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# Urban Hydrology for Small Watersheds

## TR-55

For simplified use of the procedures described  
in this manual you may wish to use the  
**HydroCAD Stormwater Modeling System**  
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# Preface

Technical Release 55 (TR-55) presents simplified procedures to calculate storm runoff volume, peak rate of discharge, hydrographs, and storage volumes required for floodwater reservoirs. These procedures are applicable in small watersheds, especially urbanizing watersheds, in the United States. First issued by the Soil Conservation Service (SCS) in January 1975, TR-55 incorporates current SCS procedures. This revision includes results of recent research and other changes based on experience with use of the original edition.

The major revisions and additions are:

- A flow chart for selecting the appropriate procedure;
- Three additional rain distributions;
- Expansion of the chapter on runoff curve numbers;
- A procedure for calculating travel times of sheet flow;
- Deletion of a chapter on peak discharges;
- Modifications to the Graphical Peak Discharge method and Tabular Hydrograph method;
- A new storage routing procedure;
- Features of the TR-55 computer program; and
- Worksheets.

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## Metric conversions

The English system of units is used in this TR. To convert to the International System of units (metric), use the following factors:

From English unit	To metric unit	Multiply by
Acre	Hectare	0.405
Square mile	Square kilometer	2.59
Cubic feet per second	Cubic meters per second	0.0283
Inch	Millimeter	25.4
Feet per second	Meters per second	0.3048
Acre-foot	Cubic meter	1233.489
Cubic foot	Cubic meter	0.0283

Perform rounding operations as appropriate to indicate the same level of precision as that of the original measurement. For example:

1. A stream discharge is recorded in cubic feet per second with three significant digits.
2. Convert stream discharge to cubic meters per second by multiplying by 0.0283.
3. Round to enough significant digits so that, when converting back to cubic feet per second, you obtain the original value (step 1) with three significant digits.

## Definitions of symbols

Symbol	Unit	Definition
a	ft <sup>2</sup>	Cross sectional flow area
A <sub>m</sub>	mi <sup>2</sup>	Drainage area
CN		Runoff curve number
CN <sub>e</sub>		Composite runoff curve number
CN <sub>p</sub>		Pervious runoff curve number
E <sub>max</sub>		Maximum stage
F <sub>p</sub>		Pond and swamp adjustment factor
H <sub>w</sub>	ft	Head over weir crest
I <sub>a</sub>	in	Initial abstraction
L	ft	Flow length
L <sub>w</sub>	ft	Weir crest length
m		Number of flow segments
n		Manning's roughness coefficient
P	in	Rainfall
P <sub>imp</sub>		Percent imperviousness
P <sub>2</sub>	in	Two-year frequency, 24-hour rainfall
p <sub>w</sub>	ft	Wetted perimeter
q	ft <sup>3</sup> /s (cfs)	Hydrograph coordinate
q <sub>i</sub>	ft <sup>3</sup> /s (cfs)	Peak inflow discharge
q <sub>o</sub>	ft <sup>3</sup> /s (cfs)	Peak outflow discharge
q <sub>p</sub>	ft <sup>3</sup> /s (cfs)	Peak discharge
q <sub>t</sub>	csn/in	Tabular hydrograph unit discharge
q <sub>u</sub>	csn/in	Unit peak discharge
Q	in	Runoff
r	ft	Hydraulic radius
R		Ratio of unconnected impervious area to total impervious area
s	ft/ft	Slope of hydraulic grade line
S	in	Potential maximum retention after runoff begins
t	hr	Hydrograph time
T <sub>c</sub>	hr	Time of concentration
T <sub>p</sub>	hr	Time to peak
T <sub>t</sub>	hr	Travel time
V	ft/s	Average velocity
V <sub>r</sub>	acre-ft, ft <sup>3</sup> or water- shed-inch	Runoff volume
V <sub>s</sub>	acre-ft, ft <sup>3</sup> or water- shed-inch	Storage volume

The conversion of rural land to urban land usually increases erosion and the discharge and volume of storm runoff in a watershed. It also causes other problems that affect soil and water. As part of programs established to alleviate these problems, engineers increasingly must assess the probable effects of urban development, as well as design and implement measures that will minimize its adverse effects.

Technical Release 55 (TR-55) presents simplified procedures for estimating runoff and peak discharges in small watersheds. In selecting the appropriate procedure, consider the scope and complexity of the problem, the available data, and the acceptable level of error. While this TR gives special emphasis to urban and urbanizing watersheds, the procedures apply to any small watershed in which certain limitations are met.

## Effects of urban development

An urban or urbanizing watershed is one in which impervious surfaces cover or will soon cover a considerable area. Impervious surfaces include roads, sidewalks, parking lots, and buildings. Natural flow paths in the watershed may be replaced or supplemented by paved gutters, storm sewers, or other elements of artificial drainage.

Hydrologic studies to determine runoff and peak discharge should ideally be based on long-term stationary streamflow records for the area. Such records are seldom available for small drainage areas. Even where they are available, accurate statistical analysis of them is usually impossible because of the conversion of land to urban uses during the period of record. It therefore is necessary to estimate peak discharges with hydrologic models based on measurable watershed characteristics. Only through an understanding of these characteristics and experience in using these models can we make sound judgments on how to alter model parameters to reflect changing watershed conditions.

Urbanization changes a watershed's response to precipitation. The most common effects are reduced infiltration and decreased travel time, which significantly increase peak discharges and runoff. Runoff is determined primarily by the amount of precipitation and by infiltration characteristics related to soil type, soil moisture, antecedent rainfall, cover type, impervi-

ous surfaces, and surface retention. Travel time is determined primarily by slope, length of flow path, depth of flow, and roughness of flow surfaces. Peak discharges are based on the relationship of these parameters and on the total drainage area of the watershed, the location of the development, the effect of any flood control works or other natural or manmade storage, and the time distribution of rainfall during a given storm event.

The model described in TR-55 begins with a rainfall amount uniformly imposed on the watershed over a specified time distribution. Mass rainfall is converted to mass runoff by using a runoff curve number (CN). CN is based on soils, plant cover, amount of impervious areas, interception, and surface storage. Runoff is then transformed into a hydrograph by using unit hydrograph theory and routing procedures that depend on runoff travel time through segments of the watershed.

For a description of the hydrograph development method used by SCS, see chapter 16 of the SCS National Engineering Handbook, Section 4—Hydrology (NEH-4) (SCS 1985). The routing method (Modified Att-Kin) is explained in appendixes G and H of draft Technical Release 20 (TR-20) (SCS 1983).

## Rainfall

TR-55 includes four regional rainfall time distributions. See appendix B for a discussion of how these distributions were developed.

All four distributions are for a 24-hour period. This period was chosen because of the general availability of daily rainfall data that were used to estimate 24-hour rainfall amounts. The 24-hour duration spans most of the applications of TR-55.

One critical parameter in the model is time of concentration ( $T_c$ ), which is the time it takes for runoff to travel to a point of interest from the hydraulically most distant point. Normally a rainfall duration equal to or greater than  $T_c$  is used. Therefore, the rainfall distributions were designed to contain the intensity of any duration of rainfall for the frequency of the event chosen. That is, if the 10-year frequency, 24-hour rainfall is used, the most intense hour will approximate the 10-year, 1-hour rainfall volume.

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## Runoff

To estimate runoff from storm rainfall, SCS uses the runoff curve number (CN) method (see chapters 4 through 10 of NEH-4, SCS 1985). Determination of CN depends on the watershed's soil and cover conditions, which the model represents as hydrologic soil group, cover type, treatment, and hydrologic condition. Chapter 2 of this TR discusses the effect of urban development on CN and explains how to use CN to estimate runoff.

## Time parameters

Chapter 3 describes a method for estimating the parameters used to distribute the runoff into a hydrograph. The method is based on velocities of flow through segments of the watershed. Two major parameters are time of concentration ( $T_c$ ) and travel time of flow through the segments ( $T_t$ ). These and the other parameters used are the same as those used in accepted hydraulic analyses of open channels.

Many methods are empirically derived from actual runoff hydrographs and watershed characteristics. The method in chapter 3 was chosen because it is basic; however, other methods may be used.

## Peak discharge and hydrographs

Chapter 4 describes a method for approximating peak rates of discharge, and chapter 5 describes a method for obtaining or routing hydrographs. Both methods were derived from hydrographs prepared by procedures outlined in chapter 16 of NEH-4 (SCS 1985). The computations were made with a computerized SCS hydrologic model, TR-20 (SCS 1983).

The methods in chapters 4 and 5 should be used in accordance with specific guidelines. If basic data are improperly prepared or adjustments not properly used, errors will result.

## Storage effects

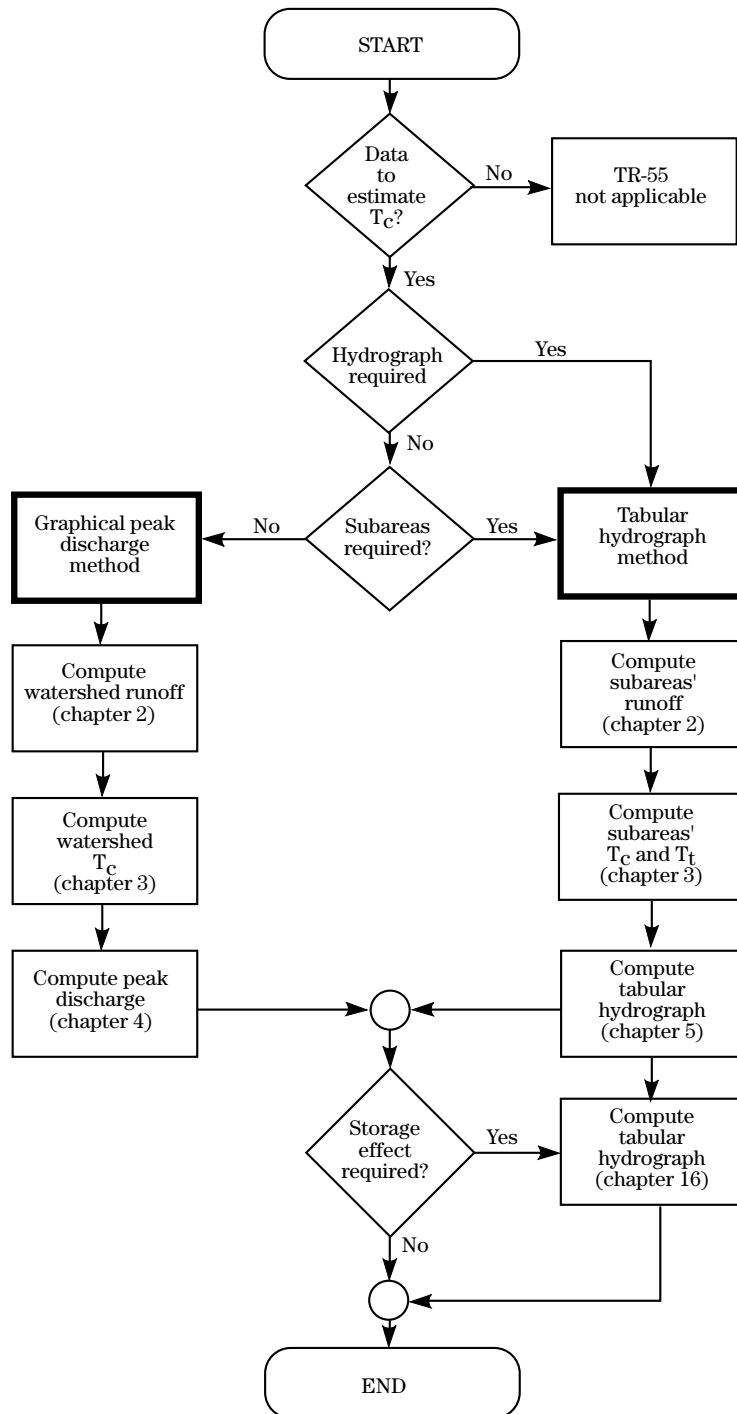
Chapter 6 outlines procedures to account for the effect of detention-type storage. It provides a shortcut method to estimate temporary flood storage based on hydrologic data developed from the Graphical Peak Discharge or Tabular Hydrograph methods.

By increasing runoff and decreasing travel times, urbanization can be expected to increase downstream peak discharges. Chapter 6 discusses how flood detention can modify the hydrograph so that, ideally, downstream peak discharge is reduced approximately to the predevelopment condition. The shortcuts in chapter 6 are useful in sizing a basin even though the final design may require a more detailed analysis.

## Selecting the appropriate procedures

Figure 1-1 is a flow chart that shows how to select the appropriate procedures to use in TR-55. In the figure, the diamond-shaped box labeled "Subareas required?" directs the user to the appropriate method based on whether the watershed needs to be divided into subareas. Watershed subdivision is required when significantly different conditions affecting runoff or timing are present in the watershed—for example, if the watershed has widely differing curve numbers or nonhomogeneous slope patterns.

**Figure 1-1** Flow chart for selecting the appropriate procedures in TR-55.



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## Limitations

To save time, the procedures in TR-55 are simplified by assumptions about some parameters. These simplifications, however, limit the use of the procedures and can provide results that are less accurate than more detailed methods. The user should examine the sensitivity of the analysis being conducted to a variation of the peak discharge or hydrograph. To ensure that the degree of error is tolerable, specific limitations are given in chapters 2 through 6. Additional general constraints to the use of TR-55 are as follows:

- The methods in this TR are based on open and unconfined flow over land or in channels. For large events during which flow is divided between sewer and overland flow, more information about hydraulics than is presented here is needed to determine  $T_c$ . After flow enters a closed system, the discharge can be assumed constant until another flow is encountered at a junction or another inlet.
- Both the Graphical Peak Discharge and Tabular Hydrograph methods are derived from TR-20 (SCS 1983) output. Their accuracy is comparable; they differ only in their products. The use of  $T_c$  permits them to be used for any size watershed within the scope of the curves or tables. The Graphical method (chapter 4) is used only for hydrologically homogeneous watersheds because the procedure is limited to a single watershed subarea. The Tabular method (chapter 5) can be used for a heterogeneous watershed that is divided into a number of homogeneous subwatersheds. Hydrographs for the subwatersheds can be routed and added.
- The approximate storage-routing curves (chapter 6) should not be used if the adjustment for ponding (chapter 4) is used. These storage-routing curves, like the peak discharge and hydrograph procedures, are generalizations derived from TR-20 routings.

## SCS runoff curve number method

The SCS Runoff Curve Number (CN) method is described in detail in NEH-4 (SCS 1985). The SCS runoff equation is

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \quad [\text{eq. 2-1}]$$

where

- Q = runoff (in)
- P = rainfall (in)
- S = potential maximum retention after runoff begins (in) and
- I<sub>a</sub> = initial abstraction (in)

Initial abstraction (I<sub>a</sub>) is all losses before runoff begins. It includes water retained in surface depressions, water intercepted by vegetation, evaporation, and infiltration. I<sub>a</sub> is highly variable but generally is correlated with soil and cover parameters. Through studies of many small agricultural watersheds, I<sub>a</sub> was found to be approximated by the following empirical equation:

$$I_a = 0.2S \quad [\text{eq. 2-2}]$$

By removing I<sub>a</sub> as an independent parameter, this approximation allows use of a combination of S and P to produce a unique runoff amount. Substituting equation 2-2 into equation 2-1 gives:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)} \quad [\text{eq. 2-3}]$$

S is related to the soil and cover conditions of the watershed through the CN. CN has a range of 0 to 100, and S is related to CN by:

$$S = \frac{1000}{CN} - 10 \quad [\text{eq. 2-4}]$$

Figure 2-1 and table 2-1 solve equations 2-3 and 2-4 for a range of CN's and rainfall.

## Factors considered in determining runoff curve numbers

The major factors that determine CN are the hydrologic soil group (HSG), cover type, treatment, hydrologic condition, and antecedent runoff condition (ARC). Another factor considered is whether impervious areas outlet directly to the drainage system (connected) or whether the flow spreads over pervious areas before entering the drainage system (unconnected). Figure 2-2 is provided to aid in selecting the appropriate figure or table for determining curve numbers.

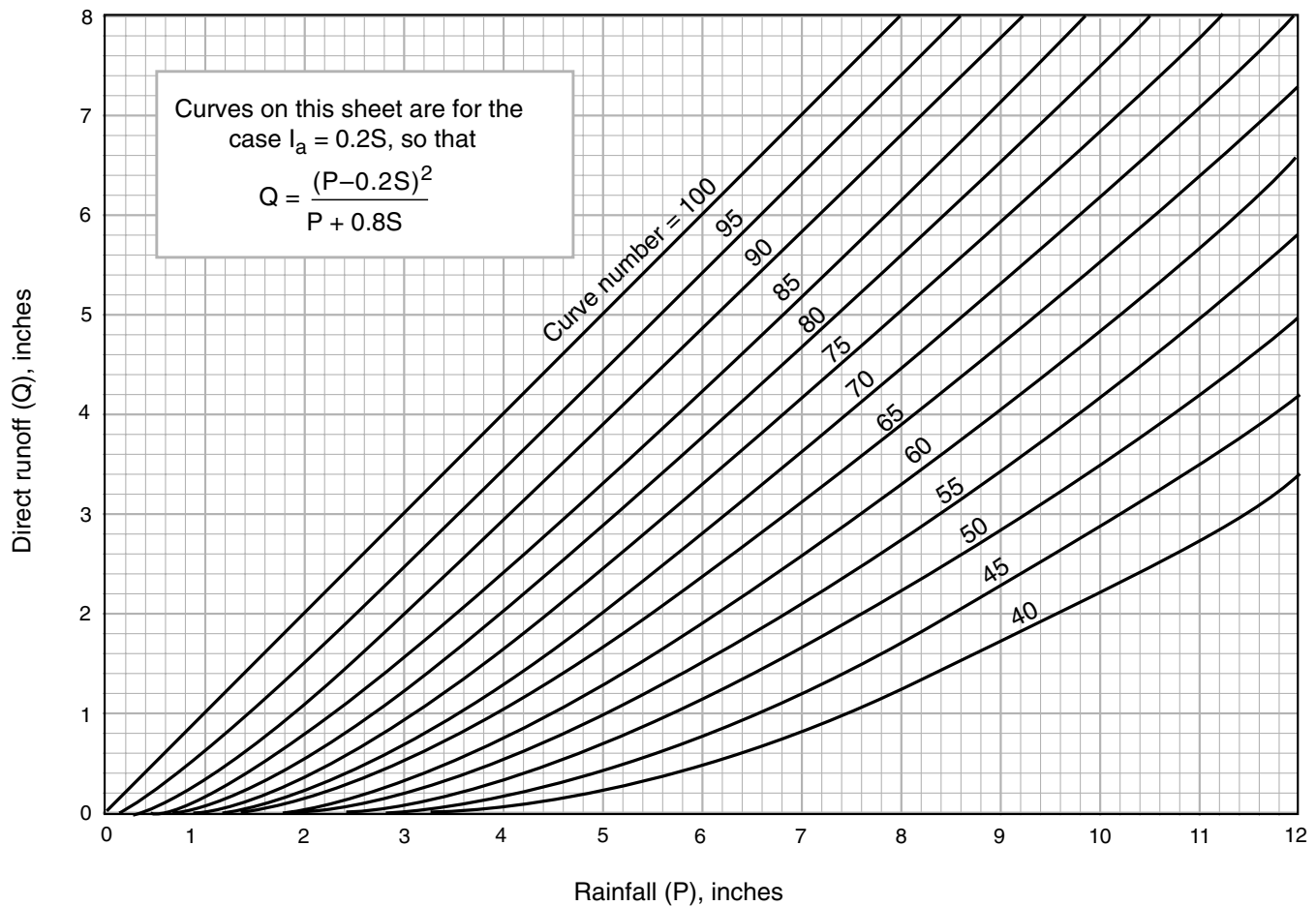
CN's in table 2-2 (*a* to *d*) represent average antecedent runoff condition for urban, cultivated agricultural, other agricultural, and arid and semiarid rangeland uses. Table 2-2 assumes impervious areas are directly connected. The following sections explain how to determine CN's and how to modify them for urban conditions.

### Hydrologic soil groups

Infiltration rates of soils vary widely and are affected by subsurface permeability as well as surface intake rates. Soils are classified into four HSG's (A, B, C, and D) according to their minimum infiltration rate, which is obtained for bare soil after prolonged wetting. Appendix A defines the four groups and provides a list of most of the soils in the United States and their group classification. The soils in the area of interest may be identified from a soil survey report, which can be obtained from local SCS offices or soil and water conservation district offices.

Most urban areas are only partially covered by impervious surfaces: the soil remains an important factor in runoff estimates. Urbanization has a greater effect on runoff in watersheds with soils having high infiltration rates (sands and gravels) than in watersheds predominantly of silts and clays, which generally have low infiltration rates.

Any disturbance of a soil profile can significantly change its infiltration characteristics. With urbanization, native soil profiles may be mixed or removed or fill material from other areas may be introduced. Therefore, a method based on soil texture is given in appendix A for determining the HSG classification for disturbed soils.

**Figure 2-1** Solution of runoff equation.

### Cover type

Table 2-2 addresses most cover types, such as vegetation, bare soil, and impervious surfaces. There are a number of methods for determining cover type. The most common are field reconnaissance, aerial photographs, and land use maps.

### Treatment

**Treatment** is a cover type modifier (used only in table 2-2b) to describe the management of cultivated agricultural lands. It includes mechanical practices, such as contouring and terracing, and management practices, such as crop rotations and reduced or no tillage.

### Hydrologic condition

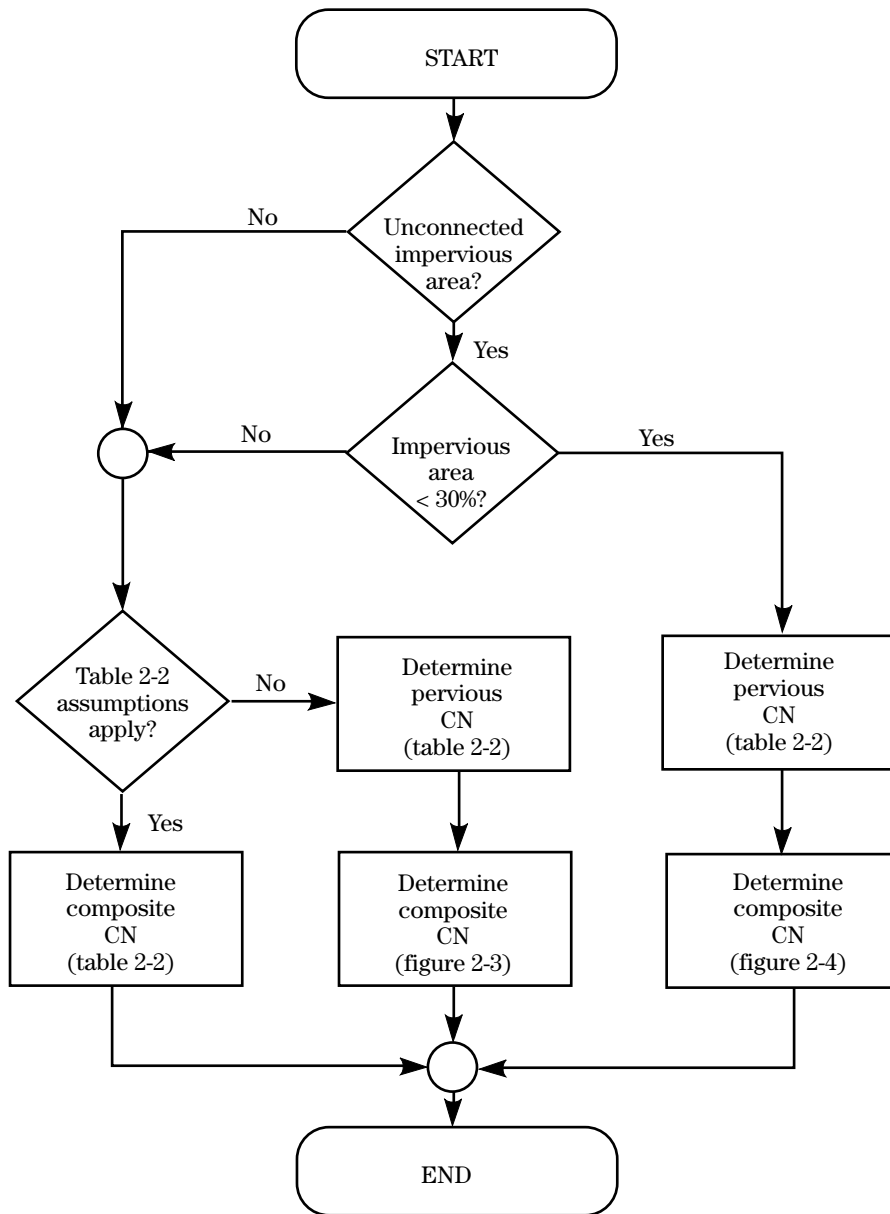
**Hydrologic condition** indicates the effects of cover type and treatment on infiltration and runoff and is generally estimated from density of plant and residue cover on sample areas. **Good** hydrologic condition indicates that the soil usually has a low runoff potential for that specific hydrologic soil group, cover type, and treatment. Some factors to consider in estimating the effect of cover on infiltration and runoff are (a) canopy or density of lawns, crops, or other vegetative areas; (b) amount of year-round cover; (c) amount of grass or close-seeded legumes in rotations; (d) percent of residue cover; and (e) degree of surface roughness.

**Table 2-1** Runoff depth for selected CN's and rainfall amounts <sup>1/</sup>

Rainfall	Runoff depth for curve number of—												
	40	45	50	55	60	65	70	75	80	85	90	95	98
	inches												
1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.17	0.32	0.56	0.79
1.2	.00	.00	.00	.00	.00	.00	.03	.07	.15	.27	.46	.74	.99
1.4	.00	.00	.00	.00	.00	.02	.06	.13	.24	.39	.61	.92	1.18
1.6	.00	.00	.00	.00	.01	.05	.11	.20	.34	.52	.76	1.11	1.38
1.8	.00	.00	.00	.00	.03	.09	.17	.29	.44	.65	.93	1.29	1.58
2.0	.00	.00	.00	.02	.06	.14	.24	.38	.56	.80	1.09	1.48	1.77
2.5	.00	.00	.02	.08	.17	.30	.46	.65	.89	1.18	1.53	1.96	2.27
3.0	.00	.02	.09	.19	.33	.51	.71	.96	1.25	1.59	1.98	2.45	2.77
3.5	.02	.08	.20	.35	.53	.75	1.01	1.30	1.64	2.02	2.45	2.94	3.27
4.0	.06	.18	.33	.53	.76	1.03	1.33	1.67	2.04	2.46	2.92	3.43	3.77
4.5	.14	.30	.50	.74	1.02	1.33	1.67	2.05	2.46	2.91	3.40	3.92	4.26
5.0	.24	.44	.69	.98	1.30	1.65	2.04	2.45	2.89	3.37	3.88	4.42	4.76
6.0	.50	.80	1.14	1.52	1.92	2.35	2.81	3.28	3.78	4.30	4.85	5.41	5.76
7.0	.84	1.24	1.68	2.12	2.60	3.10	3.62	4.15	4.69	5.25	5.82	6.41	6.76
8.0	1.25	1.74	2.25	2.78	3.33	3.89	4.46	5.04	5.63	6.21	6.81	7.40	7.76
9.0	1.71	2.29	2.88	3.49	4.10	4.72	5.33	5.95	6.57	7.18	7.79	8.40	8.76
10.0	2.23	2.89	3.56	4.23	4.90	5.56	6.22	6.88	7.52	8.16	8.78	9.40	9.76
11.0	2.78	3.52	4.26	5.00	5.72	6.43	7.13	7.81	8.48	9.13	9.77	10.39	10.76
12.0	3.38	4.19	5.00	5.79	6.56	7.32	8.05	8.76	9.45	10.11	10.76	11.39	11.76
13.0	4.00	4.89	5.76	6.61	7.42	8.21	8.98	9.71	10.42	11.10	11.76	12.39	12.76
14.0	4.65	5.62	6.55	7.44	8.30	9.12	9.91	10.67	11.39	12.08	12.75	13.39	13.76
15.0	5.33	6.36	7.35	8.29	9.19	10.04	10.85	11.63	12.37	13.07	13.74	14.39	14.76

<sup>1/</sup> Interpolate the values shown to obtain runoff depths for CN's or rainfall amounts not shown.

**Figure 2-2** Flow chart for selecting the appropriate figure or table for determining runoff curve numbers.



**Table 2-2a** Runoff curve numbers for urban areas <sup>1/</sup>

Cover description	Average percent impervious area <sup>2/</sup>	Curve numbers for hydrologic soil group			
		A	B	C	D
<b>Fully developed urban areas (vegetation established)</b>					
Open space (lawns, parks, golf courses, cemeteries, etc.) <sup>3/</sup> :					
Poor condition (grass cover < 50%) .....		68	79	86	89
Fair condition (grass cover 50% to 75%) .....		49	69	79	84
Good condition (grass cover > 75%) .....		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way) .....					
		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way) .....					
		98	98	98	98
Paved; open ditches (including right-of-way) .....					
		83	89	92	93
Gravel (including right-of-way) .....					
		76	85	89	91
Dirt (including right-of-way) .....					
		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) <sup>4/</sup> .....					
		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders) .....					
		96	96	96	96
Urban districts:					
Commercial and business .....	85	89	92	94	95
Industrial .....	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses) .....	65	77	85	90	92
1/4 acre .....	38	61	75	83	87
1/3 acre .....	30	57	72	81	86
1/2 acre .....	25	54	70	80	85
1 acre .....	20	51	68	79	84
2 acres .....	12	46	65	77	82

**Developing urban areas**

Newly graded areas  
(pervious areas only, no vegetation) <sup>5/</sup> .....

		77	86	91	94
--	--	----	----	----	----

Idle lands (CN's are determined using cover types  
similar to those in table 2-2c).

<sup>1</sup> Average runoff condition, and  $I_a = 0.2S$ .

<sup>2</sup> The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

<sup>3</sup> CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

<sup>4</sup> Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

<sup>5</sup> Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

**Table 2-2b** Runoff curve numbers for cultivated agricultural lands <sup>1/</sup>

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment <sup>2/</sup>	Hydrologic condition <sup>3/</sup>	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
C&T+ CR	Poor	65	73	79	81	
	Good	61	70	77	80	
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

<sup>1</sup> Average runoff condition, and  $I_a=0.2S$

<sup>2</sup> Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

<sup>3</sup> Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good  $\geq 20\%$ ), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

**Table 2-2c** Runoff curve numbers for other agricultural lands <sup>1/</sup>

Cover description	Hydrologic condition	Curve numbers for hydrologic soil group			
		A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. <sup>2/</sup>	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. <sup>3/</sup>	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 <sup>4/</sup>	48	65	73
Woods—grass combination (orchard or tree farm). <sup>5/</sup>	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. <sup>6/</sup>	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 <sup>4/</sup>	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

<sup>1</sup> Average runoff condition, and  $I_a = 0.2S$ .

<sup>2</sup> **Poor:** <50% ground cover or heavily grazed with no mulch.

**Fair:** 50 to 75% ground cover and not heavily grazed.

**Good:** > 75% ground cover and lightly or only occasionally grazed.

<sup>3</sup> **Poor:** <50% ground cover.

**Fair:** 50 to 75% ground cover.

**Good:** >75% ground cover.

<sup>4</sup> Actual curve number is less than 30; use CN = 30 for runoff computations.

<sup>5</sup> CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

<sup>6</sup> **Poor:** Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.

**Fair:** Woods are grazed but not burned, and some forest litter covers the soil.

**Good:** Woods are protected from grazing, and litter and brush adequately cover the soil.

**Table 2-2d** Runoff curve numbers for arid and semiarid rangelands <sup>1/</sup>

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition <sup>2/</sup>	A <sup>3/</sup>	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

<sup>1</sup> Average runoff condition, and  $I_a$ , = 0.2S. For range in humid regions, use table 2-2c.

<sup>2</sup> Poor: <30% ground cover (litter, grass, and brush overstory).

Fair: 30 to 70% ground cover.

Good: > 70% ground cover.

<sup>3</sup> Curve numbers for group A have been developed only for desert shrub.

### Antecedent runoff condition

The index of runoff potential before a storm event is the antecedent runoff condition (ARC). ARC is an attempt to account for the variation in CN at a site from storm to storm. CN for the average ARC at a site is the median value as taken from sample rainfall and runoff data. The CN's in table 2-2 are for the average ARC, which is used primarily for design applications. See NEH-4 (SCS 1985) and Rallison and Miller (1981) for more detailed discussion of storm-to-storm variation and a demonstration of upper and lower enveloping curves.

### Urban impervious area modifications

Several factors, such as the percentage of impervious area and the means of conveying runoff from impervious areas to the drainage system, should be considered in computing CN for urban areas (Rawls et al., 1981). For example, do the impervious areas connect directly to the drainage system, or do they outlet onto lawns or other pervious areas where infiltration can occur?

**Connected impervious areas** — An impervious area is considered connected if runoff from it flows directly into the drainage system. It is also considered connected if runoff from it occurs as concentrated shallow flow that runs over a pervious area and then into the drainage system.

Urban CN's (table 2-2a) were developed for typical land use relationships based on specific assumed percentages of impervious area. These CN values were developed on the assumptions that (a) pervious urban areas are equivalent to pasture in good hydrologic condition and (b) impervious areas have a CN of 98 and are directly connected to the drainage system. Some assumed percentages of impervious area are shown in table 2-2a

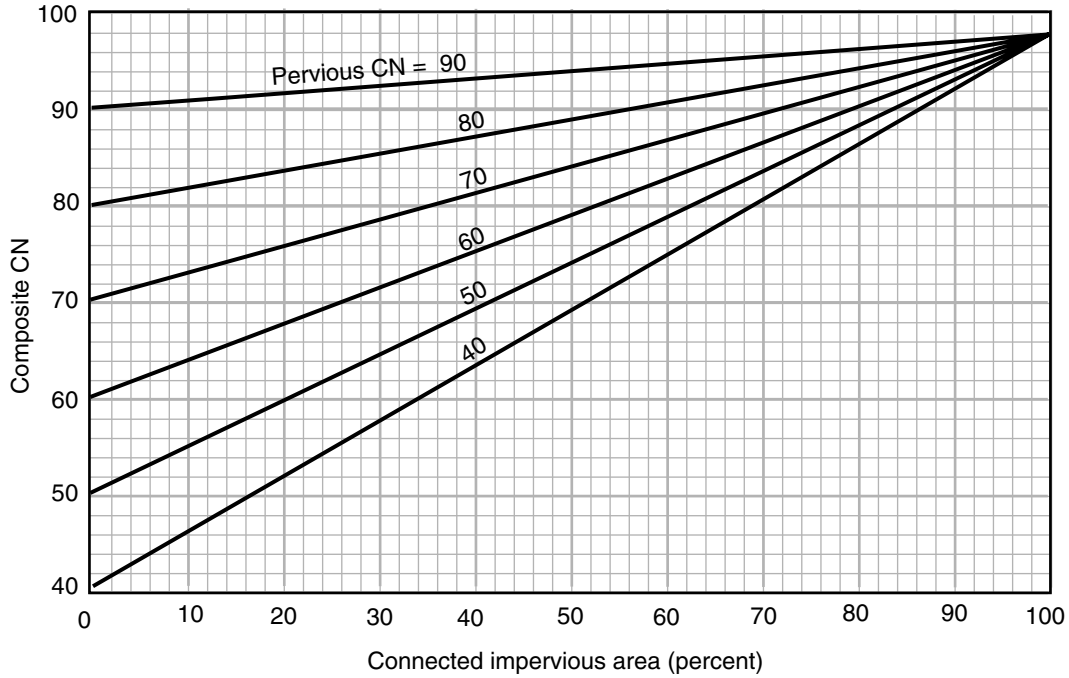
If all of the impervious area is directly connected to the drainage system, but the impervious area percentages or the pervious land use assumptions in table 2-2a are not applicable, use figure 2-3 to compute a composite CN. For example, table 2-2a gives a CN of 70 for a 1/2-acre lot in HSG B, with assumed impervious area

of 25 percent. However, if the lot has 20 percent impervious area and a pervious area CN of 61, the composite CN obtained from figure 2-3 is 68. The CN difference between 70 and 68 reflects the difference in percent impervious area.

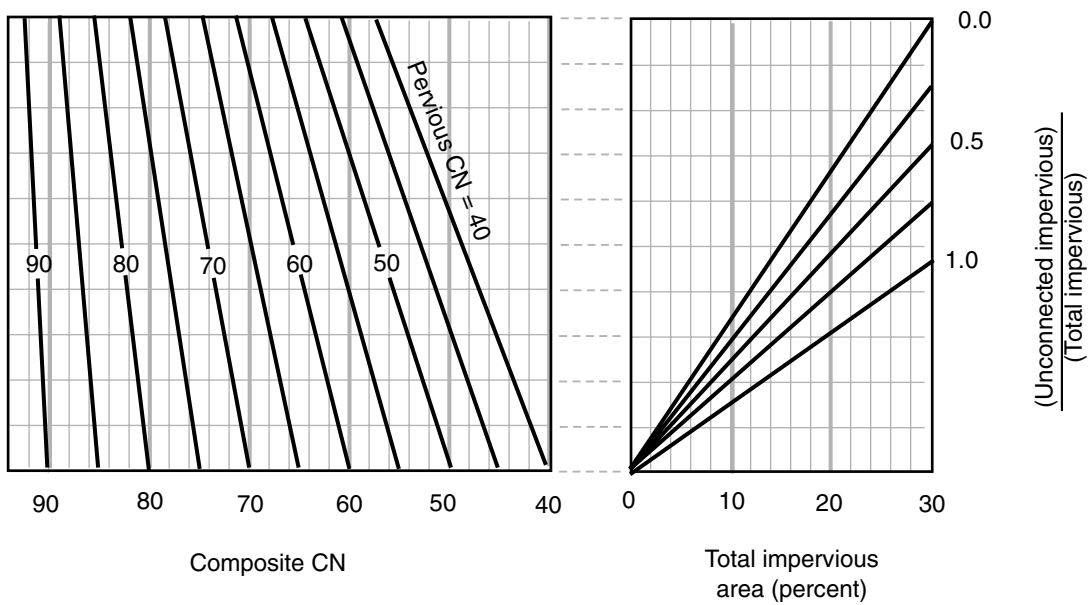
**Unconnected impervious areas** — Runoff from these areas is spread over a pervious area as sheet flow. To determine CN when all or part of the impervious area is not directly connected to the drainage system, (1) use figure 2-4 if total impervious area is less than 30 percent or (2) use figure 2-3 if the total impervious area is equal to or greater than 30 percent, because the absorptive capacity of the remaining pervious areas will not significantly affect runoff.

When impervious area is less than 30 percent, obtain the composite CN by entering the right half of figure 2-4 with the percentage of total impervious area and the ratio of total unconnected impervious area to total impervious area. Then move left to the appropriate pervious CN and read down to find the composite CN. For example, for a 1/2-acre lot with 20 percent total impervious area (75 percent of which is unconnected) and pervious CN of 61, the composite CN from figure 2-4 is 66. If all of the impervious area is connected, the resulting CN (from figure 2-3) would be 68.

**Figure 2-3** Composite CN with connected impervious area.



**Figure 2-4** Composite CN with unconnected impervious areas and total impervious area less than 30%.



## Runoff

When CN and the amount of rainfall have been determined for the watershed, determine runoff by using figure 2-1, table 2-1, or equations 2-3 and 2-4. The runoff is usually rounded to the nearest hundredth of an inch.

## Limitations

- Curve numbers describe average conditions that are useful for design purposes. If the rainfall event used is a historical storm, the modeling accuracy decreases.
- Use the runoff curve number equation with caution when re-creating specific features of an actual storm. The equation does not contain an expression for time and, therefore, does not account for rainfall duration or intensity.
- The user should understand the assumption reflected in the initial abstraction term ( $I_a$ ) and should ascertain that the assumption applies to the situation.  $I_a$ , which consists of interception, initial infiltration, surface depression storage, evapotranspiration, and other factors, was generalized as  $0.2S$  based on data from agricultural watersheds ( $S$  is the potential maximum retention after runoff begins). This approximation can be especially important in an urban application because the combination of impervious areas with pervious areas can imply a significant initial loss that may not take place. The opposite effect, a greater initial loss, can occur if the impervious areas have surface depressions that store some runoff. To use a relationship other than  $I_a = 0.2S$ , one must redevelop equation 2-3, figure 2-1, table 2-1, and table 2-2 by using the original rainfall-runoff data to establish new  $S$  or CN relationships for each cover and hydrologic soil group.
- Runoff from snowmelt or rain on frozen ground cannot be estimated using these procedures.
- The CN procedure is less accurate when runoff is less than 0.5 inch. As a check, use another procedure to determine runoff.
- The SCS runoff procedures apply only to direct surface runoff: do not overlook large sources of subsurface flow or high ground water levels that contribute to runoff. These conditions are often related to HSG A soils and forest areas that have been assigned relatively low CN's in table 2-2. Good judgment and experience based on stream gage records are needed to adjust CN's as conditions warrant.
- When the weighted CN is less than 40, use another procedure to determine runoff.

## Examples

Four examples illustrate the procedure for computing runoff curve number (CN) and runoff (Q) in inches. Worksheet 2 in appendix D is provided to assist TR-55 users. Figures 2-5 to 2-8 represent the use of worksheet 2 for each example. All four examples are based on the same watershed and the same storm event.

The watershed covers 250 acres in Dyer County, northwestern Tennessee. Seventy percent (175 acres) is a Loring soil, which is in hydrologic soil group C. Thirty percent (75 acres) is a Memphis soil, which is in group B. The event is a 25-year frequency, 24-hour storm with total rainfall of 6 inches.

Cover type and conditions in the watershed are different for each example. The examples, therefore, illustrate how to compute CN and Q for various situations of proposed, planned, or present development.

### Example 2-1

The present cover type is pasture in good hydrologic condition. (See figure 2-5 for worksheet 2 information.)

### Example 2-2

Seventy percent (175 acres) of the watershed, consisting of all the Memphis soil and 100 acres of the Loring soil, is 1/2-acre residential lots with lawns in good hydrologic condition. The rest of the watershed is scattered open space in good hydrologic condition. (See figure 2-6.)

**Example 2-3**

This example is the same as example 2-2, except that the 1/2-acre lots have a total impervious area of 35 percent. For these lots, the pervious area is lawns in good hydrologic condition. Since the impervious area percentage differs from the percentage assumed in table 2-2, use figure 2-3 to compute CN.

(See figure 2-7.)

**Example 2-4**

This example is also based on example 2-2, except that 50 percent of the impervious area associated with the 1/2-acre lots on the Loring soil is “unconnected,” that is, it is not directly connected to the drainage system. For these lots, the pervious area CN (lawn, good condition) is 74 and the impervious area is 25 percent. Use figure 2-4 to compute the CN for these lots. CN's for the 1/2-acre lots on Memphis soil and the open space on Loring soil are the same as those in example 2-2. (See figure 2-8.)

