

HYDRAULIC DESIGN ADVISORY

HDA 05-04.3

DATE: JULY 28, 2005, REVISED FEBRUARY 1, 2008, REVISED AUGUST 27, 2008

SUBJECT: Application of NRCS' "TR-55", "TR-20", & "EFH-2"
Hydrologic Computations Using NOAA ATLAS 14 Rainfall
Data

AUTHOR: D.M. LeGrande, Sr.
Senior Hydraulics Advisor

This HDA supplements Hydraulic Design Advisory HDA 05-03, issued 06/21/05 & revised 07/18/05. When using hydrologic computational methods based on 24-hr. point rainfall such as the National Resource Conservation Service's (NRCS) "TR-55", "TR-20", "EFH-2" or other methods predicated on the application of NRCS' procedures, it will be necessary to use NOAA's "ATLAS-14" Rainfall Precipitation Frequency Data. This will be required whenever these hydrologic computational methods are employed in drainage designs for Department projects or those that will ultimately come under the Department's jurisdiction. This takes effect with the issuance of this Hydraulic Design Advisory. Exceptions in the case of projects already underway are outlined in HDA 05-03.

The 24-hr. Rainfall Depths table for Virginia, presented in the VDOT DRAINAGE MANUAL in Chapter 11, Appendix 11C-3, has been revised to reflect the NOAA "ATLAS-14" data for the 1 to 100-yr. rainfall frequency events. This information was provided to the Department by the Richmond, Virginia office of the National Resource Conservation Service (NRCS) on January 29, 2008. This data can also be accessed from the Virginia NRCS web site at the following address:

<http://www.va.nrcs.usda.gov/technical/hydrology.html>

When the web page is displayed, select the link entitled Virginia NRCS NOAA Atlas 14 Rainfall Data, updated January 2008. The (VDOT) revised table will be included in the next formal revision to the VDOT DRAINAGE MANUAL. A copy of the revised table is attached to this Hydraulic Design Advisory.

It should be noted that the NRCS provided rainfall data only for Virginia counties. The rainfall data shown for Virginia cities was obtained by the Department directly from NOAA's Precipitation Frequency Data Server at the following web address:

http://hdsc.nws.noaa.gov/hdsc/pfds/orb/va_pfds.html

It should also be noted that the NRCS determined that 17 Virginia counties were covered by multiple rainfall zones within the county: some by as few as two zones, others with as many as 4. The affected counties show up in the attached table with a zone number (in

parentheses) beside the county name. In order to determine the precise location of the zone number within that county it will be necessary to consult the county zone maps located on the Richmond, Virginia NRCS' web site at the following web address:

http://www.va.nrcs.usda.gov/technical/rainfall_maps.html

The Virginia office of the NRCS has recently advised that the NOAA "ATLAS-14" rainfall data does not, in many instances, follow the current Type II and Type III temporal distribution curves. They indicated that the Type II curve, as shown in the current edition of the VDOT DRAINAGE MANUAL in Appendix 6H-1 of Chapter 6 – HYDROLOGY, will only give reasonable results for return interval (frequency) storm events up to and including a 10-yr. event and should be used with caution. They have advised that the soon to be released revised "TR-20" software package will provide a routine that will convert the "ATLAS-14" rainfall data from NOAA's Precipitation Frequency Data Server to county-specific temporal distribution curves. Their "TR-55" and "EFH-2" software packages will ultimately contain this same feature. The NRCS Virginia office has indicated that additional information on this issue, it will be posted on their web site as it becomes available.

Recent discussions with the Virginia Department of Conservation & Recreation (DCR) have confirmed that they will accept the NOAA "ATLAS-14" Rainfall Precipitation Frequency data as presented herein for regulatory purposes in lieu of the older, NRCS-based tables presented in their handbook.

