,700	30,400
Blackbird Creek at Blackbird, Del. 01483200	371	529	670	831
St. Jones River at Dover, Del. 01483700	1,100	1,420	1,660	1,910
Nanticoke River near Bridgeville, Del. 01487000	1,780	2,290	2,720	3,200
Choptank River near Greensboro, Md. 01491000	4,450	6,070	7,400	8,830
Pocomoke River near Willards, Md. 01485000	1,360	1,700	1,980	2,300
Marshyhope Creek near Adamsville, Del. 01488500	3,260	3,780	4,160	4,540

Source: Ries, K. G. and J. A. Dillow, 2006. Magnitude and Frequency of Floods on Nontidal Streams in Delaware. U. S. Geological Survey. Scientific Investigations Report 2006-5146.

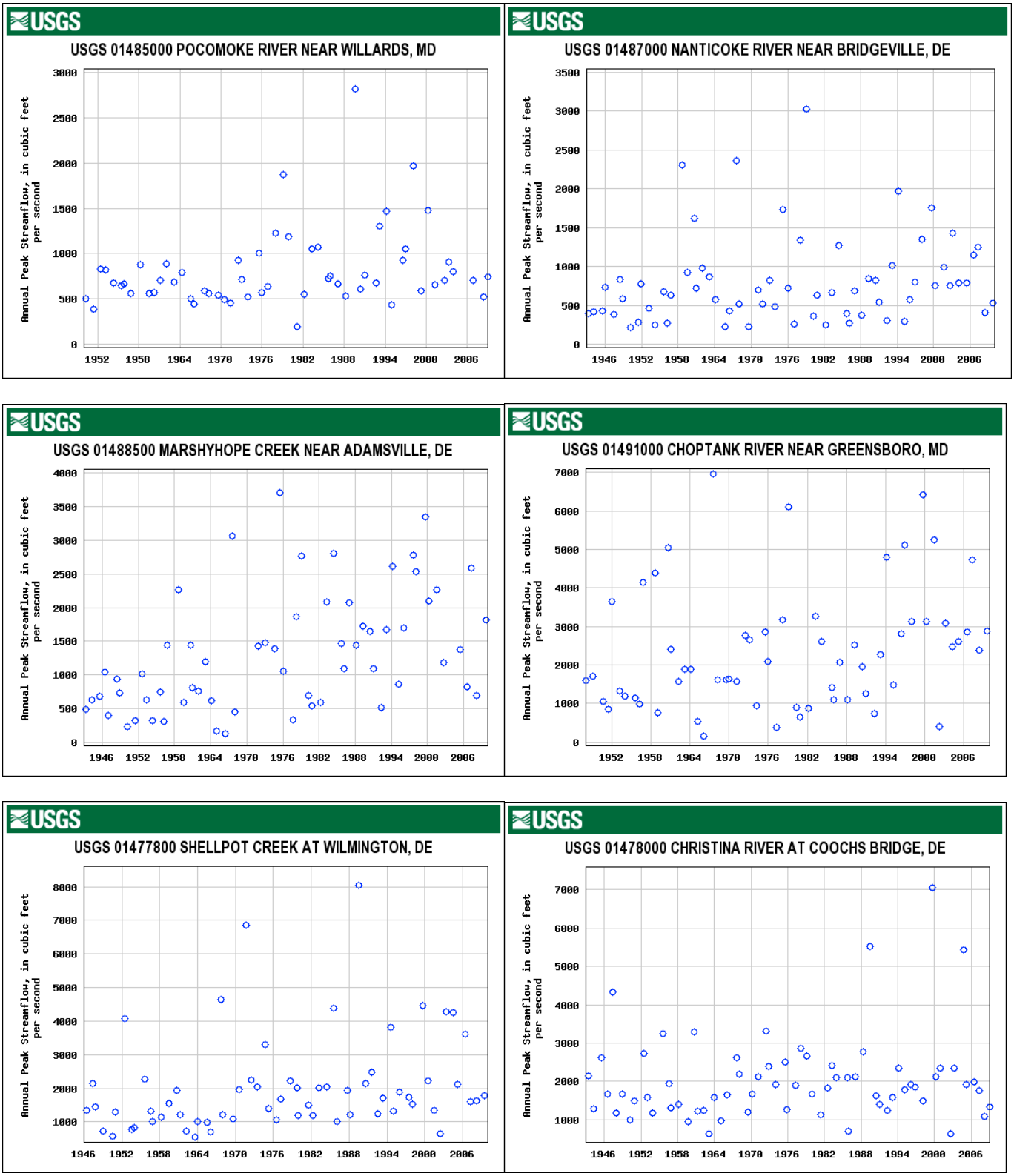
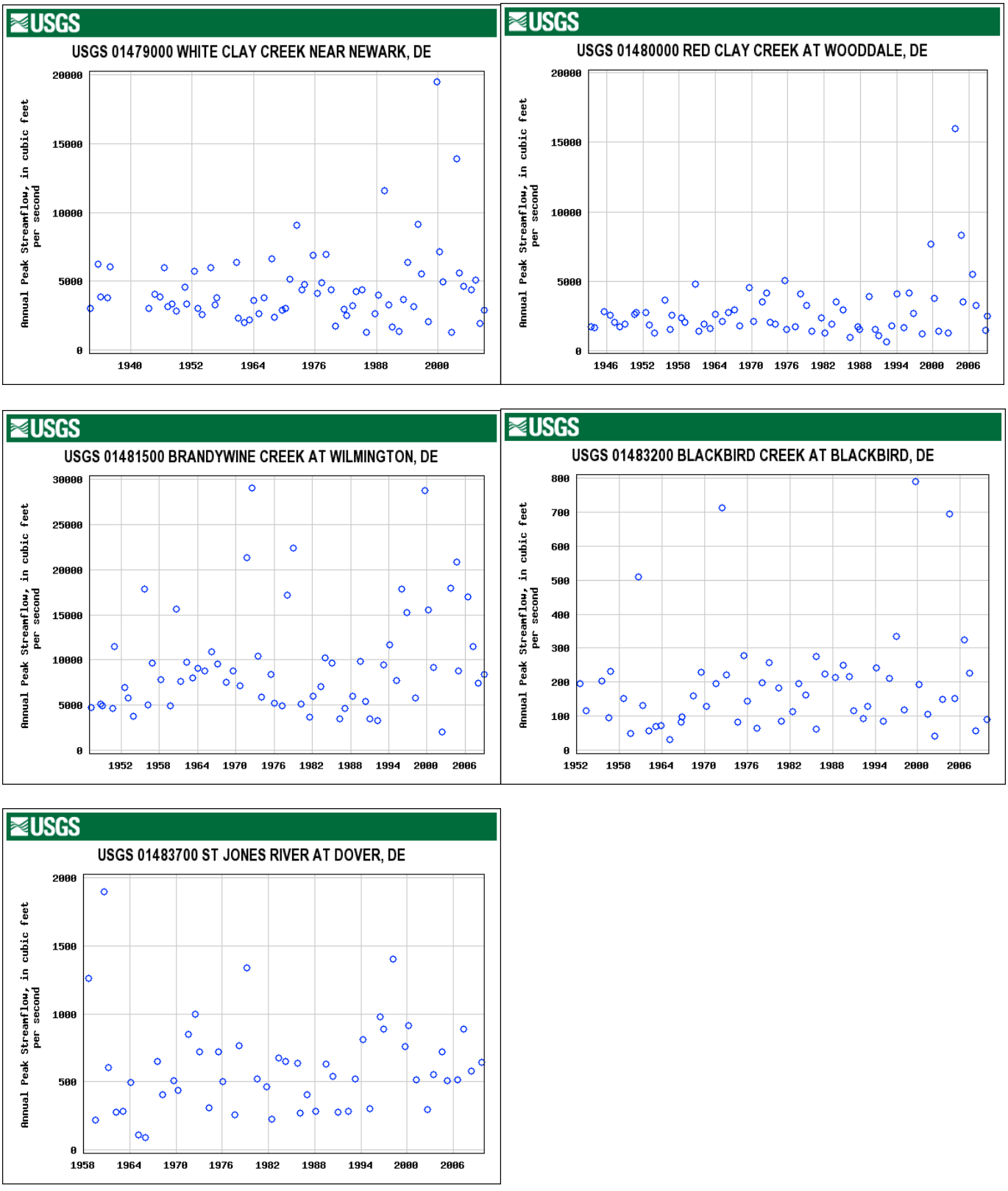


Figure 4. Highest peak flows in Delaware watersheds (source: www.usgs.gov)