**Figure 2-5** Worksheet 2 for example 2-1

### Worksheet 2: Runoff curve number and runoff

Project Heavenly Acres		By WJR		Date 10/1/85		
Location Dyer County, Tennessee		Checked NM		Date 10/3/85		
Check one: <input checked="" type="checkbox"/> Present <input type="checkbox"/> Developed						
<b>1. Runoff curve number</b>						
Soil name and hydrologic group <small>(appendix A)</small>	Cover description <small>(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)</small>	CN <sup>1/</sup>			Area <input type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input checked="" type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
Memphis, B	Pasture, good condition	61			30	1830
Loring, C	Pasture, good condition	74			70	5180
<small><sup>1/</sup> Use only one CN source per line</small>					<b>Totals</b> ➡	100   7010
$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{7010}{100} = 70.1$ ; Use CN ➡ <span style="border: 1px solid black; padding: 2px 10px;">70</span>						
<b>2. Runoff</b>						
Frequency ..... yr Rainfall, P (24-hour) ..... in Runoff, Q ..... in <small>(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)</small>		Storm #1	Storm #2	Storm #3		
		25				
		6.0				
		2.81				

**Figure 2-6** Worksheet 2 for example 2-2

**Worksheet 2: Runoff curve number and runoff**

Project Heavenly Acres	By WJR	Date 10/1/85				
Location Dyer County, Tennessee	Checked NM	Date 10/3/85				
Check one: <input type="checkbox"/> Present <input checked="" type="checkbox"/> Developed						
175 Acres residential						
1. Runoff curve number						
Soil name and hydrologic group <small>(appendix A)</small>	Cover description <small>(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)</small>	CN <sup>1/</sup>			Area <input checked="" type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
Memphis, B	25% impervious 1/2 acre lots, good condition	70			75	5250
Loring, C	25% impervious 1/2 acre lots, good condition	80			100	8000
Loring, C	Open space, good condition	74			75	5550
<sup>1/</sup> Use only one CN source per line					<b>Totals</b> ➡	250   18,800
CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{18,800}{250} = 75.2$ ; Use CN ➡ <span style="border: 1px solid black; padding: 2px 10px;">75</span>						
2. Runoff						
	Storm #1	Storm #2	Storm #3			
Frequency ..... yr	25					
Rainfall, P (24-hour) ..... in	6.0					
Runoff, Q ..... in	3.28					
(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)						

**Figure 2-7** Worksheet 2 for example 2-3

### Worksheet 2: Runoff curve number and runoff

Project Heavenly Acres		By WJR		Date 10/1/85		
Location Dyer County, Tennessee		Checked NM		Date 10/3/85		
Check one: <input type="checkbox"/> Present <input checked="" type="checkbox"/> Developed						
1. Runoff curve number						
Soil name and hydrologic group (appendix A)	Cover description  (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN <sup>1/</sup>			Area  <input checked="" type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
Memphis, B	35% impervious 1/2 acre lots, good condition		74		75	5550
Loring, C	35% impervious 1/2 acre lots, good condition		82		100	8200
Loring, C	Open space, good condition	74			75	5550
<sup>1/</sup> Use only one CN source per line					<b>Totals</b> ➡	250    19,300
$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{19,300}{250} = 77.2$ ; Use CN ➡ <span style="border: 1px solid black; padding: 2px 10px;">77</span>						
2. Runoff						
		Storm #1	Storm #2	Storm #3		
Frequency .....	yr	25				
Rainfall, P (24-hour) .....	in	6.0				
Runoff, Q .....	in	3.48				
(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)						

**Figure 2-8** Worksheet 2 for example 2-4

### Worksheet 2: Runoff curve number and runoff

Project Heavenly Acres		By WJR		Date 10/1/85		
Location Dyer County, Tennessee		Checked NM		Date 10/3/85		
Check one: <input type="checkbox"/> Present <input checked="" type="checkbox"/> Developed						
<b>1. Runoff curve number</b>						
Soil name and hydrologic group <small>(appendix A)</small>	Cover description  <small>(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)</small>	CN <sup>1/</sup>			Area <input checked="" type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
Memphis, B	25% connected impervious 1/2 acre lots, good condition	70			75	5250
Loring, C	25% impervious with 50% unconnected 1/2 acre lots, good condition			78	100	7800
Loring, C	Open space, good condition	74			75	5550
<b>Totals</b> ➡					250	18,600
<b>2. Runoff</b>						
	Storm #1	Storm #2	Storm #3			
Frequency ..... yr	25					
Rainfall, P (24-hour) ..... in	6.0					
Runoff, Q ..... in	3.19					

Travel time ( $T_t$ ) is the time it takes water to travel from one location to another in a watershed.  $T_t$  is a component of time of concentration ( $T_c$ ), which is the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed.  $T_c$  is computed by summing all the travel times for consecutive components of the drainage conveyance system.

$T_c$  influences the shape and peak of the runoff hydrograph. Urbanization usually decreases  $T_c$ , thereby increasing the peak discharge. But  $T_c$  can be increased as a result of (a) ponding behind small or inadequate drainage systems, including storm drain inlets and road culverts, or (b) reduction of land slope through grading.

### Factors affecting time of concentration and travel time

#### Surface roughness

One of the most significant effects of urban development on flow velocity is less retardance to flow. That is, undeveloped areas with very slow and shallow overland flow through vegetation become modified by urban development: the flow is then delivered to streets, gutters, and storm sewers that transport runoff downstream more rapidly. Travel time through the watershed is generally decreased.

#### Channel shape and flow patterns

In small non-urban watersheds, much of the travel time results from overland flow in upstream areas. Typically, urbanization reduces overland flow lengths by conveying storm runoff into a channel as soon as possible. Since channel designs have efficient hydraulic characteristics, runoff flow velocity increases and travel time decreases.

#### Slope

Slopes may be increased or decreased by urbanization, depending on the extent of site grading or the extent to which storm sewers and street ditches are used in the design of the water management system. Slope will tend to increase when channels are straightened and decrease when overland flow is directed through storm sewers, street gutters, and diversions.

### Computation of travel time and time of concentration

Water moves through a watershed as sheet flow, shallow concentrated flow, open channel flow, or some combination of these. The type that occurs is a function of the conveyance system and is best determined by field inspection.

Travel time ( $T_t$ ) is the ratio of flow length to flow velocity:

$$T_t = \frac{L}{3600V} \quad [\text{eq. 3-1}]$$

where:

$T_t$  = travel time (hr)

$L$  = flow length (ft)

$V$  = average velocity (ft/s)

3600 = conversion factor from seconds to hours.

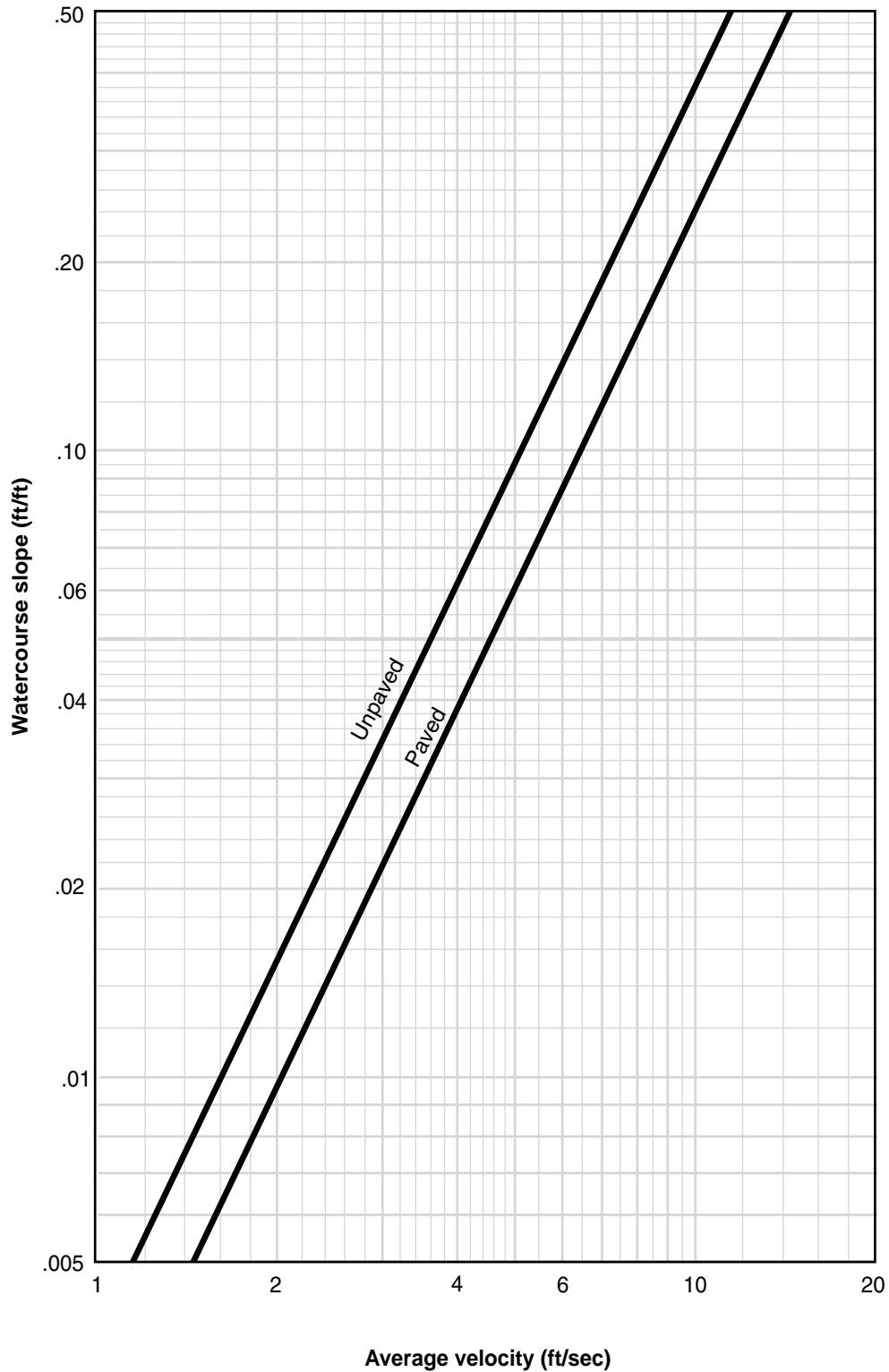
Time of concentration ( $T_c$ ) is the sum of  $T_t$  values for the various consecutive flow segments:

$$T_c = T_{t_1} + T_{t_2} + \dots + T_{t_m} \quad [\text{eq. 3-2}]$$

where:

$T_c$  = time of concentration (hr)

$m$  = number of flow segments

**Figure 3-1** Average velocities for estimating travel time for shallow concentrated flow

## Sheet flow

Sheet flow is flow over plane surfaces. It usually occurs in the headwater of streams. With sheet flow, the friction value (Manning's  $n$ ) is an effective roughness coefficient that includes the effect of raindrop impact; drag over the plane surface; obstacles such as litter, crop ridges, and rocks; and erosion and transportation of sediment. These  $n$  values are for very shallow flow depths of about 0.1 foot or so. Table 3-1 gives Manning's  $n$  values for sheet flow for various surface conditions.

**Table 3-1** Roughness coefficients (Manning's  $n$ ) for sheet flow

Surface description	$n$ <sup>1/</sup>
Smooth surfaces (concrete, asphalt, gravel, or bare soil) .....	0.011
Fallow (no residue) .....	0.05
Cultivated soils:	
Residue cover ≤20% .....	0.06
Residue cover >20% .....	0.17
Grass:	
Short grass prairie .....	0.15
Dense grasses <sup>2/</sup> .....	0.24
Bermudagrass .....	0.41
Range (natural) .....	0.13
Woods: <sup>3/</sup>	
Light underbrush .....	0.40
Dense underbrush .....	0.80

<sup>1</sup> The  $n$  values are a composite of information compiled by Engman (1986).

<sup>2</sup> Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

<sup>3</sup> When selecting  $n$ , consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overtop and Meadows 1976) to compute  $T_t$ :

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}} \quad [\text{eq. 3-3}]$$

where:

- $T_t$  = travel time (hr),
- $n$  = Manning's roughness coefficient (table 3-1)
- $L$  = flow length (ft)
- $P_2$  = 2-year, 24-hour rainfall (in)
- $s$  = slope of hydraulic grade line (land slope, ft/ft)

This simplified form of the Manning's kinematic solution is based on the following: (1) shallow steady uniform flow, (2) constant intensity of rainfall excess (that part of a rain available for runoff), (3) rainfall duration of 24 hours, and (4) minor effect of infiltration on travel time. Rainfall depth can be obtained from appendix B.

## Shallow concentrated flow

After a maximum of 300 feet, sheet flow usually becomes shallow concentrated flow. The average velocity for this flow can be determined from figure 3-1, in which average velocity is a function of watercourse slope and type of channel. For slopes less than 0.005 ft/ft, use equations given in appendix F for figure 3-1. Tillage can affect the direction of shallow concentrated flow. Flow may not always be directly down the watershed slope if tillage runs across the slope.

After determining average velocity in figure 3-1, use equation 3-1 to estimate travel time for the shallow concentrated flow segment.

## Open channels

Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on United States Geological Survey (USGS) quadrangle sheets. Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for bank-full elevation.

Manning's equation is:

$$V = \frac{1.49r^{\frac{2}{3}}s^{\frac{1}{2}}}{n} \quad [\text{eq. 3-4}]$$

where:

- V = average velocity (ft/s)
- r = hydraulic radius (ft) and is equal to  $a/p_w$
- a = cross sectional flow area (ft<sup>2</sup>)
- $p_w$  = wetted perimeter (ft)
- s = slope of the hydraulic grade line (channel slope, ft/ft)
- n = Manning's roughness coefficient for open channel flow.

Manning's n values for open channel flow can be obtained from standard textbooks such as Chow (1959) or Linsley et al. (1982). After average velocity is computed using equation 3-4,  $T_t$  for the channel segment can be estimated using equation 3-1.

### Reservoirs or lakes

Sometimes it is necessary to estimate the velocity of flow through a reservoir or lake at the outlet of a watershed. This travel time is normally very small and can be assumed as zero.

### Limitations

- Manning's kinematic solution should not be used for sheet flow longer than 300 feet. Equation 3-3 was developed for use with the four standard rainfall intensity-duration relationships.
- In watersheds with storm sewers, carefully identify the appropriate hydraulic flow path to estimate  $T_c$ . Storm sewers generally handle only a small portion of a large event. The rest of the peak flow travels by streets, lawns, and so on, to the outlet. Consult a standard hydraulics textbook to determine average velocity in pipes for either pressure or nonpressure flow.
- The minimum  $T_c$  used in TR-55 is 0.1 hour.

- A culvert or bridge can act as a reservoir outlet if there is significant storage behind it. The procedures in TR-55 can be used to determine the peak flow upstream of the culvert. Detailed storage routing procedures should be used to determine the outflow through the culvert.

### Example 3-1

The sketch below shows a watershed in Dyer County, northwestern Tennessee. The problem is to compute  $T_c$  at the outlet of the watershed (point D). The 2-year 24-hour rainfall depth is 3.6 inches. All three types of flow occur from the hydraulically most distant point (A) to the point of interest (D). To compute  $T_c$ , first determine  $T_t$  for each segment from the following information:

Segment AB: Sheet flow; dense grass; slope ( $s$ ) = 0.01 ft/ft; and length ( $L$ ) = 100 ft. Segment BC: Shallow concentrated flow; unpaved;  $s$  = 0.01 ft/ft; and  $L$  = 1,400 ft. Segment CD: Channel flow; Manning's  $n$  = .05; flow area ( $a$ ) = 27 ft<sup>2</sup>; wetted perimeter ( $p_w$ ) = 28.2 ft;  $s$  = 0.005 ft/ft; and  $L$  = 7,300 ft.

See figure 3-2 for the computations made on worksheet 3.

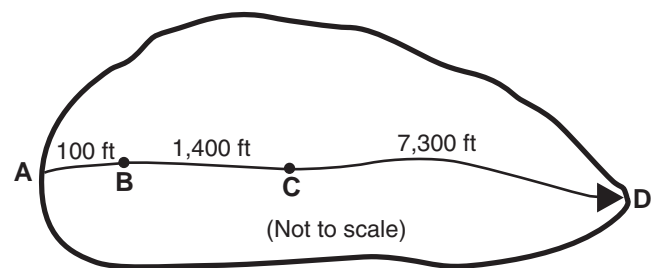


Figure 3-2 Worksheet 3 for example 3-1

### Worksheet 3: Time of Concentration (T<sub>C</sub>) or travel time (T<sub>t</sub>)

Project <i>Heavenly Acres</i>	By <i>DW</i>	Date <i>10/6/85</i>
Location <i>Dyer County, Tennessee</i>	Checked <i>NM</i>	Date <i>10/8/85</i>

Check one:  Present  Developed  
 Check one:  T<sub>C</sub>  T<sub>t</sub> through subarea  
 Notes: Space for as many as two segments per flow type can be used for each worksheet. Include a map, schematic, or description of flow segments.

**Sheet flow (Applicable to T<sub>C</sub> only)**

	Segment ID	<i>AB</i>			
1. Surface description (table 3-1) .....		<i>Dense Grass</i>			
2. Manning's roughness coefficient, n (table 3-1) .....		<i>0.24</i>			
3. Flow length, L (total L ≤ 300 ft) ..... ft		<i>100</i>			
4. Two-year 24-hour rainfall, P <sub>2</sub> ..... in		<i>3.6</i>			
5. Land slope, s ..... ft/ft		<i>0.01</i>			
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T <sub>t</sub> ..... hr		<i>0.30</i>	+		= <span style="border: 1px solid black; padding: 2px;"><i>0.30</i></span>

**Shallow concentrated flow**

	Segment ID	<i>BC</i>			
7. Surface description (paved or unpaved) .....		<i>Unpaved</i>			
8. Flow length, L .....ft		<i>1400</i>			
9. Watercourse slope, s ..... ft/ft		<i>0.01</i>			
10. Average velocity, V (figure 3-1) ..... ft/s		<i>1.6</i>			
11. $T_t = \frac{L}{3600 V}$ Compute T <sub>t</sub> ..... hr		<i>0.24</i>	+		= <span style="border: 1px solid black; padding: 2px;"><i>0.24</i></span>

**Channel flow**

	Segment ID	<i>CD</i>			
12. Cross sectional flow area, a ..... ft <sup>2</sup>		<i>27</i>			
13. Wetted perimeter, p <sub>w</sub> ..... ft		<i>28.2</i>			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ..... ft		<i>0.957</i>			
15. Channel slope, s ..... ft/ft		<i>0.005</i>			
16. Manning's roughness coefficient, n .....		<i>0.05</i>			
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V .....ft/s		<i>2.05</i>			
18. Flow length, L ..... ft		<i>7300</i>			
19. $T_t = \frac{L}{3600 V}$ Compute T <sub>t</sub> ..... hr		<i>0.99</i>	+		= <span style="border: 1px solid black; padding: 2px;"><i>0.99</i></span>
20. Watershed or subarea T <sub>C</sub> or T <sub>t</sub> (add T <sub>t</sub> in steps 6, 11, and 19) ..... Hr					= <span style="border: 1px solid black; padding: 2px;"><i>1.53</i></span>



This chapter presents the Graphical Peak Discharge method for computing peak discharge from rural and urban areas. The Graphical method was developed from hydrograph analyses using TR-20, "Computer Program for Project Formulation—Hydrology" (SCS 1983). The peak discharge equation used is:

$$q_p = q_u A_m Q F_p \quad [\text{eq. 4-1}]$$

where:

- $q_p$  = peak discharge (cfs)
- $q_u$  = unit peak discharge (csm/in)
- $A_m$  = drainage area (mi<sup>2</sup>)
- $Q$  = runoff (in)
- $F_p$  = pond and swamp adjustment factor

The input requirements for the Graphical method are as follows: (1)  $T_c$  (hr), (2) drainage area (mi<sup>2</sup>), (3) appropriate rainfall distribution (I, IA, II, or III), (4) 24-hour rainfall (in), and (5) CN. If pond and swamp areas are spread throughout the watershed and are not considered in the  $T_c$  computation, an adjustment for pond and swamp areas is also needed.

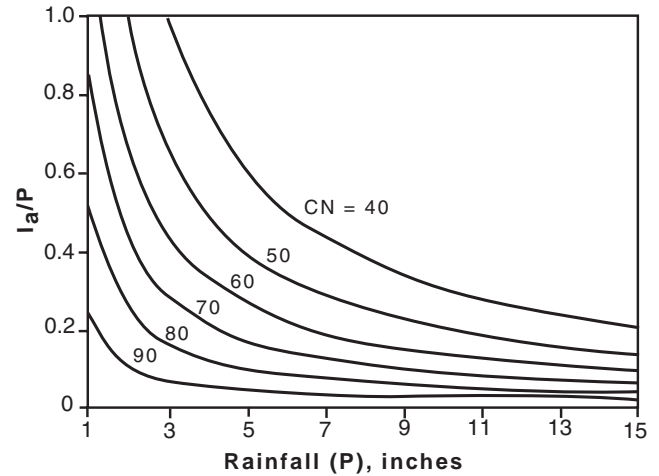
## Peak discharge computation

For a selected rainfall frequency, the 24-hour rainfall (P) is obtained from appendix B or more detailed local precipitation maps. CN and total runoff (Q) for the watershed are computed according to the methods outlined in chapter 2. The CN is used to determine the initial abstraction ( $I_a$ ) from table 4-1.  $I_a / P$  is then computed.

If the computed  $I_a / P$  ratio is outside the range in exhibit 4 (4-I, 4-IA, 4-II, and 4-III) for the rainfall distribution of interest, then the limiting value should be used. If the ratio falls between the limiting values, use linear interpolation. Figure 4-1 illustrates the sensitivity of  $I_a / P$  to CN and P.

Peak discharge per square mile per inch of runoff ( $q_u$ ) is obtained from exhibit 4-I, 4-IA, 4-II, or 4-III by using  $T_c$  (chapter 3), rainfall distribution type, and  $I_a / P$  ratio. The pond and swamp adjustment factor is obtained from table 4-2 (rounded to the nearest table value). Use worksheet 4 in appendix D to aid in computing the peak discharge using the Graphical method.

**Figure 4-1** Variation of  $I_a / P$  for P and CN



**Table 4-1**  $I_a$  values for runoff curve numbers

Curve number	$I_a$ (in)	Curve number	$I_a$ (in)
40	3.000	70	0.857
41	2.878	71	0.817
42	2.762	72	0.778
43	2.651	73	0.740
44	2.545	74	0.703
45	2.444	75	0.667
46	2.348	76	0.632
47	2.255	77	0.597
48	2.167	78	0.564
49	2.082	79	0.532
50	2.000	80	0.500
51	1.922	81	0.469
52	1.846	82	0.439
53	1.774	83	0.410
54	1.704	84	0.381
55	1.636	85	0.353
56	1.571	86	0.326
57	1.509	87	0.299
58	1.448	88	0.273
59	1.390	89	0.247
60	1.333	90	0.222
61	1.279	91	0.198
62	1.226	92	0.174
63	1.175	93	0.151
64	1.125	94	0.128
65	1.077	95	0.105
66	1.030	96	0.083
67	0.985	97	0.062
68	0.941	98	0.041
69	0.899		

**Table 4-2** Adjustment factor ( $F_p$ ) for pond and swamp areas that are spread throughout the watershed

Percentage of pond and swamp areas	$F_p$
0 .....	1.00
0.2 .....	0.97
1.0 .....	0.87
3.0 .....	0.75
5.0 .....	0.72

## Limitations

The Graphical method provides a determination of peak discharge only. If a hydrograph is needed or watershed subdivision is required, use the Tabular Hydrograph method (chapter 5). Use TR-20 if the watershed is very complex or a higher degree of accuracy is required.

- The watershed must be hydrologically homogeneous, that is, describable by one CN. Land use, soils, and cover are distributed uniformly throughout the watershed.
- The watershed may have only one main stream or, if more than one, the branches must have nearly equal  $T_C$ 's.
- The method cannot perform valley or reservoir routing.
- The  $F_p$  factor can be applied only for ponds or swamps that are not in the  $T_C$  flow path.
- Accuracy of peak discharge estimated by this method will be reduced if  $I_a/P$  values are used that are outside the range given in exhibit 4. The limiting  $I_a/P$  values are recommended for use.
- This method should be used only if the weighted CN is greater than 40.

- When this method is used to develop estimates of peak discharge for both present and developed conditions of a watershed, use the same procedure for estimating  $T_C$ .

- $T_C$  values with this method may range from 0.1 to 10 hours.

## Example 4-1

Compute the 25-year peak discharge for the 250-acre watershed described in examples 2-2 and 3-1. Figure 4-2 shows how worksheet 4 is used to compute  $q_p$  as 345 cfs.

**Example 4-1** Worksheet 4 for example 4-1

**Worksheet 4: Graphical Peak Discharge method**

Project <i>Heavenly Acres</i>	By <i>RHM</i>	Date <i>10/15/85</i>
Location <i>Dyer County, Tennessee</i>	Checked <i>NM</i>	Date <i>10/17/85</i>

Check one:  Present  Developed

1. Data

Drainage area .....  $A_m = \underline{0.39}$  mi<sup>2</sup> (acres/640) \_\_\_\_\_

Runoff curve number ..... CN = 75 (From worksheet 2), *Figure 2-6*

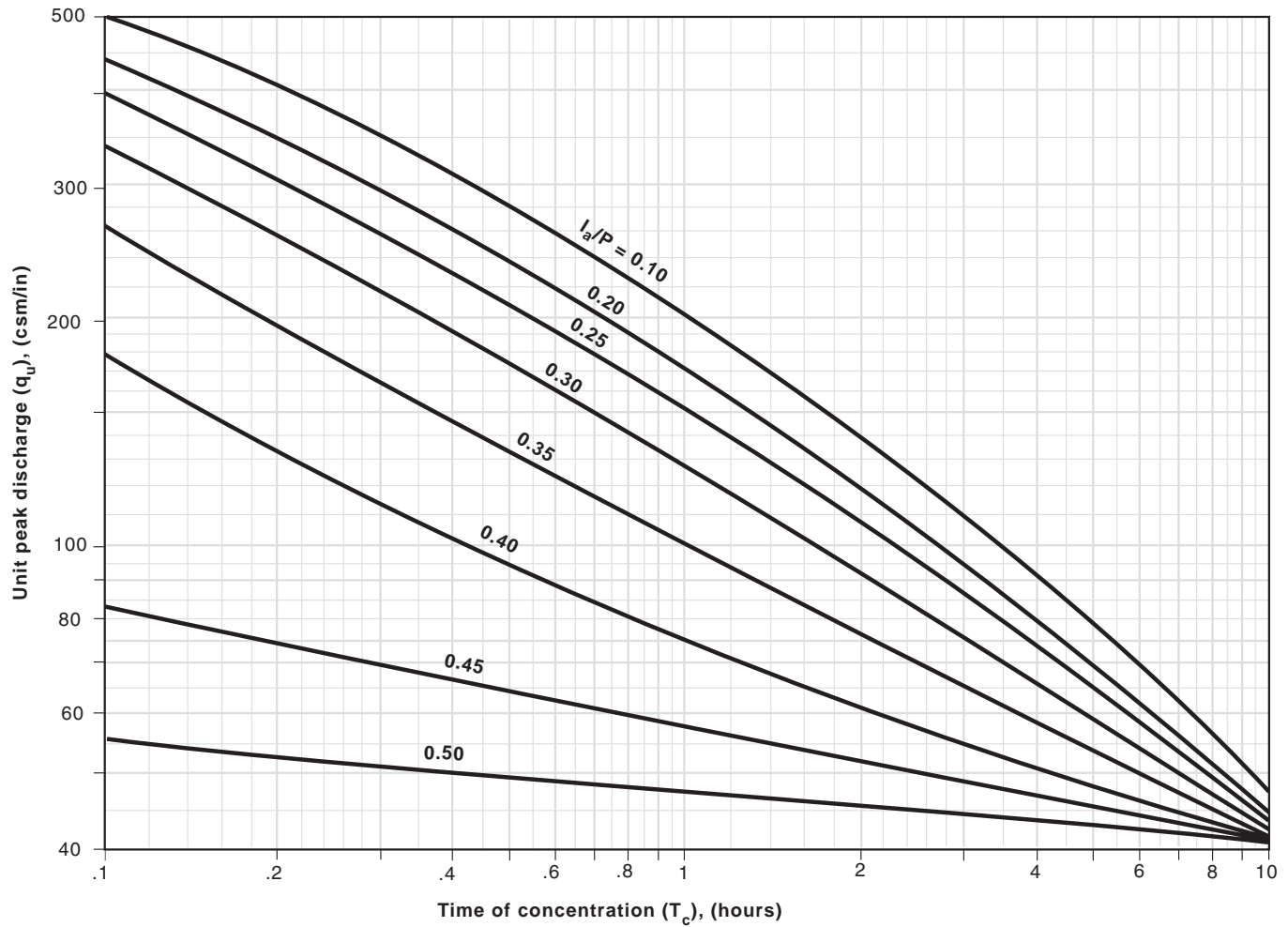
Time of concentration .....  $T_c = \underline{1.53}$  hr (From worksheet 3), *Figure 3-2*

Rainfall distribution ..... = II (I, IA, II III) \_\_\_\_\_

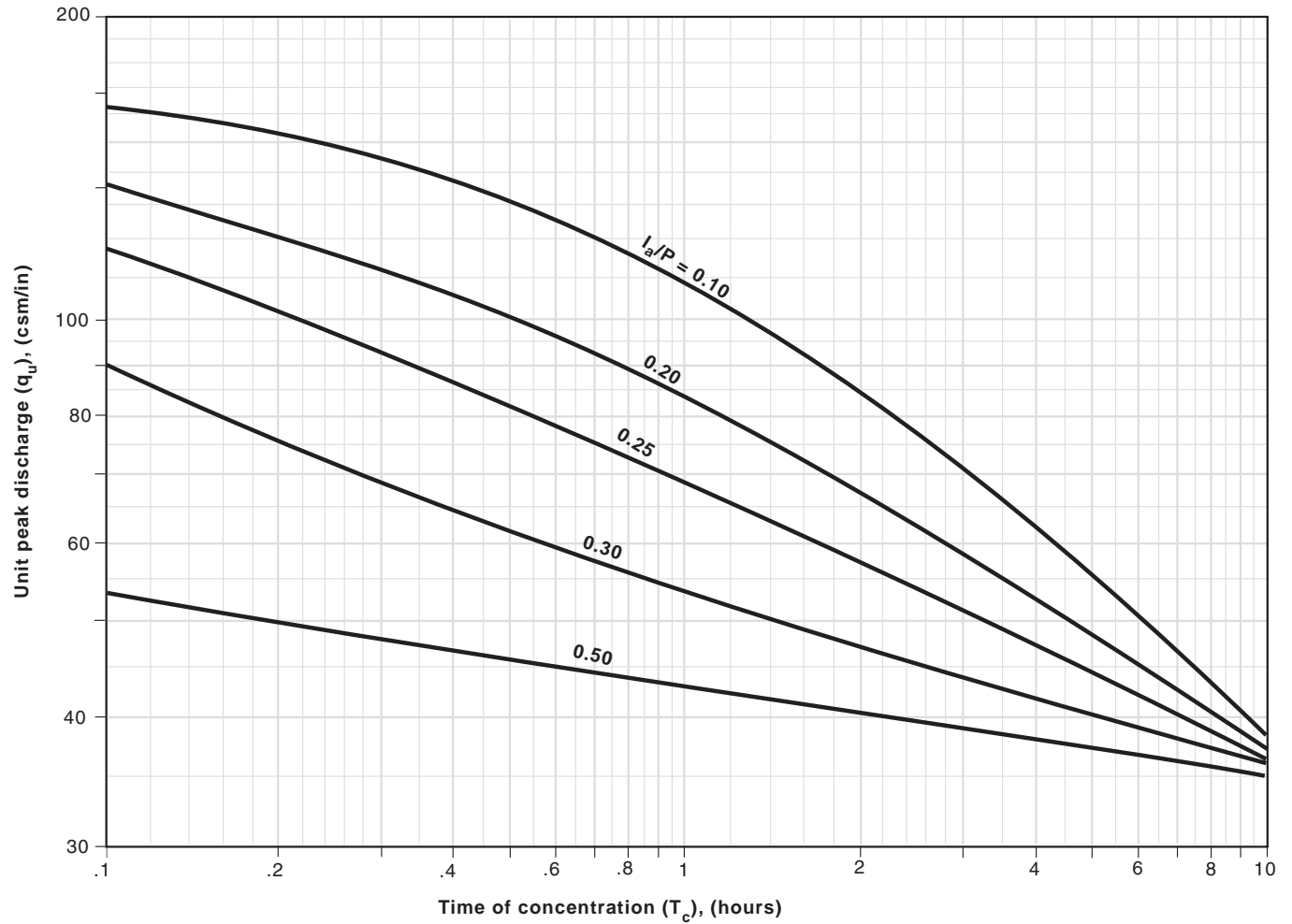
Pond and swamp areas spread throughout watershed ..... = -- percent of  $A_m$  ( -- acres or mi<sup>2</sup> covered)

	Storm #1	Storm #2	Storm #3
2. Frequency ..... yr	25		
3. Rainfall, P (24-hour) ..... in	6.0		
4. Initial abstraction, $I_a$ ..... in (Use CN with table 4-1)	0.667		
5. Compute $I_a/P$ .....	0.11		
6. Unit peak discharge, $q_u$ ..... csm/in (Use $T_c$ and $I_a/P$ with exhibit 4- <u>II</u> )	270		
7. Runoff, Q ..... in (From worksheet 2). <i>Figure 2-6</i>	3.28		
8. Pond and swamp adjustment factor, $F_p$ ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)	1.0		
9. Peak discharge, $q_p$ ..... cfs  ( Where $q_p = q_u A_m Q F_p$ )	345		

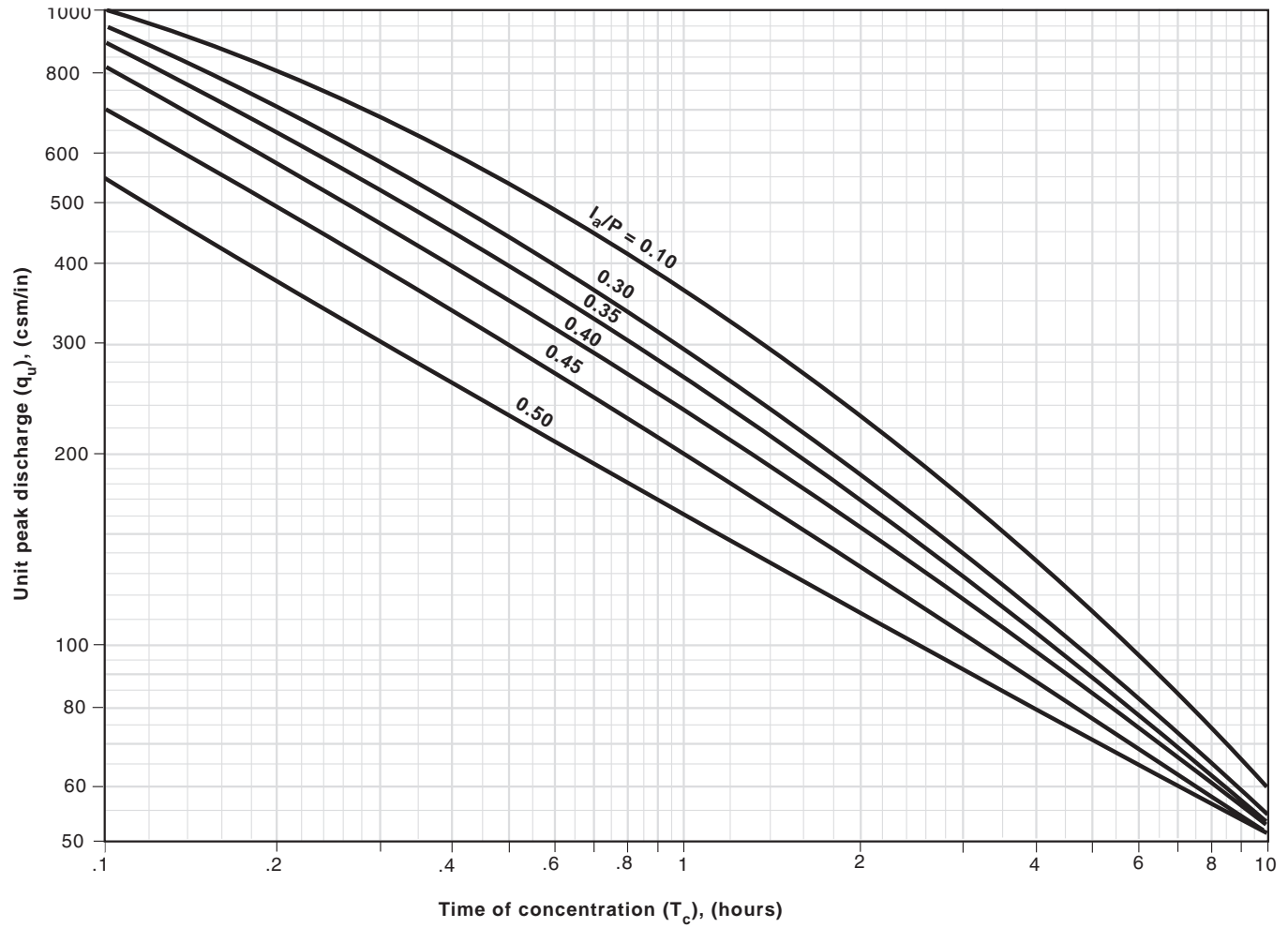
**Exhibit 4-I** Unit peak discharge ( $q_{u}$ ) for NRCS (SCS) type I rainfall distribution

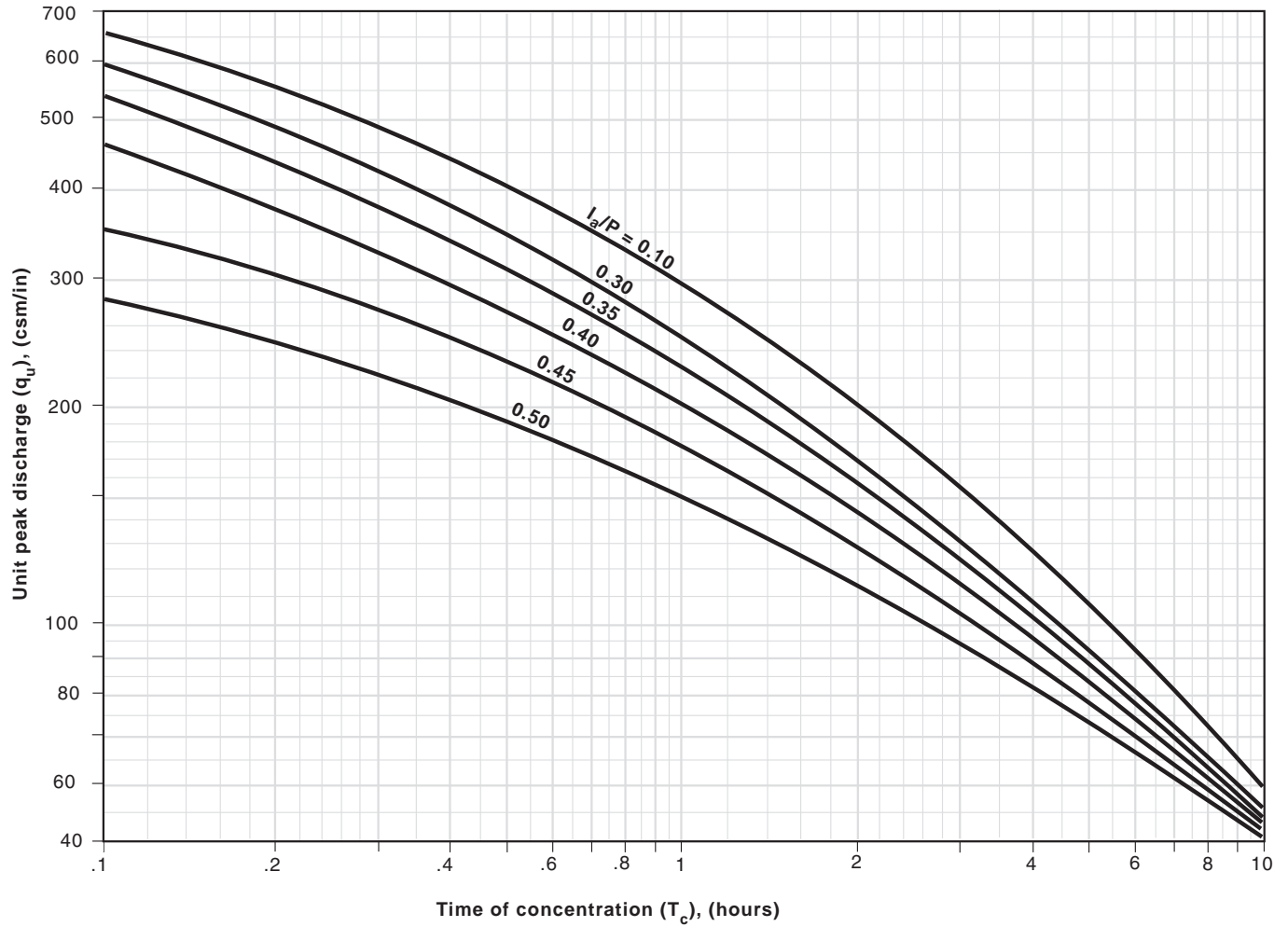


**Exhibit 4-1A** Unit peak discharge ( $q_{u}$ ) for NRCS (SCS) type IA rainfall distribution



**Exhibit 4-II** Unit peak discharge ( $q_u$ ) for NRCS (SCS) type II rainfall distribution



**Exhibit 4-III** Unit peak discharge ( $q_u$ ) for NRCS (SCS) type III rainfall distribution



This chapter presents the Tabular Hydrograph method of computing peak discharges from rural and urban areas, using time of concentration ( $T_c$ ) and travel time ( $T_t$ ) from a subarea as inputs. This method approximates TR-20, a more detailed hydrograph procedure (SCS 1983).

The Tabular method can develop partial composite flood hydrographs at any point in a watershed by dividing the watershed into homogeneous subareas. In this manner, the method can estimate runoff from nonhomogeneous watersheds. The method is especially applicable for estimating the effects of land use change in a portion of a watershed. It can also be used to estimate the effects of proposed structures.

Input data needed to develop a partial composite flood hydrograph include (1) 24-hour rainfall (in), (2) appropriate rainfall distribution (I, IA, II, or III), (3) CN, (4)  $T_c$  (hr), (5)  $T_t$  (hr), and (6) drainage area (mi<sup>2</sup>).

## Tabular Hydrograph method exhibits

Exhibit 5 (5-I, 5-IA, 5-II, and 5-III) shows tabular discharge values for the various rainfall distributions. Tabular discharges expressed in csm/in (cubic feet of discharge per second per square mile of watershed per inch of runoff) are given for a range of subarea  $T_c$ 's from 0.1 to 2 hours and reach  $T_t$ 's from 0 to 3 hours.

The exhibit was developed by computing hydrographs for 1 square mile of drainage area for selected  $T_c$ 's and routing them through stream reaches with the range of  $T_t$ 's indicated. The Modified Att-Kin method for reach routing, formulated by SCS in the late 1970's, was used to compute the tabular hydrographs (Comer et al., 1981). A CN of 75 and rainfall amounts generating appropriate  $I_a/P$  ratios were used. The resulting runoff estimate was used to convert the hydrographs in exhibits 5-I through 5-III to cubic feet of discharge per second per square mile of watershed per inch of runoff.

An assumption in development of the tabular hydrographs is that all discharges for a stream reach flow at the same velocity. By this assumption, the subarea flood hydrographs may be routed separately and added at the reference point. The tabular hydrographs in exhibit 5 are prerouted hydrographs.

For  $T_t$ 's other than zero, the tabular discharge values represent the contribution from a single subarea to the composite hydrograph at  $T_t$  downstream.

## Information required for Tabular Hydrograph method

The following information is required for the Tabular method:

1. Subdivision of the watershed into areas that are relatively homogeneous and have convenient routing reaches.
2. Drainage area of each subarea in square miles.
3.  $T_c$  for each subarea in hours. The procedure for estimating  $T_c$  is outlined in chapter 3. Worksheet 3 (appendix D) can be used to calculate  $T_c$ .
4.  $T_t$  for each routing reach in hours. The procedure for estimating  $T_t$  is outlined in chapter 3. Worksheet 3 can be used to calculate  $T_t$  through a subarea for shallow concentrated and open channel flow.
5. Weighted CN for each subarea. Table 2-2 shows CN's for individual hydrologic soil cover combinations. Worksheet 2 can be used to calculate the weighted runoff curve number.
6. Appropriate rainfall distribution according to figure B-2 (appendix B).
7. The 24-hour rainfall for the selected frequency. Appendix B contains rainfall maps for various frequencies (figures B-3 to B-8).
8. Total runoff ( $Q$ ) in inches computed from CN and rainfall.
9.  $I_a$  for each subarea from table 5-1, which is the same as table 4-1.
10. Ratio of  $I_a/P$  for each subarea. If the ratio for the rainfall distribution of interest is outside the range shown in exhibit 5, use the limiting value.

## Development of composite flood hydrograph

This section describes the procedure for developing the peak discharge and selected discharge values of a composite flood hydrograph.