Any comments or questions related to this Hydraulic Design Advisory should be directed to

Mr. Roy T. Mills (State Hydraulics Engineer)
Virginia Department of Transportation
1401 East Broad Street
Richmond, Virginia 23219

(via e-mail at) Roy.Mills@VDOT.Virginia.gov
(by phone at) (804) 786-9013

or

Mr. David M. LeGrande, Sr. (Senior Hydraulics Advisor)
Virginia Department of Transportation
1401 East Broad Street
Richmond, Virginia 23219

(via e-mail at) David.LeGrande@VDOT.Virginia.gov

(by phone at) (804) 371-2807

APPENDIX 11C-3 24-HR. RAINFALL DEPTHS (INCHES)

COUNTY	FREQ. (YRS.)						
	1	2	5	10	25	50	100
Accomack	2.67	3.25	4.23	5.07	6.36	7.48	8.75
Albemarle (Zone 1)	3.42	4.14	5.27	6.21	7.59	8.77	10.10
Albemarle (Zone 2)	3.00	3.63	4.63	5.48	6.72	7.79	8.96
Alleghany	2.39	2.88	3.60	4.20	5.05	5.77	6.53
Amelia	2.73	3.30	4.22	5.00	6.15	7.13	8.20
Amherst	2.80	3.39	4.32	5.09	6.22	7.17	8.21
Appomattox	2.82	3.42	4.37	5.17	6.36	7.37	8.49
Arlington	2.69	3.15	4.05	4.84	6.06	7.14	8.37
Augusta (Zone 1)	2.48	3.00	3.78	4.43	5.38	6.17	7.02
Augusta (Zone 2)	2.98	3.61	4.59	5.40	6.58	7.58	8.67
Bath	2.49	3.00	3.76	4.38	5.27	6.01	6.80
Bedford (Zone 1)	3.10	3.76	4.80	5.66	6.92	8.01	9.20
Bedford (Zone 2)	2.76	3.35	4.27	5.04	6.17	7.13	8.18
Bland	2.16	2.58	3.13	3.58	4.19	4.68	5.19
Botetourt	2.60	3.15	4.00	4.70	5.71	6.57	7.50
Brunswick	2.78	3.37	4.33	5.13	6.29	7.27	8.33
Buchanan	2.18	2.60	3.17	3.65	4.34	4.91	5.51
Buckingham	2.78	3.37	4.31	5.09	6.26	7.26	8.36
Campbell	2.75	3.33	4.25	5.03	6.18	7.17	8.25
Caroline	2.68	3.25	4.19	5.00	6.24	7.33	8.56
Carroll (Zone 1)	2.29	2.76	3.48	4.05	4.85	5.50	6.18
Carroll (Zone 2)	2.62	3.17	4.02	4.71	5.68	6.48	7.33
Carroll (Zone 3)	2.95	3.57	4.55	5.35	6.50	7.46	8.50
Carroll (Zone 4)	3.36	4.97	5.20	6.13	7.49	8.65	9.92
Charles City	2.82	3.42	4.41	5.25	6.49	7.57	8.76
Charlotte	2.71	3.28	4.20	4.97	6.10	7.08	8.14
Chesapeake (city)	3.03	3.69	4.76	5.67	7.01	8.17	9.44
Chesterfield	2.77	3.35	4.29	5.09	6.27	7.28	8.39
Clarke	2.41	2.90	3.64	4.25	5.16	5.92	6.75
Craig	2.40	2.89	3.64	4.25	5.12	5.86	6.65
Culpeper	2.70	3.27	4.19	4.99	6.19	7.24	8.42
Cumberland	2.71	3.28	4.19	4.96	6.09	7.07	8.14
Dickenson	2.21	2.63	3.22	3.72	4.44	5.04	5.69
Dinwiddie	2.80	3.39	4.35	5.15	6.32	7.30	8.38

APPENDIX 11C-3 24-HR. RAINFALL DEPTHS (INCHES)