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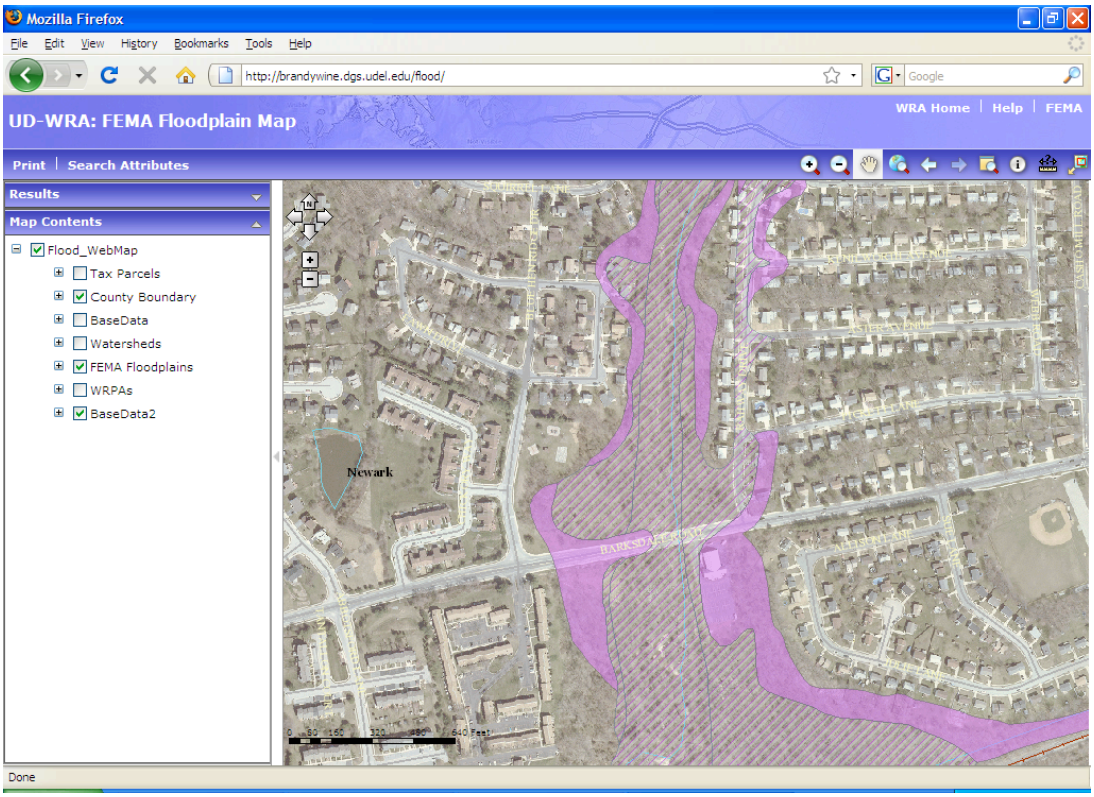