### Selecting $T_c$ and $T_t$

First, use worksheet 5a to develop a summary of basic watershed data by subarea. Then use worksheet 5b to develop a tabular hydrograph discharge summary; this summary displays the effect of individual subarea hydrographs as routed to the watershed point of

interest. Use  $\sum T_t$  for each subarea as the total reach travel time from that subarea through the watershed to the point of interest. Compute the hydrograph coordinates for selected  $\sum T_t$ 's using the appropriate sheets in exhibit 5. The flow at any time is:

$$q = q_t A_m Q \quad [\text{eq. 5-1}]$$

where:

$q$  = hydrograph coordinate (cfs) at hydrograph time  $t$

$q_t$  = tabular hydrograph unit discharge from exhibit 5 (csm/in)

$A_m$  = drainage area of individual subarea (mi<sup>2</sup>)

$Q$  = runoff (in)

**Table 5-1**  $I_a$  values for runoff curve numbers

Curve number	$I_a$ (in)	Curve number	$I_a$ (in)
40	3.000	70	0.857
41	2.878	71	0.817
42	2.762	72	0.778
43	2.651	73	0.740
44	2.545	74	0.703
45	2.444	75	0.667
46	2.348	76	0.632
47	2.255	77	0.597
48	2.167	78	0.564
49	2.082	79	0.532
50	2.000	80	0.500
51	1.922	81	0.469
52	1.846	82	0.439
53	1.774	83	0.410
54	1.704	84	0.381
55	1.636	85	0.353
56	1.571	86	0.326
57	1.509	87	0.299
58	1.448	88	0.273
59	1.390	89	0.247
60	1.333	90	0.222
61	1.279	91	0.198
62	1.226	92	0.174
63	1.175	93	0.151
64	1.125	94	0.128
65	1.077	95	0.105
66	1.030	96	0.083
67	0.985	97	0.062
68	0.941	98	0.041
69	0.899		

Since the timing of peak discharge changes with  $T_c$  and  $T_t$ , interpolation of peak discharge for  $T_c$  and  $T_t$  values for use in exhibit 5 is not recommended. Interpolation may result in an estimate of peak discharge that would be invalid because it would be lower than either of the hydrographs. Therefore, round the actual values of  $T_c$  and  $T_t$  to values presented in exhibit 5. Perform this rounding so that the sum of the selected table values is close to the sum of actual  $T_c$  and  $T_t$ . An acceptable procedure is to select the results of one of three rounding operations:

1. Round  $T_c$  and  $T_t$  separately to the nearest table value and sum,
2. Round  $T_c$  down and  $T_t$  up to nearest table value and sum,
3. Round  $T_c$  up and  $T_t$  down to nearest table value and sum.

From these three alternatives, choose the pair of rounded  $T_c$  and  $T_t$  values whose sum is closest to the sum of the actual  $T_c$  and  $T_t$ . If two rounding methods produce sums equally close to the actual sum, use the combination in which rounded  $T_c$  is closest to actual  $T_c$ . An illustration of the rounding procedure is as follows:

	Actual values	Table values by rounding method		
		1	2	3
$T_c$	1.1	1.0	1.0	1.25
$T_t$	1.7	1.5	2.0	1.5
Sum	2.8	2.5	3.0	2.75

In this instance, the results from method 3 would be selected because the sum 2.75 is closest to the actual sum of 2.8.

### Selecting $I_a/P$

The computed  $I_a/P$  value can be rounded to the nearest  $I_a/P$  value in exhibits 5-I through 5-III, or the hydrograph values (csm/in) can be linearly interpolated because  $I_a/P$  interpolation generally involves peaks that occur at the same time.

### Summing for the composite hydrograph

The composite hydrograph is the summation of prerouted individual subarea hydrographs at each time shown on worksheet 5b. Only the times encompassing the expected maximum composite discharge are summed to define a portion of the composite hydrograph.

If desired, the entire composite hydrograph can be approximated by linear extrapolation as follows:

1. Set up a table similar to worksheet 5b. Include on this table the full range of hydrograph times displayed in exhibit 5.
2. Compute the subarea discharge values for those times and insert them in the table.
3. Sum the values to obtain the composite hydrograph.
4. Apply linear extrapolation to the first two points and the last two points of the composite hydrograph. The volume under this approximation of the entire composite hydrograph may differ from the computed runoff volume.

### Limitations

The Tabular method is used to determine peak flows and hydrographs within a watershed. However, its

accuracy decreases as the complexity of the watershed increases. If you want to compare present and developed conditions of a watershed, use the same procedure for estimating  $T_c$  for both conditions.

Use the TR-20 computer program (SCS 1983) instead of the Tabular method if any of the following conditions applies:

- $T_t$  is greater than 3 hours (largest  $T_t$  in exhibit 5).
- $T_c$  is greater than 2 hours (largest  $T_c$  in exhibit 5).
- Drainage areas of individual subareas differ by a factor of 5 or more.
- The entire composite flood hydrograph or entire runoff volume is required for detailed flood routings. The hydrograph based on extrapolation is only an approximation of the entire hydrograph.
- The time of peak discharge must be more accurate than that obtained through the Tabular method.

The composite flood hydrograph should be compared with actual stream gage data where possible. The instantaneous peak flow value from the composite flood hydrograph can be compared with data from USGS curves of peak flow versus drainage area.

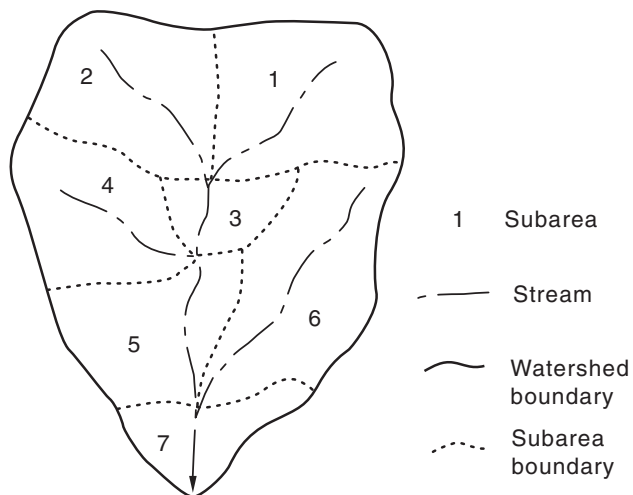
## Examples

A developer proposes to put a subdivision, Fallswood, in subareas 5, 6, and 7 of a watershed in Dyer County, northwestern Tennessee (see sketch below). Before approving the developer's proposal, the planning board wants to know how the development would affect the 25-year peak discharge at the downstream end of subarea 7. The rainfall distribution is type II (figure B-2), and the 24-hour rainfall ( $P$ ) is 6.0 inches (figure B-6).

### Example 5-1

Compute the 25-year frequency peak discharge at the downstream end of subarea 7 for present conditions, using worksheets 5a and 5b. To do this, first calculate the present condition  $CN$ ,  $T_c$ , and  $T_t$  for each subarea, using the procedures in chapters 2 and 3. Enter the values on worksheet 5a (figure 5-1).

Next, compute the prerouted hydrograph points for each subarea hydrograph over a range of time near the peak discharge using worksheet 5b (figure 5-2) and the appropriate exhibit 5. For example, for subarea 4, in which  $T_c = 0.75$  hr, refer to sheet 6 of exhibit 5-II. With  $\Sigma T_t$  of 2.00 hr (the sum of downstream travel time through subareas 5 and 7 to the outlet) and  $I_a / P$  of 0.1, the routed peak discharge of subarea 4 at the outlet of subarea 7 occurs at 14.6 hr and is 274 csm/in.



Solving equation 5-1 with appropriate values provides the peak discharge ( $q$ ) for subarea 4 at 14.6 hr:

$$q = qt(A_m Q) = (274)(0.70) = 192 \text{ cfs.}$$

Once all the prerouted subarea hydrographs have been tabulated on worksheet 5b, sum each of the time columns to obtain the composite hydrograph. The resulting 25-year frequency peak discharge is 720 cfs at 14.3 hr (figure 5-2).

### Example 5-2

Compute the 25-year frequency peak discharge at the downstream end of subarea 7 for the developed conditions, using worksheets 5a and 5b.

First, calculate the developed condition  $CN$ ,  $T_c$ , and  $T_t$  for each subarea, using the procedures in chapters 2 and 3. Enter the values on worksheet 5a (figure 5-3).

Next, compute the prerouted hydrograph points for each subarea hydrograph over a range of time near the peak discharge using worksheet 5b (figure 5-4) and the appropriate exhibit 5. For example, for subarea 6, in which  $T_c = 1.0$  hr, refer to sheet 7 of exhibit 5-II. With  $\Sigma T_t$  of 0.5 hr (downstream travel time through subarea 7 to the outlet) and  $I_a / P$  of 0.1, the peak discharge of subarea 6 at the outlet of the watershed occurs at 13.2 hr and is 311 csm/in. Solving equation 5-1 provides the peak discharge ( $q$ ):

$$q = q_t (A_m Q) = (311)(1.31) = 407 \text{ cfs}$$

Once all the prerouted subarea hydrographs have been tabulated on worksheet 5b, sum each of the time columns to obtain the composite hydrograph. The resulting 25-year frequency peak discharge is 872 cfs

### Comparison

According to the results of the two examples, the proposed subdivision at the downstream end of subarea 7 is expected to increase peak discharge from 720 to 872 cfs and to decrease the time to peak from 14.3 to 13.6 hr.

Figure 5-1 Worksheet 5a for example 5-1

**Worksheet 5a: Basic watershed data**

Project <i>Fallswood</i>				Location <i>Dyer County, Tennessee</i>				By <i>DW</i>		Date <i>10/1/85</i>	
Check one: <input checked="" type="checkbox"/> Present <input type="checkbox"/> Developed				Frequency (yr) <i>25</i>				Checked <i>NM</i>		Date <i>10/3/85</i>	
Subarea name	Drainage area $A_m$ (mi <sup>2</sup> )	Time of concentration $T_c$ (hr)	Travel time through subarea $T_t$ (hr)	Downstream subarea names	Travel time summation to outlet $\Sigma T_t$ (hr)	24-hr rain-fall $P$ (in)	Runoff curve number $CN$	Runoff $Q$ (in)	$A_m Q$ (mi <sup>2</sup> -in)	Initial abstraction $I_a$ (in)	$I_a/P$
<i>1</i>	<i>0.30</i>	<i>1.50</i>	<i>--</i>	<i>3, 5, 7</i>	<i>2.50</i>	<i>6.0</i>	<i>65</i>	<i>2.35</i>	<i>0.71</i>	<i>1.077</i>	<i>0.18</i>
<i>2</i>	<i>0.20</i>	<i>1.25</i>	<i>--</i>	<i>3, 5, 7</i>	<i>2.50</i>	<i>6.0</i>	<i>70</i>	<i>2.80</i>	<i>0.56</i>	<i>0.857</i>	<i>0.14</i>
<i>3</i>	<i>0.10</i>	<i>0.50</i>	<i>0.50</i>	<i>5, 7</i>	<i>2.00</i>	<i>6.0</i>	<i>75</i>	<i>3.28</i>	<i>0.33</i>	<i>0.667</i>	<i>0.11</i>
<i>4</i>	<i>0.25</i>	<i>0.75</i>	<i>--</i>	<i>5, 7</i>	<i>2.00</i>	<i>6.0</i>	<i>70</i>	<i>2.80</i>	<i>0.70</i>	<i>0.857</i>	<i>0.14</i>
<i>5</i>	<i>0.20</i>	<i>1.50</i>	<i>1.25</i>	<i>7</i>	<i>0.75</i>	<i>6.0</i>	<i>75</i>	<i>3.28</i>	<i>0.66</i>	<i>0.667</i>	<i>0.11</i>
<i>6</i>	<i>0.40</i>	<i>1.50</i>	<i>--</i>	<i>7</i>	<i>0.75</i>	<i>6.0</i>	<i>70</i>	<i>2.80</i>	<i>1.12</i>	<i>0.857</i>	<i>0.14</i>
<i>7</i>	<i>0.20</i>	<i>1.25</i>	<i>0.75</i>	<i>--</i>	<i>0</i>	<i>6.0</i>	<i>75</i>	<i>3.28</i>	<i>0.66</i>	<i>0.667</i>	<i>0.11</i>

From worksheet 3

From worksheet 2

From table 5-1

Figure 5-2

Worksheet 5b for example 5-1

**Worksheet 5b: Basic watershed data**

Project <i>Fallswood</i>		Location <i>Dyer County, Tennessee</i>				By <i>DW</i>			Date <i>10/1/85</i>							
Check one: <input checked="" type="checkbox"/> Present <input type="checkbox"/> Developed		Frequency (yr) <i>25</i>				Checked <i>NM</i>			Date <i>10/3/85</i>							
Subarea name	Basic watershed data used <sup>1/</sup>				Select and enter hydrograph times in hours from exhibit 5-II <sup>2/</sup>											
	Subarea T <sub>c</sub> (hr)	ΣT <sub>t</sub> to outlet (hr)	I <sub>a</sub> /P	A <sub>m</sub> Q (mi <sup>2</sup> -in)	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5
					Discharges at selected hydrograph times <sup>3/</sup> (cfs)											
<i>1</i>	<i>1.50</i>	<i>2.50</i>	<i>0.10</i>	<i>0.71</i>	<i>4</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>6</i>	<i>8</i>	<i>10</i>	<i>113</i>	<i>24</i>	<i>49</i>	<i>100</i>	<i>149</i>
<i>2</i>	<i>1.25</i>	<i>2.50</i>	<i>0.10</i>	<i>0.56</i>	<i>3</i>	<i>4</i>	<i>4</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>11</i>	<i>16</i>	<i>32</i>	<i>64</i>	<i>110</i>	<i>127</i>
<i>3</i>	<i>0.50</i>	<i>2.00</i>	<i>0.10</i>	<i>0.33</i>	<i>5</i>	<i>5</i>	<i>6</i>	<i>8</i>	<i>12</i>	<i>21</i>	<i>41</i>	<i>67</i>	<i>98</i>	<i>92</i>	<i>60</i>	<i>29</i>
<i>4</i>	<i>0.75</i>	<i>2.00</i>	<i>0.10</i>	<i>0.70</i>	<i>8</i>	<i>9</i>	<i>11</i>	<i>14</i>	<i>20</i>	<i>34</i>	<i>62</i>	<i>106</i>	<i>172</i>	<i>192</i>	<i>149</i>	<i>81</i>
<i>5</i>	<i>1.50</i>	<i>0.75</i>	<i>0.10</i>	<i>0.66</i>	<i>21</i>	<i>28</i>	<i>50</i>	<i>83</i>	<i>118</i>	<i>147</i>	<i>158</i>	<i>154</i>	<i>127</i>	<i>98</i>	<i>67</i>	<i>44</i>
<i>6</i>	<i>1.50</i>	<i>0.75</i>	<i>0.10</i>	<i>1.12</i>	<i>36</i>	<i>47</i>	<i>85</i>	<i>140</i>	<i>200</i>	<i>249</i>	<i>269</i>	<i>261</i>	<i>216</i>	<i>166</i>	<i>114</i>	<i>75</i>
<i>7</i>	<i>1.25</i>	<i>0</i>	<i>0.10</i>	<i>0.66</i>	<i>169</i>	<i>187</i>	<i>205</i>	<i>176</i>	<i>140</i>	<i>108</i>	<i>85</i>	<i>69</i>	<i>51</i>	<i>40</i>	<i>31</i>	<i>24</i>
Composite hydrograph at outlet					<i>246</i>	<i>284</i>	<i>366</i>	<i>433</i>	<i>503</i>	<i>575</i>	<i>636</i>	<i>686</i>	<i>720</i>	<i>701</i>	<i>631</i>	<i>529</i>

<sup>1/</sup> Worksheet 5a. Rounded as needed for use with exhibit 5.

<sup>2/</sup> Enter rainfall distribution type used.

<sup>3/</sup> Hydrograph discharge for selected times is A<sub>m</sub>Q multiplied by tabular discharge from appropriate exhibit 5.

Figure 5-3 Worksheet 5a for example 5-2

**Worksheet 5a: Basic watershed data**

Project <i>Fallswood</i>				Location <i>Dyer County, Tennessee</i>				By <i>DW</i>		Date <i>10/1/85</i>	
Check one: <input type="checkbox"/> Present <input checked="" type="checkbox"/> Developed				Frequency (yr) <i>25</i>				Checked <i>NM</i>		Date <i>10/3/85</i>	
Subarea name	Drainage area $A_m$ (mi <sup>2</sup> )	Time of concentration $T_c$ (hr)	Travel time through subarea $T_t$ (hr)	Downstream subarea names	Travel time summation to outlet $\Sigma T_t$ (hr)	24-hr rainfall $P$ (in)	Runoff curve number $CN$	Runoff $Q$ (in)	$A_m Q$ (mi <sup>2</sup> —in)	Initial abstraction $I_a$ (in)	$I_a/P$
<i>1</i>	<i>0.30</i>	<i>1.50</i>	<i>--</i>	<i>3, 5, 7</i>	<i>2.00</i>	<i>6.0</i>	<i>65</i>	<i>2.35</i>	<i>0.71</i>	<i>1.077</i>	<i>0.18</i>
<i>2</i>	<i>0.20</i>	<i>1.25</i>	<i>--</i>	<i>3, 5, 7</i>	<i>2.00</i>	<i>6.0</i>	<i>70</i>	<i>2.80</i>	<i>0.56</i>	<i>0.857</i>	<i>0.14</i>
<i>3</i>	<i>0.10</i>	<i>0.50</i>	<i>0.50</i>	<i>5, 7</i>	<i>1.50</i>	<i>6.0</i>	<i>75</i>	<i>3.28</i>	<i>0.33</i>	<i>0.667</i>	<i>0.11</i>
<i>4</i>	<i>0.25</i>	<i>0.75</i>	<i>--</i>	<i>5, 7</i>	<i>1.50</i>	<i>6.0</i>	<i>70</i>	<i>2.80</i>	<i>0.70</i>	<i>0.857</i>	<i>0.14</i>
<i>5</i>	<i>0.20</i>	<i>1.50</i>	<i>1.00</i>	<i>7</i>	<i>0.50</i>	<i>6.0</i>	<i>85</i>	<i>4.31</i>	<i>0.86</i>	<i>0.353</i>	<i>0.06</i>
<i>6</i>	<i>0.40</i>	<i>1.00</i>	<i>--</i>	<i>7</i>	<i>0.50</i>	<i>6.0</i>	<i>75</i>	<i>3.28</i>	<i>1.31</i>	<i>0.857</i>	<i>0.14</i>
<i>7</i>	<i>0.20</i>	<i>0.75</i>	<i>0.50</i>	<i>--</i>	<i>0</i>	<i>6.0</i>	<i>90</i>	<i>4.85</i>	<i>0.97</i>	<i>0.222</i>	<i>0.04</i>

From worksheet 3

From worksheet 2

From table 5-1

Figure 5-4

Worksheet 5b for example 5-2

**Worksheet 5b: Basic watershed data**

Project <i>Fallswood</i>		Location <i>Dyer County, Tennessee</i>				By <i>DW</i>		Date <i>10/1/85</i>									
Check one: <input type="checkbox"/> Present <input checked="" type="checkbox"/> Developed		Frequency (yr) <i>25</i>				Checked <i>NM</i>		Date <i>10/3/85</i>									
Subarea name	Basic watershed data used <sup>1/</sup>				Select and enter hydrograph times in hours from exhibit 5-II <sup>2/</sup>												
	Subarea T <sub>c</sub> (hr)	ΣT <sub>t</sub> to outlet (hr)	I <sub>a</sub> /P	A <sub>m</sub> Q (mi <sup>2</sup> -in)	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	
					Discharges at selected hydrograph times <sup>3/</sup> (cfs)												
1	1.50	2.00	0.10	0.71	6	6	7	9	11	16	24	40	78	122	155	133	
2	1.25	2.00	0.10	0.56	6	6	7	9	12	20	33	55	96	132	132	87	
3	0.50	1.50	0.10	0.33	8	9	14	29	58	89	106	102	74	46	25	16	
4	0.75	1.50	0.10	0.70	13	14	19	32	63	114	169	207	193	143	83	46	
5	1.50	0.50	0.10	0.86	51	69	117	167	205	214	202	175	132	99	70	48	
6	1.00	0.50	0.10	1.31	149	208	331	407	393	329	255	195	134	97	69	52	
7	0.75	0	0.10	0.97	398	358	244	167	119	90	72	59	48	40	34	30	
Composite hydrograph at outlet					631	670	739	820	861	872	861	833	755	679	568	412	

<sup>1/</sup> Worksheet 5a. Rounded as needed for use with exhibit 5.  
<sup>2/</sup> Enter rainfall distribution type used.  
<sup>3/</sup> Hydrograph discharge for selected times is A<sub>m</sub>Q multiplied by tabular discharge from appropriate exhibit 5.

### Exhibit 5-I: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution

TRVL TIME (hr)	HYDROGRAPH TIME(HOURS)																																
	9.3	9.9	10.1	10.3	10.5	10.7	11.0	11.4	11.8	12.3	13.0	14.0	15.0	16.0	18.0	24.0	9.0	9.6	10.0	10.2	10.4	10.6	10.8	11.2	11.6	12.0	12.6	13.5	14.5	15.5	17.0	20.0	
	IA/P = 0.10												IA/P = 0.10																				
	*** TC = 0.1 HR ***																																
0.0	30	40	56	183	337	504	326	155	122	107	93	81	73	66	60	56	54	52	49	46	44	40	36	32	30	29	28	27	26	24	20	13	
.10	26	35	48	93	153	276	428	360	223	156	123	103	83	72	65	59	56	54	51	47	45	42	37	33	30	29	28	28	26	24	21	13	
.20	23	30	41	60	82	129	227	361	360	269	194	147	118	85	71	63	58	55	53	49	46	43	39	35	31	29	29	28	26	24	21	14	
.30	22	29	39	56	73	111	188	303	341	293	227	173	136	94	75	65	60	56	54	50	47	43	39	35	31	29	29	28	26	25	21	14	
.40	18	25	34	46	53	66	96	157	255	312	300	251	199	126	90	73	64	59	56	52	48	44	40	36	32	30	29	28	26	25	21	14	
.50	18	24	32	44	50	61	84	133	214	280	293	265	221	144	99	77	66	60	56	52	49	45	41	37	32	30	29	28	27	25	21	14	
.75	14	19	25	34	38	43	49	62	88	134	190	234	252	221	162	115	87	71	63	56	52	47	43	39	35	31	29	29	27	25	22	15	
1.0	11	14	19	26	28	31	34	38	44	52	68	98	141	222	238	191	139	101	79	63	53	56	51	45	41	37	33	30	29	27	26	22	15
1.5	9	10	13	17	18	20	22	25	27	30	34	38	44	74	132	191	211	190	151	101	73	58	50	45	41	37	33	30	28	27	23	16	
2.0	6	7	9	11	12	13	14	15	16	18	20	22	24	29	38	58	97	148	193	193	141	89	61	51	46	41	37	33	29	27	24	17	
2.5	4	5	7	8	9	9	10	11	11	12	13	14	16	19	23	29	39	58	93	154	181	147	87	61	51	45	41	37	30	28	25	18	
3.0	2	3	5	6	6	7	7	8	9	9	10	10	11	13	15	19	23	28	39	72	124	170	138	86	61	50	45	40	33	29	26	19	
	IA/P = 0.30												IA/P = 0.30																				
	*** TC = 0.1 HR ***																																
0.0	0	0	0	61	195	343	232	129	113	103	91	81	76	71	66	64	62	61	59	56	54	51	47	43	40	40	39	39	37	36	31	21	
.10	0	0	0	12	45	145	277	247	169	131	112	98	87	76	70	65	64	62	60	57	55	53	49	44	40	40	39	39	38	36	32	21	
.20	0	0	0	9	33	107	220	238	192	151	125	107	94	79	71	66	64	62	61	58	56	53	49	45	41	40	40	39	38	36	32	21	
.30	0	0	0	1	6	24	79	173	216	200	168	139	118	90	77	70	66	64	62	59	57	54	50	46	41	40	40	39	38	36	32	22	
.40	0	0	0	1	4	17	59	135	189	196	177	152	129	97	81	72	67	64	63	60	57	54	51	46	42	40	40	39	38	36	32	22	
.50	0	0	0	0	0	3	12	43	104	161	185	180	161	121	93	79	71	66	64	61	58	55	52	48	43	40	40	39	38	37	33	22	
.75	0	0	0	0	0	1	5	18	49	92	130	153	159	142	114	92	79	71	66	63	60	56	53	49	44	41	40	40	38	37	33	23	
1.0	0	0	0	0	0	0	0	2	9	27	56	92	144	152	128	103	86	75	67	63	59	55	51	47	43	40	40	39	37	34	24		
1.5	0	0	0	0	0	0	0	0	0	0	2	6	32	79	121	136	127	109	85	72	64	58	55	51	47	43	40	39	38	34	25		
2.0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	33	70	105	126	118	97	75	63	58	54	50	46	42	40	39	35	26		
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11	32	63	105	118	100	75	63	58	54	50	46	40	39	36	27			
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	12	43	84	112	96	74	63	58	54	50	42	40	37	28			
	IA/P = 0.50												IA/P = 0.50																				
	*** TC = 0.1 HR ***																																
0.0	0	0	0	0	0	3	13	28	39	44	45	46	46	48	49	51	53	54	54	55	56	55	53	50	50	49	49	49	49	48	45	32	
.10	0	0	0	0	0	2	9	22	33	41	44	45	46	48	49	50	52	54	54	54	56	55	53	50	50	49	49	49	49	48	45	32	
.20	0	0	0	0	0	0	1	7	17	28	36	41	44	46	48	49	51	53	54	54	56	56	54	51	50	50	49	49	49	48	45	32	
.30	0	0	0	0	0	0	1	5	13	23	32	38	44	47	48	50	51	53	54	54	55	54	52	50	50	49	49	49	48	46	33		
.40	0	0	0	0	0	0	0	3	10	18	27	34	43	46	48	49	51	53	54	54	55	54	52	50	50	49	49	49	48	46	33		
.50	0	0	0	0	0	0	0	0	2	7	15	23	36	43	46	48	50	51	53	54	55	55	53	50	50	49	49	49	48	46	34		
.75	0	0	0	0	0	0	0	0	1	3	7	13	27	37	43	46	48	50	52	54	55	55	54	51	50	50	49	49	48	46	34		
1.0	0	0	0	0	0	0	0	0	0	0	0	1	8	20	32	40	45	47	50	52	54	55	54	52	50	50	49	49	49	47	36		
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	13	23	33	42	47	51	54	55	54	53	50	50	49	49	48	37		
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	12	25	37	46	51	54	55	54	52	50	49	49	48	39			
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	15	31	45	51	53	55	54	52	50	49	48	48	41			
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	14	32	45	51	53	54	54	51	49	48	42		

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Exhibit 5-I: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution—continued

Table with columns for TRVL TIME (hr) and HYDROGRAPH TIME (HOURS) from 9.0 to 24.0. It contains multiple rows of unit discharge data for different rainfall types (IA/P = 0.10, 0.30, 0.50) and a total catchment time (TC = 0.2 HR). The data is organized into sections for each IA/P value, with rows representing different time intervals (e.g., 0.0, .10, .20, .30, .40, .50, .75, 1.0, 1.5, 2.0, 2.5, 3.0 hours).

### Exhibit 5-I: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME (HOURS)																																																															
	9.3	9.9	10.1	10.3	10.5	10.7	11.0	11.4	11.8	12.3	13.0	14.0	15.0	16.0	18.0	24.0	9.0	9.6	10.0	10.2	10.4	10.6	10.8	11.2	11.6	12.0	12.6	13.5	14.5	15.5	17.0	20.0																																
IA/P = 0.10														* * * TC = 0.3 HR * * *														IA/P = 0.10																																				
0.0	25	34	46	87	138	242	349	346	256	182	141	115	97	76	66	60	57	54	52	48	45	42	38	34	30	29	28	28	26	24	21	13	25	34	46	87	138	242	349	346	256	182	141	115	97	76	66	60	57	54	52	48	45	42	38	34	30	29	28	28	26	24	21	13
.10	24	32	44	77	118	200	299	330	281	215	166	132	109	82	69	62	58	55	52	49	46	42	38	34	30	29	29	28	26	24	21	14	24	32	44	77	118	200	299	330	281	215	166	132	109	82	69	62	58	55	52	49	46	42	38	34	30	29	29	28	26	24	21	14
.20	21	28	38	54	69	102	167	255	305	289	240	190	152	103	79	67	61	57	54	50	47	44	40	35	31	30	29	28	26	25	21	14	21	28	38	54	69	102	167	255	305	289	240	190	152	103	79	67	61	57	54	50	47	44	40	35	31	30	29	28	26	25	21	14
.30	20	27	36	51	63	89	141	217	276	285	255	212	172	115	85	71	63	58	55	51	48	44	40	36	32	30	29	28	26	25	21	14	20	27	36	51	63	89	141	217	276	285	255	212	172	115	85	71	63	58	55	51	48	44	40	36	32	30	29	28	26	25	21	14
.40	17	23	31	42	48	58	79	120	185	246	272	260	228	156	108	82	69	62	57	53	49	45	41	37	33	30	29	28	27	25	22	14	17	23	31	42	48	58	79	120	185	246	272	260	228	156	108	82	69	62	57	53	49	45	41	37	33	30	29	28	27	25	22	14
.50	16	22	30	40	45	54	70	104	158	216	253	258	238	173	120	89	72	63	58	54	50	46	42	37	33	30	29	28	27	25	22	14	16	22	30	40	45	54	70	104	158	216	253	258	238	173	120	89	72	63	58	54	50	46	42	37	33	30	29	28	27	25	22	14
.75	13	17	24	32	35	39	45	54	72	104	147	189	219	231	182	135	100	79	67	58	53	48	44	40	35	32	30	29	27	26	22	15	13	17	24	32	35	39	45	54	72	104	147	189	219	231	182	135	100	79	67	58	53	48	44	40	35	32	30	29	27	26	22	15
1.0	11	13	17	24	26	29	32	35	40	46	58	79	110	184	221	202	158	118	90	68	58	52	46	42	38	34	31	29	28	26	23	15	11	13	17	24	26	29	32	35	40	46	58	79	110	184	221	202	158	118	90	68	58	52	46	42	38	34	31	29	28	26	23	15
1.5	8	10	12	15	17	19	21	23	25	28	31	35	40	62	107	163	199	193	165	114	81	61	52	46	42	37	33	31	28	27	23	16	8	10	12	15	17	19	21	23	25	28	31	35	40	62	107	163	199	193	165	114	81	61	52	46	42	37	33	31	28	27	23	16
2.0	5	7	9	10	11	12	13	14	15	17	18	20	22	27	35	50	80	125	165	184	152	99	64	53	47	42	38	34	29	28	24	17	5	7	9	10	11	12	13	14	15	17	18	20	22	27	35	50	80	125	165	184	152	99	64	53	47	42	38	34	29	28	24	17
2.5	3	5	6	8	8	9	10	10	11	12	13	14	15	18	22	27	35	50	78	134	173	154	96	64	52	46	42	37	31	28	25	18	3	5	6	8	8	9	10	10	11	12	13	14	15	18	22	27	35	50	78	134	173	154	96	64	52	46	42	37	31	28	25	18
3.0	2	3	4	6	6	7	7	8	8	9	9	10	11	12	14	17	21	26	34	61	107	164	145	94	64	52	46	41	33	29	26	19	2	3	4	6	6	7	7	8	8	9	9	10	11	12	14	17	21	26	34	61	107	164	145	94	64	52	46	41	33	29	26	19
IA/P = 0.30														* * * TC = 0.3 HR * * *														IA/P = 0.30																																				
0.0	0	0	0	8	32	98	198	217	192	148	125	108	95	79	72	67	64	63	61	58	56	53	49	45	41	40	40	39	38	36	32	22	0	0	0	8	32	98	198	217	192	148	125	108	95	79	72	67	64	63	61	58	56	53	49	45	41	40	40	39	38	36	32	22
.10	0	0	0	1	6	23	73	156	197	194	164	138	118	91	77	70	66	64	62	59	57	54	50	46	41	40	40	39	38	36	32	22	0	0	0	1	6	23	73	156	197	194	164	138	118	91	77	70	66	64	62	59	57	54	50	46	41	40	40	39	38	36	32	22
.20	0	0	0	1	4	17	54	122	172	187	171	149	128	98	81	72	67	64	63	60	57	54	51	46	42	40	40	39	38	36	32	22	0	0	0	1	4	17	54	122	172	187	171	149	128	98	81	72	67	64	63	60	57	54	51	46	42	40	40	39	38	36	32	22
.30	0	0	0	0	0	3	12	40	95	146	173	172	157	120	34	79	71	67	64	61	58	55	52	48	43	40	40	39	38	37	33	23	0	0	0	0	0	3	12	40	95	146	173	172	157	120	34	79	71	67	64	61	58	55	52	48	43	40	40	39	38	37	33	23
.40	0	0	0	0	0	2	9	30	73	122	156	167	160	128	100	83	73	68	65	62	59	56	52	48	44	41	40	39	38	37	33	23	0	0	0	0	0	2	9	30	73	122	156	167	160	128	100	83	73	68	65	62	59	56	52	48	44	41	40	39	38	37	33	23
.50	0	0	0	0	0	1	6	22	56	100	137	157	159	135	107	87	76	69	65	62	59	56	53	49	44	41	40	40	38	37	33	23	0	0	0	0	0	1	6	22	56	100	137	157	159	135	107	87	76	69	65	62	59	56	53	49	44	41	40	40	38	37	33	23
.75	0	0	0	0	0	0	1	3	9	26	53	86	115	143	134	113	93	80	72	65	62	58	54	51	46	42	40	40	39	37	33	23	0	0	0	0	0	0	1	3	9	26	53	86	115	143	134	113	93	80	72	65	62	58	54	51	46	42	40	40	39	37	33	23
1.0	0	0	0	0	0	0	0	0	1	5	14	32	57	111	138	132	113	94	81	69	64	60	56	52	48	44	41	40	39	37	34	24	0	0	0	0	0	0	0	0	1	5	14	32	57	111	138	132	113	94	81	69	64	60	56	52	48	44	41	40	39	37	34	24
1.5	0	0	0	0	0	0	0	0	0	0	0	0	1	8	34	74	111	126	121	99	80	67	61	56	53	49	44	41	39	38	35	26	0	0	0	0	0	0	0	0	0	0	0	0	1	8	34	74	111	126	121	99	80	67	61	56	53	49	44	41	39	38	35	26
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11	33	66	97	118	108	84	67	60	56	52	48	44	40	39	36	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11	33	66	97	118	108	84	67	60	56	52	48	44	40	39	36	27
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	12	32	74	106	112	83	67	60	56	52	48	41	39	37	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	12	32	74	106	112	83	67	60	56	52	48	41	39	37	28	
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	21	54	98	107	81	67	60	55	51	43	40	37	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	21	54	98	107	81	67	60	55	51	43	40	37	29	
IA/P = 0.50														* * * TC = 0.3 HR * * *														IA/P = 0.50																																				
0.0	0	0	0	0	0	0	1	6	16	27	36	41	44	46	48	49	51	52	52	52	52	52	52	51	50	50	49	49	49	48	46	33	0	0	0	0	0	0	1	6	16	27	36	41	44	46	48	49	51	52	52	52	52	52	52	51	50	50	49	49	49	48	46	33
.10	0	0	0	0	0	0	1	4	12	22	31	38	42	45	48	49																																																

### Exhibit 5-I: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME (HOURS)																															
	9.0	9.3	9.6	9.9	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	11.0	11.2	11.4	11.6	11.8	12.0	12.3	12.6	13.0	13.5	14.0	14.5	15.0	15.5	16.0	17.0	18.0	20.0	24.0
IA/P = 0.10												* * * TC = 0.4 HR * * *												IA/P = 0.10								
0.0	23	31	42	66	96	157	250	310	304	244	186	149	122	89	73	64	59	56	53	49	46	43	39	35	31	29	29	28	26	25	21	14
.10	22	29	40	61	84	133	211	277	295	261	211	170	138	98	78	66	60	56	54	50	47	43	39	35	31	29	29	28	26	25	21	14
.20	19	26	34	47	56	75	114	178	244	278	267	230	190	128	93	75	65	59	56	52	48	44	40	36	32	30	29	28	27	25	21	14
.30	18	24	33	45	53	67	98	152	213	257	263	241	207	143	102	80	68	61	57	52	49	45	41	37	32	30	29	28	27	25	21	14
.40	15	21	28	38	43	49	61	86	130	185	233	253	245	188	132	97	77	66	60	55	51	46	42	38	34	30	29	28	27	25	22	14
.50	15	20	27	36	41	46	56	76	112	161	209	238	243	201	146	106	82	69	61	55	51	47	42	38	34	31	29	29	27	25	22	14
.75	12	16	21	29	32	35	39	46	57	77	108	147	184	220	200	157	118	91	74	61	55	50	45	40	36	32	30	29	27	26	22	15
1.0	10	12	16	21	24	26	29	32	36	40	48	61	83	147	202	212	178	138	105	75	62	54	47	43	39	35	31	29	28	26	23	16
1.5	8	9	11	14	16	17	19	21	23	25	28	31	35	50	83	134	179	193	177	131	92	65	53	47	42	38	34	31	29	27	24	16
2.0	5	6	8	10	10	11	12	13	14	15	17	18	20	25	31	42	64	102	144	179	163	111	70	55	48	43	39	35	30	28	25	17
2.5	3	4	6	7	8	8	9	9	10	11	12	13	14	16	20	24	30	42	63	114	160	170	107	70	54	47	43	38	31	29	25	18
3.0	2	3	4	5	6	6	7	7	8	8	9	9	10	11	13	16	19	23	30	51	90	148	161	104	69	54	47	42	34	29	26	19
IA/P = 0.30												* * * TC = 0.4 HR * * *												IA/P = 0.30								
0.0	0	0	0	3	14	48	115	184	192	178	148	127	111	88	77	70	66	64	62	59	56	54	50	46	41	40	40	39	38	36	32	22
.10	0	0	0	0	2	10	35	89	152	179	178	158	137	105	85	75	69	65	63	60	58	55	51	47	42	40	40	39	38	36	32	22
.20	0	0	0	0	2	7	26	68	124	161	172	163	146	113	90	78	70	66	64	61	58	55	52	47	43	40	40	39	38	37	33	22
.30	0	0	0	0	1	5	19	52	100	140	162	162	151	120	96	81	72	67	64	61	59	55	52	48	43	41	40	39	38	37	33	23
.40	0	0	0	0	0	1	4	14	39	80	120	148	158	142	114	92	79	71	67	63	60	57	53	49	45	41	40	40	38	37	33	23
.50	0	0	0	0	0	1	3	10	29	63	101	132	152	145	120	97	82	73	68	63	60	57	53	50	45	41	40	40	38	37	33	23
.75	0	0	0	0	0	0	0	1	4	13	31	58	87	130	138	123	103	87	77	68	63	59	55	51	47	43	41	40	39	37	34	24
1.0	0	0	0	0	0	0	0	0	0	2	7	18	36	86	125	134	122	104	88	73	66	61	57	53	49	45	41	40	39	38	34	24
1.5	0	0	0	0	0	0	0	0	0	0	0	0	1	10	36	75	109	124	120	100	81	68	61	56	53	49	44	41	40	38	35	26
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	22	50	83	116	116	91	70	61	57	53	49	45	40	39	36	27
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	22	60	97	111	88	70	61	56	53	48	42	39	37	28	
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	14	43	89	106	86	69	61	56	52	44	40	37	29
IA/P = 0.50												* * * TC = 0.4 HR * * *												IA/P = 0.50								
0.0	0	0	0	0	0	0	0	2	8	17	27	34	40	44	47	49	50	51	51	51	51	51	51	51	50	50	49	49	49	48	46	33
.10	0	0	0	0	0	0	0	0	2	6	13	22	30	40	45	47	49	50	51	51	51	51	51	51	51	50	50	49	49	48	46	34
.20	0	0	0	0	0	0	0	0	2	1	4	10	18	33	41	45	48	49	51	51	51	51	51	51	50	50	50	49	49	49	46	34
.30	0	0	0	0	0	0	0	0	0	0	1	3	8	22	35	42	46	48	50	51	51	51	51	51	51	50	50	49	49	49	47	35
.40	0	0	0	0	0	0	0	0	0	0	1	2	6	19	32	40	45	47	49	51	51	51	51	51	51	50	50	49	49	49	47	35
.50	0	0	0	0	0	0	0	0	0	0	0	0	2	9	23	34	41	45	48	50	51	51	51	51	51	50	50	49	49	49	47	35
.75	0	0	0	0	0	0	0	0	0	0	0	0	1	5	14	26	35	42	46	49	50	51	51	51	51	50	50	50	49	49	47	36
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	14	25	35	44	48	50	51	51	51	51	50	50	49	49	48	37
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	13	27	39	47	50	51	51	51	51	51	50	49	49	48	39
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	21	36	47	50	51	51	51	51	50	49	48	40
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	19	37	47	50	51	51	51	50	40	48	42
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	25	40	48	50	51	51	50	50	49	43

RAINFALL TYPE = I

\* \* \* TC = 0.4 HR \* \* \*

SHEET 4 OF 10



Exhibit 5-I: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution—continued

Table with columns for TRVL TIME (hr) and HYDROGRAPH TIME (HOURS). Rows include rainfall rates (0.0 to 3.0) and IA/P ratios (0.10, 0.30, 0.50). Data points represent unit discharges in csm/in. Includes parameters like TC = 0.75 HR and RAINFALL TYPE = I.