COUNTY	FREQ. (YRS.)						
	1	2	5	10	25	50	100
Essex	2.67	3.25	4.20	5.03	6.29	7.40	8.64
Fairfax	2.57	3.11	4.00	4.78	5.98	7.05	8.25
Fauquier	2.59	3.13	3.99	4.74	5.88	6.88	7.99
Floyd (Zone 1)	2.55	3.09	3.93	4.62	5.64	6.49	7.40
Floyd (Zone 2)	2.86	3.47	4.42	5.21	6.37	7.34	8.41
Floyd (Zone 3)	3.38	4.11	5.24	6.19	7.59	8.78	10.09
Floyd (Zone 4)	3.81	4.63	5.92	7.00	8.59	9.97	11.49
Fluvanna	2.68	3.25	4.15	4.91	6.03	7.00	8.05
Franklin	2.83	3.43	4.37	5.16	6.32	7.31	8.39
Frederick	2.36	2.83	3.53	4.11	4.96	5.68	6.46
Giles (Zone 1)	2.11	2.53	3.14	3.63	4.34	4.92	5.53
Giles (Zone 2)	2.34	2.81	3.51	4.08	4.90	5.57	6.31
Gloucester	2.87	3.49	4.52	5.41	6.73	7.89	9.19
Goochland	2.71	3.28	4.19	4.97	6.12	7.11	8.19
Grayson (Zone 1)	3.24	3.89	4.83	5.59	6.68	7.59	8.57
Grayson (Zone 2)	2.46	2.95	3.66	4.22	5.00	5.64	6.29
Grayson (Zone 3)	2.59	3.13	3.94	4.59	5.50	6.24	7.02
Greene (Zone 1)	3.38	4.09	5.19	6.11	7.47	8.63	9.92
Greene (Zone 2)	3.05	3.69	4.70	5.54	6.79	7.85	9.03
Greensville	2.74	3.32	4.28	5.08	6.25	7.23	8.31
Halifax	2.70	3.26	4.15	4.89	5.96	6.86	7.84
Hampton (city)	2.93	3.57	4.62	5.53	6.87	8.04	9.33
Hanover	2.71	3.28	4.21	5.01	6.21	7.26	8.42
Henrico	2.75	3.33	4.27	5.06	6.26	7.28	8.42
Henry	2.89	3.50	4.47	5.29	6.49	7.51	8.63
Highland	2.44	2.93	3.61	4.18	5.01	5.69	6.42
Isle of Wight	2.95	3.59	4.64	5.53	6.84	7.96	9.20
James City	2.90	3.53	4.56	5.45	6.75	7.89	9.15
King and Queen	2.72	3.31	4.28	5.11	6.38	7.49	8.73
King George	2.62	3.19	4.12	4.94	6.19	7.28	8.52
King William	2.70	3.28	4.23	5.05	6.30	7.38	8.59
Lancaster	2.74	3.33	4.33	5.19	6.49	7.63	8.91
Lee	2.56	3.05	3.71	4.26	5.03	5.68	6.38
Loudoun	2.53	3.05	3.89	4.61	5.70	6.64	7.70

APPENDIX 11C-3 24-HR. RAINFALL DEPTHS (INCHES)

COUNTY	FREQ. (YRS.)						
	1	2	5	10	25	50	100
Louisa	2.73	3.31	4.23	5.01	6.18	7.18	8.28
Lunenburg	2.72	3.29	4.21	4.99	6.12	7.09	8.15
Lynchburg (city)	2.75	3.33	4.26	5.03	6.17	7.14	8.20
Madison (Zone 1)	3.36	4.07	5.18	6.10	7.46	8.62	9.91
Madison (Zone 2)	2.87	3.48	4.44	5.25	6.45	7.48	8.61
Mathews	2.83	3.45	4.47	5.36	6.70	7.87	9.17
Mecklenburg	2.68	3.25	4.14	4.87	5.94	6.84	7.82
Middlesex	2.77	3.37	4.37	5.24	6.54	7.68	8.96
Montgomery (Zone 1)	2.00	2.42	3.06	3.58	4.34	4.97	5.64
Montgomery (Zone 2)	2.28	2.76	3.50	4.11	4.99	5.73	6.52
Montgomery (Zone 3)	2.60	3.15	4.01	4.72	5.75	6.61	7.55
Nelson	2.99	3.62	4.62	5.45	6.66	7.70	8.83
New Kent	2.78	3.37	4.35	5.19	6.45	7.53	8.75
Newport News (city)	2.94	3.58	4.63	5.53	6.86	8.01	9.28
Norfolk (city)	2.94	3.57	4.62	5.50	6.82	7.95	9.20
Northampton	2.74	3.33	4.33	5.19	6.48	7.61	8.88
Northumberland	2.69	3.27	4.25	5.10	6.39	7.51	8.78
Nottoway	2.73	3.31	4.23	5.00	6.15	7.12	8.19
Orange	2.76	3.34	4.27	5.07	6.27	7.30	8.46
Page (Zone 1)	2.44	2.94	3.71	4.35	5.28	6.07	6.93
Page (Zone 2)	3.06	3.70	4.69	5.52	6.73	7.77	8.90
Patrick (Zone 1)	3.79	4.61	5.89	6.97	8.57	9.94	11.46
Patrick (Zone 2)	3.33	4.04	5.16	6.10	7.49	8.68	9.98
Patrick (Zone 3)	3.06	3.71	4.73	5.59	6.85	7.93	9.10
Petersburg (city)	2.80	3.40	4.35	5.16	6.35	7.36	8.46
Pittsylvania	2.78	3.37	4.29	5.07	6.20	7.17	8.23
Poquoson (city)	2.93	3.56	4.61	5.42	6.87	8.05	9.35
Portsmouth (city)	2.96	3.61	4.66	5.55	6.87	8.01	9.27
Powhatan	2.71	3.28	4.20	4.97	6.12	7.11	8.19
Prince Edward	2.74	3.32	4.24	5.02	6.18	7.16	8.25
Prince George	2.81	3.41	4.39	5.21	6.42	7.45	8.58
Prince William	2.51	3.04	3.91	4.67	5.84	6.86	8.03
Pulaski	2.03	2.46	3.10	3.63	4.39	5.02	5.69
Rappahannock	2.74	3.31	4.22	4.98	6.12	7.10	8.18