Figure 5. Floodplain map along Upper Christina River in City of Newark, Delaware

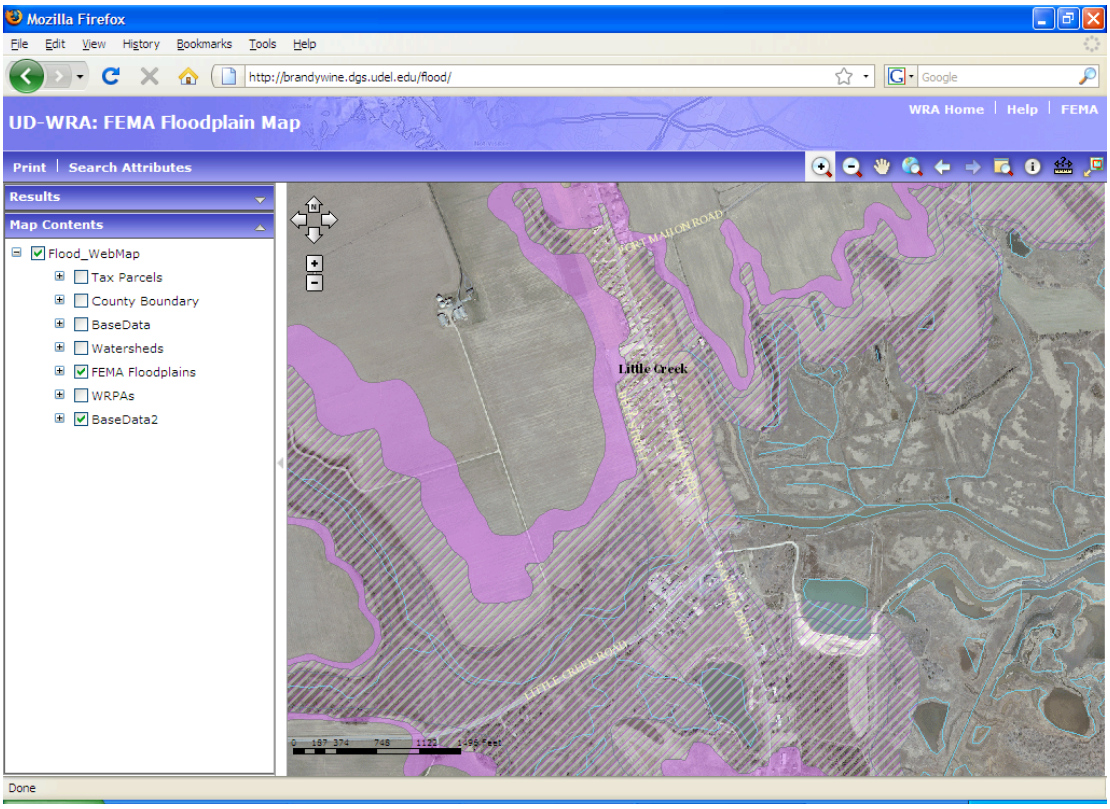

Figure 6. Floodplain map along Little Creek in Kent County, Delaware

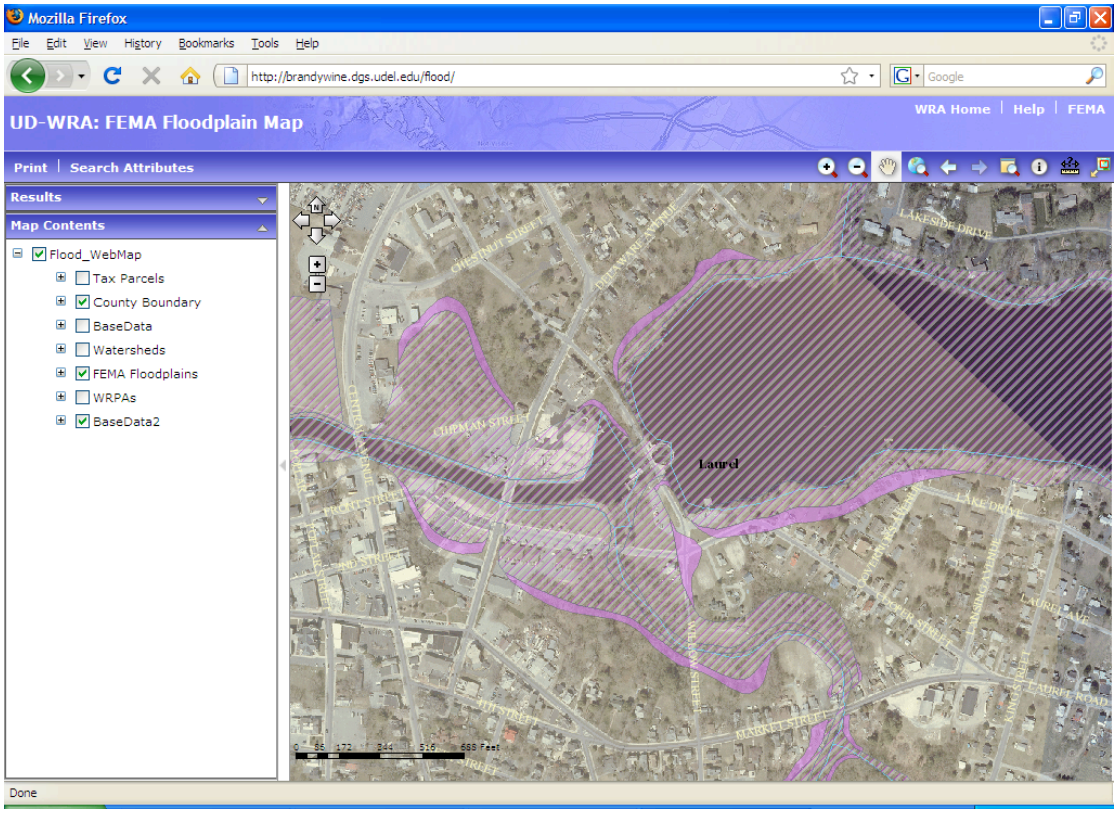

Figure 7. Floodplain map along Broad Creek in Laurel, Delaware