**Exhibit 5-I: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution—continued**

TRVL TIME (hr)	9.0	9.3	9.6	9.9	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	11.0	11.4	11.8	12.0	12.3	12.6	13.0	13.5	14.0	14.5	15.0	15.5	16.0	17.0	18.0	20.0	24.0			
	IA/P = 0.10																																
	*** TC = 1.0 HR ***																																
0.0	14	19	25	34	38	46	58	79	106	136	165	186	202	185	153	122	101	85	74	63	56	50	44	40	35	32	30	29	27	26	22	15	
.10	13	18	24	32	36	42	53	70	94	122	151	174	194	188	160	130	106	89	77	65	57	50	44	40	36	32	30	29	27	26	22	15	
.20	12	15	21	28	31	34	40	49	63	83	109	137	162	190	180	152	124	102	86	70	61	53	46	41	37	33	31	29	27	26	22	15	
.30	12	15	20	26	29	33	37	45	57	75	98	124	149	187	183	159	131	107	90	73	62	53	47	42	37	33	31	29	28	26	23	15	
.40	10	13	17	23	25	28	31	35	42	52	67	88	112	160	183	176	151	125	103	81	67	56	48	43	39	35	31	30	28	26	23	15	
.50	10	13	16	22	24	27	30	33	39	48	61	79	101	148	181	181	157	131	108	84	69	58	49	43	39	35	32	30	28	26	23	16	
.75	9	11	14	19	21	23	26	29	33	38	47	59	75	115	153	172	167	148	125	96	77	62	51	45	40	36	33	30	28	27	23	16	
1.0	8	9	11	15	16	17	19	21	23	26	29	33	40	61	95	134	162	169	157	126	97	72	57	49	43	39	35	32	29	27	24	16	
1.5	5	6	8	10	10	11	12	13	14	16	17	19	21	25	33	48	74	107	138	160	148	111	76	59	50	44	39	35	30	28	25	17	
2.0	3	4	6	7	8	8	9	9	10	11	12	13	14	17	20	25	33	48	71	115	153	153	108	75	58	49	43	39	32	29	25	18	
2.5	2	3	4	5	5	6	6	7	7	8	9	9	10	12	14	16	20	25	33	56	94	139	147	104	74	58	49	43	34	30	26	19	
3.0	1	1	2	3	3	4	4	4	5	5	6	6	7	8	9	10	12	14	17	24	38	76	131	143	108	78	60	50	39	32	27	20	
	IA/P = 0.30																																
	*** TC = 1.0 HR ***																																
0.0	0	0	0	0	1	2	7	17	34	55	79	99	114	128	114	100	89	80	74	68	63	59	54	51	46	43	41	40	39	37	33	23	
.10	0	0	0	0	0	0	2	5	13	27	46	68	89	116	124	110	98	87	79	71	65	60	56	52	48	43	41	40	39	37	34	24	
.20	0	0	0	0	0	0	1	4	10	21	37	58	78	109	121	113	101	90	81	72	66	61	56	52	48	44	41	40	39	37	34	24	
.30	0	0	0	0	0	0	0	1	3	8	17	31	49	87	113	118	109	98	87	76	69	63	57	53	49	45	42	40	39	38	34	24	
.40	0	0	0	0	0	0	0	1	2	6	13	25	41	78	107	117	111	101	90	78	70	63	58	54	50	45	42	41	39	38	34	25	
.50	0	0	0	0	0	0	0	0	2	5	10	20	34	69	100	115	113	103	93	80	71	64	58	54	50	46	42	41	39	38	34	25	
.75	0	0	0	0	0	0	0	0	0	1	2	5	10	31	61	90	107	110	104	90	79	69	61	56	52	48	44	41	40	38	35	25	
1.0	0	0	0	0	0	0	0	0	0	0	0	1	3	12	33	61	89	105	109	99	86	73	64	58	54	50	45	42	40	38	35	26	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	13	31	55	80	104	104	88	73	63	58	53	49	45	41	39	36	27	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	20	51	82	100	90	74	64	58	54	50	42	40	37	28		
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	13	37	76	98	88	73	64	58	53	45	41	38	30		
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	34	77	95	86	73	63	58	49	42	38	31		
	IA/P = 0.50																																
	*** TC = 1.0 HR ***																																
0.0	0	0	0	0	0	0	0	0	0	1	3	5	9	18	28	35	40	44	47	48	48	48	48	48	48	48	48	48	48	47	35		
.10	0	0	0	0	0	0	0	0	0	1	2	4	7	16	25	33	39	43	46	48	48	48	48	48	48	48	48	48	48	48	47	35	
.20	0	0	0	0	0	0	0	0	0	1	2	3	6	14	23	31	38	42	45	47	48	48	48	48	48	48	48	48	48	48	47	36	
.30	0	0	0	0	0	0	0	0	0	1	3	5	12	21	29	36	41	44	47	48	48	48	48	48	48	48	48	48	48	48	47	36	
.40	0	0	0	0	0	0	0	0	0	1	2	4	10	19	27	34	40	44	47	48	48	48	48	48	48	48	48	48	48	48	47	36	
.50	0	0	0	0	0	0	0	0	0	1	2	3	8	16	25	33	38	43	46	48	48	48	48	48	48	48	48	48	48	48	47	36	
.75	0	0	0	0	0	0	0	0	0	1	2	3	8	15	23	30	36	41	45	47	48	48	48	48	48	48	48	48	48	48	47	36	
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	11	19	27	33	41	45	47	48	48	48	48	48	48	48	48	48	47	37
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	5	11	17	28	37	44	47	48	48	48	48	48	48	48	48	48	39
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	16	26	38	45	47	48	48	48	48	48	48	48	48	48	40
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	12	24	38	45	47	47	47	47	47	47	47	47	47	47	41
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	14	29	40	46	47	47	47	47	47	47	47	47	47	42
	RAINFALL TYPE = I																																
	*** TC = 1.0 HR ***																																

(210-VI-TR-55, Second Ed., June 1986)

### Exhibit 5-I: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME(HOURS)																																
	9.0	9.3	9.6	9.9	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	11.0	11.4	11.6	11.8	12.0	12.3	12.6	13.0	13.5	14.0	14.5	15.0	16.0	17.0	18.0	20.0	24.0			
IA/P = 0.10												* * * TC = 1.25 HR * * *												IA/P = 0.10									
0.0	12	16	22	29	33	38	47	61	80	103	127	149	164	180	163	138	115	98	85	71	62	53	47	41	37	33	31	29	27	26	22	15	
.10	11	14	19	25	28	31	36	44	55	72	92	116	138	167	175	156	132	111	95	77	66	56	48	43	38	34	31	30	28	26	23	15	
.20	11	14	18	24	27	30	34	40	50	65	83	105	127	160	172	160	138	116	99	80	68	57	49	43	39	34	31	30	28	26	23	15	
.30	10	12	16	21	23	25	28	32	38	46	58	75	95	136	164	169	154	132	112	89	74	61	51	45	40	36	32	30	28	26	23	16	
.40	9	12	15	20	22	24	27	30	35	42	53	68	86	126	157	167	157	137	117	92	76	62	52	46	40	36	33	30	28	26	23	16	
.50	9	11	13	17	19	21	23	26	29	33	39	49	61	97	134	160	165	152	132	104	84	67	55	47	42	37	33	31	28	27	23	16	
.75	7	9	11	14	15	17	18	20	22	25	28	32	38	59	90	124	150	159	152	126	101	77	60	51	45	40	35	32	29	27	24	17	
1.0	6	8	10	12	13	14	15	17	19	20	23	25	29	40	60	91	123	148	157	144	118	88	66	54	47	41	37	33	29	27	24	17	
1.5	4	6	7	9	9	10	11	12	13	14	15	16	18	22	28	40	59	85	114	145	150	121	86	65	54	46	41	37	31	28	25	13	
2.0	2	3	5	6	6	7	7	8	9	9	10	11	11	13	16	19	24	33	47	80	119	144	124	90	68	55	47	42	33	29	26	19	
2.5	1	2	3	4	4	5	5	6	6	7	7	8	8	10	11	13	16	19	24	38	65	111	140	120	88	67	54	47	37	31	27	20	
3.0	1	1	2	2	3	3	3	4	4	5	5	5	6	7	8	9	11	13	15	21	32	62	114	136	116	86	66	54	41	33	27	20	
IA/P = 0.30												* * * TC = 1.25 HR * * *												IA/P = 0.30									
0.0	0	0	0	0	0	1	4	10	21	35	53	71	86	106	115	104	94	86	79	72	66	61	56	52	48	44	41	40	39	37	34	24	
.10	0	0	0	0	0	0	1	3	8	16	29	45	62	92	107	113	101	92	84	75	69	63	58	53	49	45	42	41	39	38	34	24	
.20	0	0	0	0	0	0	1	2	6	13	23	37	54	84	104	110	104	94	86	77	70	64	58	54	49	45	42	41	39	38	34	24	
.30	0	0	0	0	0	0	0	0	2	4	10	19	31	62	90	106	109	101	92	81	73	66	60	55	51	46	43	41	39	38	34	25	
.40	0	0	0	0	0	0	0	0	1	3	8	15	26	55	83	102	107	103	94	83	74	67	60	56	51	47	43	41	39	38	35	25	
.50	0	0	0	0	0	0	0	0	0	1	3	6	12	33	62	38	103	106	100	88	78	69	62	57	53	48	44	42	40	38	35	25	
.75	0	0	0	0	0	0	0	0	0	0	0	1	3	12	31	56	80	97	103	97	87	75	65	59	55	50	46	43	40	39	35	26	
1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	13	32	56	79	95	101	94	80	69	61	56	52	48	44	40	39	36	27	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	13	30	51	81	98	94	79	68	61	56	52	47	42	39	36	28	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	13	37	66	95	95	78	68	61	56	51	44	40	37	29		
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	26	61	93	89	77	67	60	55	47	41	38	30			
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	24	64	91	87	76	66	60	50	43	39	31			
IA/P = 0.50												* * * TC = 1.25 HR * * *												IA/P = 0.50									
0.0	0	0	0	0	0	0	0	0	0	1	2	3	6	13	21	29	35	40	43	47	47	47	47	47	47	47	47	47	47	47	47	36	
.10	0	0	0	0	0	0	0	0	0	1	3	5	11	19	27	34	39	42	47	47	47	47	47	47	47	47	47	47	47	47	47	36	
.20	0	0	0	0	0	0	0	0	0	1	2	4	9	17	25	32	37	41	46	47	47	47	47	47	47	47	47	47	47	47	47	36	
.30	0	0	0	0	0	0	0	0	0	1	2	3	8	15	23	30	36	40	45	47	47	47	47	47	47	47	47	47	47	47	47	36	
.40	0	0	0	0	0	0	0	0	0	0	0	1	2	7	13	21	28	35	39	45	47	47	47	47	47	47	47	47	47	47	47	37	
.50	0	0	0	0	0	0	0	0	0	0	0	1	2	6	12	19	27	33	38	44	46	47	47	47	47	47	47	47	47	47	47	37	
.75	0	0	0	0	0	0	0	0	0	0	0	0	1	3	8	14	21	28	34	41	45	47	47	47	47	47	47	47	47	47	47	37	
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	5	11	17	24	34	41	46	47	47	47	47	47	47	47	47	47	38	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	5	10	19	29	39	45	47	47	47	47	47	47	47	47	47	40	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	9	18	30	41	46	47	47	47	47	47	47	47	47	47	41	
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	17	31	41	46	47	47	47	47	47	47	47	47	47	42	
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	18	32	42	46	47	47	47	47	47	47	47	47	47	43

RAINFALL TYPE = I

\* \* \* TC = 1.25 HR \* \* \*

SHEET 8 OF 10

**Exhibit 5-I: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution—continued**

TRVL TIME (hr)	9.3	9.6	9.9	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	11.0	11.4	11.8	12.0	12.3	12.6	13.0	13.5	14.0	14.5	15.0	15.5	16.0	17.0	18.0	20.0	24.0				
-----HYDROGRAPH TIME(HOURS)-----																																	
IA/P = 0.10														IA/P = 0.10																			
*** TC = 1.5 HR ***														*** TC = 1.5 HR ***																			
0.0	11	14	19	25	28	32	39	48	60	76	94	112	129	151	163	147	130	112	97	81	69	59	50	44	39	35	32	30	28	26	23	15	
.10	10	12	16	22	24	27	30	36	44	55	69	86	103	135	152	159	143	125	108	88	75	62	52	46	41	36	32	30	28	26	23	16	
.20	9	11	14	19	21	23	25	29	34	41	50	63	78	112	140	155	152	138	121	98	81	67	55	43	42	37	33	31	28	27	23	16	
.30	9	11	14	18	20	22	24	27	31	38	46	57	71	104	133	151	154	141	125	101	84	68	56	48	43	38	34	31	29	27	23	16	
.40	8	10	13	17	19	21	23	26	30	35	42	52	65	96	126	147	152	144	129	105	87	70	57	49	43	38	34	31	29	27	23	16	
.50	8	9	12	15	17	18	20	22	25	28	33	39	48	73	104	131	148	151	140	117	95	75	60	51	45	40	35	32	29	27	24	17	
.75	7	8	11	13	15	16	18	19	21	24	27	32	38	56	82	110	133	146	144	127	106	83	65	54	47	41	36	33	29	27	24	17	
1.0	5	7	9	11	11	12	13	15	16	18	19	22	24	32	47	69	96	122	139	145	127	99	74	60	51	44	39	35	30	28	24	17	
1.5	4	5	6	8	8	9	10	10	11	12	13	14	16	19	24	32	46	66	90	124	139	128	97	73	59	50	44	39	32	29	25	18	
2.0	2	3	4	5	5	6	6	7	7	8	9	9	10	12	14	17	21	27	38	63	96	135	129	100	76	61	51	44	35	30	26	19	
2.5	1	2	2	3	4	4	4	5	5	6	6	7	7	8	10	11	14	16	20	31	51	91	132	124	98	75	60	51	39	32	27	20	
3.0	0	1	1	2	2	2	2	3	3	3	4	4	5	6	7	8	9	10	12	16	23	42	86	123	128	101	77	62	45	35	28	21	
IA/P = 0.30														IA/P = 0.30																			
*** TC = 1.5 HR ***														*** TC = 1.5 HR ***																			
0.0	0	0	0	0	0	1	3	7	13	21	33	46	60	83	97	106	97	90	84	76	70	64	59	54	50	45	43	41	39	38	34	25	
.10	0	0	0	0	0	0	1	2	5	10	18	28	40	66	86	98	103	95	88	80	73	66	60	55	51	47	43	41	39	38	35	25	
.20	0	0	0	0	0	0	0	1	4	8	14	23	34	60	81	95	101	97	90	81	74	67	61	56	52	47	44	41	40	38	35	25	
.30	0	0	0	0	0	0	0	0	1	3	6	12	19	41	65	85	98	100	95	85	77	69	62	57	53	48	44	42	40	38	35	25	
.40	0	0	0	0	0	0	0	0	1	2	5	9	16	36	59	80	94	99	96	87	79	70	63	58	53	49	45	42	40	38	35	26	
.50	0	0	0	0	0	0	0	0	1	2	4	8	13	31	54	75	91	98	97	88	80	71	64	58	54	49	45	42	40	38	35	26	
.75	0	0	0	0	0	0	0	0	0	0	1	2	4	13	28	49	69	85	95	95	87	76	67	61	56	51	47	44	40	39	36	26	
1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	13	29	49	69	84	95	92	81	71	63	58	53	49	45	41	39	36	27	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	9	20	35	63	84	92	83	72	64	58	54	49	43	40	37	28	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	9	25	50	79	90	81	71	63	58	53	45	41	38	29		
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	18	46	79	88	80	70	63	57	49	42	38	31			
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	17	50	79	87	79	70	62	52	45	39	32		
IA/P = 0.50														IA/P = 0.50																			
*** TC = 1.5 HR ***														*** TC = 1.5 HR ***																			
0.0	0	0	0	0	0	0	0	0	0	0	1	2	3	8	15	22	29	34	39	44	46	46	46	46	46	46	46	46	46	46	46	37	
.10	0	0	0	0	0	0	0	0	0	0	0	1	2	5	10	17	24	30	35	41	46	46	46	46	46	46	46	46	46	46	46	46	37
.20	0	0	0	0	0	0	0	0	0	0	0	1	1	4	9	15	22	28	34	40	45	46	46	46	46	46	46	46	46	46	46	46	37
.30	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	13	20	27	33	39	44	46	46	46	46	46	46	46	46	46	46	46	38
.40	0	0	0	0	0	0	0	0	0	0	0	0	1	3	6	12	18	25	31	38	44	46	46	46	46	46	46	46	46	46	46	46	38
.50	0	0	0	0	0	0	0	0	0	0	0	0	1	2	5	10	17	23	30	37	43	46	46	46	46	46	46	46	46	46	46	46	38
.75	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	12	19	25	33	40	45	46	46	46	46	46	46	46	46	46	46	38
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	5	10	15	25	33	42	46	46	46	46	46	46	46	46	46	46	39
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	14	23	34	43	46	46	46	46	46	46	46	46	46	46	40
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	11	22	35	43	46	46	46	46	46	46	46	46	46	46	42
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	10	23	36	43	46	46	46	46	46	46	46	46	46	43
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	14	27	38	44	46	46	46	46	46	46	46	46	44
RAINFALL TYPE = I														*** TC = 1.5 HR ***																			

210-VI-TR-55, Second Ed., June 1986

### Exhibit 5-I: Tabular hydrograph unit discharges (csm/in) for type I rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME (HOURS)																															
	9.3	9.9	10.1	10.3	10.5	10.7	11.0	11.4	11.8	12.3	13.0	14.0	15.0	16.0	18.0	24.0	9.0	9.6	10.0	10.2	10.4	10.6	10.8	11.2	11.6	12.0	12.6	13.5	14.5	15.5	17.0	20.0
	IA/P = 0.10												IA/P = 0.10																			
0.0	9	11	14	19	21	24	28	33	40	49	59	70	82	106	123	138	138	125	115	97	83	70	59	50	44	39	35	32	29	27	23	16
.10	8	10	13	17	18	20	23	26	31	37	45	54	65	89	110	125	135	130	123	106	90	75	62	53	46	40	36	33	29	27	24	16
.20	8	10	12	16	17	19	22	25	29	34	41	50	60	83	105	121	132	131	125	109	92	77	63	53	46	41	36	33	29	27	24	17
.30	7	9	11	14	15	17	18	21	23	27	32	38	46	66	89	109	123	131	129	117	100	82	66	56	48	42	38	34	30	28	24	17
.40	7	8	10	13	15	16	18	20	22	25	30	35	43	61	83	104	120	131	131	119	103	84	68	57	49	43	38	34	30	28	24	17
.50	6	8	10	13	14	15	17	19	21	24	28	33	39	56	78	99	116	127	130	121	106	86	69	58	50	44	39	35	30	28	24	17
.75	5	7	8	11	12	13	14	15	16	18	20	23	27	38	53	73	93	111	123	127	118	98	77	63	54	47	41	37	31	28	25	17
1.0	4	5	7	8	9	10	11	12	13	14	15	17	18	24	32	45	63	83	102	122	126	113	89	71	59	51	44	39	32	29	25	18
1.5	3	4	5	6	7	7	8	8	9	10	10	11	12	15	18	23	32	44	60	88	111	123	110	87	70	58	50	44	35	30	26	19
2.0	1	2	3	4	5	5	5	6	6	7	7	8	9	10	12	14	18	23	31	49	74	106	121	107	86	69	58	49	38	32	27	20
2.5	1	1	2	2	3	3	3	4	4	5	5	5	6	7	8	9	11	13	16	22	35	62	101	118	108	88	71	59	44	35	28	21
3.0	0	0	1	1	1	2	2	2	3	3	3	3	4	5	5	6	8	9	10	14	19	34	67	103	116	105	86	70	50	39	29	21
	IA/P = 0.30												IA/P = 0.30																			
0.0	0	0	0	0	0	0	1	3	6	10	16	23	31	49	65	77	84	92	86	80	75	69	63	58	53	49	45	43	40	38	35	26
.10	0	0	0	0	0	0	0	1	2	5	9	13	19	35	53	68	79	85	90	83	77	71	64	59	55	50	46	43	40	39	35	26
.20	0	0	0	0	0	0	0	1	2	4	7	11	19	24	40	57	71	81	89	89	80	73	66	61	56	51	47	44	41	39	35	26
.30	0	0	0	0	0	0	0	1	1	3	6	9	20	36	53	68	78	84	88	81	74	67	61	56	52	48	44	41	39	36	26	
.40	0	0	0	0	0	0	0	0	0	1	2	5	12	24	40	57	70	80	87	84	76	69	63	58	53	49	45	41	39	36	27	
.50	0	0	0	0	0	0	0	0	0	1	2	4	10	21	36	53	67	77	87	85	77	69	63	58	54	49	46	41	39	36	27	
.75	0	0	0	0	0	0	0	0	0	0	1	2	6	14	26	41	56	69	82	85	80	72	65	60	55	51	47	42	40	36	27	
1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	10	20	34	49	68	81	85	77	69	63	58	53	49	43	40	37	28	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	10	19	38	58	78	83	76	68	62	57	53	45	41	37	29	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	13	29	55	77	82	75	68	62	57	48	43	38	30	
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	22	51	75	81	75	68	62	53	45	39	32	
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	25	54	75	80	75	68	57	48	43	33	
	IA/P = 0.50												IA/P = 0.50																			
0.0	0	0	0	0	0	0	0	0	0	0	1	2	4	8	13	18	24	29	36	41	46	46	46	46	46	46	46	46	46	46	46	38
.10	0	0	0	0	0	0	0	0	0	0	1	1	3	7	12	17	22	28	35	40	45	46	46	46	46	46	46	46	46	46	46	38
.20	0	0	0	0	0	0	0	0	0	0	0	1	2	4	8	13	18	24	31	38	44	46	46	46	46	46	46	46	46	46	46	39
.30	0	0	0	0	0	0	0	0	0	0	0	0	1	4	7	12	17	22	30	37	43	45	46	46	46	46	46	46	46	46	46	39
.40	0	0	0	0	0	0	0	0	0	0	0	0	1	3	6	11	16	21	29	36	42	45	46	46	46	46	46	46	46	46	46	39
.50	0	0	0	0	0	0	0	0	0	0	0	0	1	3	5	9	14	20	28	35	42	45	45	45	45	45	45	45	45	45	45	39
.75	0	0	0	0	0	0	0	0	0	0	0	0	1	2	5	9	13	18	26	33	41	45	45	45	45	45	45	45	45	45	45	39
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	5	9	16	24	33	42	45	45	45	45	45	45	45	45	45	45	40
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	4	8	15	25	36	43	45	45	45	45	45	45	45	45	45	42
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	6	14	26	37	43	45	45	45	45	45	45	45	45	43
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	15	27	37	43	45	45	45	45	45	45	45	44
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	19	30	39	44	45	45	45	45	45	45

### Exhibit 5-IA: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution

TRVL TIME (hr)	HYDROGRAPH TIME (HOURS)																																		
	7.3	7.9	8.1	8.3	8.5	8.7	9.0	9.4	9.8	10.3	11.0	12.0	13.0	14.0	16.0	22.0	7.0	7.6	8.0	8.2	8.4	8.6	8.8	9.2	9.6	10.0	10.6	11.5	12.5	13.5	15.0	18.0			
IA/P = 0.10																	* * * TC = 0.1 HR * * *										IA/P = 0.10								
0.0	28	36	50	143	154	163	140	103	87	76	68	67	65	61	54	49	45	44	44	41	40	39	36	33	32	32	31	30	30	29	26	21			
.10	27	32	43	104	130	146	157	145	117	97	83	73	69	65	59	53	48	45	45	42	40	39	37	34	33	32	32	31	30	29	27	22			
.20	26	29	37	59	89	116	136	150	147	127	107	91	79	68	63	57	52	47	45	44	41	39	37	35	33	32	32	31	30	29	27	22			
.30	25	28	35	53	77	103	125	142	145	133	116	99	86	71	65	59	53	48	46	44	41	39	38	35	33	32	32	31	30	29	27	22			
.40	24	26	31	41	49	68	91	114	132	141	136	122	107	82	70	63	57	52	48	45	43	40	38	36	33	32	32	31	30	29	27	22			
.50	24	26	30	39	46	60	81	103	123	135	135	127	114	88	73	65	59	53	49	45	43	40	39	36	33	33	32	31	30	29	27	22			
.75	20	24	27	32	35	39	47	60	76	94	111	122	125	114	94	79	68	61	55	48	45	42	39	37	35	33	32	32	30	30	27	22			
1.0	16	20	24	27	28	30	32	36	41	49	62	77	94	118	122	104	86	74	65	55	49	44	41	39	36	34	33	32	31	30	28	23			
1.5	12	15	18	22	23	24	25	27	28	30	32	36	42	61	86	107	112	104	91	73	60	50	44	41	38	36	34	33	31	30	28	23			
2.0	7	10	12	15	16	18	19	20	21	22	24	25	26	30	36	50	69	90	106	103	87	67	52	45	41	39	36	34	32	31	29	24			
2.5	4	6	8	11	12	13	14	15	16	17	18	19	21	23	26	30	36	49	66	91	101	89	66	51	44	41	38	36	33	31	29	25			
3.0	2	3	5	7	8	9	10	11	11	12	13	14	16	18	20	23	25	29	36	55	79	98	86	65	51	44	41	38	34	32	30	25			
IA/P = 0.30																	* * * TC = 0.1 HR * * *										IA/P = 0.30								
0.0	0	0	1	45	65	89	78	64	59	54	54	53	51	50	48	45	44	43	43	43	42	42	41	40	40	40	40	40	39	39	38	33			
.10	0	0	0	18	36	55	78	78	69	62	57	55	53	51	50	47	44	44	43	43	42	42	41	40	40	40	40	40	39	39	38	34			
.20	0	0	0	13	29	46	67	74	71	65	60	56	54	52	50	48	45	44	43	43	42	41	41	40	40	40	40	40	39	39	38	34			
.30	0	0	0	10	22	38	58	69	70	67	62	58	56	52	51	48	46	44	44	43	43	42	41	41	40	40	40	40	39	39	38	34			
.40	0	0	0	2	7	17	31	49	62	67	67	64	60	55	52	50	48	45	44	43	43	42	42	41	40	40	40	40	39	39	38	34			
.50	0	0	0	1	5	13	25	41	55	63	66	64	61	56	53	51	48	46	44	43	43	42	42	41	40	40	40	40	39	39	38	34			
.75	0	0	0	0	0	2	6	13	24	36	47	55	61	61	57	54	51	49	47	44	43	43	42	41	41	40	40	40	39	38	34				
1.0	0	0	0	0	0	1	3	8	15	25	36	46	53	60	59	55	53	50	48	45	44	43	42	42	41	40	40	40	39	38	35				
1.5	0	0	0	0	0	0	0	0	1	2	5	9	15	31	47	55	57	56	53	50	46	44	43	42	41	41	40	40	40	39	39	35			
2.0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	15	28	42	51	55	54	51	47	44	43	42	41	41	40	40	39	39	36			
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	14	26	38	50	54	52	47	44	43	42	41	40	40	39	36				
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	13	29	43	53	51	47	44	43	42	41	40	40	39	37			
IA/P = 0.50																	* * * TC = 0.1 HR * * *										IA/P = 0.50								
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	12	14	18	21	23	26	30	32	33	37	38	41	42	46	48	53	49			
.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	9	12	15	19	22	25	29	32	32	35	39	41	42	45	48	53	49			
.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	7	11	14	18	22	24	28	32	32	35	39	41	42	45	48	53	49			
.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	8	12	15	20	23	27	31	31	34	39	40	41	45	48	53	49			
.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	9	13	18	22	25	30	31	33	37	39	41	44	47	53	49			
.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	10	15	20	24	29	31	32	36	39	41	44	47	53	53				
.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	11	16	21	26	30	31	34	38	40	43	46	53	53					
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	11	17	23	28	31	32	35	39	42	45	53	53					
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	17	23	28	31	32	35	40	43	49	52				
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	17	23	28	31	32	38	42	48	52				
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	10	18	24	28	31	36	40	47	52					
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	11	18	24	28	33	39	45	52						

RAINFALL TYPE = IA

\* \* \* TC = 0.1 HR \* \* \*

SHEET 1 OF 10

Exhibit 5-IA: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution—continued

Table with columns for TRVL TIME (hr) and HYDROGRAPH TIME (HOURS) ranging from 7.0 to 22.0. Rows show unit discharge values for various time intervals. Includes parameters IA/P = 0.10, 0.30, 0.50 and RAINFALL TYPE = IA. A note at the bottom indicates SHEET 2 OF 10.

(210-VI-TR-55, Second Ed., June 1986)

### Exhibit 5-IA: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME(HOURS)																															
	7.3	7.9	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	9.0	9.2	9.4	9.6	9.8	10.0	10.3	10.6	11.0	11.5	12.0	12.5	13.0	13.5	14.0	15.0	16.0	18.0	22.0			
IA/P = 0.10														IA/P = 0.10																		
0.0	26	31	41	92	120	138	145	144	125	105	90	78	71	66	60	54	49	46	45	43	40	39	37	34	33	32	32	31	30	29	27	22
.10	26	30	39	80	106	128	139	142	131	113	98	85	76	68	62	56	51	47	45	43	41	39	37	34	33	32	32	31	30	29	27	22
.20	25	28	34	51	70	94	117	131	139	133	120	105	92	74	67	60	54	49	46	44	42	40	38	35	33	33	32	31	30	29	27	22
.30	24	26	31	40	47	62	84	106	123	133	133	124	112	87	73	65	59	53	49	45	43	40	39	36	33	33	32	32	30	29	27	22
.40	23	26	30	38	44	56	75	95	114	127	131	127	117	93	76	67	60	55	50	46	43	40	39	36	34	33	32	32	30	29	27	22
.50	21	25	28	34	37	42	51	67	86	104	119	127	127	110	88	74	66	59	53	47	45	41	39	37	34	33	32	32	30	30	27	22
.75	19	23	26	31	33	36	42	51	64	80	96	109	119	116	102	85	73	65	58	50	46	43	40	38	35	33	33	32	31	30	28	23
1.0	15	19	23	26	27	29	31	33	37	44	53	66	80	106	116	109	93	79	69	58	51	45	41	39	37	34	33	32	31	30	28	23
1.5	11	14	17	21	22	23	24	26	27	29	31	34	38	53	75	97	109	106	96	78	64	52	45	41	39	36	34	33	32	30	28	24
2.0	6	9	11	14	16	17	18	19	20	21	23	24	25	28	34	44	61	81	97	103	91	71	54	46	42	39	37	34	32	31	29	24
2.5	4	5	8	10	11	12	13	14	15	16	17	19	20	22	25	28	34	44	58	84	59	92	70	54	46	41	39	36	33	32	29	25
3.0	2	3	5	7	7	8	9	10	11	12	13	14	15	17	19	22	24	28	33	49	71	96	89	68	53	45	41	39	34	32	30	25
IA/P = 0.30														IA/P = 0.30																		
0.0	0	0	0	13	28	45	63	69	69	65	60	55	53	53	51	48	45	44	43	43	42	42	42	40	40	40	40	40	39	39	38	34
.10	0	0	0	9	21	37	54	64	67	65	62	57	54	53	51	49	46	44	43	43	42	42	42	41	40	40	40	40	40	39	38	34
.20	0	0	0	7	17	30	46	58	64	65	63	59	56	53	52	49	46	44	44	43	42	42	42	41	40	40	40	40	40	39	38	34
.30	0	0	0	1	5	13	25	39	52	60	63	63	60	55	53	51	49	46	44	43	43	42	42	41	40	40	40	40	40	39	38	34
.40	0	0	0	1	4	10	20	33	45	55	61	62	61	56	54	52	49	46	45	43	43	42	42	41	40	40	40	40	40	39	38	34
.50	0	0	0	1	3	7	15	27	39	50	57	60	61	57	54	52	50	47	45	44	43	42	42	41	40	40	40	40	40	39	38	34
.75	0	0	0	0	1	3	8	15	24	34	43	51	55	58	56	54	52	49	47	44	43	43	42	41	41	40	40	40	40	39	38	34
1.0	0	0	0	0	0	0	0	2	4	9	16	25	34	49	56	57	55	53	50	47	44	43	42	42	41	40	40	40	40	39	39	35
1.5	0	0	0	0	0	0	0	0	0	1	3	5	10	23	37	49	54	55	54	51	47	44	43	42	42	41	40	40	40	39	39	35
2.0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	10	21	33	44	51	54	52	48	44	43	42	41	41	40	40	40	39	36
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	10	19	30	45	53	53	48	44	43	42	41	41	40	40	39	37
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	9	23	37	50	52	47	44	43	42	41	40	40	39	37
IA/P = 0.50														IA/P = 0.50																		
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	7	11	14	18	22	24	28	32	32	35	40	41	42	45	48	48	48
.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	8	12	15	20	23	27	31	31	34	39	40	41	45	48	48	48
.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	9	13	18	21	25	30	31	33	37	39	41	44	47	48	48
.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	8	12	17	21	25	30	31	33	37	39	41	44	47	48	48
.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	9	14	19	23	28	31	32	35	39	41	44	47	48	48
.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	10	15	21	26	30	31	33	38	40	43	46	48	48
.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	13	19	24	29	31	33	36	39	42	46	48	48
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	9	16	22	27	31	32	35	38	42	45	48	48
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	8	16	23	27	31	32	35	40	43	48	48
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	16	22	27	30	32	38	42	47	48	48
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	16	22	27	30	35	40	46	48	48
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	9	17	23	27	33	38	45	48	48

RAINFALL TYPE = IA

\* \* \* TC = 0.3 HR \* \* \*

SHEET 3 OF 10

Exhibit 5-IA: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution—continued

Table with columns for TRVL TIME (hr) and HYDROGRAPH TIME (HOURS). Rows represent time intervals from 0.0 to 3.0 hours, with sub-rows for 0.10, 0.30, and 0.50 hour intervals. The table contains numerical values for unit discharges and includes parameters like IA/P = 0.10, 0.30, 0.50 and TC = 0.4 HR.

### Exhibit 5-IA: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME(HOURS)																															
	7.3	7.9	8.1	8.3	8.5	8.7	9.0	9.4	9.8	10.3	11.0	12.0	13.0	14.0	16.0	22.0	7.0	7.6	8.0	8.2	8.4	8.6	8.8	9.2	9.6	10.0	10.6	11.5	12.5	13.5	15.0	18.0
IA/P = 0.10														IA/P = 0.10																		
0.0	25	28	34	53	72	94	115	129	130	129	117	104	92	76	68	61	55	50	47	44	42	40	38	34	33	33	32	31	30	29	27	22
.10	24	27	33	49	64	84	105	121	127	128	121	109	98	80	70	63	57	51	48	45	42	40	38	34	33	33	32	32	30	29	27	22
.20	23	26	30	39	46	58	75	95	112	122	126	123	114	93	78	69	61	55	50	46	44	41	39	36	34	33	32	32	30	29	27	22
.30	21	24	27	34	37	43	53	68	86	103	116	123	123	108	89	76	67	60	54	48	45	42	39	37	34	33	33	32	30	30	27	22
.40	20	24	27	32	35	40	49	61	78	95	109	118	121	111	93	79	69	62	55	49	45	42	40	37	34	33	33	32	30	30	27	22
.50	18	22	25	29	31	34	38	45	56	70	87	101	113	118	106	89	77	67	60	52	47	43	40	38	35	33	33	32	31	30	28	23
.75	15	19	23	26	27	29	31	34	38	45	54	67	80	104	112	106	93	80	70	59	51	46	41	39	36	34	33	33	31	30	28	23
1.0	13	16	20	24	25	26	27	29	31	34	39	46	56	80	102	110	105	93	81	66	56	48	43	40	38	35	33	33	31	30	28	23
1.5	9	12	15	18	20	21	22	23	24	26	27	29	31	39	55	75	94	104	103	89	74	58	48	43	40	37	35	33	32	31	29	24
2.0	5	7	10	12	13	14	15	17	18	19	20	21	23	25	29	35	45	62	79	100	100	81	61	49	43	40	38	35	33	31	29	25
2.5	3	4	6	8	9	10	11	12	13	14	15	16	17	20	22	25	28	34	45	67	88	96	79	60	49	43	40	37	33	32	30	25
3.0	1	2	3	5	6	7	8	9	10	11	12	13	15	17	19	21	24	28	38	56	83	93	77	59	48	43	40	35	33	30	26	
IA/P = 0.30														IA/P = 0.30																		
0.0	0	0	0	2	8	18	31	46	57	61	61	61	58	54	53	51	48	45	44	44	43	42	42	41	40	40	40	40	40	39	38	34
.10	0	0	0	2	6	14	25	39	51	58	60	61	59	55	53	51	49	46	44	44	43	42	42	41	40	40	40	40	40	39	38	34
.20	0	0	0	0	1	4	11	21	33	45	54	58	60	58	55	53	51	48	46	44	43	42	42	41	40	40	40	40	39	38	34	
.30	0	0	0	0	1	3	8	16	27	39	49	55	59	59	55	53	51	49	46	44	43	42	42	41	40	40	40	40	39	39	34	
.40	0	0	0	0	1	2	6	13	23	34	44	51	56	58	56	54	52	49	47	44	43	42	42	41	40	40	40	40	39	39	34	
.50	0	0	0	0	0	0	2	5	10	18	29	39	47	56	57	55	53	51	49	45	44	43	42	41	41	40	40	40	39	39	35	
.75	0	0	0	0	0	0	1	2	5	10	17	25	34	48	54	56	55	53	50	47	45	43	42	42	41	40	40	40	39	39	35	
1.0	0	0	0	0	0	0	0	0	0	1	3	6	11	26	41	51	55	55	54	50	47	44	43	42	41	41	40	40	40	39	35	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	1	4	11	23	36	47	52	54	52	48	44	43	42	41	40	40	40	39	36	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	16	27	38	49	53	51	47	44	42	42	41	40	40	39	36	
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	15	30	43	52	50	46	44	42	42	41	40	39	37	
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	10	23	40	51	50	46	44	42	42	40	40	39	37	
IA/P = 0.50														IA/P = 0.50																		
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	11	14	19	22	26	30	31	34	38	40	41	45	46	46	46
.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	8	12	17	21	25	29	31	33	37	39	41	44	46	46	46
.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	9	14	19	23	28	31	32	35	39	41	43	46	46	46
.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	6	12	17	22	27	31	32	34	38	40	43	46	46	46
.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	11	16	21	26	30	32	34	38	40	43	46	46	46
.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	8	13	19	25	31	33	37	39	42	46	46	46	
.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	11	17	23	28	31	32	35	39	42	46	46	46
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	11	18	24	29	31	33	36	41	44	46	46
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	11	19	24	29	31	33	39	42	46	46
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	12	19	25	29	31	37	41	46	46
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	13	20	25	29	34	39	45	46
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	14	20	26	32	37	44	46

RAINFALL TYPE = IA

\* \* \* TC = 0.5 HR \* \* \*

SHEET 5 OF 10

### Exhibit 5-IA: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME (HOURS)																															
	7.0	7.3	7.6	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	9.0	9.2	9.4	9.6	9.8	10.0	10.3	10.6	11.0	11.5	12.0	12.5	13.0	13.5	14.0	15.0	16.0	18.0	22.0
IA/P = 0.10											* * * TC = 0.75 HR * * *											IA/P = 0.10										
0.0	22	25	29	38	45	56	71	87	103	114	117	111	95	81	72	65	58	53	48	45	41	39	36	33	33	33	32	30	29	27	22	
.10	21	25	28	36	42	51	64	79	95	108	114	116	113	99	85	74	66	60	54	48	45	42	39	37	34	33	33	32	30	30	27	22
.20	19	23	26	32	35	39	47	58	72	87	101	110	114	109	95	82	72	65	58	51	47	43	40	38	34	33	33	32	31	30	27	23
.30	19	22	26	31	33	37	44	54	66	80	94	104	112	110	98	85	75	67	60	52	47	43	40	38	34	33	33	32	31	30	28	23
.40	17	21	24	28	30	32	36	41	49	61	74	87	99	111	106	94	82	73	65	56	49	45	41	39	35	33	33	33	31	30	28	23
.50	16	20	23	27	29	31	34	39	46	56	68	81	93	109	107	97	85	75	67	57	50	45	41	39	36	33	33	33	31	30	28	23
.75	15	18	22	25	27	28	31	34	38	45	54	64	75	95	104	102	93	83	74	62	54	47	42	40	37	34	33	33	31	30	28	23
1.0	12	15	18	22	23	24	25	27	29	31	34	39	46	65	85	100	103	98	88	74	62	52	45	41	39	35	33	33	32	30	28	23
1.5	7	10	12	15	17	18	19	20	21	22	24	25	26	31	39	53	71	87	99	99	85	68	53	46	41	39	36	34	33	31	29	24
2.0	4	6	8	11	12	13	14	15	16	17	18	19	21	23	26	31	39	51	67	88	95	86	67	53	45	41	38	36	33	32	29	25
2.5	2	3	5	7	8	9	10	11	11	12	13	14	16	18	20	23	26	30	38	56	77	93	84	66	52	45	41	38	34	33	30	25
3.0	0	1	2	4	4	5	6	6	7	8	8	9	10	12	14	16	18	21	24	30	42	67	90	84	68	54	46	42	36	33	30	26
IA/P = 0.30											* * * TC = 0.75 HR * * *											IA/P = 0.30										
0.0	0	0	0	0	2	4	10	19	29	39	48	53	56	56	54	53	51	49	46	44	44	42	42	40	40	40	40	40	40	39	39	34
.10	0	0	0	0	1	3	8	15	24	34	43	50	54	56	54	53	52	49	47	45	44	42	42	41	40	40	40	40	40	39	39	34
.20	0	0	0	0	0	1	2	6	12	20	30	39	46	54	55	54	53	51	49	46	44	43	42	41	40	40	40	40	40	39	39	35
.30	0	0	0	0	0	1	2	5	10	17	25	34	42	52	55	54	53	51	49	46	44	43	42	42	40	40	40	40	40	39	39	35
.40	0	0	0	0	0	0	1	4	8	14	21	30	38	50	55	55	53	52	50	47	45	43	42	42	40	40	40	40	40	39	39	35
.50	0	0	0	0	0	0	1	3	6	11	18	26	34	47	53	54	54	52	50	47	45	43	42	42	40	40	40	40	40	39	39	35
.75	0	0	0	0	0	0	1	3	6	10	16	23	37	47	52	53	53	53	52	49	46	44	42	42	41	40	40	40	40	40	39	35
1.0	0	0	0	0	0	0	0	0	1	2	4	7	17	30	42	50	53	53	51	49	45	45	43	42	41	40	40	40	40	40	39	36
1.5	0	0	0	0	0	0	0	0	0	0	0	1	4	11	21	33	43	49	52	51	48	45	43	42	41	40	40	40	40	40	39	36
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	11	20	30	43	50	51	48	45	43	42	41	40	40	40	40	39	37
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	10	23	36	48	51	47	44	43	42	41	40	40	40	39	37
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	17	34	48	50	47	44	43	42	40	40	40	39	38
IA/P = 0.50											* * * TC = 0.75 HR * * *											IA/P = 0.50										
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	6	10	15	19	23	28	31	32	36	39	41	44	44	44	44	
.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	7	12	17	22	27	30	32	34	38	40	43	44	44	44	
.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	5	10	15	20	25	30	31	33	37	39	43	44	44	44	
.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	12	18	24	29	31	33	36	39	42	44	44	44	
.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	10	16	22	27	30	32	35	38	42	44	44	44	
.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	14	21	26	30	31	34	38	41	44	44	44	
.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	11	19	24	29	31	33	36	41	44	44	44	
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	8	16	22	27	30	32	35	40	43	44	44	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	9	16	23	27	30	32	38	42	44	44	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	10	17	23	28	30	36	40	44	44	
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	11	18	23	28	33	39	44	44	
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	10	17	23	30	36	43	44	