APPENDIX 11C-3 24-HR. RAINFALL DEPTHS (INCHES)

COUNTY	FREQ. (YRS.)						
	1	2	5	10	25	50	100
Richmond (city)	2.76	3.34	4.28	5.08	6.27	7.29	8.42
Richmond	2.70	3.29	4.26	5.11	6.40	7.52	8.80
Roanoke (Zone 1)	2.37	2.87	3.64	4.27	5.19	5.96	6.78
Roanoke (Zone 2)	2.62	3.17	4.03	4.74	5.77	6.64	7.58
Rockbridge (Zone 1)	2.54	3.07	3.90	4.58	5.57	6.39	7.29
Rockbridge (Zone 2)	2.94	3.56	4.53	5.33	6.48	7.46	8.51
Rockingham (Zone 1)	2.27	2.73	3.43	4.03	4.91	5.66	6.49
Rockingham (Zone 2)	3.06	3.69	4.68	5.50	6.69	7.72	8.84
Russell	2.20	2.62	3.17	3.62	4.27	4.80	5.36
Scott (Zone 1)	2.39	2.84	3.43	3.91	4.59	5.15	5.75
Scott (Zone 2)	2.25	2.67	3.18	3.59	4.14	4.58	5.02
Shenandoah	2.31	2.78	3.48	4.07	4.94	5.69	6.50
Smyth	2.34	2.78	3.35	3.81	4.44	4.95	5.47
Southampton	2.87	3.49	4.50	5.35	6.60	7.66	8.83
Spotsylvania	2.66	3.22	4.14	4.93	6.13	7.19	8.37
Stafford	2.58	3.11	4.00	4.79	5.99	7.05	8.25
Suffolk (city)	2.99	3.64	4.70	5.59	6.91	8.04	9.28
Surry	2.90	3.52	4.55	5.42	6.70	7.80	9.02
Sussex	2.85	3.46	4.45	5.29	6.50	7.52	8.63
Tazewell	2.16	2.56	3.09	3.52	4.12	4.61	5.11
Virginia Beach (city)	3.01	3.67	4.74	5.65	6.99	8.15	9.42
Warren (Zone 1)	2.48	2.99	3.78	4.43	5.38	6.19	7.08
Warren (Zone 2)	2.84	3.43	4.35	5.11	6.25	7.23	8.31
Washington	2.21	2.62	3.13	3.54	4.10	4.54	4.99
Westmoreland	2.66	3.24	4.20	5.04	6.31	7.42	8.68
Wise	2.29	2.73	3.33	3.85	4.59	5.21	5.87
Wythe	2.13	2.55	3.13	3.60	4.24	4.75	5.27
York	2.93	3.56	4.61	5.51	6.84	8.00	9.28