RAINFALL TYPE = IA

\* \* \* TC = 0.75 HR \* \* \*

SHEET 6 OF 10

## Exhibit 5-IA: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME(HOURS)																																																					
	7.3	7.9	8.1	8.3	8.5	8.7	9.0	9.4	9.8	10.3	11.0	12.0	13.0	14.0	16.0	22.0	7.0	7.6	8.0	8.2	8.4	8.6	8.8	9.2	9.6	10.0	10.6	11.5	12.5	13.5	15.0	18.0																						
	IA/P = 0.10																IA/P = 0.10																																					
0.0	19	23	26	33	37	43	52	63	76	88	97	104	108	102	91	81	72	65	59	52	48	43	40	38	34	33	33	32	31	30	28	23	104	108	102	91	81	72	65	59	52	48	43	40	38	34	33	33	32	31	30	28	23	
.10	19	22	26	32	35	41	48	58	70	82	92	100	105	103	94	83	75	67	61	53	48	44	40	38	35	33	33	32	31	30	28	23	100	105	103	94	83	75	67	61	53	48	44	40	38	35	33	33	32	31	30	28	23	
.20	17	21	24	28	30	34	38	45	54	65	76	87	96	104	100	91	81	73	66	57	51	45	41	39	36	33	33	33	31	30	28	23	87	96	104	100	91	81	73	66	57	51	45	41	39	36	33	33	33	31	30	28	23	
.30	16	20	23	27	29	32	36	42	50	60	71	81	91	103	101	93	84	75	67	58	52	46	42	39	36	34	33	33	31	30	28	23	81	91	103	101	93	84	75	67	58	52	46	42	39	36	34	33	33	31	30	28	23	
.40	15	18	22	25	27	29	31	35	40	46	55	65	76	94	102	99	91	81	73	63	55	48	43	40	37	34	33	33	31	30	28	23	65	76	94	102	99	91	81	73	63	55	48	43	40	37	34	33	33	31	30	28	23	
.50	14	18	21	25	26	28	30	33	37	43	51	61	71	90	101	101	93	84	75	64	56	49	43	40	37	34	33	33	31	30	28	23	61	71	90	101	101	93	84	75	64	56	49	43	40	37	34	33	33	31	30	28	23	
.75	13	16	19	23	24	25	27	29	32	37	42	49	58	76	91	98	96	89	81	70	60	51	45	41	38	35	34	33	32	30	28	23	49	58	76	91	98	96	89	81	70	60	51	45	41	38	35	34	33	32	30	28	23	
1.0	10	13	16	19	20	22	23	24	26	27	30	33	37	50	67	83	94	97	93	81	70	58	48	43	40	37	34	33	32	31	29	24	33	37	50	67	83	94	97	93	81	70	58	48	43	40	37	34	33	32	31	29	24	
1.5	6	8	10	13	14	15	16	18	19	20	21	22	24	27	33	42	56	71	84	93	89	75	59	49	44	40	37	35	33	31	29	24	22	24	27	33	42	56	71	84	93	89	75	59	49	44	40	37	35	33	31	29	24	
2.0	3	5	7	9	10	11	12	13	14	15	16	17	18	21	23	27	32	41	53	74	88	91	74	59	49	43	40	37	34	32	30	25	17	18	21	23	27	32	41	53	74	88	91	74	59	49	43	40	37	34	32	30	25	
2.5	1	2	4	6	7	7	8	9	10	11	11	12	13	16	18	20	23	26	32	45	64	84	89	72	58	48	43	40	34	33	30	26	12	13	16	18	20	23	26	32	45	64	84	89	72	58	48	43	40	34	33	30	26	
3.0	0	1	2	3	3	4	4	5	6	6	7	8	9	10	12	14	16	18	21	26	35	55	81	87	73	59	50	44	37	34	31	26	8	9	10	12	14	16	18	21	26	35	55	81	87	73	59	50	44	37	34	31	26	
	IA/P = 0.30																IA/P = 0.30																																					
0.0	0	0	0	0	1	2	5	10	16	23	31	38	44	51	53	52	52	50	48	46	44	43	42	41	40	40	40	40	40	40	39	35	38	44	51	53	52	52	50	48	46	44	43	42	41	40	40	40	40	40	40	39	35	
.10	0	0	0	0	0	1	2	4	8	13	20	27	35	46	51	53	52	51	50	47	45	44	42	42	40	40	40	40	40	40	39	35	27	35	46	51	53	52	51	50	47	45	44	42	42	40	40	40	40	40	40	39	35	
.20	0	0	0	0	0	0	1	3	6	11	17	24	31	43	50	52	52	51	50	47	45	44	42	42	40	40	40	40	40	40	39	35	24	31	43	50	52	52	51	50	47	45	44	42	42	40	40	40	40	40	40	39	35	
.30	0	0	0	0	0	0	1	2	5	9	14	21	28	40	48	52	52	52	50	48	46	44	43	42	40	40	40	40	40	40	39	35	21	28	40	48	52	52	52	50	48	46	44	43	42	40	40	40	40	40	40	39	35	
.40	0	0	0	0	0	0	0	1	2	4	7	12	18	31	42	49	52	52	51	49	47	45	43	42	41	40	40	40	40	40	39	35	12	18	31	42	49	52	52	51	49	47	45	43	42	41	40	40	40	40	40	39	35	
.50	0	0	0	0	0	0	0	1	1	3	6	10	15	28	39	47	51	52	51	49	47	45	43	42	41	40	40	40	40	40	39	35	10	15	28	39	47	51	52	51	49	47	45	43	42	41	40	40	40	40	40	39	35	
.75	0	0	0	0	0	0	0	0	1	1	3	6	9	19	31	41	47	50	51	50	48	46	43	42	41	40	40	40	40	40	39	36	6	9	19	31	41	47	50	51	50	48	46	43	42	41	40	40	40	40	40	39	36	
1.0	0	0	0	0	0	0	0	0	0	0	0	1	2	6	14	25	36	44	49	51	50	47	45	43	42	41	40	40	40	40	39	36	1	2	6	14	25	36	44	49	51	50	47	45	43	42	41	40	40	40	40	39	36	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	6	13	23	33	44	49	50	47	44	43	42	41	40	40	40	39	37	0	0	1	2	6	13	23	33	44	49	50	47	44	43	42	41	40	40	40	39	37	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	6	13	25	38	48	50	47	44	43	42	41	40	40	39	37	0	0	0	0	0	1	2	6	13	25	38	48	50	47	44	43	42	41	40	40	39	37
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	9	19	36	48	49	47	44	43	42	40	40	39	38	0	0	0	0	0	0	1	3	9	19	36	48	49	47	44	43	42	40	40	39	38		
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	18	37	47	49	46	44	43	41	40	40	38	0	0	0	0	0	0	0	0	2	6	18	37	47	49	46	44	43	41	40	40	38		
	IA/P = 0.50																IA/P = 0.50																																					
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	7	11	16	21	26	30	32	34	38	40	43	43	43	43	0	0	0	0	0	2	4	7	11	16	21	26	30	32	34	38	40	43	43	43	43		
.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	5	9	14	19	25	29	31	33	37	39	42	43	43	43	0	0	0	0	0	1	2	5	9	14	19	25	29	31	33	37	39	42	43	43	43		
.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	11	17	23	28	30	32	36	39	42	43	43	43	0	0	0	0	0	0	1	3	7	11	17	23	28	30	32	36	39	42	43	43	43		
.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	9	15	21	27	30	32	35	38	41	43	43	43	0	0	0	0	0	0	0	1	5	9	15	21	27	30	32	35	38	41	43	43	43		
.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	13	20	25	29	31	34	37	41	43	43	43	0	0	0	0	0	0	0	1	3	7	13	20	25	29	31	34	37	41	43	43	43		
.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	11	18	24	28	31	33	36	41	43	43	43	0	0	0	0	0	0	0	0	2	5	11	18	24	28	31	33	36	41	43	43	43		
.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	8	16	22	27	30	32	35	40	43	43	43	0	0	0	0	0	0	0	0	1	3	8	16	22	27	30	32	35	40	43	43	43		
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	13	20	25	29	31	34																											

### Exhibit 5-IA: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME (HOURS)																															
	7.3	7.9	8.1	8.3	8.5	8.7	9.0	9.4	9.8	10.3	11.0	12.0	13.0	14.0	16.0	22.0	7.0	7.6	8.0	8.2	8.4	8.6	8.8	9.2	9.6	10.0	10.6	11.5	12.5	13.5	15.0	18.0
	IA/P = 0.10														IA/P = 0.10																	
0.0	17	21	24	29	33	37	43	52	61	71	81	89	95	100	94	86	78	71	64	57	51	46	42	39	35	34	33	33	31	30	28	23
.10	16	19	23	27	29	31	35	41	48	57	66	76	85	96	99	92	84	76	69	60	54	47	43	40	36	34	34	33	31	30	28	23
.20	15	19	22	26	28	30	33	38	45	53	62	71	80	93	97	93	86	78	71	62	55	48	43	40	37	34	34	33	31	30	28	23
.30	14	17	20	24	25	27	29	32	36	42	49	58	67	84	95	96	91	84	76	66	58	50	44	41	38	35	34	33	31	30	28	23
.40	13	16	20	23	25	26	28	31	34	39	46	54	62	80	92	96	93	86	78	68	59	51	45	41	38	35	34	33	31	30	28	23
.50	12	15	18	21	23	24	25	27	29	33	37	43	50	67	83	93	95	91	84	73	63	54	46	42	39	36	34	33	32	30	28	23
.75	10	13	16	20	21	22	23	25	27	29	32	36	42	55	71	84	93	93	88	78	68	57	49	43	40	37	34	34	32	31	28	24
1.0	8	10	13	16	17	19	20	21	22	23	25	27	29	37	49	63	78	88	92	88	78	65	53	46	42	39	36	34	33	31	29	24
1.5	5	7	9	12	13	14	15	16	17	18	19	20	22	25	29	36	47	60	73	87	89	79	64	53	46	42	38	36	33	32	29	25
2.0	2	4	6	8	9	10	10	11	12	13	14	15	16	19	21	24	29	36	45	64	80	87	77	63	52	46	41	38	34	32	30	25
2.5	1	2	3	4	5	6	7	8	8	9	10	11	13	15	17	19	22	26	35	49	72	85	78	65	53	46	42	36	33	30	26	
3.0	0	1	2	3	3	4	4	5	5	6	7	7	9	11	12	14	17	19	23	31	47	73	84	76	63	53	46	38	34	31	26	
	IA/P = 0.30														IA/P = 0.30																	
0.0	0	0	0	0	1	3	6	10	15	22	28	34	43	48	51	51	51	49	47	45	44	43	42	40	40	40	40	40	40	40	39	35
.10	0	0	0	0	0	1	2	5	8	13	19	25	36	45	49	51	50	50	48	46	44	43	42	40	40	40	40	40	40	40	39	35
.20	0	0	0	0	0	1	2	4	7	11	16	22	34	43	48	50	50	50	48	46	44	43	42	41	40	40	40	40	40	40	39	35
.30	0	0	0	0	0	1	1	3	5	9	14	19	31	40	46	49	50	50	48	46	45	43	42	41	40	40	40	40	40	40	39	35
.40	0	0	0	0	0	0	1	2	4	8	12	17	28	38	45	49	50	50	49	47	45	43	42	41	40	40	40	40	40	39	35	
.50	0	0	0	0	0	0	1	2	4	6	10	14	25	36	43	48	50	50	49	47	45	43	42	41	40	40	40	40	40	39	35	
.75	0	0	0	0	0	0	0	1	2	3	6	13	23	33	41	46	49	50	48	46	44	43	42	40	40	40	40	40	40	39	36	
1.0	0	0	0	0	0	0	0	0	0	1	2	6	14	23	32	40	46	49	49	47	45	43	42	41	40	40	40	40	40	39	36	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	1	2	6	13	21	30	41	47	49	47	45	43	42	41	40	40	40	39	37	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	6	12	23	35	45	48	47	45	43	42	41	40	40	40	40	37	
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	8	18	33	45	48	46	44	43	42	40	40	40	40	38		
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	17	34	45	48	46	44	43	41	40	40	40	38			
	IA/P = 0.50														IA/P = 0.50																	
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	5	9	14	19	24	28	31	33	37	39	42	42	42	42	42	
.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	11	17	23	27	30	32	36	38	42	42	42	42		
.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	5	9	15	21	26	29	32	35	38	41	42	42	42		
.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	13	19	25	29	31	34	37	41	42	42	42			
.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	11	17	23	28	30	33	36	40	42	42	42			
.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	8	15	22	26	30	32	35	40	42	42	42			
.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	7	13	20	25	29	31	34	39	42	42	42				
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	11	17	23	27	30	33	38	42	42	42					
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	11	18	23	28	30	36	40	42	42					
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	12	18	24	28	33	39	42	42						
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	13	19	24	28	31	37	42	42						
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	12	18	28	33	42	42								

RAINFALL TYPE = IA

\* \* \* TC = 1.25 HR \* \* \*

SHEET 8 OF 10

### Exhibit 5-IA: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME(HOURS)																																																																
	7.3	7.9	8.1	8.3	8.5	8.7	9.0	9.4	9.8	10.3	11.0	12.0	13.0	14.0	16.0	22.0	7.0	7.6	8.0	8.2	8.4	8.6	8.8	9.2	9.6	10.0	10.6	11.5	12.5	13.5	15.0	18.0																																	
	IA/P = 0.10																	IA/P = 0.10																																															
0.0	15	19	22	27	29	32	37	42	49	57	65	73	80	89	94	89	83	76	70	62	55	49	44	40	37	35	34	33	31	30	28	23	15	19	22	27	29	32	37	42	49	57	65	73	80	89	94	89	83	76	70	62	55	49	44	40	37	35	34	33	31	30	28	23	
.10	14	17	20	24	26	28	31	35	40	46	53	61	69	82	90	92	87	81	74	65	58	51	45	41	38	35	34	33	31	30	28	23	14	17	20	24	26	28	31	35	40	46	53	61	69	82	90	92	87	81	74	65	58	51	45	41	38	35	34	33	31	30	28	23	
.20	13	16	20	23	25	27	29	33	37	43	50	57	65	79	88	91	88	82	76	67	59	52	46	42	38	35	34	33	32	30	28	23	13	16	20	23	25	27	29	33	37	43	50	57	65	79	88	91	88	82	76	67	59	52	46	42	38	35	34	33	32	30	28	23	
.30	12	15	18	22	23	24	26	28	31	35	41	47	54	69	81	89	90	86	81	71	63	54	47	43	39	36	34	34	32	30	28	24	12	15	18	22	23	24	26	28	31	35	41	47	54	69	81	89	90	86	81	71	63	54	47	43	39	36	34	34	32	30	28	24	
.40	11	14	18	21	22	24	25	27	30	34	38	44	51	65	78	87	90	87	82	73	64	55	48	43	40	36	34	34	32	30	28	24	11	14	18	21	22	24	25	27	30	34	38	44	51	65	78	87	90	87	82	73	64	55	48	43	40	36	34	34	32	30	28	24	
.50	10	13	16	19	20	22	23	24	26	29	32	36	41	54	69	81	88	89	86	77	68	58	50	44	41	37	35	34	32	31	29	24	10	13	16	19	20	22	23	24	26	29	32	36	41	54	69	81	88	89	86	77	68	58	50	44	41	37	35	34	32	31	29	24	
.75	9	11	14	18	19	20	21	22	24	26	28	31	35	46	58	71	82	88	88	81	73	62	52	46	42	38	35	34	32	31	29	24	9	11	14	18	19	20	21	22	24	26	28	31	35	46	58	71	82	88	88	81	73	62	52	46	42	38	35	34	32	31	29	24	
1.0	7	9	11	14	15	16	18	19	20	21	22	24	26	32	40	52	65	76	84	87	81	70	58	49	44	40	37	35	33	31	29	24	7	9	11	14	15	16	18	19	20	21	22	24	26	32	40	52	65	76	84	87	81	70	58	49	44	40	37	35	33	31	29	24	
1.5	4	6	8	10	11	12	13	14	15	16	17	18	19	22	26	31	39	50	62	77	85	81	69	57	49	44	40	37	34	32	30	25	4	6	8	10	11	12	13	14	15	16	17	18	19	22	26	31	39	50	62	77	85	81	69	57	49	44	40	37	34	32	30	25	
2.0	2	3	5	7	7	8	9	10	11	12	12	13	14	17	19	22	25	31	38	53	69	83	80	68	56	48	43	40	35	33	30	25	2	3	5	7	7	8	9	10	11	12	12	13	14	17	19	22	25	31	38	53	69	83	80	68	56	48	43	40	35	33	30	25	
2.5	1	1	2	3	4	5	5	6	6	7	8	9	9	11	13	15	17	20	23	30	41	61	82	82	69	58	49	44	37	34	31	26	1	1	2	3	4	5	5	6	6	7	8	9	9	11	13	15	17	20	23	30	41	61	82	82	69	58	49	44	37	34	31	26	
3.0	0	0	1	2	2	2	3	3	4	4	5	5	6	8	9	11	13	15	17	21	27	40	63	80	78	68	57	49	40	35	31	27	0	0	1	2	2	2	3	3	4	4	5	5	6	8	9	11	13	15	17	21	27	40	63	80	78	68	57	49	40	35	31	27	
	IA/P = 0.30																	IA/P = 0.30																																															
0.0	0	0	0	0	0	1	2	4	6	10	14	19	24	34	41	46	48	49	48	47	46	44	43	42	41	40	40	40	40	40	39	35	0	0	0	0	0	1	2	4	6	10	14	19	24	34	41	46	48	49	48	47	46	44	43	42	41	40	40	40	40	40	40	39	35
.10	0	0	0	0	0	0	1	1	3	5	8	12	17	27	36	42	46	48	49	48	46	45	43	42	41	40	40	40	40	40	39	36	0	0	0	0	0	0	1	1	3	5	8	12	17	27	36	42	46	48	49	48	46	45	43	42	41	40	40	40	40	40	40	39	36
.20	0	0	0	0	0	0	1	2	4	7	10	15	24	33	41	45	48	49	48	47	45	43	42	41	40	40	40	40	40	40	39	36	0	0	0	0	0	0	1	2	4	7	10	15	24	33	41	45	48	49	48	47	45	43	42	41	40	40	40	40	40	40	39	36	
.30	0	0	0	0	0	0	1	2	3	6	9	13	22	31	39	44	47	48	48	47	45	44	43	41	40	40	40	40	40	40	39	36	0	0	0	0	0	0	1	2	3	6	9	13	22	31	39	44	47	48	48	47	45	44	43	41	40	40	40	40	40	40	39	36	
.40	0	0	0	0	0	0	0	1	1	3	5	7	15	24	33	40	45	47	48	47	46	44	43	42	40	40	40	40	40	40	39	36	0	0	0	0	0	0	0	1	1	3	5	7	15	24	33	40	45	47	48	47	46	44	43	42	40	40	40	40	40	40	39	36	
.50	0	0	0	0	0	0	0	0	1	2	4	6	13	22	31	38	44	47	48	48	46	44	43	42	40	40	40	40	40	40	39	36	0	0	0	0	0	0	0	0	1	2	4	6	13	22	31	38	44	47	48	48	46	44	43	42	40	40	40	40	40	40	39	36	
.75	0	0	0	0	0	0	0	0	1	1	2	4	9	16	24	33	39	44	47	48	47	45	43	42	41	40	40	40	40	40	39	36	0	0	0	0	0	0	0	0	1	1	2	4	9	16	24	33	39	44	47	48	47	45	43	42	41	40	40	40	40	40	39	36	
1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	6	12	20	29	36	44	47	48	46	44	43	42	40	40	40	40	40	36	0	0	0	0	0	0	0	0	0	0	0	0	1	2	6	12	20	29	36	44	47	48	46	44	43	42	40	40	40	40	40	36	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	6	12	19	30	39	46	47	46	44	43	42	40	40	40	40	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	6	12	19	30	39	46	47	46	44	43	42	40	40	40	40	37	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	4	8	17	28	40	46	47	45	44	42	41	40	40	40	37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	4	8	17	28	40	46	47	45	44	42	41	40	40	40	37	
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	6	13	26	40	47	47	45	43	42	40	40	40	40	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	6	13	26	40	47	47	45	43	42	40	40	40	40	38		
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	12	28	41	46	46	45	43	41	40	40	40	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	12	28	41	46	46	45	43	41	40	40	40	38		
	IA/P = 0.50																	IA/P = 0.50																																															
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	7	11	16	22	27	30	32	35	38	42	42	42	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	7	11	16	22	27	30	32	35	38	42	42	42	42			
.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	4	7	13	19	24	28	31	34	37	41	42	42	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	4	7	13	19	24	28	31	34	37	41	42	42	42				
.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	12	19	24	28	31	33	36	41	42	42	42	0	0	0	0																														

### Exhibit 5-IA: Tabular hydrograph unit discharges (csm/in) for type IA rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME(HOURS)																															
	7.0	7.3	7.6	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	9.0	9.2	9.4	9.6	9.8	10.0	10.3	10.6	11.0	11.5	12.0	12.5	13.0	13.5	14.0	15.0	16.0	18.0	22.0
IA/P = 0.10												* * * TC = 2.0 HR * * *												IA/P = 0.10								
0.0	12	15	18	22	24	26	28	32	36	41	46	52	58	68	76	80	84	79	76	68	62	55	48	44	40	37	35	34	32	31	28	24
.10	11	13	16	20	21	23	25	27	30	34	38	43	49	60	70	77	83	83	78	72	65	57	50	45	41	38	36	34	32	31	29	24
.20	9	12	15	18	19	21	22	24	26	29	32	36	41	52	63	72	78	82	81	75	68	60	52	46	42	39	36	35	32	31	29	24
.30	9	12	14	18	19	20	21	23	25	28	31	34	39	49	60	70	77	81	81	76	70	61	53	47	43	39	36	35	33	31	29	24
.40	9	11	14	17	18	19	21	22	24	26	29	33	37	47	57	67	75	80	81	77	71	62	53	47	43	39	37	35	33	31	29	24
.50	7	10	12	15	17	18	19	20	21	23	25	28	31	39	49	60	69	76	81	79	74	65	56	49	44	40	37	35	33	31	29	24
.75	6	9	11	14	15	16	17	18	20	21	23	25	27	34	42	52	62	70	76	79	76	68	59	51	46	41	38	36	33	31	29	24
1.0	5	6	9	11	12	13	14	15	16	17	18	20	21	25	30	38	47	57	66	76	79	75	64	55	49	44	40	37	34	32	29	25
1.5	3	4	6	8	8	9	10	11	12	13	14	15	16	18	21	24	30	37	45	59	71	78	73	63	55	48	43	40	35	33	30	25
2.0	1	2	3	4	5	5	6	7	7	8	9	10	10	12	14	16	19	22	26	36	48	65	77	73	64	56	49	44	37	34	31	26
2.5	0	1	1	2	3	3	4	4	5	5	6	6	7	8	10	12	14	16	18	23	31	46	66	76	72	63	55	48	40	35	31	27
3.0	0	0	1	1	1	2	2	2	3	3	3	4	4	5	7	8	10	11	13	17	21	30	49	67	75	71	63	54	43	37	32	27
IA/P = 0.30												* * * TC = 2.0 HR * * *												IA/P = 0.30								
0.0	0	0	0	0	0	0	1	2	3	5	7	10	13	20	27	34	39	42	44	47	45	45	44	43	42	40	40	40	40	40	39	36
.10	0	0	0	0	0	0	0	1	1	2	4	6	8	15	22	29	35	40	43	45	46	45	44	43	42	41	40	40	40	40	40	36
.20	0	0	0	0	0	0	0	0	1	1	2	3	5	10	17	24	31	36	41	44	46	45	44	43	42	41	40	40	40	40	40	36
.30	0	0	0	0	0	0	0	0	0	1	2	3	4	9	15	22	29	35	39	44	46	45	44	43	42	41	40	40	40	40	40	36
.40	0	0	0	0	0	0	0	0	0	1	1	2	4	8	14	20	27	33	38	43	46	46	44	43	42	41	40	40	40	40	40	36
.50	0	0	0	0	0	0	0	0	0	0	1	1	2	5	9	15	22	29	35	41	44	45	45	44	43	42	40	40	40	40	40	36
.75	0	0	0	0	0	0	0	0	0	0	1	1	3	6	11	17	24	30	38	42	45	45	44	43	42	41	40	40	40	40	40	37
1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	5	9	14	21	30	38	43	45	44	44	43	43	41	40	40	40	40	37
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	4	8	16	25	36	43	45	44	43	42	41	40	40	40	40	38
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	6	12	24	36	43	45	44	43	42	40	40	40	40	38
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	12	25	37	43	45	44	43	41	40	40	40	38
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	13	26	37	43	44	44	42	40	40	40	39
IA/P = 0.50												* * * TC = 2.0 HR * * *												IA/P = 0.50								
0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	4	7	12	18	23	27	30	33	36	40	40	40	40	40
.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	5	10	16	21	26	29	32	35	40	40	40	40	40
.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	4	8	14	20	25	28	31	34	39	40	40	40	40
.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	6	12	18	23	27	30	33	38	40	40	40	40
.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	5	11	16	22	26	29	32	38	40	40	40	40
.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	9	15	20	25	28	31	37	40	40	40	40
.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	7	13	19	24	27	30	36	40	40	40	40
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	8	14	20	24	28	34	39	40	40	40
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	10	16	21	25	32	37	40	40	40
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	11	16	21	29	35	40	40	40
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	11	17	26	32	40	40	40
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	11	21	29	39	40	40

RAINFALL TYPE = IA

\* \* \* TC = 2.0 HR \* \* \*

SHEET 10 OF 10

## Exhibit 5-II: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution

TRVL TIME (hr)	HYDROGRAPH TIME(HOURS)																																																															
	11.3	11.9	12.1	12.3	12.5	12.7	13.0	13.4	13.8	14.3	15.0	16.0	17.0	18.0	20.0	26.0	11.0	11.6	12.0	12.2	12.4	12.6	12.8	13.2	13.6	14.0	14.6	15.5	16.5	17.5	19.0	22.0																																
	IA/P = 0.10														IA/P = 0.10																																																	
0.0	24	34	53	334	647	1010	623	217	147	123	104	86	76	66	57	51	46	42	38	34	32	29	26	23	21	20	19	18	15	13	12	0	24	34	53	334	647	1010	623	217	147	123	104	86	76	66	57	51	46	42	38	34	32	29	26	23	21	20	19	18	15	13	12	0
.10	21	29	43	134	267	520	847	701	378	224	157	122	98	75	64	56	50	45	41	36	33	30	27	24	21	20	19	18	16	13	12	0	21	29	43	134	267	520	847	701	378	224	157	122	98	75	64	56	50	45	41	36	33	30	27	24	21	20	19	18	16	13	12	0
.20	18	25	35	61	110	215	418	704	702	486	312	209	151	94	73	62	54	49	44	38	34	31	28	25	22	21	19	18	16	14	12	0	18	25	35	61	110	215	418	704	702	486	312	209	151	94	73	62	54	49	44	38	34	31	28	25	22	21	19	18	16	14	12	0
.30	17	23	33	56	92	174	337	582	662	545	389	269	190	109	79	65	56	50	45	39	35	32	29	25	22	21	20	18	16	14	12	0	17	23	33	56	92	174	337	582	662	545	389	269	190	109	79	65	56	50	45	39	35	32	29	25	22	21	20	18	16	14	12	0
.40	15	20	28	41	51	78	142	272	478	601	563	447	328	172	104	76	63	55	49	42	37	33	29	26	23	21	20	19	17	14	12	0	15	20	28	41	51	78	142	272	478	601	563	447	328	172	104	76	63	55	49	42	37	33	29	26	23	21	20	19	17	14	12	0
.50	14	19	26	39	47	68	117	220	392	531	553	482	380	209	121	84	67	57	51	43	38	33	30	27	23	21	20	19	17	14	12	0	14	19	26	39	47	68	117	220	392	531	553	482	380	209	121	84	67	57	51	43	38	33	30	27	23	21	20	19	17	14	12	0
.75	12	15	21	29	33	38	49	73	126	224	343	432	464	385	252	156	103	76	62	50	43	36	31	28	25	22	21	19	17	15	12	0	12	15	21	29	33	38	49	73	126	224	343	432	464	385	252	156	103	76	62	50	43	36	31	28	25	22	21	19	17	15	12	0
1.0	9	12	15	21	23	26	29	33	40	55	86	148	238	406	434	317	205	130	89	62	50	41	34	30	27	24	22	20	18	16	12	0	9	12	15	21	23	26	29	33	40	55	86	148	238	406	434	317	205	130	89	62	50	41	34	30	27	24	22	20	18	16	12	0
1.5	7	8	10	14	15	16	18	20	22	25	29	34	45	101	220	339	373	320	234	131	80	53	40	34	30	27	24	21	19	17	12	2	7	8	10	14	15	16	18	20	22	25	29	34	45	101	220	339	373	320	234	131	80	53	40	34	30	27	24	21	19	17	12	2
2.0	4	6	7	9	9	10	11	12	13	15	16	18	20	25	37	72	150	252	336	312	216	109	58	42	34	30	27	24	20	18	13	8	4	6	7	9	9	10	11	12	13	15	16	18	20	25	37	72	150	252	336	312	216	109	58	42	34	30	27	24	20	18	13	8
2.5	3	4	5	6	7	7	8	8	9	10	11	12	13	16	19	25	39	75	142	262	308	229	108	58	41	34	30	27	22	19	14	11	3	4	5	6	7	7	8	8	9	10	11	12	13	16	19	25	39	75	142	262	308	229	108	58	41	34	30	27	22	19	14	11
3.0	1	2	3	4	4	5	5	6	6	7	7	8	8	10	12	14	17	22	31	76	169	288	236	122	64	43	35	30	24	20	16	11	1	2	3	4	4	5	5	6	6	7	7	8	8	10	12	14	17	22	31	76	169	288	236	122	64	43	35	30	24	20	16	11
	IA/P = 0.30														IA/P = 0.30																																																	
0.0	0	0	0	154	568	936	524	217	172	149	126	107	97	86	76	69	63	58	53	48	46	42	38	34	31	30	28	27	24	20	19	0	0	0	0	154	568	936	524	217	172	149	126	107	97	86	76	69	63	58	53	48	46	42	38	34	31	30	28	27	24	20	19	0
.10	0	0	0	19	109	415	762	603	346	230	176	143	119	96	84	74	68	62	57	50	47	44	40	35	32	30	29	27	24	21	19	0	0	0	0	19	109	415	762	603	346	230	176	143	119	96	84	74	68	62	57	50	47	44	40	35	32	30	29	27	24	21	19	0
.20	0	0	0	13	77	302	609	605	432	297	217	167	115	94	81	73	66	60	53	48	45	41	37	33	31	29	28	25	21	19	0	0	0	0	13	77	302	609	605	432	297	217	167	115	94	81	73	66	60	53	48	45	41	37	33	31	29	28	25	21	19	0		
.30	0	0	0	9	54	219	479	563	476	357	263	199	129	99	85	75	68	62	54	49	45	41	37	33	31	29	28	25	21	19	0	0	0	0	9	54	219	479	563	476	357	263	199	129	99	85	75	68	62	54	49	45	41	37	33	31	29	28	25	21	19	0		
.40	0	0	0	0	0	6	38	159	372	500	484	399	309	183	123	96	82	73	66	58	51	46	42	38	34	31	30	28	25	22	19	0	0	0	0	0	0	6	38	159	372	500	484	399	309	183	123	96	82	73	66	58	51	46	42	38	34	31	30	28	25	22	19	0
.50	0	0	0	0	0	4	27	115	287	429	465	421	346	213	138	103	86	76	68	59	52	47	43	39	34	32	30	29	25	22	19	0	0	0	0	0	0	4	27	115	287	429	465	421	346	213	138	103	86	76	68	59	52	47	43	39	34	32	30	29	25	22	19	0
.75	0	0	0	0	0	1	10	46	132	246	338	381	341	243	165	119	94	80	67	58	50	45	41	37	33	31	29	26	23	19	0	0	0	0	0	0	1	10	46	132	246	338	381	341	243	165	119	94	80	67	58	50	45	41	37	33	31	29	26	23	19	0		
1.0	0	0	0	0	0	0	1	4	22	69	149	241	357	331	246	170	122	96	76	64	54	47	42	38	34	32	30	27	24	19	0	0	0	0	0	0	0	1	4	22	69	149	241	357	331	246	170	122	96	76	64	54	47	42	38	34	32	30	27	24	19	0		
1.5	0	0	0	0	0	0	0	0	0	0	1	4	41	142	258	310	285	224	142	97	71	55	47	43	39	35	32	29	25	20	4	0	0	0	0	0	0	0	0	0	0	0	1	4	41	142	258	310	285	224	142	97	71	55	47	43	39	35	32	29	25	20	4	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	1	10	49	130	221	279	255	182	108	70	55	47	42	38	34	30	27	20	11	0	0	0	0	0	0	0	0	0	0	0	0	1	10	49	130	221	279	255	182	108	70	55	47	42	38	34	30	27	20	11		
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	14	52	119	224	256	193	107	70	55	47	42	38	32	28	22	17	0	0	0	0	0	0	0	0	0	0	0	0	0	2	14	52	119	224	256	193	107	70	55	47	42	38	32	28	22	17			
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	52	141	240	199	117	74	56	48	43	35	30	24	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	52	141	240	199	117	74	56	48	43	35	30	24	18			
	IA/P = 0.50														IA/P = 0.50																																																	
0.0	0	0	0	70	539	377	196	171	154	134	117	108	99	89	83	77	72	67	61	59	56	51	46	43	42	40	38	34	30	28	0	0	0	0	70	539	377	196	171	154	134	117	108	99	89	83	77	72	67	61	59	56	51	46	43	42	40	38	34	30	28	0		
.10	0	0	0	47	375	376	256	199	169	146	126	114	102	92	85	79	73	68	62	59	56	52	47	43	42	40	38	34																																				

### Exhibit 5-II: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution—continued

TRVL TIME (hr)	11.3	11.9	12.1	12.3	12.5	12.7	13.0	13.4	13.8	14.3	15.0	16.0	17.0	18.0	20.0	26.0																
(hr)	11.0	11.6	12.0	12.2	12.4	12.6	12.8	13.2	13.6	14.0	14.6	15.5	16.5	17.5	19.0	22.0																
IA/P = 0.10																																
* * * TC = 0.2 HR * * *																																
IA/P = 0.10																																
0.0	23	31	47	209	403	739	800	481	250	166	128	102	86	70	61	54	49	44	40	35	33	30	27	24	21	20	19	18	16	13	12	0
.10	19	26	39	86	168	325	601	733	565	355	229	161	122	83	69	59	53	47	43	37	34	31	28	25	22	21	19	18	16	14	12	0
.20	17	23	32	49	74	136	262	488	652	594	435	298	207	115	81	67	58	51	46	40	35	32	29	26	23	21	20	19	16	14	12	0
.30	16	22	30	46	64	112	212	396	566	585	485	360	258	139	90	71	60	53	48	41	36	32	29	26	23	21	20	19	16	14	12	0
.40	14	19	25	37	43	57	94	173	322	485	551	507	409	227	129	87	68	58	52	44	38	33	30	27	24	21	20	19	17	14	12	0
.50	13	18	24	35	40	52	80	142	262	410	504	506	441	269	153	98	73	61	53	45	39	34	30	27	24	22	20	19	17	15	12	0
.75	10	13	17	23	26	30	34	40	55	86	150	247	349	438	360	240	151	101	75	57	47	39	33	29	26	23	21	20	18	15	12	0
1.0	9	11	14	19	21	24	26	30	35	44	62	101	167	337	413	353	245	157	104	68	53	42	35	31	28	24	22	20	18	16	12	0
1.5	6	8	10	13	14	15	17	19	21	23	26	30	37	73	166	288	356	337	264	154	91	57	42	35	30	27	24	22	19	17	13	3
2.0	4	5	7	8	9	10	10	11	12	14	15	16	18	23	31	55	114	206	291	324	239	125	63	44	35	31	28	24	20	18	14	9
2.5	3	4	5	6	6	7	7	8	9	9	10	11	12	15	18	22	32	58	111	227	298	246	122	63	43	35	31	27	22	19	15	11
3.0	1	2	3	4	4	4	5	5	6	6	7	7	8	9	11	13	16	19	27	59	138	280	248	137	70	46	36	31	25	21	16	11
IA/P = 0.30																																
* * * TC = 0.2 HR * * *																																
IA/P = 0.30																																
0.0	0	0	0	39	180	545	697	497	276	198	158	130	110	93	81	73	67	61	56	49	46	43	39	35	32	30	29	27	24	21	19	0
.10	0	0	0	2	27	129	407	600	532	361	252	190	150	108	90	79	71	65	59	52	48	44	41	36	32	31	29	28	25	21	19	0
.20	0	0	0	2	19	92	302	501	521	415	306	228	176	119	95	82	73	67	61	53	48	45	41	37	33	31	29	28	25	21	19	0
.30	0	0	0	0	1	13	66	223	408	484	438	350	269	163	114	93	80	72	65	57	51	46	42	38	34	31	30	28	25	22	19	0
.40	0	0	0	0	1	9	47	164	327	431	436	379	306	189	127	98	83	74	67	58	52	47	43	38	34	31	30	28	25	22	19	0
.50	0	0	0	0	0	0	6	33	120	258	374	415	391	271	173	121	95	81	72	62	55	48	44	40	35	32	30	29	26	22	19	0
.75	0	0	0	0	0	0	2	13	50	126	221	302	348	323	240	167	121	96	81	68	59	50	45	41	37	33	31	29	26	23	19	0
1.0	0	0	0	0	0	0	0	0	1	6	24	69	139	285	331	280	204	145	109	82	68	56	48	43	39	35	32	30	27	24	19	0
1.5	0	0	0	0	0	0	0	0	0	0	0	0	1	16	79	186	271	288	247	165	110	76	58	49	44	40	35	32	29	26	20	5
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	24	80	163	235	262	202	123	76	58	49	43	39	35	30	27	21	13
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	28	77	179	242	207	120	75	57	48	43	39	32	29	22	17
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	30	101	207	227	130	80	59	49	44	35	30	24	18
IA/P = 0.50																																
* * * TC = 0.2 HR * * *																																
IA/P = 0.50																																
0.0	0	0	0	7	98	371	322	221	182	158	137	120	104	94	86	80	74	69	62	60	57	52	47	44	42	40	39	35	30	28	0	
.10	0	0	0	4	67	270	305	249	204	174	149	130	108	97	88	82	76	71	64	60	57	53	48	44	42	41	39	35	30	28	0	
.20	0	0	0	0	3	45	195	268	255	221	189	163	125	106	95	87	80	75	67	62	58	54	49	45	43	41	39	35	31	28	0	
.30	0	0	0	0	0	2	31	140	226	245	229	203	176	134	111	98	89	82	76	68	62	59	55	50	45	43	41	39	36	31	28	0
.40	0	0	0	0	0	1	21	101	184	225	228	211	188	144	117	101	91	84	78	69	63	59	55	50	45	43	41	40	36	31	28	0
.50	0	0	0	0	0	0	1	14	72	146	199	218	213	175	137	113	99	89	82	73	66	60	56	52	47	43	42	40	36	32	28	0
.75	0	0	0	0	0	0	0	5	28	71	121	162	186	193	161	133	112	98	88	78	70	62	57	53	48	44	42	41	37	33	28	0
1.0	0	0	0	0	0	0	0	0	0	2	13	38	77	154	186	174	147	122	105	89	78	68	60	56	51	46	43	42	38	34	28	0
1.5	0	0	0	0	0	0	0	0	0	0	0	0	2	22	71	129	163	168	150	120	98	80	67	60	55	51	46	43	40	36	28	4
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	25	65	112	146	157	134	103	79	67	60	55	50	46	41	38	29	14
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	26	60	117	148	136	101	79	66	59	54	50	43	39	31	24
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	40	90	142	130	99	78	66	59	54	45	41	33	26

RAINFALL TYPE = II

\* \* \* TC = 0.2 HR \* \* \*

SHEET 2 OF 10

### Exhibit 5-II: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME(HOURS)																																																															
	11.3	11.9	12.1	12.3	12.5	12.7	13.0	13.4	13.8	14.3	15.0	16.0	17.0	18.0	20.0	26.0	11.0	11.6	12.0	12.2	12.4	12.6	12.8	13.2	13.6	14.0	14.6	15.5	16.5	17.5	19.0	22.0																																
	IA/P = 0.10													* * * TC = 0.3 HR * * *													IA/P = 0.10																																					
0.0	20	28	41	118	235	447	676	676	459	283	196	146	114	80	66	57	51	46	42	37	33	31	28	24	22	20	19	18	16	13	12	0	20	28	41	118	235	447	676	676	459	283	196	146	114	80	66	57	51	46	42	37	33	31	28	24	22	20	19	18	16	13	12	0
.10	19	26	39	99	189	361	571	641	520	362	251	181	136	89	70	60	53	48	43	37	34	31	28	25	22	21	19	18	16	14	12	0	19	26	39	99	189	361	571	641	520	362	251	181	136	89	70	60	53	48	43	37	34	31	28	25	22	21	19	18	16	14	12	0
.20	17	23	32	53	83	154	292	478	587	542	422	308	223	127	86	68	58	52	46	40	35	32	29	26	23	21	20	19	16	14	12	0	17	23	32	53	83	154	292	478	587	542	422	308	223	127	86	68	58	52	46	40	35	32	29	26	23	21	20	19	16	14	12	0
.30	16	22	30	49	72	127	237	398	524	536	460	359	268	151	97	73	61	53	48	41	36	32	29	26	23	21	20	19	16	14	12	0	16	22	30	49	72	127	237	398	524	536	460	359	268	151	97	73	61	53	48	41	36	32	29	26	23	21	20	19	16	14	12	0
.40	14	19	25	37	45	63	105	193	330	459	510	477	398	237	139	92	70	59	52	44	38	34	30	27	24	21	20	19	17	14	12	0	14	19	25	37	45	63	105	193	330	459	510	477	398	237	139	92	70	59	52	44	38	34	30	27	24	21	20	19	17	14	12	0
.50	13	18	24	35	42	56	89	158	272	397	472	475	424	274	163	104	76	62	54	46	39	34	30	27	24	22	20	19	17	15	12	0	13	18	24	35	42	56	89	158	272	397	472	475	424	274	163	104	76	62	54	46	39	34	30	27	24	22	20	19	17	15	12	0
.75	11	14	19	26	30	34	42	59	95	160	250	339	417	398	299	196	128	89	69	54	45	37	32	29	26	23	21	20	17	15	12	0	11	14	19	26	30	34	42	59	95	160	250	339	417	398	299	196	128	89	69	54	45	37	32	29	26	23	21	20	17	15	12	0
1.0	9	11	14	19	21	24	27	30	36	46	68	109	174	328	396	346	248	163	109	70	54	43	35	31	28	24	22	20	18	16	12	0	9	11	14	19	21	24	27	30	36	46	68	109	174	328	396	346	248	163	109	70	54	43	35	31	28	24	22	20	18	16	12	0
1.5	6	8	10	13	14	15	17	19	21	23	26	31	38	77	169	282	347	330	264	158	94	58	42	35	31	27	24	22	19	17	13	3	6	8	10	13	14	15	17	19	21	23	26	31	38	77	169	282	347	330	264	158	94	58	42	35	31	27	24	22	19	17	13	3
2.0	4	5	7	8	9	10	10	11	12	14	15	16	18	23	32	57	116	205	285	317	239	128	64	44	36	31	28	25	20	18	14	9	4	5	7	8	9	10	10	11	12	14	15	16	18	23	32	57	116	205	285	317	239	128	64	44	36	31	28	25	20	18	14	9
2.5	2	4	5	6	6	7	7	8	9	10	11	11	12	15	18	23	33	60	113	223	293	245	125	65	44	35	31	27	22	19	15	11	2	4	5	6	6	7	7	8	9	10	11	11	12	15	18	23	33	60	113	223	293	245	125	65	44	35	31	27	22	19	15	11
3.0	1	2	3	4	4	4	5	5	6	6	7	7	8	9	11	13	16	20	27	61	138	275	246	139	72	46	36	31	25	21	16	11	1	2	3	4	4	4	5	5	6	6	7	7	8	9	11	13	16	20	27	61	138	275	246	139	72	46	36	31	25	21	16	11
	IA/P = 0.30													* * * TC = 0.3 HR * * *													IA/P = 0.30																																					
0.0	0	0	0	11	64	251	525	574	454	303	221	173	140	104	88	77	70	64	58	51	47	44	40	36	32	31	29	28	24	21	19	0	0	0	0	11	64	251	525	574	454	303	221	173	140	104	88	77	70	64	58	51	47	44	40	36	32	31	29	28	24	21	19	0
.10	0	0	0	0	7	45	183	411	520	476	360	268	205	133	101	85	76	69	62	55	49	45	41	37	33	31	30	28	25	21	19	0	0	0	0	0	7	45	183	411	520	476	360	268	205	133	101	85	76	69	62	55	49	45	41	37	33	31	30	28	25	21	19	0
.20	0	0	0	0	5	32	132	318	452	468	396	310	240	151	109	90	78	70	64	56	50	46	42	38	33	31	30	28	25	22	19	0	0	0	0	0	5	32	132	318	452	468	396	310	240	151	109	90	78	70	64	56	50	46	42	38	33	31	30	28	25	22	19	0
.30	0	0	0	0	0	3	22	96	244	383	440	411	344	217	142	105	87	76	69	60	53	47	43	39	35	32	30	29	26	22	19	0	0	0	0	0	0	3	22	96	244	383	440	411	344	217	142	105	87	76	69	60	53	47	43	39	35	32	30	29	26	22	19	0
.40	0	0	0	0	0	2	16	69	186	317	399	407	365	246	160	115	92	79	71	61	54	48	43	39	35	32	30	29	26	22	19	0	0	0	0	0	0	2	16	69	186	317	399	407	365	246	160	115	92	79	71	61	54	48	43	39	35	32	30	29	26	22	19	0
.50	0	0	0	0	0	0	2	11	50	140	258	352	389	327	223	149	110	89	77	66	57	50	45	41	36	33	31	29	26	23	19	0	0	0	0	0	0	0	2	11	50	140	258	352	389	327	223	149	110	89	77	66	57	50	45	41	36	33	31	29	26	23	19	0
.75	0	0	0	0	0	0	1	4	20	63	135	219	290	335	281	205	146	110	89	72	62	52	46	42	38	34	31	30	27	23	19	0	0	0	0	0	0	0	1	4	20	63	135	219	290	335	281	205	146	110	89	72	62	52	46	42	38	34	31	30	27	23	19	0
1.0	0	0	0	0	0	0	0	0	0	2	9	32	78	216	320	306	243	176	128	90	72	59	49	44	40	36	33	31	28	24	19	1	0	0	0	0	0	0	0	0	0	2	9	32	78	216	320	306	243	176	128	90	72	59	49	44	40	36	33	31	28	24	19	1
1.5	0	0	0	0	0	0	0	0	0	0	0	0	2	20	84	185	264	281	246	168	112	77	58	49	44	40	36	32	29	26	20	5	0	0	0	0	0	0	0	0	0	0	2	20	84	185	264	281	246	168	112	77	58	49	44	40	36	32	29	26	20	5		
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	12	50	121	200	257	224	141	83	61	50	44	40	36	31	28	21	14	0	0	0	0	0	0	0	0	0	0	1	12	50	121	200	257	224	141	83	61	50	44	40	36	31	28	21	14				
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	16	51	145	239	223	137	82	60	50	44	40	33	29	22	17	0	0	0	0	0	0	0	0	0	0	0	0	3	16	51	145	239	223	137	82	60	50	44	40	33	29	22	17				
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	19	74	184	224	146	89	63	51	45	36	31	24	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	19	74	184	224	146	89	63	51	45	36	31	24	18	
	IA/P = 0.50													* * * TC = 0.3 HR * * *													IA/P = 0.50																																					
0.0	0	0	0	1	25	151	299	277	219	187	162	141	113	100	90	84	78	72	65	61	58	53	48	44	42	41	39	35	31	28	0	0	0	0	1	25	151	299	277	219	187	162	141	113	100	90	84	78	72	65	61	58	53	48	44	42	41	39	35	31	28	0		
.10	0	0	0	0	1	17	106	235	263																																																							

### Exhibit 5-II: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution—continued

TRVL TIME (hr)	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0					
IA/P = 0.10																	* * * TC = 0.4 HR * * *											IA/P = 0.10									
0.0	18	25	36	77	141	271	468	592	574	431	298	216	163	104	77	63	55	49	44	38	34	31	28	25	22	21	20	18	16	14	12	0					
.10	18	24	34	67	116	219	385	523	557	473	357	263	196	119	84	67	57	51	46	39	35	32	29	25	22	21	20	19	16	14	12	0					
.20	15	20	28	44	59	97	179	316	454	523	489	401	309	178	112	81	65	56	49	42	37	33	30	26	23	21	20	19	17	14	12	0					
.30	15	20	27	41	53	82	147	260	389	478	486	429	349	210	129	89	69	58	51	43	38	33	30	27	24	21	20	19	17	14	12	0					
.40	13	17	23	33	38	48	71	121	214	331	429	467	442	308	189	120	85	66	56	47	41	35	31	28	24	22	20	19	17	15	12	0					
.50	12	16	22	31	36	44	62	102	176	279	379	438	440	339	218	137	94	71	59	49	42	35	31	28	25	22	21	19	17	15	12	0					
.75	10	13	17	24	26	30	35	45	65	106	170	251	326	393	341	245	164	112	81	59	48	39	33	30	26	23	21	20	18	15	12	0					
1.0	8	10	13	17	19	21	24	27	31	37	50	75	118	251	360	376	292	205	138	83	60	45	36	32	28	25	22	21	18	16	12	1					
1.5	6	7	9	12	13	14	15	17	19	21	23	26	31	56	121	224	311	333	293	192	115	66	45	36	31	28	25	22	19	17	13	4					
2.0	4	5	6	8	8	9	10	10	11	12	14	15	16	20	27	43	85	159	243	306	264	154	74	47	37	32	28	25	21	18	14	9					
2.5	2	3	4	5	6	6	7	7	8	9	9	10	11	13	16	20	27	46	85	184	285	262	147	74	47	37	32	28	22	19	15	11					
3.0	1	2	2	3	4	4	4	5	5	6	6	7	7	8	10	12	14	17	23	47	109	227	268	160	83	50	38	32	25	21	16	11					
IA/P = 0.30																	* * * TC = 0.4 HR * * *											IA/P = 0.30									
0.0	0	0	0	4	26	113	296	480	495	413	306	234	186	127	100	84	74	67	61	54	49	45	41	37	33	31	29	28	25	21	19	0					
.10	0	0	0	0	2	18	81	224	395	462	430	347	272	172	121	96	82	73	66	57	51	46	42	38	34	31	30	28	25	22	19	0					
.20	0	0	0	0	2	13	59	169	320	414	424	373	305	196	134	103	85	75	67	59	52	47	43	39	34	32	30	29	25	22	19	0					
.30	0	0	0	0	0	1	9	42	127	255	361	403	383	274	181	127	99	83	73	63	55	48	44	40	36	32	30	29	26	23	19	0					
.40	0	0	0	0	0	1	6	30	94	202	308	372	379	298	203	141	106	87	76	65	56	49	44	40	36	32	31	29	26	23	19	0					
.50	0	0	0	0	0	0	0	4	21	70	158	258	334	364	270	187	133	102	85	70	60	51	46	41	37	33	31	30	26	23	19	0					
.75	0	0	0	0	0	0	0	2	8	30	76	145	219	321	305	241	177	130	102	78	65	55	47	43	38	34	32	30	27	24	19	0					
1.0	0	0	0	0	0	0	0	0	0	1	4	15	42	150	267	308	272	209	154	103	79	62	51	45	41	37	33	31	28	25	19	1					
1.5	0	0	0	0	0	0	0	0	0	0	0	0	1	10	51	136	226	274	263	195	131	85	62	51	45	41	36	33	29	26	20	6					
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	31	86	162	252	239	162	93	64	52	45	41	37	31	28	21	15					
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	33	112	202	235	155	92	64	52	45	41	33	29	23	18						
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	21	76	182	221	148	90	63	51	45	36	31	24	18					
IA/P = 0.50																	* * * TC = 0.4 HR * * *											IA/P = 0.50									
0.0	0	0	0	0	0	7	59	168	245	257	213	186	163	128	109	96	88	81	75	67	62	58	54	50	45	43	41	39	35	31	28	0					
.10	0	0	0	0	0	0	5	41	125	205	240	222	198	154	123	106	94	86	79	71	64	60	56	51	46	43	42	40	36	32	28	0					
.20	0	0	0	0	0	0	3	28	93	168	216	220	205	164	131	110	97	88	81	72	65	60	56	51	46	43	42	40	36	32	28	0					
.30	0	0	0	0	0	0	0	2	20	69	135	189	209	192	155	126	107	95	86	77	69	62	57	53	48	44	42	41	37	33	28	0					
.40	0	0	0	0	0	0	0	1	14	50	106	161	193	202	163	133	112	98	89	78	70	62	58	53	48	44	42	41	37	33	28	0					
.50	0	0	0	0	0	0	0	1	9	37	83	135	174	194	171	140	117	102	91	80	71	63	58	54	49	45	43	41	37	33	28	0					
.75	0	0	0	0	0	0	0	0	0	3	15	40	76	147	177	169	146	124	107	90	79	68	60	56	51	47	43	42	38	34	28	0					
1.0	0	0	0	0	0	0	0	0	0	0	1	7	21	78	141	173	167	146	125	101	86	73	63	58	53	48	45	42	39	35	28	1					
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	5	26	71	121	153	159	139	113	89	72	63	57	53	48	44	40	37	29	7					
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	16	45	86	138	150	125	93	74	64	58	53	48	42	39	31	20					
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	17	59	112	143	121	91	73	63	57	53	45	40	32	26						
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	11	40	101	138	117	90	73	63	57	48	42	34	27					

RAINFALL TYPE = II

\* \* \* TC = 0.4 HR \* \* \*

SHEET 4 OF 10

### Exhibit 5-II: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME (HOURS)																																																															
	11.3	11.9	12.1	12.3	12.5	12.7	13.0	13.4	13.8	14.3	15.0	16.0	17.0	18.0	20.0	26.0	11.0	11.6	12.0	12.2	12.4	12.6	12.8	13.2	13.6	14.0	14.6	15.5	16.5	17.5	19.0	22.0																																
	IA/P = 0.10													* * * TC = 0.5 HR * * *													IA/P = 0.10																																					
0.0	17	23	32	57	94	170	308	467	529	507	402	297	226	140	96	74	61	53	47	41	36	32	29	26	23	21	20	19	16	14	12	0	17	23	32	57	94	170	308	467	529	507	402	297	226	140	96	74	61	53	47	41	36	32	29	26	23	21	20	19	16	14	12	0
.10	16	22	30	51	80	140	252	395	484	499	434	343	265	162	108	80	65	55	49	42	36	33	29	26	23	21	20	19	16	14	12	0	16	22	30	51	80	140	252	395	484	499	434	343	265	162	108	80	65	55	49	42	36	33	29	26	23	21	20	19	16	14	12	0
.20	14	19	25	38	47	69	116	207	332	434	477	449	378	238	149	101	77	62	53	45	39	34	30	27	24	22	20	19	17	14	12	0	14	19	25	38	47	69	116	207	332	434	477	449	378	238	149	101	77	62	53	45	39	34	30	27	24	22	20	19	17	14	12	0
.30	13	18	24	35	43	60	97	170	278	382	446	448	401	270	171	114	83	66	56	46	40	34	31	27	24	22	20	19	17	15	12	0	13	18	24	35	43	60	97	170	278	382	446	448	401	270	171	114	83	66	56	46	40	34	31	27	24	22	20	19	17	15	12	0
.40	12	15	21	29	33	40	53	83	141	233	332	408	434	361	243	157	107	79	64	51	43	36	32	28	25	22	21	20	17	15	12	0	12	15	21	29	33	40	53	83	141	233	332	408	434	361	243	157	107	79	64	51	43	36	32	28	25	22	21	20	17	15	12	0
.50	11	15	20	28	31	37	48	71	118	194	286	367	412	378	271	178	119	86	68	53	44	37	32	29	25	23	21	20	17	15	12	0	11	15	20	28	31	37	48	71	118	194	286	367	412	378	271	178	119	86	68	53	44	37	32	29	25	23	21	20	17	15	12	0
.75	9	11	14	19	21	24	27	31	37	49	74	118	182	319	374	328	244	169	117	76	56	43	35	31	28	25	22	21	18	16	12	1	9	11	14	19	21	24	27	31	37	49	74	118	182	319	374	328	244	169	117	76	56	43	35	31	28	25	22	21	18	16	12	1
1.0	7	9	12	16	17	19	21	24	27	32	40	55	83	188	309	359	322	245	172	102	68	49	38	32	29	26	23	21	19	16	12	1	7	9	12	16	17	19	21	24	27	32	40	55	83	188	309	359	322	245	172	102	68	49	38	32	29	26	23	21	19	16	12	1
1.5	5	7	8	11	12	13	14	15	17	19	21	23	27	43	89	175	269	322	309	225	140	77	49	38	32	29	25	23	20	17	13	5	5	7	8	11	12	13	14	15	17	19	21	23	27	43	89	175	269	322	309	225	140	77	49	38	32	29	25	23	20	17	13	5
2.0	3	4	6	7	8	8	9	10	10	11	12	14	15	18	23	35	65	123	202	297	280	181	88	52	39	33	29	26	21	19	14	10	3	4	6	7	8	8	9	10	10	11	12	14	15	18	23	35	65	123	202	297	280	181	88	52	39	33	29	26	21	19	14	10
2.5	2	3	4	5	5	6	6	7	7	8	9	9	10	12	15	18	24	36	66	150	244	278	171	87	52	39	33	29	23	20	15	11	2	3	4	5	5	6	6	7	7	8	9	9	10	12	15	18	24	36	66	150	244	278	171	87	52	39	33	29	23	20	15	11
3.0	1	1	2	3	3	4	4	4	5	5	6	6	7	8	9	11	13	16	20	37	86	198	263	182	96	56	40	33	26	21	16	11	1	1	2	3	3	4	4	4	5	5	6	6	7	8	9	11	13	16	20	37	86	198	263	182	96	56	40	33	26	21	16	11
	IA/P = 0.30													* * * TC = 0.5 HR * * *													IA/P = 0.30																																					
0.0	0	0	0	1	9	53	157	314	433	439	379	299	237	159	118	95	81	71	65	56	50	46	42	38	34	31	30	28	25	22	19	0	0	0	0	1	9	53	157	314	433	439	379	299	237	159	118	95	81	71	65	56	50	46	42	38	34	31	30	28	25	22	19	0
.10	0	0	0	0	1	6	37	117	248	372	416	391	330	218	150	113	92	79	70	60	53	47	43	39	35	32	30	29	26	22	19	0	0	0	0	0	1	6	37	117	248	372	416	391	330	218	150	113	92	79	70	60	53	47	43	39	35	32	30	29	26	22	19	0
.20	0	0	0	0	1	4	26	87	194	313	382	388	349	244	167	122	97	82	72	62	54	48	43	39	35	32	30	29	26	22	19	0	0	0	0	0	1	4	26	87	194	313	382	388	349	244	167	122	97	82	72	62	54	48	43	39	35	32	30	29	26	22	19	0
.30	0	0	0	0	0	0	3	19	64	151	259	341	372	316	223	156	117	94	80	67	58	50	45	41	36	33	31	29	26	23	19	0	0	0	0	0	0	0	3	19	64	151	259	341	372	316	223	156	117	94	80	67	58	50	45	41	36	33	31	29	26	23	19	0
.40	0	0	0	0	0	0	2	13	47	116	211	298	354	328	245	172	127	100	83	69	59	51	45	41	37	33	31	29	26	23	19	0	0	0	0	0	0	0	2	13	47	116	211	298	354	328	245	172	127	100	83	69	59	51	45	41	37	33	31	29	26	23	19	0
.50	0	0	0	0	0	0	0	1	9	34	89	170	255	341	303	225	161	120	96	76	64	54	47	42	38	34	31	30	27	24	19	0	0	0	0	0	0	0	0	1	9	34	89	170	255	341	303	225	161	120	96	76	64	54	47	42	38	34	31	30	27	24	19	0
.75	0	0	0	0	0	0	0	1	4	14	41	89	152	270	305	268	207	155	118	87	70	57	48	44	39	35	32	30	27	24	19	0	0	0	0	0	0	0	0	1	4	14	41	89	152	270	305	268	207	155	118	87	70	57	48	44	39	35	32	30	27	24	19	0
1.0	0	0	0	0	0	0	0	0	0	0	2	7	22	98	212	295	285	237	181	120	88	67	53	46	42	38	34	31	28	25	19	2	0	0	0	0	0	0	0	0	0	0	2	7	22	98	212	295	285	237	181	120	88	67	53	46	42	38	34	31	28	25	19	2
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	5	30	95	183	249	265	217	152	96	66	53	46	41	37	34	30	26	20	8	0	0	0	0	0	0	0	0	0	0	0	0	0	5	30	95	183	249	265	217	152	96	66	53	46	41	37	34	30	26	20	8
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	18	59	125	221	245	182	105	69	54	47	42	38	32	28	22	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	18	59	125	221	245	182	105	69	54	47	42	38	32	28	22	16	
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	21	84	174	230	172	103	69	54	46	42	34	30	23	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	21	84	174	230	172	103	69	54	46	42	34	30	23	18			
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13	56	157	217	163	101	68	53	46	37	31	25	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13	56	157	217	163	101	68	53	46	37	31	25	18
	IA/P = 0.50													* * * TC = 0.5 HR * * *													IA/P = 0.50																																					
0.0	0	0	0	0	0	2	26	89	170	217	229	200	179	144	119	104	93	85	78	70	64	59	55	51	46	43	41	40	36	32	28	0	0	0	0	0	0	2	26	89	170	217	229	200	179	144	119	104	93	85	78	70	64	59	55	51	46	43	41	40	36	32	28	0
.10	0	0	0	0	0	0	1	18																																																								

**Exhibit 5-II: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution—continued**

TRVL TIME (hr)	11.3 11.0	11.9 11.6	12.1 12.0	12.2 12.2	12.3 12.4	12.5 12.6	12.7 12.8	13.0 13.2	13.4 13.6	13.8 14.0	14.3 14.6	15.0 15.5	16.0 16.5	17.0 17.5	18.0 19.0	20.0 22.0	26.0																																				
IA/P = 0.10																		* * * TC = 0.75 HR * * *																		IA/P = 0.10																	
0.0	13	18	24	36	46	68	115	194	294	380	424	410	369	252	172	123	93	74	61	49	41	35	31	27	24	22	20	19	17	15	12	0																					
.10	13	17	23	34	42	59	97	162	250	337	395	405	381	279	191	135	100	79	65	51	42	36	31	28	25	22	21	19	17	15	12	0																					
.20	11	15	20	28	32	39	52	82	135	211	295	362	391	351	255	178	127	95	75	57	46	38	32	29	26	23	21	20	17	15	12	0																					
.30	11	14	19	26	30	36	47	70	113	179	256	326	379	360	277	196	140	103	80	60	48	38	33	29	26	23	21	20	18	15	12	0																					
.40	10	12	16	22	25	28	33	42	61	96	151	221	291	367	336	255	182	131	98	69	54	42	34	30	27	24	22	20	18	16	12	0																					
.50	9	12	16	21	24	27	31	39	53	82	128	190	258	358	343	274	200	144	106	74	56	43	35	30	27	24	22	20	18	16	12	0																					
.75	8	10	13	17	18	21	23	26	31	39	55	82	122	230	314	329	281	217	161	104	72	51	38	33	29	26	23	21	19	16	12	1																					
1.0	6	8	10	13	14	15	17	19	21	23	27	32	42	89	177	272	319	303	249	163	105	66	45	36	31	27	24	22	19	17	13	3																					
1.5	4	6	7	9	10	10	11	12	14	15	16	18	20	27	46	90	163	241	295	275	204	119	66	45	35	31	27	24	20	18	13	7																					
2.0	3	4	5	6	7	7	8	9	9	10	11	12	13	16	20	28	48	89	151	245	274	213	115	65	44	35	30	27	22	19	14	10																					
2.5	1	2	3	4	4	5	5	6	6	7	7	8	8	10	12	14	17	24	37	86	170	260	219	127	71	47	36	31	24	20	16	11																					
3.0	1	1	2	3	3	3	4	4	4	5	5	5	6	7	8	10	11	14	17	30	64	157	247	205	122	70	46	36	27	22	17	12																					
IA/P = 0.30																		* * * TC = 0.75 HR * * *																		IA/P = 0.30																	
0.0	0	0	0	0	1	6	30	86	174	266	326	348	328	246	181	138	110	92	79	66	57	49	44	40	36	32	31	29	26	23	19	0																					
.10	0	0	0	0	0	1	4	22	65	137	223	292	329	303	228	170	131	106	89	73	61	52	46	41	37	33	31	29	26	23	19	0																					
.20	0	0	0	0	0	0	3	15	48	108	185	256	305	321	245	184	141	112	93	75	63	53	46	42	37	34	31	30	27	23	19	0																					
.30	0	0	0	0	0	0	2	11	36	84	151	221	277	308	260	199	152	120	98	78	65	54	47	42	38	34	31	30	27	23	19	0																					
.40	0	0	0	0	0	0	0	1	8	27	65	122	188	286	301	243	187	144	114	87	71	57	48	43	39	35	32	30	27	24	19	1																					
.50	0	0	0	0	0	0	0	1	6	20	50	98	158	263	292	254	200	155	122	91	74	59	49	44	40	35	32	30	27	24	19	1																					
.75	0	0	0	0	0	0	0	0	0	2	8	23	51	140	231	269	253	211	167	119	90	68	53	46	42	37	34	31	28	25	19	2																					
1.0	0	0	0	0	0	0	0	0	0	0	0	1	4	29	96	186	249	261	231	169	120	84	61	50	44	40	36	33	29	26	20	5																					
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	34	91	163	220	241	197	131	83	61	50	44	40	35	31	27	21	12																					
2.0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	2	11	36	85	174	226	200	127	82	60	49	44	39	32	29	22	17																					
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	37	105	196	214	135	87	62	51	44	36	31	24	18																					
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	24	96	205	189	130	85	62	50	39	32	26	18																					
IA/P = 0.50																		* * * TC = 0.75 HR * * *																		IA/P = 0.50																	
0.0	0	0	0	0	0	0	2	16	45	92	137	166	185	170	146	125	110	98	89	79	70	63	58	53	48	44	42	41	37	33	28	0																					
.10	0	0	0	0	0	0	0	1	11	34	73	115	149	180	163	141	122	107	96	84	74	65	59	54	50	45	43	41	38	33	28	0																					
.20	0	0	0	0	0	0	0	1	8	25	57	96	131	173	166	146	126	111	99	86	76	66	59	55	50	46	43	41	38	34	28	0																					
.30	0	0	0	0	0	0	0	0	1	5	18	44	79	143	170	160	141	122	108	92	81	69	61	56	52	47	44	42	38	34	28	1																					
.40	0	0	0	0	0	0	0	0	0	4	14	34	64	127	166	162	145	127	111	95	82	70	62	57	52	47	44	42	38	34	28	1																					
.50	0	0	0	0	0	0	0	0	0	0	2	10	26	82	138	162	157	140	123	103	88	75	64	58	53	49	45	43	39	35	28	2																					
.75	0	0	0	0	0	0	0	0	0	0	1	4	12	47	98	139	154	148	135	113	96	80	67	60	55	50	46	43	39	36	29	3																					
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	30	73	119	146	151	134	113	91	74	63	58	53	48	45	41	37	29	7																					
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	30	66	105	143	143	117	90	73	63	57	52	48	42	39	30	18																					
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11	30	77	121	137	114	88	72	63	57	52	44	40	32	25																					
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	19	55	111	132	111	87	71	62	56	47	42	34	27																					
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	12	51	112	128	108	86	71	62	51	44	36	27																					

RAINFALL TYPE = II

\* \* \* TC = 0.75 HR \* \* \*

SHEET 6 OF 10

**Exhibit 5-II: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution—continued**

TRVL TIME (hr)	11.3	11.9	12.1	12.3	12.5	12.7	13.0	13.4	13.8	14.3	15.0	16.0	17.0	18.0	20.0	26.0																													
(hr)	11.0	11.6	12.0	12.2	12.4	12.6	12.8	13.2	13.6	14.0	14.6	15.5	16.5	17.5	19.0	22.0																													
	IA/P = 0.10															* * * TC = 1.0 HR * * *															IA/P = 0.10														
0.0	11	15	20	29	35	47	72	112	168	231	289	329	357	313	239	175	133	103	83	63	50	40	33	29	26	23	21	20	17	15	12	0													
.10	10	13	17	24	27	33	42	62	95	144	202	260	306	340	293	222	165	126	98	72	56	43	35	30	27	24	22	20	18	15	12	0													
.20	10	13	17	23	26	30	38	54	82	123	176	232	281	332	303	238	179	136	105	76	59	45	35	30	27	24	22	20	18	16	12	1													
.30	9	12	16	22	24	28	35	48	70	105	152	205	256	323	310	254	193	146	113	81	61	46	36	31	27	24	22	20	18	16	12	1													
.40	8	11	14	19	21	23	27	32	42	61	91	132	181	276	318	294	237	181	138	95	70	51	39	32	28	25	23	21	18	16	12	1													
.50	8	10	13	18	20	22	25	30	38	53	78	114	159	253	311	300	251	195	149	102	74	53	40	33	29	25	23	21	18	16	12	1													
.75	7	8	11	14	16	17	19	21	25	30	38	53	76	146	228	284	293	256	208	143	99	66	46	36	31	27	24	22	19	17	13	2													
1.0	5	7	8	11	12	13	14	16	17	19	22	25	31	57	111	188	256	286	272	208	144	90	56	41	33	29	26	23	20	17	13	4													
1.5	4	5	6	8	8	9	10	11	12	13	14	15	17	22	33	59	107	171	231	268	235	157	88	56	41	33	29	25	21	18	14	8													
2.0	2	3	4	5	5	6	6	7	7	8	9	9	10	12	15	19	27	44	78	157	231	252	167	96	59	42	34	29	23	20	15	11													
2.5	1	2	2	3	4	4	4	5	5	6	6	7	7	8	10	12	15	19	27	58	120	214	241	159	94	59	42	34	26	21	16	11													
3.0	0	1	1	2	2	3	3	3	4	4	4	5	5	6	7	8	10	12	14	22	44	113	214	231	152	91	58	42	29	23	17	12													
	IA/P = 0.30															* * * TC = 1.0 HR * * *															IA/P = 0.30														
0.0	0	0	0	0	1	4	16	42	83	137	195	243	271	292	227	178	143	117	98	79	66	55	47	42	38	34	31	30	27	23	19	0													
.10	0	0	0	0	0	0	3	12	32	66	113	168	218	279	260	213	169	136	113	88	72	59	49	43	39	35	32	30	27	24	19	1													
.20	0	0	0	0	0	0	2	9	24	52	93	143	193	271	271	225	180	145	119	92	75	60	50	44	39	35	32	30	27	24	19	1													
.30	0	0	0	0	0	0	1	6	18	41	75	120	169	246	264	234	191	153	125	96	78	62	51	44	40	36	33	31	27	24	19	1													
.40	0	0	0	0	0	0	0	1	4	14	32	61	100	190	251	259	222	181	146	109	86	67	53	46	41	37	33	31	28	25	19	2													
.50	0	0	0	0	0	0	0	1	3	10	24	49	83	168	237	254	230	191	155	115	90	69	54	47	42	37	34	31	28	25	19	2													
.75	0	0	0	0	0	0	0	0	1	4	12	25	76	150	213	239	228	198	149	112	82	61	50	44	39	35	32	29	26	20	4														
1.0	0	0	0	0	0	0	0	0	0	0	0	1	2	15	51	113	182	226	234	197	150	104	72	56	47	42	38	34	30	27	20	7													
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	18	51	104	162	220	210	158	102	71	56	47	42	37	31	28	22	13													
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	20	49	121	187	209	152	100	70	55	47	41	34	29	23	17													
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	32	87	171	199	146	98	69	54	46	37	31	24	18													
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	13	62	158	192	151	103	73	56	41	34	26	18													
	IA/P = 0.50															* * * TC = 1.0 HR * * *															IA/P = 0.50														
0.0	0	0	0	0	0	0	1	7	21	42	71	101	126	160	154	138	123	110	100	87	77	67	60	55	50	46	43	41	38	34	28	1													
.10	0	0	0	0	0	0	0	1	5	15	33	58	87	134	156	149	134	120	108	93	82	71	62	57	52	47	44	42	38	34	28	1													
.20	0	0	0	0	0	0	0	1	4	12	26	48	74	123	153	153	137	123	111	95	84	72	63	57	52	47	44	42	38	34	28	1													
.30	0	0	0	0	0	0	0	0	3	9	20	38	62	111	143	150	140	127	114	98	86	73	63	58	53	48	45	42	39	35	28	1													
.40	0	0	0	0	0	0	0	0	0	2	6	16	31	75	120	145	148	137	123	106	91	77	66	59	54	49	45	43	39	35	29	2													
.50	0	0	0	0	0	0	0	0	0	1	5	12	25	64	109	139	146	139	127	108	94	79	67	60	55	50	46	43	39	36	29	3													
.75	0	0	0	0	0	0	0	0	0	0	2	5	12	39	78	115	136	140	134	117	101	84	70	62	56	51	47	44	40	36	29	4													
1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	26	59	96	125	139	133	117	97	78	66	59	54	49	46	41	37	29	8													
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9	26	54	86	123	133	119	95	77	66	59	54	49	43	39	31	17													
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	10	25	64	104	129	116	93	76	65	58	53	45	41	33	24														
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	10	34	84	125	117	96	78	66	59	49	43	35	27													
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	32	89	122	114	94	77	66	53	45	37	27													
	RAINFALL TYPE = II															* * * TC = 1.0 HR * * *															SHEET 7 OF 10														

### Exhibit 5-II: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution —continued

TRVL TIME (hr)	11.0	11.3	11.6	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.0	19.0	20.0	22.0	26.0										
-----HYDROGRAPH TIME(HOURS)-----																																										
IA/P = 0.10																	* * * TC = 1.25 HR * * *																IA/P = 0.10									
0.0	10	13	18	25	29	38	54	81	118	163	213	256	284	311	266	212	163	129	104	78	61	47	37	31	27	24	22	20	18	16	12	1										
.10	10	13	17	23	27	34	47	69	102	143	189	234	267	297	274	226	175	138	111	82	64	48	38	31	27	24	22	20	18	16	12	1										
.20	9	11	15	20	22	26	31	42	60	88	124	168	212	280	292	261	212	166	131	95	72	53	40	33	28	25	23	21	18	16	12	1										
.30	8	11	14	19	21	24	29	38	53	76	108	148	190	263	288	268	224	177	140	101	76	55	41	34	29	25	23	21	18	16	12	2										
.40	8	10	13	18	20	23	27	34	46	66	94	130	170	245	282	273	235	188	149	107	80	58	42	34	29	26	23	21	19	16	12	2										
.50	7	9	12	16	17	19	22	25	31	41	58	82	114	190	256	279	262	222	178	127	93	65	46	36	31	27	24	22	19	17	13	2										
.75	6	8	10	14	15	17	19	21	25	31	41	56	78	139	207	254	265	245	208	152	110	75	51	39	32	28	25	22	19	17	13	3										
1.0	5	6	8	10	11	13	14	15	17	19	22	26	33	60	109	173	230	261	255	208	153	100	64	46	36	30	26	24	20	18	13	5										
1.5	3	4	5	7	7	8	9	9	10	11	12	13	15	19	27	45	79	130	186	247	239	180	108	68	48	37	31	27	22	19	14	10										
2.0	2	3	4	5	6	6	7	7	8	8	9	10	11	13	16	22	35	59	98	171	236	236	156	95	62	44	35	30	23	20	15	11										
2.5	1	2	2	3	4	4	4	5	5	5	6	6	7	8	10	12	14	19	28	58	114	197	226	163	102	65	46	36	26	14	11											
3.0	0	1	1	2	2	2	2	3	3	3	4	4	4	5	6	7	9	10	13	19	35	88	184	218	169	109	70	49	31	24	18	12										
-----IA/P = 0.30																	* * * TC = 1.25 HR * * *																IA/P = 0.30									
0.0	0	0	0	0	0	2	9	25	50	86	130	174	208	253	235	201	164	136	115	92	76	61	51	44	39	35	32	30	27	24	19	1										
.10	0	0	0	0	0	0	1	6	19	40	71	110	153	217	247	227	191	157	131	103	84	66	53	46	41	36	33	31	28	24	19	2										
.20	0	0	0	0	0	0	1	4	14	31	58	93	133	202	239	231	199	165	138	108	87	68	55	47	41	37	33	31	28	25	19	2										
.30	0	0	0	0	0	0	0	1	3	10	24	46	77	152	210	236	222	190	158	122	97	74	58	49	43	38	34	32	28	25	20	3										
.40	0	0	0	0	0	0	0	0	2	8	19	37	64	134	196	232	225	198	166	127	101	77	59	50	43	38	35	32	28	25	20	3										
.50	0	0	0	0	0	0	0	0	0	2	6	14	30	82	151	206	228	217	189	146	113	85	64	52	45	40	36	33	29	26	20	5										
.75	0	0	0	0	0	0	0	0	0	1	2	7	15	49	105	164	205	218	205	166	129	95	69	55	47	41	37	33	29	26	20	6										
1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	32	77	134	185	214	203	166	120	83	63	52	45	39	35	30	27	21	10										
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11	33	72	121	184	203	171	117	82	62	51	44	39	32	29	22	15										
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	21	67	132	194	174	123	86	64	52	45	35	31	24	18											
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	13	46	121	187	166	119	84	63	52	39	32	25	18										
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	44	129	180	160	116	83	63	44	35	27	18										
-----IA/P = 0.50																	* * * TC = 1.25 HR * * *																IA/P = 0.50									
0.0	0	0	0	0	0	0	1	5	13	26	44	68	91	125	142	142	128	117	107	94	83	72	63	57	52	47	44	42	38	34	28	2										
.10	0	0	0	0	0	0	0	0	3	10	20	36	57	100	129	140	136	125	114	100	88	76	65	59	54	49	45	43	39	35	29	3										
.20	0	0	0	0	0	0	0	0	2	7	16	30	48	90	122	139	139	127	117	102	90	77	66	60	54	49	45	43	39	35	29	3										
.30	0	0	0	0	0	0	0	0	0	2	5	12	24	59	98	126	137	134	125	109	96	82	69	61	56	51	46	44	40	36	29	4										
.40	0	0	0	0	0	0	0	0	1	4	10	19	51	89	119	134	136	127	112	98	83	70	62	56	51	47	44	40	36	29	5											
.50	0	0	0	0	0	0	0	0	1	3	7	15	43	79	112	131	135	129	114	100	85	71	63	57	52	47	44	40	36	29	6											
.75	0	0	0	0	0	0	0	0	0	0	1	3	15	39	71	102	123	130	125	112	94	78	67	60	54	49	46	41	37	29	9											
1.0	0	0	0	0	0	0	0	0	0	0	0	1	4	17	40	71	101	121	129	121	103	84	71	62	56	51	47	42	38	30	13											
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	10	26	51	92	119	125	105	86	72	63	57	52	44	40	32	23											
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	11	35	72	112	122	103	85	71	63	56	47	42	34	26											
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	24	66	111	119	101	83	71	62	51	44	36	27											
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	23	71	110	116	99	82	70	55	46	37	27											
-----RAINFALL TYPE = II																	* * * TC = 1.25 HR * * *																SHEET 8 OF 10									

**Exhibit 5-II: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution—continued**

TRVL TIME (hr)	11.3	11.9	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	13.0	13.4	13.8	14.3	15.0	16.0	17.0	18.0	20.0	26.0											
	11.0	11.6	12.0	12.2	12.4	12.6	12.8	13.2	13.6	14.0	14.6	15.5	16.5	17.5	19.0	22.0																
IA/P = 0.10											*** TC = 1.5 HR ***											IA/P = 0.10										
0.0	9	11	15	21	25	31	41	58	82	112	147	184	216	255	275	236	198	159	129	98	76	57	43	35	30	25	23	21	18	16	12	1
.10	8	10	13	18	20	23	28	37	51	72	98	131	166	226	265	254	226	187	151	113	86	63	46	37	31	26	23	21	19	16	13	2
.20	8	10	13	17	19	22	26	33	45	63	87	116	149	212	259	259	233	197	160	119	90	66	48	38	32	27	24	22	19	16	13	2
.30	7	9	12	16	18	21	24	30	40	55	76	103	134	197	244	255	238	206	169	125	95	68	49	38	32	27	24	22	19	17	13	2
.40	7	8	11	14	15	17	19	23	28	36	49	67	91	151	208	247	252	230	196	146	109	77	54	41	34	29	25	22	19	17	13	3
.50	6	8	10	13	15	16	18	21	26	33	43	59	80	136	194	238	249	235	204	154	115	81	56	42	34	29	25	23	20	17	13	3
.75	5	7	8	11	12	13	14	16	18	21	25	32	42	76	125	179	222	240	233	193	148	102	67	48	38	32	27	24	20	18	13	5
1.0	4	5	7	8	9	10	11	12	13	14	16	18	22	34	59	101	152	201	236	230	193	135	86	59	44	35	30	27	21	18	14	7
1.5	3	4	5	6	6	7	8	8	9	10	11	12	13	16	22	34	58	95	141	203	226	197	131	84	58	43	35	29	23	20	15	10
2.0	1	2	3	4	4	5	5	6	6	7	7	8	9	10	12	16	22	34	56	110	172	218	187	126	82	57	43	34	25	21	16	11
2.5	1	1	2	2	3	3	3	4	4	4	5	5	6	7	8	9	11	14	18	34	69	141	210	190	133	87	60	44	30	23	17	12
3.0	0	0	1	1	2	2	2	2	3	3	3	3	4	5	5	6	8	9	11	16	27	66	149	204	181	128	85	58	35	25	18	12
IA/P = 0.30											*** TC = 1.5 HR ***											IA/P = 0.30										
0.0	0	0	0	0	0	1	6	15	31	53	80	112	144	193	225	208	186	157	134	108	89	70	56	48	42	37	34	31	28	25	20	2
.10	0	0	0	0	0	0	1	4	12	25	43	68	97	157	198	219	203	178	151	120	98	77	60	50	44	38	35	32	28	25	20	3
.20	0	0	0	0	0	0	1	3	9	19	35	57	114	168	201	213	196	171	135	108	84	64	53	46	40	36	33	29	26	20	4	
.30	0	0	0	0	0	0	1	2	7	15	29	48	100	155	193	210	200	177	140	113	87	66	54	46	41	36	33	29	26	20	5	
.40	0	0	0	0	0	0	0	2	5	12	23	39	87	141	184	207	202	182	146	117	89	68	55	47	41	36	33	29	26	20	5	
.50	0	0	0	0	0	0	0	0	1	4	9	18	51	101	153	190	205	197	164	131	99	73	58	49	43	38	34	30	26	20	7	
.75	0	0	0	0	0	0	0	0	0	2	4	9	30	68	116	160	189	197	179	147	110	80	62	52	45	39	35	30	27	21	8	
1.0	0	0	0	0	0	0	0	0	0	0	0	1	5	20	49	92	138	175	195	178	137	97	72	57	48	42	37	31	28	21	12	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	21	47	85	145	187	178	133	95	71	57	48	42	34	29	23	16	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	13	45	97	162	180	138	99	74	58	49	38	32	25	18		
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	31	89	161	174	133	97	72	58	42	34	26	18			
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	29	98	160	169	129	95	71	48	37	28	19	
IA/P = 0.50											*** TC = 1.5 HR ***											IA/P = 0.50										
.0	0	0	0	0	0	0	3	8	16	27	42	59	92	116	128	130	121	112	100	90	78	67	60	55	50	46	43	39	35	29	4	
.10	0	0	0	0	0	0	2	6	12	22	35	51	84	110	125	128	123	114	102	91	79	68	61	55	50	46	43	39	35	29	4	
.20	0	0	0	0	0	0	0	1	4	10	18	29	60	91	114	126	128	120	108	97	83	71	63	57	52	47	44	40	36	29	5	
.30	0	0	0	0	0	0	0	1	3	8	14	24	52	83	108	123	126	122	110	98	85	72	63	57	52	48	44	40	36	29	6	
.40	0	0	0	0	0	0	0	0	1	2	6	12	31	60	90	112	124	126	116	104	90	75	66	59	54	49	45	41	37	29	8	
.50	0	0	0	0	0	0	0	0	0	2	4	9	26	53	83	106	121	125	118	106	91	77	67	60	54	49	46	41	37	29	8	
.75	0	0	0	0	0	0	0	0	0	1	2	5	16	36	62	88	108	119	122	112	97	81	69	62	56	51	47	42	38	30	11	
1.0	0	0	0	0	0	0	0	0	0	0	0	0	3	10	26	49	75	98	118	121	108	90	76	66	59	54	49	43	39	31	16	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	11	25	45	80	107	118	106	89	75	65	59	53	45	41	32	23	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	11	32	63	100	115	104	87	74	65	58	48	42	34	26		
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	16	48	94	113	105	89	76	66	53	45	36	27			
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	15	54	96	111	103	88	75	58	48	38	28			

RAINFALL TYPE = II

\*\*\* TC = 1.5 HR \*\*\*

SHEET 9 OF 10

### Exhibit 5-II: Tabular hydrograph unit discharges (csm/in) for type II rainfall distribution—continued

TRVL TIME (hr)	11.3	11.9	12.1	12.3	12.5	12.7	13.0	13.4	13.8	14.3	15.0	16.0	17.0	18.0	20.0	26.0																
	11.0	11.6	12.0	12.2	12.4	12.6	12.8	13.2	13.6	14.0	14.6	15.5	16.5	17.5	19.0	22.0																
IA/P = 0.10																																
*** TC = 2.0 HR ***																																
0.0	7	9	12	16	18	21	27	36	49	64	82	104	127	171	201	226	208	193	171	132	105	79	58	45	36	30	26	23	20	17	13	3
.10	6	8	10	14	15	17	20	25	33	43	57	74	94	139	179	204	218	205	188	150	118	88	63	48	38	32	27	24	20	17	13	4
.20	6	8	10	13	14	16	19	23	29	39	51	66	84	128	169	198	213	207	192	157	123	91	65	49	39	33	28	24	20	17	13	4
.30	6	7	9	12	14	15	18	21	27	35	45	59	76	117	159	191	211	208	196	163	128	95	68	51	40	33	28	25	20	18	13	4
.40	5	6	8	11	12	13	15	17	20	24	31	41	53	87	128	167	197	209	205	180	145	106	75	55	43	35	30	26	21	18	14	5
.50	5	6	8	10	11	13	14	16	18	22	28	37	48	78	118	158	190	208	208	185	151	111	77	57	44	36	30	26	21	18	14	5
.75	4	6	7	9	10	11	12	13	15	18	22	27	35	58	91	129	164	191	202	194	167	125	87	63	48	38	32	27	22	18	14	6
1.0	3	4	6	7	8	8	9	10	11	12	14	16	18	28	46	74	110	147	178	201	193	156	108	76	56	43	35	30	23	19	14	8
1.5	2	3	3	5	5	5	6	6	7	8	8	9	10	12	16	23	36	57	86	137	178	195	160	113	79	58	45	36	26	21	16	11
2.0	1	2	2	3	3	4	4	4	5	5	6	6	7	8	10	12	16	23	35	67	112	169	190	154	110	78	57	44	30	23	17	11
2.5	0	1	1	2	2	2	3	3	3	4	4	4	5	6	7	8	9	12	16	28	52	105	170	185	149	107	76	56	35	26	18	12
3.0	0	0	1	1	1	1	1	2	2	2	2	3	3	3	4	5	6	7	8	12	18	41	99	161	180	152	112	80	45	30	19	12
IA/P = 0.30																																
*** TC = 2.0 HR ***																																
0.0	0	0	0	0	0	1	3	8	15	25	38	54	74	115	148	168	185	170	159	131	110	89	70	57	49	42	38	34	29	26	20	5
.10	0	0	0	0	0	0	2	6	12	21	32	47	67	85	124	153	169	180	168	145	120	96	75	60	51	44	39	35	30	26	20	6
.20	0	0	0	0	0	0	2	4	10	17	27	41	75	114	146	165	175	170	149	124	99	76	62	52	45	39	35	30	27	21	6	
.30	0	0	0	0	0	0	0	1	3	7	14	23	49	86	122	151	170	174	160	136	107	82	66	54	47	41	37	31	27	21	8	
.40	0	0	0	0	0	0	0	1	2	6	11	19	43	77	113	144	165	173	163	140	111	85	67	55	47	41	37	31	27	21	8	
.50	0	0	0	0	0	0	0	1	2	4	9	16	37	68	104	136	160	171	165	144	114	87	69	56	48	42	37	31	27	21	9	
.75	0	0	0	0	0	0	0	0	0	1	2	5	15	34	62	96	127	152	167	160	132	100	77	62	52	45	40	32	28	22	11	
1.0	0	0	0	0	0	0	0	0	0	0	0	0	3	10	24	48	79	111	150	166	153	118	90	71	58	49	43	34	29	23	14	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	10	24	45	88	130	161	148	115	88	70	57	48	37	31	24	17	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	10	32	68	122	157	143	113	87	68	56	42	34	26	18	
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	16	51	114	153	144	116	89	70	49	38	27	19	
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	15	59	118	150	140	113	88	57	42	29	19	
IA/P = 0.50																																
*** TC = 2.0 HR ***																																
0.0	0	0	0	0	0	0	1	4	8	13	20	28	51	73	92	104	111	112	106	97	86	75	66	60	54	49	46	41	37	30	7	
.10	0	0	0	0	0	0	0	1	3	6	11	17	24	45	68	87	101	109	112	107	98	88	76	67	60	55	50	46	41	37	30	8
.20	0	0	0	0	0	0	0	1	2	5	9	14	21	40	62	82	98	107	111	108	100	89	77	68	61	55	50	47	41	37	30	8
.30	0	0	0	0	0	0	0	0	2	4	7	12	26	46	67	86	100	108	111	104	93	80	70	63	57	52	48	42	38	30	10	
.40	0	0	0	0	0	0	0	1	3	6	10	22	41	62	81	96	106	110	105	94	81	71	63	57	52	48	42	38	30	11		
.50	0	0	0	0	0	0	0	1	2	4	13	27	46	67	85	99	110	108	98	85	74	66	59	54	49	43	39	31	13			
.75	0	0	0	0	0	0	0	0	0	1	2	7	18	33	52	71	88	104	108	102	89	77	68	61	55	50	44	39	31	15		
1.0	0	0	0	0	0	0	0	0	0	0	0	1	5	13	25	43	62	87	103	108	97	84	73	65	59	53	45	41	32	20		
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	12	24	48	74	99	106	95	83	72	64	58	48	43	34	25	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	17	37	69	99	104	94	82	72	64	52	45	36	27		
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	27	65	95	102	95	83	73	58	49	38	28			
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	32	68	95	101	93	82	64	52	40	28		
RAINFALL TYPE = II																																
*** TC = 2.0 HR ***																																



Exhibit 5-III: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution—continued

Table with columns for TRVL TIME (hr) and HYDROGRAPH TIME (HOURS) from 11.0 to 26.0. Rows show discharge values for various time intervals (0.0 to 3.0 hours) under different IA/P ratios (0.10, 0.30, 0.50) and TC values (0.2 HR). Includes rainfall type III and sheet 2 of 10.

### Exhibit 5-III: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME (HOURS)																															
	11.3	11.9	12.1	12.3	12.5	12.7	13.0	13.4	13.8	14.3	15.0	16.0	17.0	18.0	20.0	26.0	11.0	11.6	12.0	12.2	12.4	12.6	12.8	13.2	13.6	14.0	14.6	15.5	16.5	17.5	19.0	22.0
	IA/P = 0.10												* * * TC = 0.3 HR * * *												IA/P = 0.10							
0.0	25	31	44	84	124	181	287	441	498	451	358	276	204	118	87	70	63	58	54	48	44	39	34	29	24	22	20	17	14	13	11	0
.10	22	28	37	56	74	108	156	244	375	457	453	389	314	180	113	83	69	62	57	51	46	41	36	31	26	23	20	18	15	13	11	0
.20	21	27	35	53	67	94	136	208	319	411	439	406	345	212	130	91	73	64	59	52	46	42	36	31	26	23	21	18	15	13	11	0
.30	19	24	30	42	49	61	83	118	178	272	365	414	409	305	190	121	87	71	63	55	49	43	38	33	27	24	21	19	15	14	11	0
.40	18	23	29	40	46	56	74	103	153	232	321	383	400	329	217	138	96	75	65	57	50	44	38	33	28	24	21	19	15	14	11	0
.50	16	21	26	34	38	43	52	67	91	132	199	280	349	383	297	196	128	91	73	60	53	46	40	35	30	25	22	20	16	14	11	0
.75	14	18	23	30	33	37	43	52	66	91	131	187	251	347	331	260	182	126	92	68	57	49	42	36	31	26	23	21	16	14	12	0
1.0	11	15	18	23	25	28	30	33	38	44	54	71	98	192	296	334	294	221	154	94	69	55	45	40	34	29	25	22	17	15	12	0
1.5	7	9	12	15	17	18	19	21	23	25	27	30	33	45	75	137	222	287	300	233	149	84	57	47	40	35	30	25	20	16	13	3
2.0	4	6	8	11	12	13	14	15	16	17	19	20	22	26	33	46	76	131	201	278	258	165	85	57	46	40	34	29	22	17	13	7
2.5	2	3	5	7	7	8	9	10	10	11	12	13	14	17	20	24	29	39	60	125	213	260	177	94	60	47	40	35	25	20	14	9
3.0	1	2	3	4	5	5	6	6	7	8	8	9	10	12	14	16	19	23	29	48	95	195	247	167	93	60	47	40	29	22	15	10
	IA/P = 0.30												* * * TC = 0.3 HR * * *												IA/P = 0.30							
0.0	0	0	0	6	22	58	146	308	424	422	367	303	234	145	111	92	84	79	74	67	62	57	50	43	36	33	30	26	22	20	17	0
.10	0	0	0	4	16	44	112	243	364	402	379	328	266	166	120	97	86	80	75	68	62	57	51	44	37	33	30	27	22	21	17	0
.20	0	0	0	3	12	33	86	190	306	370	376	344	292	189	132	103	89	82	77	69	63	58	51	44	37	34	30	27	23	21	17	0
.30	0	0	0	0	2	8	25	65	149	254	331	361	350	261	175	126	100	88	81	73	66	60	53	46	39	35	31	28	23	21	18	0
.40	0	0	0	0	1	6	19	50	116	208	290	338	346	282	195	138	107	91	83	74	67	60	54	47	40	35	32	28	23	21	18	0
.50	0	0	0	0	0	1	4	14	38	90	168	250	308	333	256	180	131	103	89	78	71	63	56	49	42	36	33	29	23	21	18	0
.75	0	0	0	0	0	0	2	6	17	43	89	150	213	299	286	229	171	129	104	85	75	65	58	51	44	38	34	30	24	22	18	0
1.0	0	0	0	0	0	0	0	0	1	3	9	24	53	153	253	288	257	200	150	105	85	72	62	55	48	41	36	32	26	22	19	0
1.5	0	0	0	0	0	0	0	0	0	0	0	1	2	15	59	138	217	258	248	187	130	91	71	62	55	48	41	36	29	23	19	3
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	36	90	159	239	227	158	97	74	63	55	48	42	32	26	20	10
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	12	37	113	194	224	151	96	73	62	55	48	36	29	21	14
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	24	78	176	211	145	95	73	62	54	41	32	22	15
	IA/P = 0.50												* * * TC = 0.3 HR * * *												IA/P = 0.50							
0.0	0	0	0	0	0	2	33	116	193	221	221	200	165	129	110	99	95	92	87	81	77	72	65	56	49	45	41	37	32	30	25	0
.10	0	0	0	0	0	1	23	85	157	200	214	205	178	138	115	102	96	92	88	82	77	73	66	57	50	46	42	37	32	30	26	0
.20	0	0	0	0	0	1	15	62	125	175	201	203	187	147	121	105	98	94	89	83	78	73	66	58	50	46	42	38	32	30	26	0
.30	0	0	0	0	0	0	10	45	99	149	184	197	174	140	117	104	97	93	86	80	75	69	61	52	47	43	39	33	30	26	0	
.40	0	0	0	0	0	0	7	32	76	125	164	189	179	148	123	107	99	94	87	81	76	69	62	53	48	44	39	33	30	26	0	
.50	0	0	0	0	0	0	0	5	23	59	103	144	183	169	141	119	105	98	90	84	78	71	64	55	49	45	41	33	31	26	0	
.75	0	0	0	0	0	0	0	2	9	27	55	89	148	168	156	135	117	105	94	87	80	73	66	58	51	46	42	34	31	27	0	
1.0	0	0	0	0	0	0	0	0	0	1	4	14	59	119	157	163	145	126	105	95	85	77	71	63	55	49	44	36	32	27	0	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	19	56	103	139	151	138	116	97	85	77	70	62	54	48	40	33	28	3
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	21	52	91	135	143	120	96	84	76	69	61	54	44	35	29	11
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	22	65	112	136	117	96	83	75	68	60	48	39	30	19	
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	13	45	102	131	114	95	83	75	67	53	43	31	22	

RAINFALL TYPE = III

\* \* \* TC = 0.3 HR \* \* \*

SHEET 3 OF 10

Exhibit 5-III: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution—continued

Table with columns for TRVL TIME (hr) and HYDROGRAPH TIME (HOURS) from 11.0 to 26.0. Rows show unit discharges for various time intervals (0.0 to 3.0 hours) under different IA/P ratios (0.10, 0.30, 0.50). Includes parameters like RAINFALL TYPE = III and TC = 0.4 HR.

### Exhibit 5-III: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME(HOURS)																																																															
	11.3	11.9	12.1	12.3	12.5	12.7	13.0	13.4	13.8	14.3	15.0	16.0	17.0	18.0	20.0	26.0	11.0	11.6	12.0	12.2	12.4	12.6	12.8	13.2	13.6	14.0	14.6	15.5	16.5	17.5	19.0	22.0																																
	IA/P = 0.10												* * * TC = 0.5 HR * * *												IA/P = 0.10																																							
0.0	21	27	35	54	70	97	144	217	316	397	411	388	330	214	139	99	78	67	60	52	47	42	36	31	26	23	21	18	15	13	11	0	21	27	35	54	70	97	144	217	316	397	411	388	330	214	139	99	78	67	60	52	47	42	36	31	26	23	21	18	15	13	11	0
.10	19	24	30	43	50	64	86	125	186	273	355	392	390	296	194	129	94	75	65	56	49	43	38	33	28	24	21	19	15	14	11	0	19	24	30	43	50	64	86	125	186	273	355	392	390	296	194	129	94	75	65	56	49	43	38	33	28	24	21	19	15	14	11	0
.20	18	23	29	40	47	58	77	109	161	235	315	367	382	318	218	145	103	80	68	57	50	44	39	33	28	24	22	19	15	14	11	0	18	23	29	40	47	58	77	109	161	235	315	367	382	318	218	145	103	80	68	57	50	44	39	33	28	24	22	19	15	14	11	0
.30	16	21	26	34	38	44	53	69	95	139	203	278	337	367	289	199	135	98	77	62	54	46	40	35	30	25	22	20	16	14	11	0	16	21	26	34	38	44	53	69	95	139	203	278	337	367	289	199	135	98	77	62	54	46	40	35	30	25	22	20	16	14	11	0
.40	16	20	25	33	36	41	49	62	84	121	176	244	306	358	306	220	151	107	83	64	55	47	41	35	30	25	23	20	16	14	12	0	16	20	25	33	36	41	49	62	84	121	176	244	306	358	306	220	151	107	83	64	55	47	41	35	30	25	23	20	16	14	12	0
.50	14	18	22	28	31	35	39	46	57	75	106	152	213	323	346	282	202	140	102	73	59	50	42	37	32	27	23	21	16	14	12	0	14	18	22	28	31	35	39	46	57	75	106	152	213	323	346	282	202	140	102	73	59	50	42	37	32	27	23	21	16	14	12	0
.75	12	16	20	25	28	30	34	38	45	56	75	104	145	246	319	308	252	187	135	89	67	53	44	39	33	28	24	22	17	14	12	0	12	16	20	25	28	30	34	38	45	56	75	104	145	246	319	308	252	187	135	89	67	53	44	39	33	28	24	22	17	14	12	0
1.0	10	12	16	20	22	23	25	28	31	34	39	47	60	110	197	280	309	279	220	138	90	63	49	42	37	31	26	23	18	15	12	1	10	12	16	20	22	23	25	28	31	34	39	47	60	110	197	280	309	279	220	138	90	63	49	42	37	31	26	23	18	15	12	1
1.5	6	8	10	13	14	15	17	18	19	21	23	25	27	34	49	82	143	218	283	271	203	116	68	51	43	37	32	27	21	16	13	4	6	8	10	13	14	15	17	18	19	21	23	25	27	34	49	82	143	218	283	271	203	116	68	51	43	37	32	27	21	16	13	4
2.0	3	5	7	9	10	11	12	13	14	15	16	17	19	22	27	34	50	82	135	226	265	211	114	67	50	42	37	31	23	18	13	8	3	5	7	9	10	11	12	13	14	15	16	17	19	22	27	34	50	82	135	226	265	211	114	67	50	42	37	31	23	18	13	8
2.5	2	3	4	6	7	7	8	9	10	10	11	12	13	16	18	22	26	34	50	102	182	249	197	111	67	50	42	36	26	20	14	9	2	3	4	6	7	7	8	9	10	10	11	12	13	16	18	22	26	34	50	102	182	249	197	111	67	50	42	36	26	20	14	9
3.0	1	1	2	3	4	4	5	5	6	6	7	8	8	10	12	14	16	19	23	34	63	144	238	201	121	72	52	43	31	23	15	10	1	1	2	3	4	4	5	5	6	6	7	8	8	10	12	14	16	19	23	34	63	144	238	201	121	72	52	43	31	23	15	10
	IA/P = 0.30												* * * TC = 0.5 HR * * *												IA/P = 0.30																																							
0.0	0	0	1	4	15	40	101	198	295	345	345	325	232	161	122	100	88	80	72	65	59	53	46	39	34	31	28	23	21	18	0	0	0	1	4	15	40	101	198	295	345	345	325	232	161	122	100	88	80	72	65	59	53	46	39	34	31	28	23	21	18	0		
.10	0	0	1	3	11	30	77	158	249	313	335	329	253	178	132	106	91	82	73	66	60	53	47	40	35	31	28	23	21	18	0	0	0	1	3	11	30	77	158	249	313	335	329	253	178	132	106	91	82	73	66	60	53	47	40	35	31	28	23	21	18	0		
.20	0	0	0	2	8	23	59	125	208	278	316	324	271	196	144	112	95	85	75	67	61	54	47	40	35	32	28	23	21	18	0	0	0	0	2	8	23	59	125	208	278	316	324	271	196	144	112	95	85	75	67	61	54	47	40	35	32	28	23	21	18	0		
.30	0	0	0	0	2	6	17	45	98	171	242	291	313	249	182	136	108	92	80	71	63	56	49	42	36	33	29	24	21	18	0	0	0	0	0	2	6	17	45	98	171	242	291	313	249	182	136	108	92	80	71	63	56	49	42	36	33	29	24	21	18	0		
.40	0	0	0	0	1	4	13	34	77	140	208	264	304	263	198	148	115	97	81	72	64	57	50	43	37	33	30	24	21	18	0	0	0	0	0	1	4	13	34	77	140	208	264	304	263	198	148	115	97	81	72	64	57	50	43	37	33	30	24	21	18	0		
.50	0	0	0	0	0	1	3	10	26	60	113	177	276	295	244	185	140	111	88	77	67	59	52	45	39	34	31	24	22	18	0	0	0	0	0	0	1	3	10	26	60	113	177	276	295	244	185	140	111	88	77	67	59	52	45	39	34	31	24	22	18	0		
.75	0	0	0	0	0	0	1	4	12	29	60	104	204	271	263	222	174	136	101	83	70	61	54	47	40	35	32	25	22	18	0	0	0	0	0	0	0	1	4	12	29	60	104	204	271	263	222	174	136	101	83	70	61	54	47	40	35	32	25	22	18	0		
1.0	0	0	0	0	0	0	0	0	1	2	6	16	67	155	235	263	242	198	138	102	80	66	58	51	44	38	34	27	23	19	1	0	0	0	0	0	0	0	0	1	2	6	16	67	155	235	263	242	198	138	102	80	66	58	51	44	38	34	27	23	19	1		
1.5	0	0	0	0	0	0	0	0	0	0	0	0	4	22	67	138	205	241	221	167	110	79	66	58	51	44	38	30	24	20	5	0	0	0	0	0	0	0	0	0	0	0	0	4	22	67	138	205	241	221	167	110	79	66	58	51	44	38	30	24	20	5		
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	13	42	93	182	225	191	119	83	67	58	51	44	34	27	21	12	0	0	0	0	0	0	0	0	0	0	0	0	0	3	13	42	93	182	225	191	119	83	67	58	51	44	34	27	21	12			
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	15	62	139	213	180	117	82	67	58	51	38	30	22	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	15	62	139	213	180	117	82	67	58	51	38	30	22	15			
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	10	41	127	203	171	114	81	66	57	43	33	23	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	10	41	127	203	171	114	81	66	57	43	33	23	16			
	IA/P = 0.50												* * * TC = 0.5 HR * * *												IA/P = 0.50																																							
0.0	0	0	0	0	0	3	24	68	124	174	190	190	162	133	114	103	97	92	85	80	75	68	60	52	47	43	39	33	30	26	0	0	0	0	0	0	3	24	68	124	174	190	190	162	133	114	103	97	92	85	80	75	68	60	52	47	43	39	33	30	26	0		
.10	0	0	0	0	0	2	17	51	100	149	177	186	169	140	119	106	99	93	86	81	75	69	61	52	47																																							

Exhibit 5-III: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution—continued

Table with columns for TRVL TIME (hr) and HYDROGRAPH TIME (HOURS) from 11.0 to 26.0. It contains multiple rows of unit discharge data for different rainfall types (IA/P = 0.10, 0.30, 0.50) and includes parameters like TC and HR.

### Exhibit 5-III: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME(HOURS)																															
	11.3	11.9	12.1	12.3	12.5	12.7	13.0	13.4	13.8	14.3	15.0	16.0	17.0	18.0	20.0	26.0	11.0	11.6	12.0	12.2	12.4	12.6	12.8	13.2	13.6	14.0	14.6	15.5	16.5	17.5	19.0	22.0
	IA/P = 0.10												* * * TC = 1.0 HR * * *												IA/P = 0.10							
0.0	15	19	24	32	37	44	54	71	98	136	181	227	264	297	270	215	164	128	103	78	64	52	43	36	31	26	23	21	16	14	12	0
.10	13	17	22	28	31	35	41	49	64	87	120	161	205	273	289	254	201	155	122	90	71	56	45	38	33	28	24	21	17	14	12	0
.20	13	16	21	27	29	33	38	46	58	77	105	142	184	257	285	263	214	167	130	95	74	57	46	39	33	28	24	22	17	14	12	0
.30	12	16	20	26	28	31	36	42	53	69	93	126	165	240	279	268	225	178	139	100	77	59	47	39	34	29	25	22	17	15	12	1
.40	11	14	18	23	25	27	30	34	40	48	62	83	112	185	251	276	256	213	168	118	87	65	50	41	35	30	26	23	18	15	12	1
.50	11	13	17	22	24	26	29	32	37	45	56	74	99	167	235	270	261	223	179	126	92	67	51	42	36	31	26	23	18	15	12	1
.75	8	10	13	17	18	19	21	23	25	28	31	36	44	72	122	186	239	258	243	189	136	90	62	48	40	34	29	25	20	16	12	2
1.0	6	9	11	14	15	17	18	20	21	23	25	28	32	46	75	124	185	234	253	226	170	110	71	53	43	37	31	27	21	16	13	4
1.5	4	6	8	10	11	12	13	14	15	16	17	19	21	25	32	46	74	118	170	230	239	179	108	70	52	43	36	31	23	18	13	7
2.0	2	3	4	6	7	7	8	9	10	10	11	12	13	16	18	22	28	38	58	111	179	228	185	116	75	54	44	37	27	21	14	9
2.5	1	1	2	4	4	5	5	6	6	7	8	8	9	11	13	15	18	22	28	46	87	167	219	176	113	73	54	43	31	23	15	10
3.0	0	0	1	2	2	2	3	3	3	4	4	5	5	7	8	10	12	14	16	21	32	68	156	210	179	120	78	56	37	27	16	11
	IA/P = 0.30												* * * TC = 1.0 HR * * *												IA/P = 0.30							
0.0	0	0	0	0	0	1	5	13	30	57	95	141	186	243	249	213	174	142	119	97	83	70	60	53	46	39	35	31	25	22	18	0
.10	0	0	0	0	0	1	3	10	23	46	79	120	164	230	245	221	183	150	125	101	85	72	61	53	46	40	35	31	25	22	18	0
.20	0	0	0	0	0	1	3	7	18	36	65	102	183	233	241	210	174	144	112	92	76	64	56	48	42	36	33	26	22	19	1	
.30	0	0	0	0	0	1	2	6	14	29	53	86	163	221	237	217	183	151	117	95	78	65	56	49	42	37	33	26	22	19	1	
.40	0	0	0	0	0	0	0	1	4	11	23	43	107	180	225	233	207	175	133	105	84	68	59	51	44	38	34	27	23	19	1	
.50	0	0	0	0	0	0	0	1	3	8	18	34	91	162	214	230	213	183	139	109	86	70	60	52	45	39	34	27	23	19	1	
.75	0	0	0	0	0	0	0	0	0	1	4	9	33	82	145	196	218	211	174	135	101	77	64	56	48	42	37	29	24	19	3	
1.0	0	0	0	0	0	0	0	0	0	0	1	2	11	37	85	144	192	214	199	160	116	85	69	59	51	44	38	30	25	20	5	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	23	56	104	174	203	177	123	89	71	60	52	45	35	27	21	11
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	24	73	139	194	169	120	87	70	59	51	39	30	22	14	
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	15	51	127	186	162	117	86	69	59	44	34	23	16	
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6	35	117	180	164	122	90	71	51	39	25	16	
	IA/P = 0.50												* * * TC = 1.0 HR * * *												IA/P = 0.50							
0.0	0	0	0	0	0	0	2	6	17	34	57	83	127	151	142	130	118	109	99	91	83	75	68	59	52	47	43	35	31	27	1	
.10	0	0	0	0	0	0	1	5	13	27	47	71	117	146	144	133	121	112	101	92	84	76	68	60	53	48	43	35	32	27	1	
.20	0	0	0	0	0	0	1	3	10	21	38	60	106	138	143	135	124	114	102	94	85	76	69	61	54	48	44	35	32	27	1	
.30	0	0	0	0	0	0	0	0	2	7	16	31	73	114	139	142	132	121	108	98	88	79	71	64	56	50	45	36	32	27	1	
.40	0	0	0	0	0	0	0	0	2	5	13	25	62	104	133	140	134	124	110	99	89	80	72	64	56	50	45	37	32	27	1	
.50	0	0	0	0	0	0	0	0	1	4	10	35	74	112	134	138	131	117	104	93	82	74	67	59	52	47	38	33	28	2		
.75	0	0	0	0	0	0	0	0	0	2	5	19	43	84	115	131	134	123	110	97	85	77	69	61	54	48	39	33	28	3		
1.0	0	0	0	0	0	0	0	0	0	0	1	6	21	49	84	113	129	132	119	103	89	80	72	64	56	50	41	34	28	5		
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	21	46	75	113	128	120	102	88	79	71	63	56	45	37	29	12
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	14	42	82	119	124	104	90	80	72	64	50	41	31	20	
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	29	75	117	121	102	89	79	71	56	45	32	23	
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	28	80	118	118	101	88	79	63	49	34	24	

RAINFALL TYPE = III

\* \* \* TC = 1.0 HR \* \* \*

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Exhibit 5-III: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution—continued

Table with columns for TRVL TIME (hr) and HYDROGRAPH TIME (HOURS) from 11.0 to 26.0. It contains multiple rows of data for different rainfall types (IA/P = 0.10, 0.30, 0.50) and includes parameters like TC = 1.25 HR. The table is organized into sections based on IA/P values and rainfall types.

### Exhibit 5-III: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution—continued

TRVL TIME (hr)	HYDROGRAPH TIME(HOURS)																															
	11.3	11.9	12.1	12.3	12.5	12.7	13.0	13.4	13.8	14.3	15.0	16.0	17.0	18.0	20.0	26.0	11.0	11.6	12.0	12.2	12.4	12.6	12.8	13.2	13.6	14.0	14.6	15.5	16.5	17.5	19.0	22.0
	IA/P = 0.10												* * * TC = 1.5 HR * * *												IA/P = 0.10							
0.0	12	15	19	25	27	31	37	45	57	75	97	122	151	203	231	238	213	182	150	115	91	70	54	44	37	30	26	23	18	15	12	1
.10	10	13	17	21	23	26	29	34	41	52	67	87	111	165	210	233	227	205	173	131	102	77	58	46	39	32	27	24	19	15	12	1
.20	10	13	16	21	23	25	28	32	38	47	61	78	100	152	199	228	231	210	181	138	107	80	59	47	39	33	28	24	19	15	12	2
.30	9	12	15	20	22	24	27	30	36	44	55	70	90	139	188	221	228	215	188	145	112	83	61	48	40	33	28	24	19	15	12	2
.40	8	11	14	18	19	21	23	25	29	33	40	50	64	103	152	196	223	226	208	166	127	92	66	52	42	35	30	25	20	16	13	2
.50	8	10	13	17	18	20	22	24	27	31	37	46	58	93	140	186	216	224	212	173	133	96	69	53	43	36	30	26	20	16	13	3
.75	6	8	11	14	15	16	18	19	21	23	26	31	36	55	87	130	173	205	217	202	165	119	81	60	48	39	33	28	21	17	13	4
1.0	5	6	8	11	12	13	14	15	16	18	19	21	24	31	46	71	109	151	189	214	200	153	102	72	55	44	37	31	23	18	13	6
1.5	3	4	5	7	8	9	10	11	11	12	14	15	16	19	24	31	45	69	103	159	207	207	147	99	71	54	44	36	26	20	14	8
2.0	1	2	3	5	5	6	6	7	8	9	9	10	11	13	16	19	23	31	45	81	132	189	199	142	97	69	53	43	30	22	15	10
2.5	0	1	1	2	3	3	4	4	4	5	6	6	7	8	10	12	14	17	20	31	53	107	179	194	147	102	73	55	36	26	16	10
3.0	0	0	1	1	1	2	2	2	3	3	3	4	4	5	7	8	10	11	13	18	26	51	116	178	188	142	100	71	43	30	18	11
	IA/P = 0.30												* * * TC = 1.5 HR * * *												IA/P = 0.30							
0.0	0	0	0	0	0	1	2	5	11	22	38	59	84	138	180	200	195	176	154	125	105	86	71	60	52	44	39	34	27	23	19	2
.10	0	0	0	0	0	0	0	1	4	9	18	31	50	99	149	184	198	190	170	139	115	93	75	63	55	47	40	35	28	23	19	3
.20	0	0	0	0	0	0	0	1	3	7	14	25	41	86	137	176	195	192	175	144	119	95	76	64	55	47	41	36	28	24	19	3
.30	0	0	0	0	0	0	0	0	1	2	5	11	21	53	100	147	181	194	187	159	130	103	81	68	58	50	43	37	29	24	19	4
.40	0	0	0	0	0	0	0	0	0	2	4	9	17	45	88	136	172	192	189	164	135	106	83	69	59	51	43	38	30	24	20	4
.50	0	0	0	0	0	0	0	0	0	0	1	3	7	23	56	101	145	177	190	177	149	116	89	73	62	53	45	39	31	25	20	6
.75	0	0	0	0	0	0	0	0	0	0	0	1	3	13	35	71	113	151	176	184	162	128	97	77	65	55	48	41	32	26	20	7
1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	24	53	92	132	174	182	153	114	88	72	61	52	45	34	27	21	10
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	9	24	50	103	152	175	148	112	87	71	60	51	38	30	22	14
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	24	62	127	170	151	116	89	73	61	45	34	23	16
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	16	58	131	165	146	113	88	72	52	39	25	16
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	16	67	134	161	142	111	87	60	44	27	17
	IA/P = 0.50												* * * TC = 1.5 HR * * *												IA/P = 0.50							
0.0	0	0	0	0	0	0	1	2	6	13	22	34	65	94	114	129	122	117	108	100	91	81	74	66	58	52	46	38	33	28	2	
.10	0	0	0	0	0	0	0	0	2	5	10	18	42	73	99	116	126	121	112	104	94	84	76	68	60	53	48	39	33	28	3	
.20	0	0	0	0	0	0	0	0	1	4	8	15	36	65	93	112	123	122	113	105	95	85	77	69	61	54	48	39	34	28	4	
.30	0	0	0	0	0	0	0	0	0	1	3	6	20	44	72	97	114	122	118	109	99	88	79	71	63	56	50	41	34	28	5	
.40	0	0	0	0	0	0	0	0	0	1	2	5	16	38	65	91	110	121	119	110	100	89	80	72	64	57	51	41	34	29	5	
.50	0	0	0	0	0	0	0	0	0	0	1	4	13	33	59	85	105	118	120	112	101	90	81	73	65	57	51	41	35	29	6	
.75	0	0	0	0	0	0	0	0	0	0	1	2	7	20	41	66	89	107	118	115	105	93	83	75	67	60	53	43	35	29	8	
1.0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	14	31	53	78	106	117	113	100	89	80	72	64	57	46	37	30	12	
1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	14	29	60	91	115	111	99	88	79	71	63	50	41	31	18	
2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	20	45	85	113	109	98	87	78	70	56	45	32	22	
2.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	13	42	87	111	107	97	86	78	62	49	34	24	
3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	39	82	109	109	98	87	70	56	37	25	

RAINFALL TYPE = III

\* \* \* TC = 1.5 HR \* \* \*

SHEET 9 OF 10

Exhibit 5-III: Tabular hydrograph unit discharges (csm/in) for type III rainfall distribution—continued

Table with columns for TRVL TIME (hr) and HYDROGRAPH TIME (HOURS) from 11.0 to 26.0. Rows show unit discharges for various rainfall types (IA/P = 0.10, 0.30, 0.50) and durations (2.0 HR). Includes parameters like TC and RAINFALL TYPE = III.

As rural areas become urbanized, the resulting increases in peak discharges can adversely affect downstream flood plains. Increasingly, planners, developers, and the public want these downstream areas to be protected. Many local governments are adopting ordinances to control the type of development and its allowable impacts on the watershed. One of the most common controls requires that postdevelopment discharges do not exceed present-condition discharges for one or more storm frequencies at specified points along a channel.

This chapter discusses ways to manage peak discharges by delaying runoff. It also presents a procedure for estimating the storage capacity required to maintain the peaks within a specified level.

Efforts to reduce the effects of increased runoff from urban areas have been innovative and diverse. Many methods have been used effectively, such as infiltration trenches, porous pavement, rooftop storage, and cisterns. But these solutions can be expensive or require site conditions that cannot be provided.

The detention basin is the most widely used measure for controlling peak discharge. It is generally the least expensive and most reliable of the measures that have been considered. It can be designed to fit a wide variety of sites and can accommodate multiple-outlet spillways to meet requirements for multifrequency control of outflow. Measures other than a detention basin may be preferred in some locations; their omission here is not intended to discourage their use. Any device selected, however, should be assessed as to its function, maintenance needs, and impact.

### Estimating the effect of storage

When a detention basin is installed, hydrologic routing procedures can be used to estimate the effect on hydrographs. Both the TR-20 (SCS 1983) and DAMS2 (SCS 1982) computer programs provide accurate methods of analysis. Programmable calculator and computer programs are available for routing hydrographs through dams.

This chapter contains a manual method for quick estimates of the effects of temporary detention on peak discharges. The method is based on average storage and routing effects for many structures.

Figure 6-1 relates two ratios: peak outflow to peak inflow discharge ( $q_o/q_i$ ) and storage volume runoff volume ( $V_s/V_r$ ) for all rainfall distributions.

The relationships in figure 6-1 were determined on the basis of single stage outflow devices. Some were controlled by pipe flow, others by weir flow. Verification runs were made using multiple stage outflow devices, and the variance was similar to that in the base data. The method can therefore be used for both single- and multiple-stage outflow devices. The only constraints are that (1) each stage requires a design storm and a computation of the storage required for it and (2) the discharge if the upper stage(s) includes the discharge of the lower stage(s).

The brevity of the procedure allows the planner to examine many combinations of detention basins. When combined with the Tabular Hydrograph method, the procedure's usefulness is increased. Its principal use is to develop preliminary indications of storage adequacy and to allocate control to a group of detention basins. It is also adequate, however, for final design of small detention basins.

## Input requirements and procedures

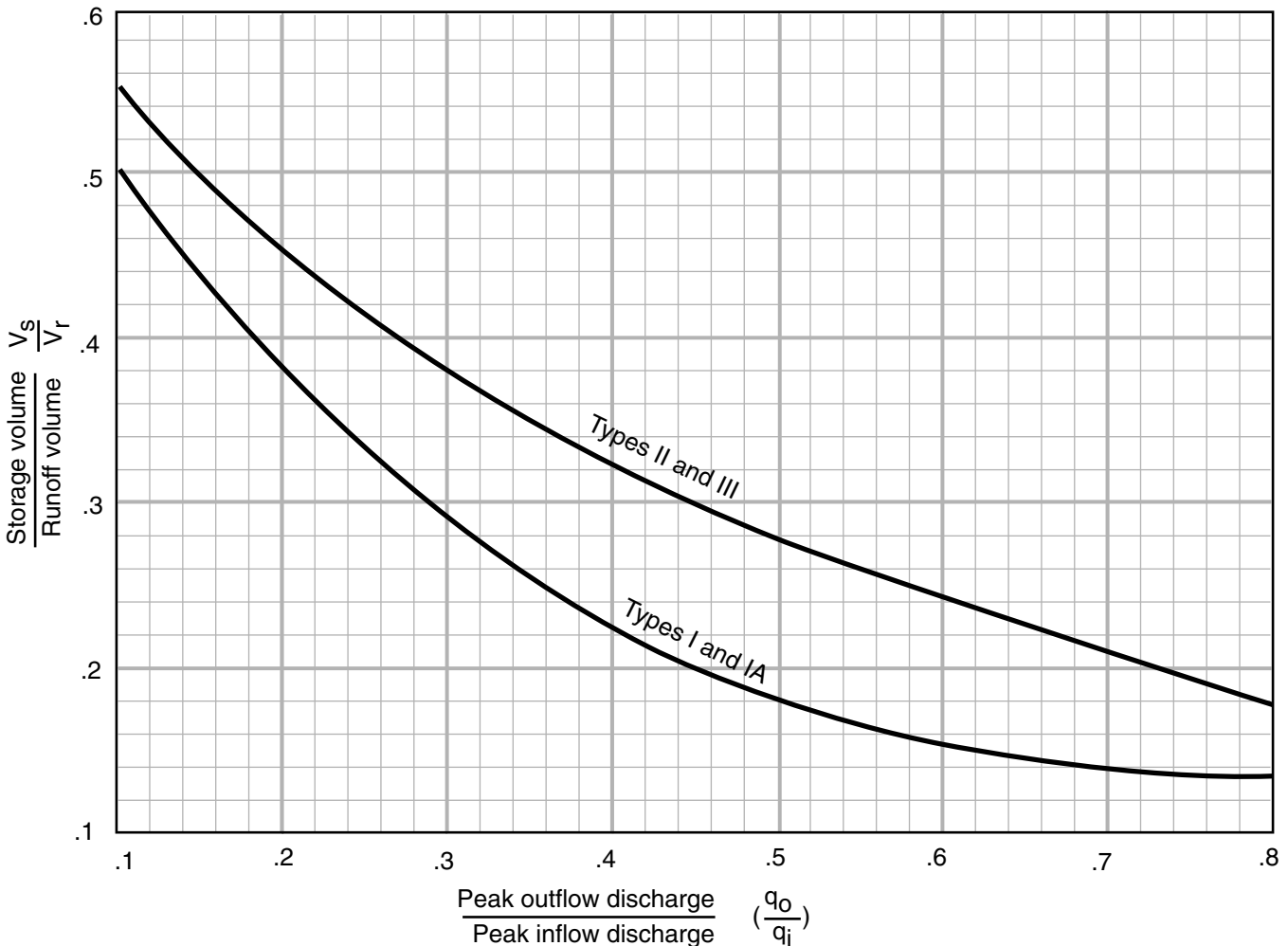
Use figure 6-1 estimate storage volume ( $V_s$ ) required or peak outflow discharge ( $q_o$ ). The most frequent application is to estimate  $V_s$ , for which the required inputs are runoff volume ( $V_r$ ),  $q_o$ , and peak inflow discharge ( $q_i$ ). To estimate  $q_o$ , the required inputs are  $V_r$ ,  $V_s$ , and  $q_i$ .

## Estimating $V_s$

Use worksheet 6a to estimate  $V_s$ , storage volume required, by the following procedure.

1. Determine  $q_o$ . Many factors may dictate the selection of peak outflow discharge. The most common is to limit downstream discharges to a desired level, such as predevelopment discharge. Another factor may be that the outflow device has already been selected.
2. Estimate  $q_i$  by procedures in chapters 4 or 5. Do not use peak discharges developed by other procedure. When using the Tabular Hydrograph method to estimate  $q_i$  for a subarea, only use peak discharge associated with  $T_t = 0$ .

**Figure 6-1** Approximate detention basin routing for rainfall types I, IA, II, and III



3. Compute  $q_o/q_i$  and determine  $V_s/V_r$  from figure 6-1.
4.  $Q$  (in inches) was determined when computing  $q_i$  in step 2, but now it must be converted to the units in which  $V_s$  is to be expressed—most likely, acre-feet or cubic feet. The most common conversion of  $Q$  to  $V_r$  is expressed in acre-feet:

$$V_r = 53.33Q(A_m) \quad [\text{eq. 6-1}]$$

where

$V_r$  = runoff volume (acre-ft)

$Q$  = runoff (in)

$A_m$  = drainage area (mi<sup>2</sup>), and

53.33 = conversion factor from in-mi<sup>2</sup>  
to acre-ft.

5. Use the results of steps 3 to 4 to compute  $V_s$ :

$$V_s = V_r \left( \frac{V_s}{V_i} \right) \quad [\text{eq. 6-2}]$$

where

$V_s$  = storage volume required (acre-ft).

6. The stage in the detention basin corresponding to  $V_s$  must be equal to the stage used to generate  $q_o$ . In most situations a minor modification of the outflow device can be made. If the device has been preselected, repeat the calculations with a modified  $q_o$  value.

### Estimating $q_o$

Use worksheet 6b to estimate  $q_o$ , required peak outflow discharge, by the following procedure.

1. Determine  $V_s$ . If the maximum stage in the detention basin is constrained, set  $V_s$  by the maximum permissible stage.
2. Compute  $Q$  (in inches) by the procedures in chapter 2, and convert it to the same units as  $V_s$  (see step 4 in “estimating  $V_s$ ”).
3. Compute  $V_s/V_r$  and determine  $q_o/q_i$  from figure 6-1.
4. Estimate  $q_i$  by the procedures in chapters 4 or 5. Do not use discharges developed by any other method. When using Tabular method to estimate  $q_i$  for a subarea, use only the peak discharge associated with  $T_t = 0$ .

5. From steps 3 to 4, compute  $q_o$ :

$$q_o = q_i \left( \frac{q_o}{q_i} \right) \quad [\text{eq. 6-3}]$$

6. Proportion the outflow device so that the stage at  $q_o$  is equal to the stage corresponding to  $V_s$ . If  $q_o$  cannot be calibrated except in discrete steps (i.e., pipe sizes), repeat the procedure until the stages for  $q_o$  and  $V_s$  are approximately equal.

### Limitations

- This routing method is less accurate as the  $q_o/q_i$  ratio approaches the limits shown in figure 6-1. The curves in figure 6-1 depend on the relationship between available storage, outflow device, inflow volume, and shape of the inflow hydrograph. When storage volume ( $V_s$ ) required is small, the shape of the outflow hydrograph is sensitive to the rate of the inflow hydrograph. Conversely, when  $V_s$  is large, the inflow hydrograph shape has little effect on the outflow hydrograph. In such instances, the outflow hydrograph is controlled by the hydraulics of the outflow device and the procedure therefore yields consistent results. When the peak outflow discharge ( $q_o$ ) approaches the peak flow discharge ( $q_i$ ) parameters that affect the rate of rise of a hydrograph, such as rainfall volume, curve number, and time of concentration, become especially significant.
- The procedure should not be used to perform final design if an error in storage of 25 percent cannot be tolerated. Figure 6-1 is biased to prevent undersizing of outflow devices, but it may significantly overestimate the required storage capacity. More detailed hydrograph development and routing will often pay for itself through reduced construction costs.

## Examples

Four examples illustrate the use of figure 6-1. Examples 6-1 through 6-4, respectively, show estimation of  $V_s$  of a two-stage structure, estimation of  $q_o$ , and use the Tabular Hydrograph method.

### Example 6-1: Estimating $V_s$ , single-stage structure

A development is being planned in a 75-acre (0.1170 mi<sup>2</sup>) watershed that outlets into an existing concrete-lined channel designed for present conditions. If the channel capacity is exceeded, damages will be substantial. The watershed is in the type II storm distribution region. The present channel capacity, 180 cfs, was established by computing discharge for the 25-year-frequency storm by the Graphical Peak Discharge method (chapter 4).

The developed-condition peak discharge ( $q_i$ ) computed by the same method is 360 cfs, and runoff ( $Q$ ) is 3.4 inches. Since outflow must be held to 180 cfs, a detention basin having that maximum outflow discharge ( $q_o$ ) will be built at the watershed outlet.

How much storage ( $V_s$ ) will be required to meet the maximum outflow discharge ( $q_o$ ) of 180 cfs, and what will be the approximate dimensions of a rectangular weir outflow structure? Figure 6-2 shows how worksheet 6a is used to estimate required storage ( $V_s = 5.9$  acre-ft) and maximum stage ( $E_{\max} = 105.7$  ft).

The rectangular weir was chosen for its simplicity; however, several types of outlets can meet the outflow device proportion requirement. Most hydraulic references, along with considerable research data that are available, provide more guidance on variations of outlet devices that can be summarized here.

An outlet device should be proportioned to meet specific objectives. A single-stage device was specified in this example because only one storm was considered. A weir is suitable here because of the low head. The weir crest elevation is 100.00 ft.

Using  $V_s = 5.9$  acre-ft (figure 6-2, step 9) and the elevation-storage curve, the maximum stage ( $E_{\max}$ ) is 105.7 ft.

The rectangular weir equation is

$$q_o = 3.2L_w H_w^{1.5} \quad [\text{eq. 6-4}]$$

where

$q_o$  = peak outflow discharge (cfs)

$L_w$  = weir crest length (ft)

$H_w$  = head over weir crest (ft)

$H_w$  and  $q_o$  are computed as follows:

$$\begin{aligned} H_w &= E_{\max} - \text{weir crest elevation} \\ &= 105.7 - 100.0 = 5.7 \text{ ft.} \end{aligned}$$

Since  $q_o$  is known to be 180 cfs, solving equation 6-4 for  $L_w$  yields

$$\begin{aligned} L_w &= \frac{q_o}{3.2H_w^{1.5}} \\ &= \frac{180}{3.2(5.7)^{1.5}} \\ &= 4.1 \text{ ft} \end{aligned} \quad [\text{eq. 6-5}]$$

In summary, the outlet structure is a rectangular weir with crest length of 4.1 ft,  $H_w = 5.7$  ft, and  $q_o = 180$  cfs corresponding to a  $V_s = 5.9$  acre-ft.

Figure 6-2 Worksheet 6a for example 6-1

### Worksheet 6a: Detention basin storage, peak outflow discharge ( $q_o$ ) known

Project <i>Robbinsville</i>	By <i>SWR</i>	Date <i>11/5/85</i>
Location <i>Dyer County, Tennessee</i>	Checked <i>RGC</i>	Date <i>11/8/85</i>

Check one:  Present  Developed Single stage structure

1. Data:  
 Drainage area .....  $A_m = \frac{0.117}{11}$  mi<sup>2</sup>  
 Rainfall distribution type ( I, IA, II, III) = \_\_\_\_\_
2. Frequency ..... yr
3. Peak inflow discharge  $q_i$  ..... cfs
4. Peak outflow discharge  $q_u$  ..... cfs  <sup>1/</sup>
5. Compute  $\frac{q_o}{q_i}$  .....

<table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <tr> <td style="width: 50%; text-align: center;">1st Stage</td> <td style="width: 50%; text-align: center;">2nd Stage</td> </tr> </table>	1st Stage	2nd Stage	6. $\frac{V_s}{V_r}$ ..... <input style="width: 50px; text-align: center;" type="text" value="0.28"/> ( Use $\frac{q_o}{q_i}$ with figure 6-1)
1st Stage	2nd Stage		
	7. Runoff, Q ..... in <input style="width: 50px; text-align: center;" type="text" value="3.4"/> ( From worksheet 2)		
	8. Runoff volume $V_r$ ..... ac-ft <input style="width: 50px; text-align: center;" type="text" value="21.2"/> ( $V_r = QA_m$ 53.33)		
	9. Storage volume, $V_s$ ..... ac-ft <input style="width: 50px; text-align: center;" type="text" value="5.9"/> ( $V_s = V_r ( \frac{V_s}{V_r} )$ )		
	10. Maximum storage $E_{max}$ (from plot) <input style="width: 50px; text-align: center;" type="text" value="105.7"/>		

<sup>1/</sup> 2nd stage  $q_o$  includes 1st stage  $q_o$ .

**Example 6-2 Estimating  $V_s$ , Two-stage structure**

In addition to the requirements for a 25-year peak outflow discharge of 180 cfs stated in example 6-1, a decision was made to limit the 2-year outflow discharge to 50 cfs because of potential damages to agricultural property below the lined channel. By the method in chapter 4, the estimated 2-year peak discharge for developed conditions will be 91 cfs and runoff ( $Q$ ) will be 1.5 inches.

Again, a rectangular concrete weir outlet device was selected; the device could have been another type, but it is important to remember that the flows through the first stage are part of the total discharge of the higher stage.

Figure 6-3 shows how worksheet 6a is used to compute the  $V_s$  of 2.4 acre-ft and  $E_{\max}$  of 103.6 for the stage.  $E_{\max}$  of 103.6 is the weir crest elevation for the second stage.

Equation 6-5 is again used to compute  $L_w$  for the first stage. The weir crest elevation for the first stage is 100.00 ft and  $q_o = 50$  cfs. The first-stage computations for  $H_w$  and  $L_w$  are

$$\begin{aligned} H_w &= E_{\max} - \text{weir crest elevation} \\ &= 103.6 - 100.0 = 3.6 \text{ ft;} \end{aligned}$$

and, from equation 6-5,

$$\begin{aligned} L_w &= \frac{50}{3.2(3.6)^{1.5}} \\ &= 2.3 \text{ ft} \end{aligned}$$

The second stage is then proportioned to discharge the correct amount at 105.7 feet (fig. 6-2, step 10). Compute the discharge through the first stage for elevation 105.7 feet using

$$L_w = 2.3 \text{ ft (first stage)}$$

and

$$H_w = 105.7 - 100.0 = 5.7 \text{ ft}$$

By substituting these values in equation 6-4, discharge ( $q_o$ ) through the first stage at 105.7 feet is calculated:

$$\begin{aligned} q_o &= 3.2(2.3)(5.7)^{1.5} \\ &= 100 \text{ ft}^3 / \text{s} \end{aligned}$$

Now compute the required weir crest length ( $L_w$ ) for the second stage, using equation 6-5. Since the second stage crest elevation is 103.6 feet,

$$\begin{aligned} H_w &= 105.7 - 103.6 \\ &= 2.1 \text{ ft} \end{aligned}$$

and, since  $q_o$  for the second stage equals the total discharge from example 6-1 minus discharge through the first stage,

$$\begin{aligned} q_o &= 180 - 100 \\ &= 80 \text{ ft}^3 / \text{s} \end{aligned}$$

Finally, substituting these  $H_w$  and  $q_o$  values in equation 6-5 results in

$$\begin{aligned} L_w &= \frac{80}{3.2(2.1)^{1.5}} \\ &= 8.2 \text{ ft} \end{aligned}$$

In summary, the outlet structure is a two-stage rectangular weir with first stage crest length of 2.3 feet at elevation 100.0, and second stage crest length of 8.2 feet at elevation 103.6 feet.

The weir equation used is probably less accurate for the two-stage example than for the single-stage example. The actual second-stage discharge will be slightly more than the one computed, but a discussion of hydraulics of outflow devices is outside the scope of this technical release. Example 6-2 is presented only to illustrate the interrelationship of outflow discharges and storage volume and to show how to develop preliminary estimates of storage requirements for two-stage outlet structures.

Figure 6-3 Worksheet 6a for example 6-2

**Worksheet 6a: Detention basin storage, peak outflow discharge ( $q_o$ ) known**

Project <i>Robbinsville</i>	By <i>SWR</i>	Date <i>11/6/85</i>
Location <i>Dyer County, Tennessee</i>	Checked <i>RGC</i>	Date <i>11/9/85</i>

Check one:  Present  Developed

*2 - Stage structure*

Elevation or  stage

Detention basin storage ( acre-feet )

- Data:  
 Drainage area .....  $A_m = \frac{0.117}{11}$  mi<sup>2</sup>  
 Rainfall distribution type ( I, IA, II, III) =
- Frequency ..... yr 

2	25
---	----
- Peak inflow discharge  $q_i$  ..... cfs 

91	360
----	-----

  
(from worksheet 4 or 5b)
- Peak outflow discharge  $q_u$  ..... cfs 

50	180
----	-----

  
<sup>1/</sup>
- Compute  $\frac{q_o}{q_i}$  ..... 

0.55	0.50
------	------
- $\frac{V_s}{V_r}$  ..... 

0.26	0.28
------	------

  
( Use  $\frac{q_o}{q_i}$  with figure 6-1)
- Runoff, Q ..... in 

1.5	3.4
-----	-----

  
( From worksheet 2)
- Runoff volume  $V_r$  ..... ac-ft 

9.4	21.2
-----	------

  
( $V_r = QA_m$  53.33)
- Storage volume,  $V_s$  ..... ac-ft 

2.4	5.9
-----	-----

  
( $V_s = V_r ( \frac{V_s}{V_r} )$ )
- Maximum storage  $E_{max}$  (from plot) 

103.6	105.7
-------	-------

<sup>1/</sup> 2nd stage  $q_o$  includes 1st stage  $q_o$

---

**Example 6-3 Estimating  $q_o$** 

A development is being planned for a 10-acre watershed ( $0.0156 \text{ mi}^2$ ). A county ordinance requires that the developed-condition outflow from the watershed for 24-hr, 100-year frequency storm does not exceed the outflow for present conditions. The peak discharge from the watershed for present conditions, 35 cfs, is calculated from procedures in chapter 4. For developed conditions, runoff ( $Q$ ) is 5.4 inches, peak discharge from the watershed is 42 cfs from procedures in chapter 4, and rainfall distribution is type II. What will be the peak outflow discharge ( $q_o$ ) from a detention basin that is located at the outlet and has maximum allowable storage volume ( $V_s$ ) of  $35,000 \text{ ft}^3$  and peak inflow discharge ( $q_i$ ) of 42 cfs? Figure 6-4 shows how worksheet 6b is used to estimate  $q_o$  as 33 cfs, which is within the 35 cfs limit. An outflow device will be selected to discharge 33 cfs at a stage corresponding to a  $V_s$  of  $35,000 \text{ ft}^3$ .

**Figure 6-4** Worksheet 6b for example 6-3

### Worksheet 6b: Detention basin storage, storage volume ( $V_s$ ) known

Project <i>Woods Acres</i>	By <i>SWR</i>	Date <i>11/8/85</i>
Location <i>Dyer county, Tennessee</i>	Checked <i>RGC</i>	Date <i>11/11/85</i>

Check one:  Present  Developed

Detention basin storage

- Data:  
 Drainage area .....  $A_m = \frac{0.0156}{11}$  mi<sup>2</sup>  
 Rainfall distribution type ( I, IA, II, III)
- Frequency ..... yr
- Storage volume  $V_s$  ..... ac-ft
- Runoff, Q ..... in (from worksheet 2)
- Runoff volume ..... ac-ft ( $V_r = QA_m$  53.33)
- Compute  $\frac{V_s}{V_r}$  .....
- $\frac{q_o}{q_i}$  ..... in    
 ( Use  $\frac{V_s}{V_r}$  with figure 6-1)
- Peak inflow discharge  $q_i$  ..... in    
 ( From worksheet 4 or 5b)
- Peak outflow discharge  $q_o$  ..... cfs    
 ( $q_o = q_i ( \frac{q_o}{q_i} )$ )
- Maximum storage  $E_{max}$  (from plot)

1/ 2nd stage  $q_o$  includes 1st stage  $q_o$

### Example 6-4 Estimating $V_s$ , Tabular Hydrograph method

This example builds on examples 5-1 and 5-2. If peak outflow discharge from subarea 7 must not exceed the discharge for present conditions, what will be the storage volume ( $V_s$ ) required in a detention basin at the outlet of subarea 6?

First, compute the outflow hydrograph without subarea 6 as shown in the table below, which presents developed-condition discharges for example 5-2. (The information in the table is from figure 5-4.)

Sub area	Discharge (cfs) at time (hr)								
	13.0	13.2	13.4	13.6	13.8	14.0	14.3	14.6	15.0
	cfs								
1	7	9	11	16	24	40	78	122	155
2	7	9	12	20	33	55	96	132	132
3	14	29	58	89	106	102	74	46	25
4	19	32	63	114	169	207	193	143	83
5	117	167	205	214	202	175	132	99	70
6 omitted	—	—	—	—	—	—	—	—	—
7	244	167	119	90	72	59	48	40	34
Total without subarea 6	408	413	468	543	606	638	621	582	499

After computing the outflow hydrograph, determine the maximum permissible outflow discharge from subarea 6. The present condition peak discharge at the outlet of subarea 7 is 750 cfs at 14.3 hr (figure 5-2), and the developed condition peak discharge at the outlet of subarea 7 minus subarea 6 is 638 cfs (table above). The difference between these two discharges, 82 cfs, is the maximum outflow discharge ( $q_o$ ) for the detention basin.

Next, determine the peak discharge for subarea 6 for developed conditions by substituting values in equation 5-1:

$$q = q_t A_m Q \quad [\text{eq 5-1}]$$

From exhibit 5-II, the largest  $q_t$  value is 357 csm/in (exhibit 5-II, sheet 7:  $T_c = 1.0$  hr,  $T_t = 0$ , and  $I_a/P = 0.10$  at 12.8 hr). From figure 5-4,  $A_m Q$  for subarea 6 is 1.31. Therefore,

$$q = (357)(1.31) = 468 \text{ cfs}$$

This  $q$  value is, of course, the same as the peak inflow discharge ( $q_i$ ) into the detention basin.

Finally, use worksheet 6a (fig. 6-5) to compute  $V_s$  as 33.2 acre-feet.

The required storage volume of 33.2 acre-feet is the basis for determining the required stage in the detention basin. This stage is a guide proportioning a spillway that will discharge 82 cfs or less at that storage. The timing or routing effect is not considered because the outflow hydrograph will discharge at near  $q_o$  for a significant period.

**Figure 6-5** Worksheet 6a for example 6-4

### Worksheet 6a: Detention basin storage, peak outflow discharge ( $q_o$ ) known

Project <i>Fallswood</i>	By <i>SWR</i>	Date <i>11/8/85</i>
Location <i>Dyer county, Tennessee</i>	Checked <i>RGC</i>	Date <i>11/10/85</i>

Check one:  Present  Developed

Elevation or  stage

Not applicable to this example

Detention basin storage ( acre feet )

1. Data:

Drainage area .....  $A_m = \frac{0.40}{11}$  mi<sup>2</sup>

Rainfall distribution type ( I, IA, II, III) = \_\_\_\_\_

1st Stage	2nd Stage
-----------	-----------

2. Frequency ..... yr

3. Peak inflow discharge  $q_i$  ..... cfs

(from worksheet 4 or 5b)

4. Peak outflow discharge  $q_u$  ..... cfs

<sup>1/</sup>

5. Compute  $\frac{q_o}{q_i}$  .....

6.  $\frac{V_s}{V_r}$  .....

( Use  $\frac{q_o}{q_i}$  with figure 6-1)

7. Runoff, Q ..... in

( From worksheet 2)

8. Runoff volume  $V_r$  ..... ac-ft

( $V_r = QA_m$  53.33)

9. Storage volume,  $V_s$  ..... ac-ft

$(V_s = V_r ( \frac{V_s}{V_r} ))$

10. Maximum storage  $E_{max}$  (from plot)

<sup>1/</sup> 2nd stage  $q_o$  includes 1st stage  $q_o$ .



# Appendix A

# Hydrologic Soil Groups

Soils are classified into hydrologic soil groups (HSG's) to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. The HSG's, which are A, B, C, and D, are one element used in determining runoff curve numbers (see chapter 2). For the convenience of TR-55 users, exhibit A-1 lists the HSG classification of United States soils.

The infiltration rate is the rate at which water enters the soil at the soil surface. It is controlled by surface conditions. HSG also indicates the transmission rate—the rate at which the water moves within the soil. This rate is controlled by the soil profile. Approximate numerical ranges for transmission rates shown in the HSG definitions were first published by Musgrave (USDA 1955). The four groups are defined by SCS soil scientists as follows:

**Group A**soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (greater than 0.30 in/hr).

**Group B**soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.30 in/hr).

**Group C**soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05-0.15 in/hr).

**Group D**soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/hr).

In exhibit A-1, some of the listed soils have an added modifier; for example, "Abrazo, gravelly." This refers to a gravelly phase of the Abrazo series that is found in SCS soil map legends.

## Disturbed soil profiles

As a result of urbanization, the soil profile may be considerably altered and the listed group classification may no longer apply. In these circumstances, use the following to determine HSG according to the texture of the new surface soil, provided that significant compaction has not occurred (Brakensiek and Rawls 1983).

<i>HSG</i>	<i>Soil textures</i>
A	Sand, loamy sand, or sandy loam
B	Silt loam or loam
C	Sandy clay loam
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay

## Drainage and group D soils

Some soils in the list are in group D because of a high water table that creates a drainage problem. Once these soils are effectively drained, they are placed in a different group. For example, Ackerman soil is classified as A/D. This indicates that the drained Ackerman soil is in group A and the undrained soil is in group D.

# Exhibit A: Hydrologic Soil Groups for the United States

AABAB	D	ACTI	D	AGUILITA	B	ALBUS	B
AABERG	D	ACTON	B	AGUIRRE	D	ALCALDE	D
AARON	C	ACUFF	B	AGUSTIN	B	ALCAN	D
AARUP	D	ACUNA	C	AHART	B	ALCESTER	B
AASTAD	B	ACY	C	AHCHEW	D	ALCOA	B
AAZDAHL	B	ADA	C	AHL	C	ALCONA	B
ABAC	D	ADABOI	C	AHLSTROM	D	ALCOT	A
ABAJO	C	ADAIR	C	AHMEEK	C	ALCOVA	B
ABALAN	D	ADAMANT	B	AHOLT	D	ALCOVY	C
ABALOBADIAH	B	ADAMS	A	AHPAH	C	ALDA, Saline	B/D
ABARCA	B	ADAMSLAKE	B	AHREN	B	ALDA	C
ABBAYE	B	ADAMSON	B	AHRNKLIN	C	ALDAPE	D
ABBEYLAKE	A	ADAMSVILLE	C	AHRS	B	ALDAX	D
ABBIE	D	ADATON	D	AHSAHKA	C	ALDEN	D
ABBOTT	D	ADAVEN	C	AHTANUM	C/D	ALDENLAKE	B
ABBOTTSRING	B	ADCO	D	AHWAHNEE	B	ALDER	C
ABBOTTSTOWN	C	ADDER	A/D	AIBONITO	D	ALDERDALE	C
ABEGG	B	ADDERTON	B	AIDO	D	ALDERFLATS	D
ABELA	B	ADDICKS	D	AIKEN	B	ALDERMAND	B
ABELL	B	ADDIELOU	B	AIKMAN	D	ALDERON	B
ABENAKI	B	ADE	A	AILEY	B	ALDERWOOD	C
ABERDEEN	C	ADEK	B	AIMELIJK	B	ALDI	D
ABERONE	B	ADEL	B	AINAKEA	B	ALDINE	D
ABERSITO	C	ADEL, Wet	D	AINSLEY	B	ALDING	D
ABERT	B	ADELAIDE	D	AINSWORTH	B	ALDINO	C
ABES	D	ADELANTO	B	AIRMONT	C	ALDO	A
ABGESE	B	ADELINO	B	AIRPORT, Wet	C	ALDRICH	C
ABILENE	C	ADELINO, Saline-Alkali	C	AIRPORT	D	ALEDO	C
ABIN	B	ADELMANN	C	AITS	B	ALEGROS	C
ABIQUA	B	ADELPHIA	B/D	AJAX	D	ALEKNAGIK	C
ABIQUA, Flooded	C	ADEN	C	AJO	C	ALEMEDA	C
ABIQUIU	C	ADENA	C	AJOLITO	D	ALESNA	C
ABITA	C	ADGER	D	AKAD	C	ALEX	B
ABO	C	ADIEUX	B	AKAKA	A	ALEX, Wet Substratum	C
ABOR	D	ADILIS	B	AKAN	B/D	ALEXANDER	C
ABORIGINE	D	ADINOT	D	AKASKA	B	ALEXANDRIA	C
ABOTEN	D	ADIOS	D	AKBASH	B	ALFLACK	C
ABRA	B	ADIRONDAK	D	AKELA	D	ALFORD	B
ABRACON	B	ADJIDAUMO	D	AKELEY	A	ALGARROBO	A
ABRAM	D	ADJUNTAS	C	AKERCAN	B	ALGIERS	C/D
ABRAZO, Gravelly	C	ADKINS	B	AKERITE	B	ALGOA	C
ABRAZO	D	ADLER	C	AKERS	B	ALGOMA	D
ABREU	B	ADMAN	D	AKERUE	D	ALIBATES	B
ABRIGO	B	ADOBE	D	AKHONI	D	ALIBI	D
ABSAQUIL	B	ADOLPH	B/D	AKINA	B	ALICEL	B
ABSAROOKEE	C	ADOS	C	AKINVILLE	B	ALICIA	B
ABSAROOK Cool	B	ADRIAN	A/D	AKLER	D	ALIDA	B
ABSAROOK	C	ADVOKAY	D	AKSARBEN	B	ALIKCHI	B
ABSAY	D	ADWELL	C	ALABASTER	D	ALINE	A
ABSCO	A	ADY	B	ALADDIN	B	ALIRE	B
ABSCOTA	A	ADYEVILLE	C	ALADSHI	B	ALIVAR	B
ABSHER	D	AECET	C	ALAE	A	ALKABO	C
ABSTON	C	AENEAS	B	ALAELOA	B	ALKIRIDGE	C
ACACIO	B	AETNA	C	ALAGA	A	ALLAGASH	B
ACADEMY	C	AFFEY	C	ALAKAI	D	ALLAMORE	D
ACADIA	D	AFLEY	B	PARANAT	C	ALLANTON	B/D
ACADIANA	D	AFLEY, Extremely Stony	C	ALAMA	B	ALLARD	B
ACAMPO	C	AFTAD	B	ALAMADITAS	C	ALLDOWN	C
ACANA	D	AFTADEN	D	ALAMANCE	B	ALLEN	B
ACANOD	C	AFTON	C/D	ALAMBIQUE	B	ALLENDALE	C
ACASCO	D	AGA	C	ALAMEDAWELL	B	ALLENS PARK	B
ACCELERATOR	B	AGAN	D	ALAMO	D	ALLENS PARK, Stony	C
ACCOLA	B	AGAR	B	ALAMOGORDO	B	ALLENTINE	D
ACEITUNAS	B	AGASSIZ	D	ALAMUCHEE	B	ALLENWOOD	B
ACEL	C	AGATE	D	ALANGO	D	ALLHANDS	D
ACHELAKE	B	AGATHA	B	ALANOS	B	ALLINGHAM	B
ACHIMIN	C	AGAWAM	B	ALANOS, Cool	D	ALLIS	D
ACKELTON	B	AGEE	D	ALAPAHA	B/D	ALLIVAR	B
ACKER	B	AGENCY	B	ALAPAI	A	ALLKER	B
ACKERMAN	A/D	AGENCY, Stony	C	ALAZAN	C	ALLOUEZ	B
ACKETT	D	AGERDELLY	D	ALBAN	B	ALLOWAY	B
ACKLEY	B	AGFAYAN	D	ALBANO	D	ALLUVIAL LAND	A
ACKMEN	B	AGNAL	D	ALBANY	C	ALLWIT	D
ACKMEN, Wet	C	AGNESS	B	ALBATON	D	ALMAC	B
ACKMORE, Poorly Drained	B	AGNEW	C	ALBEE	C	ALMAVILLE	D
ACKNA	B	AGNOS	D	ALBEMARLE	B	ALMIRANTE	B
ACKWATER	D	AGON	C	ALBERS	D	ALMO	D
ACME	C	AGORT	C	ALBERTI	C	ALMOND	C
ACO	B	AGRA	D	ALBERTON	B	ALMONT	D
ACOMA	C	AGUA	B	ALBERTVILLE	C	ALMORA	B
ACORD	C	AGUA DULCE	B	ALBICALIS	D	ALNITE	D
ACOVE	C	AGUA FRIA	C	ALBINAS	B	ALNULT	B
ACREE	C	AGUADILLA	A	ALBION	B	ALOGIA	C
ACRELANE	C	AGUALT	B	ALBRIGHTS	C	ALOHA	C
ACTEM	D	AGUEDA	B	ALBURZ	B/C	ALOMAX	D
		AGUILARES	B				

## Exhibit A: Hydrologic Soil Groups for the United States

ALONA	B	AMITY	D	ANOKA	B	ARGALT	D
ALONEMILL	B	AMMON	B	ANONES	C	ARGEE	C
ALONSO	B	AMNICON	D	ANOWELL	D	ARGENTA	C
ALONZEVILLE	B	AMODAC	C	ANSGAR	B/D	ARGONNE	B
ALOVAR	C	AMOLE	C	ANSPING	B	ARGORA	B
ALPENA	A	AMOR	B	ANT FLAT	D	ARGOVAR	D
ALPHA	B	AMORUS	D	ANTARES	A	ARGYLE	B
ALPIN	A	AMOS	C	ANTARES	C	ARIDIC USTIFLUVENTS	B
ALPINEPEAK	C	AMOSTOWN	C	ANTELOPE SPRINGS	D	ARIEL	C
ALPON	B	AMPAD	C	ANTERO	D	ARIMO	B
ALPOWA	B	AMPHION	C	ANTHOLOP	D	ARISTINE	C
ALRED	B	AMSDEN	B	ANTIGO	B	ARIVACA	C
ALROS	C	AMSTERDAM	B	ANTILON	C	ARIVACA, Very Cobbly	D
ALS	A	AMTOFT	D	ANTIOCH	D	ARIZER	B
ALSASH	B	AMUZET	A	ANTOINE	B	ARKABUTLA	C
ALSCO	B	AMUZET, Gravelly	B	ANTOKEN	C	ARKAQUA	C
ALSEA	B	AMWELL	C	ANTON	D	ARKONA	B
ALSPAUGH	C	AMY	D	ANTONITO	C	ARKPORT	B
ALSTAD	C	ANACAPA	B	ANTOSA	B	ARKRIGHT	B
ALSTONY	B	ANACOCO	D	ANTWERP	C	ARKSON	B
ALSTOWN	B	ANACONDA	B	ANUNDE	B	ARKTON	C
ALSUP	C	ANAHEIM	C	ANVIL	C	ARLAND	B
ALTA	B	ANAHUAC	D	APALACHEE	D	ARLE	C
ALTAMONT	D	ANALULU	B	APALO	D	ARLEN	B
ALTAPEAK	B	ANAMAC	B	APELDORN	B	ARLINGTON, Thick Solum	B
ALTAR	B	ANAMITE	D	APEX	B	ARLINGTON	C
ALTASLOUGH	C	ANAN	D	APISON	B	ARLOVAL	A
ALTAVISTA	C	ANAPRA	B	APMAT	B	ARLYNDA	D
ALTDORF	D	ANASAZI	C	APMAY	B	ARMENDARIS	C
ALTHOUSE	B	ANATOLIAN	C	APOLLO	B	ARMENIA	D
ALTICREST	C	ANATONE	D	APOPKA	A	ARMESA	B
ALTITA	C	ANAUD	D	APPAM	B	ARMESPAN	B
ALTMAR	B	ANAUVERDE	B	APPANOOSE	D	ARMINGTON	D
ALTO	C	ANAWALT	D	APPERSON	C	ARMISTEAD	C
ALTOGA	C	ANCENY	B	APPLEDELLIA	C	ARMITAGE	C
ALTON	A	ANCHO	B	APPLEGATE	C	ARMO	B
ALTUDA	D	ANCHO, Saline	C	APPLERIVER	B	ARMOINE	D
ALTURAS	C	ANCHOR POINT	D	APPLESEED	D	ARMPUP	C
ALTUS	B	ANCHORAGE	A	APPLESHALL	D	ARNESS	D
ALTVAN	B	ANCHUSTEQUI	D	APPLING	B	ARNEY	B
ALUF	A	ANCHUTZ	B	APPOMATTOX	B	ARNHEIM	D
ALUM	B	ANCLOTE	B/D	APPOQUINMINK	D	ARNO	D
ALUSA	D	ANCO	C	APRON	B	ARNOLD	A
ALVADA	B/D	ANDERGEORGE	B	APT	B	ARNTZ	C
ALVARADO	B	ANDERLY	C	APTAKISIC	B	AROL	D
ALVIN	B	ANDERSON	C	APTOS	C	AROSA	C
ALVISO	D	ANDERSON, Hard Substratum	C	AQUANDIC HUMAQUEPTS	C	ARP	C
ALVODEST	D	ANDOK	B	AQUARIUS	C	ARRADA	D
ALVOR	D	ANDOVER	D	AQUATNA	D	ARRASTRE	B
ALWILDA	B	ANDRADA	D	AQUILLA	A	ARRIBA	C
ALZADA	D	ANDREGG	B	AQUIMA	B	ARRINGTON	B
ALZOLA	C	ANDRES	C	AQUINAS	C	ARRIOLA	D
AMABILIS	C	ANDREWS	C	ARADA	B	ARRITOLA	D
AMADON	D	ANDRUSIA	A	ARADARAN	C	ARROD	D
AMADOR	D	ANDRY	D	ARAGON	C	ARROLIME	C
AMAGON	D	ANDYS	B	ARAMBURU	C	ARRON	D
AMAL	B	ANED	D	ARAPAHOE	B/D	ARROWHEAD	C
AMALIA	B	ANELA	B	ARARAT	B	ARROYADA	D
AMALU	D	ANGELICA	B/D	ARAT	D	ARROYO SECO	B
AMANA	B	ANGELINA	D	ARAVAIPA	C	ARSITE	D
AMANDA	C	ANGELPEAK	B	ARAWAK	B	ARTA	C
AMARILLO	B	ANGELUS	B	ARBELA	C	ARTIL	A
AMASA	B	ANGIE	D	ARBOLES	C	ARTNOC	B
AMBER	B	ANGLE	A	ARBOR	B	ARTRAY	D
AMBIA	D	ANGLEN	C	ARBUCKLE	C	ARUJO	B
AMBOAT	D	ANGOLA	C	ARBUS	B	ARUNDEL	C
AMBOY	C	ANGORA	B	ARBUTUS	A	ARVA	D
AMBRANT	B	ANGUS	B	ARCADIAN	D	ARVADA	C
AMBRAW	B/D	ANHALT	D	ARCATA	B	ARVANA	C
AMBROSIA	A	ANIAK	D	ARCHABAL	B	ARVILLA	B
AMCEC	B	ANIGON	B	ARCHBOLD	A	ARWITE	B
AMELAR	B	ANIMAS	C	ARCHER	C	ARZO	C
AMELIA	C	ANNABERG	D	ARCHIN, Cool	D	ASAAYI	D
AMENIA	D	ANNAHOOTZ	A	ARCHIN	D	ASABEAN	B
AMENSON	D	ANNALAKE	B	ARCO	B/C	ASBILL	D
AMERICANOS	B	ANNAROSE	B	ARD	C	ASCAR	C
AMERICUS	A	ANNAW	B	ARDENING	B	ASHART	D
AMERIMINE	B	ANNEMAINE	C	ARDENMONT	B	ASHBURN	B
AMERY	B	ANNISQUAM	C	ARDEP	C	ASHCAMP	C
AMES	C/D	ANNISTON	B	ARDILLA	C	ASHCROFT	B
AMESHA	B/D	ANNLAKE	B/D	ARDTOO	B	ASHDALE	B
AMHERST	D	ANNOA	D	ARECIBO	A	ASHDOS	C
AMIRET	B	ANNROMA	D	ARENA	C/D	ASHERTON	B
AMISTAD	D	ANNUM	B	ARENALES	A	ASHFORD	D
		ANOCON	C	ARENOSA	A	ASHFORK	D

# Exhibit A: Hydrologic Soil Groups for the United States

ASHIPPUN	C	ASHEVILLE	D	BALDKNOB	D	BART	B
ASHKUM	B/D	ASHGROVE	B	BALDMOUNTAIN	B	BARTHOLF	B
ASHLEY	B	ASHLAND	B	BALDRIDGE	B	BARTINE	C
ASHLO	B	ASHLEY	B	BALDWIN	D	BARTMUS	D
ASHMED	B	ASHMUN	D	BALE	B	BARTO	D
ASHMUN	D	ASHNOLA	B	BALE, Wet	D	BARTOME	D
ASHNOLA	B	ASHOLLOW	B	BALHUD LOAM	B	BARTON	B
ASHOLLOW	B	ASHONE	C	BALLAHACK	D	BARTONFLAT	B
ASHONE	C	ASHPORT	B	BALLARD	B	BARTONHILL	B
ASHPORT	B	ASHTRE	C	BALLINGER	D	BARZEE	D
ASHTRE	C	ASHUE	B	BALLTOWN	D	BASCAL	B
ASHUE	B	ASHUELOT	D	BALLVAR	B	BASCOM	B
ASHUELOT	D	ASHVILLE	D	BALM	D	BASCOVY	D
ASHVILLE	D	ASHWOOD	C	BALMAN	C	BASH	C
ASHWOOD	C	ASHWORTH	B	BALMLAKE	B	BASHER	B
ASHWORTH	B	ASKECKSY	A/D	BALON	B	BASILE	D
ASKECKSY	A/D	ASLINGER	C	BALSORA	B	BASIN	C
ASLINGER	C	ASOLT	D	BALTIMORE	B	BASINGER	B/D
ASOLT	D	ASOTIN	C	BAMA	B	BASINPEAK	B
ASOTIN	C	ASPARAS	B	BAMBER	B	BASKET	B
ASPARAS	B	ASPEN	B	BAMFIELD	C	BASNOB	A
ASPEN	B	ASPENLAKE	C	BANADERU	D	BASSEL	B
ASPENLAKE	C	ASPERMONT	B	BANAT	B	BASSFIELD	B
ASPERMONT	B	ASPERSON	C	BANBURY	D	BASTIAN	C
ASPERSON	C	ASSATEAGUE	A	BANCAS	B	BASTON	C
ASSATEAGUE	A	ASSININS	B	BANCKER	D	BASTROP	B
ASSININS	B	ASTATULA	A	BANDANA	B	BASTSIL	B
ASTATULA	A	ASTOR	B/D	BANDON	C	BATA	B
ASTOR	B/D	ASTOR, Flooded	D	BANE	A	BATEMAN	B
ASTOR, Flooded	D	ASTRAG	A	BANGTAIL	C	BATES	B
ASTRAG	A	ATASCO	C	BANIDA	D	BATESVILLE	C
ATASCO	C	ATATE	B	BANKER	D	BATHEL	C
ATATE	B	ATCHISON	B	BANKHEAD	B	BATTEAU	C
ATCHISON	B	ATCO	B	BANLIC	C	BATTLE CREEK	C
ATCO	B	ATESH	C	BANNEL	B	BATTLEBUTTE	D
ATESH	C	ATLANTIS	C	BANNER	C	BATTLEFIELD	A/D
ATLANTIS	C	ATLAS	D	BANNING	C	BATTLEGROUND	B
ATLAS	D	ATLATL	C	BANQUITO	C	BATTYDOE	B
ATLATL	C	ATLEE	C	BANTRY	A/D	BATZA	D
ATLEE	C	ATMORE	B/D	BARANA	B	BAUDETTE	B
ATMORE	B/D	ATOKA	C	BARANOF	C	BAUGO	C
ATOKA	C	ATOM	B	BARASCO	C	BAUMAN	C
ATOM	B	ATRAVESADA	D	BARATARI	A/D	BAUX	B
ATRAVESADA	D	ATRYPA	D	BARBARELA	B	BAUXSON	B
ATRYPA	D	ATSION	C/D	BARBAROSA	D	BAVARIA	C
ATSION	C/D	ATSION, Tide Flooded	D	BARBARY	D	BAVDARK	B
ATSION, Tide Flooded	D	ATTELLA	D	BARBERMILL	C	BAXTERVILLE	B
ATTELLA	D	ATTEWAN, Wet	D	BARBERT	D	BAYAMON	B
ATTEWAN, Wet	D	ATTICA	B	BARBOUR	B	BAYFIELD	D
ATTICA	B	ATTOYAC	B	BARBOURVILLE	B	BAYHOOK	B
ATTOYAC	B	ATWELL	D	BARCE	B	BAYHORSE	D
ATWELL	D	ATWOOD	B	BARCELONA	C	BAYLIS	B
ATWOOD	B	AU GRES	C	BARCLAY	C	BAYLOR	A
AU GRES	C	AUA	B	BARCUS	A	BAYMEADE	A
AUA	B	AUBARQUE	D	BARDEN	C	BAYOU	D
AUBARQUE	D	AUBERRY	B	BARDEWELL	B	BAYOUDAN	D
AUBERRY	B	AUCHARD	C	BARFAN	D	BAYS	C
AUCHARD	C	AUDUBON	C	BARFUSS	B	BAYSHORE, Moderately Wet	B
AUDUBON	C	AUFCO	D	BARGAMIN	B	BAYSHORE	D
AUFCO	D	AUGANAUSH	C	BARGE	C	BAYTOWN	B
AUGANAUSH	C	AUGGIE	B	BARGER	C	BAYUCOS	D
AUGGIE	B	AUGUSTA	C	BARHISKEY	A	BAYVIEW	D
AUGUSTA	C	AUGUSTINE	B	BARIO	B	BAYWOOD	A
AUGUSTINE	B	AUGWOOD	B	BARISHMAN	C	BAZETTE	C
AUGWOOD	B	AURA	B	BARKEY	B	BEACH	D
AURA	B	AURAND	C	BARKSHANTY	B	BEAD	C
AURAND	C	AURORA	C	BARLING	C	BEAL	C
AURORA	C	AUSABLE	D	BARLOW	B	BEALAND	B
AUSABLE	D	AUSTIN	C	BARNABE	D	BEALES	B
AUSTIN	C	AUSTINVILLE	B	BARNELLCREEK	B	BEAMTON	C
AUSTINVILLE	B	AUSTONIO	B	BARNESTON	A	BEANBLOSSUM	B
AUSTONIO	B	AUSTWELL	D	BARNHARDT	B	BEANFLAT	C
AUSTWELL	D	AUT	C	BARNMOT	D	BEANO	D
AUT	C	AUTOMBA	B	BARNSDALL	B	BEAR BASIN	B
AUTOMBA	B	AUTRYVILLE	A	BARNWELL	C	BEAR CREEK	C
AUTRYVILLE	A	AUXVASSE	D	BARODA	D	BEARCAMP	B
AUXVASSE	D	AUZQUI	B	BAROID	D	BEARDALL	C
AUZQUI	B	AVA	C	BARPEAK	B	BEARDSLEY	C
AVA	C	AVAL	D	BARRADA	D	BEARDSTOWN	C
AVAL	D	AVANT	B	BARRE	D	BEARGULCH	B
AVANT	B	AVAR	D	BARRETT	D	BEARHEAD	B
AVAR	D	AVAWATZ	A	BARRON	B	BEARPEN	C
AVAWATZ	A	AVENAL	B	BARRYMORE	C	BEARRUN	C
AVENAL	B	AVERLANDE	D	BARSAC	C	BEARTOOTH	B
AVERLANDE	D			BARSHAAD	D	BEARTRAP	B
		AVERY	C				
		AVIS	A				
		AVISTON	B				
		AVOCA	B				
		AVON	C				
		AVONDA	B				
		AVONVILLE	B				
		AVTABLE	D				
		AWBRIG	D				
		AWET	B				
		AXFORD	B				
		AXIS	D				
		AXTELL	D				
		AYCOCK	B				
		AYDELOTTE	D				
		AYERSVILLE	B				
		AYLMER	A				
		AYMATE	C				
		AYOCK	B				
		AYOUB	C				
		AYR	B				
		AYRMOUNT	B				
		AZAAR	C				
		AZABACHE	D				
		AZELTINE	B				
		AZTALAN	C				
		AZTEC	B				
		AZTEC, High Rainfall	C				
		AZURE	D				
		AZWELL	C				
		BAAHISH	B				
		BABBINGTON	B				
		BABCO	C				
		BABELTHUAP	B				
		BABERWIT	C				
		BABOON	C				
		BABOQUIVARI	B				
		BABOQUIVARI, Sandy Substratum	C				
		BACBUSTER	C				
		BACH	B/D				
		BACHELOR	B				
		BACHO	D				
		BACHUS	C				
		BACID	B				
		BACKBAY	D				
		BACKCANYON	D				
		BACKROAD	B				
		BACLIFF	D				
		BACONA	B				
		BADAXE	B				
		BADEN	C/D				
		BADGER	C				
		BADGERCAMP	D				
		BADGERMONT	C				
		BADITO	C				
		BADRIVER	D				
		BADUS	C/D				
		BADWATER	B				
		BAGGER	B				
		BAGGOTT	D				
		BAGGS	B				
		BAGLEY	B				
		BAGMONT	B				
		BAGNESS	B				
		BAHIA	A				
		BAHIAHONDA	B				
		BAHNER	C				
		BAILE	D				
		BAILING	C				
		BAINES	D				
		BAINTER	B				
		BAINVILLE	C				
		BAIRD HOLLOW	D				
		BAKERSFIELD, Drained	B				
		BAKERSFIELD, Saline-Sodic	C				
		BAKERSVILLE	D				
		BAKSCRATCH	D				
		BALAKE	B				
		BALATON	B				
		BALCHER	C				
		BALD	C				
		BALDEAGLE	B				
		BALDER	D				
		BALDHILL	B				

## Exhibit A: Hydrologic Soil Groups for the United States

BEARVILLE	C	BELTAVA	B	BEW	C	BISHOP	C
BEARWALLOW	C	BELTON	C	BEWEARZE	B	BISON	B
BEASLEY	C	BELTSVILLE	C	BEWLEYVILLE	B	BISPING	B
BEASON	C	BELUGA	C/D	BEXAR	D	BISSETT	D
BEATRICE	D	BELVOIR	C	BEZO	D	BISSONNET	D
BEAUCOUP	B/D	BELZAR	C	BIAGGI	B	BIT	C
BEAUFORD	D	BEMIDJI	B	BICKERDYKE	D	BITCREEK	B
BEAUGHTON	D	BEMIS	C	BICKETT	D	BITCREEK LOAM	B
BEAUREGARD	C	BEMISHAVE	C	BICKFORD	D	BITNER	C
BEAUSITE	C	BEN LOMOND	B	BICKLETON	B	BITTER	B
BEAUVAIS	B	BENADUM	C/D	BICONDOA	C/D	BITTERCREEK	D
BEAVERCREEK	B	BENCHLEY	D	BIDDLE	C/D	BITTERROOT	C
BEAVERDAM	C	BEND	B	BIDONIA	D	BIVANS	D
BEAVERDUMP	B	BENDAHL	B	BIDRIM	D	BIWABIK	A
BEAVERFLAT	B	BENDAVIS	C	BIEDELL	D	BIXBY	B
BEAVERTAIL	D	BENDER	B	BIEDSAW	D	BJORKLAND	B/D
BEBEEVAR	B	BENDERLY	A	BIFFLE	B	BLACK CANYON	C/D
BECA	C	BENDOH	B	BIG TIMBER	D	BLACKBURN	B
BECHTEL	B	BENEMES	A	BIGA	C	BLACKCREEK	C
BECHYN	D	BENEVOLA	C	BIGBEAVER	C	BLACKDOG	B
BECKER	B	BENEWAH	D	BIGBEE	A	BLACKFOOT	B/C
BECKHAM	B	BENFIELD	C	BIGBOW	B	BLACKHAMMER	B
BECKMAN	D	BENITO	D	BIGBROWN	C	BLACKHOOF	D
BECKS	C	BENKA	B	BIGCREEK	C	BLACKHORSE	D
BECKSTRAND	C	BENKELMAN	B	BIGDRAW	B	BLACKLAKE	D
BECKVILLE	B	BENKLIN	C	BIGDUTCH	B	BLACKLEG	D
BECKWITH	D	BENMAN	C	BIGELOW	B	BLACKMORE	B
BECCRAFT	B	BENNDALE	B	BIGFOOT	C	BLACKMOUNT	B
BEDEN	D	BENNING	B	BIGFROG	D	BLACKNEST	B
BEDFORD	C	BENRIDGE	B	BIGGSVILLE	B	BLACKOAR	B/D
BEDKE	B	BENSLEY	B	BIGHAT	D	BLACKPIPE	C
BEDNER	C	BENSON	D	BIGHILL	B	BLACKRIVER	B
BEDSTEAD	C	BENSTOT	C	BIGLAKE	A	BLACKSAN	B
BEDWYR	D	BENTAXLE	D	BIGLICK	D	BLACKSPAR	D
BEDZEE	D	BENTEEN	C	BIGLOST	B	BLACKSPOT	D
BEECH	C	BENTILLA	C	BIGLOST, Wet	C	BLACKTOP	D
BEECH GROVE	C	BENTONSPORT	B	BIGPAW	B	BLACKWATER	D
BEECHER	C	BENZ	D	BIGPOOL	C	BLACKWOOD	B
BEECHWOOD	C	BEOR	D	BIGRIVER	B	BLAG	D
BEELEM	D	BEOWAWE	B	BIGSAG	D	BLAGO	D
BEENO	C	BEQUINN	B	BIGSHEEP	B	BLAINEGATE	D
BEERBO	D	BERDA	B	BIGWIN	C	BLAIR	C
BEERSHEBA	B	BERDUGO	C	BIJORJA	C	BLAKABIN	C
BEESKOVE	B	BEREA	C	BIKEN	D	BLAKENEY	D
BEEWON	D	BERGQUIST	B	BIKEYAH	C	BLALOCK	D
BEEZEE	B	BERGSTROM	B	BILGER	D	BLAMER	C
BEHEMOTOSH	C	BERGSVIK	D	BILGRAY	C	BLANCA	B
BEHRING	D	BERLAND	D	BILHAUL	D	BLANCHE	B
BEIGLE	B	BERLIN	C	BILHIL	C	BLANCHESTER	B/D
BEIRMAN	D	BERMUDIAN	B	BILLMAN	C	BLANCOVERDE	C
BEJUCOS	B	BERN	B	BILLYBOY	C	BLAND	C
BELAIN	C	BERNALDO	B	BILLYCREEK	B	BLANEY	B
BELATE	B	BERNARD	D	BILLYHAW	D	BLANKET	C
BELCHER	D	BERNICE	A	BILLYRIDGE	B	BLANKOUT	A
BELDEN	C	BERNOW	B	BILMOD	B	BLANTON	B
BELDING	B	BERON	D	BILSON	B	BLAPPERT	D
BELFON	B	BERRAY	B	BILTMORE	A	BLAQUIRRE	C
BELGARRA	C	BERRYHILL	D	BIMINI	C	BLASE	C
BELGRADE	B	BERRYMAN	C	BIMMER	D	BLASHKE	A
BELINDA	D	BERTHAHILL	B	BINDLE	B	BLAYDEN	D
BELK	D	BERTHOUD	B	BINFORD	B	BLAZEFORK	D
BELKNAP	C	BERTOLOTTI	B	BINGER	B	BLEAKHILL	C
BELLA	D	BERTRAND	B	BINGHAMPTON	B	BLEAKWOOD	C
BELLAMY	C	BERVILLE	B/D	BINGHAMVILLE	D	BLEIBLERVILLE	D
BELLAVISTA	C	BERWOLF	B	BINNSVILLE	D	BLEUMONT	C
BELLE	B	BERZATIC	D	BINS	B	BLEUVINS	B
BELLECHESTER	A	BESHERM	C	BINTON, Reclaimed	B	BLEVINTON	B
BELLEHELEN	D	BESNER	B	BINTON	C	BLEWETT	D
BELLENMINE	D	BESS	C	BINVAR	C	BLICHTON	D
BELLEVILLE	B/D	BESSIE	D	BIPLANE	D	BLIMO	B
BELLEVILLE, Ponged	D	BESSLEN	D	BIPPUS	B	BLIND	B
BELLEVUE	B	BESTPITCH	D	BIRCHBAY	C	BLINDSPRING	A
BELLICUM	B	BESTROM	C	BIRCHFIELD	D	BLINN	C
BELLINGHAM	C/D	BETHALTO	B	BIRCHLAKE	C	BLINT	B
BELLOTA	D	BETHANY	C	BIRDSALL	D	BLISSHILL	C
BELLPASS	D	BETHUNE	C	BIRDSBEAK	D	BLITZEN	C
BELLPINE	C	BETIS	A	BIRDSVIEW	A	BLIZZARD	D
BELLSLAKE	D	BETRA	C	BIRKBECK	B	BLOCKER	D
BELLTOWER	B	BETTERAVIA	C	BIRMINGHAM	B	BLOCKHOUSE	D
BELLWOOD	D	BEULAH	B	BISBEE	A	BLOCKTOWN	C/D
BELMILL	B	BEVERIDGE	D	BISCAY	D	BLOOMFIELD	A
BELPRE	C	BEVERLY	A	BISCAYNE	B/D	BLOOMING	B
BELRICK	B	BEVIER	C	BISCHOFF	B	BLOOMINGDALE	D
BELROSE	B	BEVIL	D	BISCUIT	B/D	BLOOR	D
BELSAC	B	BEVINGTON	B	BISGANI	B	BLOSSBERG	C

# Exhibit A: Hydrologic Soil Groups for the United States

BLUCHER	C	BONA	B	BOTETOURT	C	BRASHEAR	C
BLUE EARTH	D	BONAIR	D	BOTHOMPEEK	D	BRASSFIELD	B
BLUE LAKE	A	BONANZA	B	BOTHWELL	B	BRASSTOWN	B
BLUEAGLE	B	BONAPARTE	A	BOTLEG	C	BRATTON	B
BLUEBIRD	C	BONDMAN	D	BOTT	B	BRAUN	C
BLUECANYON	D	BONDOE	B	BOTTINEAU	B	BRAVO	B
BLUECREEK	D	BONDUEL	C	BOTTLE	C	BRAWLEY	D
BLUEDOME	C	BONE	D	BOTTLEROCK	C	BRAY	D
BLUEGULCH	B	BONFIELD	B	BOULDER POINT	B	BRAYS	C
BLUEHILL	C	BONFRI	C	BOULDIN	B	BRAZILTON	D
BLUEMASS	D	BONG	A	BOULOGNE	B/D	BRAZITO, Thck Surface	B
BLUENOSE	B	BONHAM	D	BOUNCER	D	BRAZITO, Saline-Alkali	C
BLUERIM	C	BONIDU	C	BOUNDARY	B	BREADLOAF	D
BLUESKY	D	BONIFAY	A	BOURBON	B	BRECKEN	B
BLUESLIDE	D	BONJEA	D	BOURNE	C	BRECKENRIDGE	B/D
BLUESTOCKING	C	BONJON	B	BOUSIC	D	BRECKSVILLE	C
BLUESTONE	D	BONN	D	BOWBAC	B	BREEDS	B
BLUEWATER	D	BONNASH	B	BOWERS	C	BREHM	C
BLUEWING	B	BONNEAU	A	BOWERY	B	BREIEN	B
BLUEYE	C	BONNEFEMME	C	BOWES	B	BREMER, Sandy Substratum	B
BLUFF	D	BONNERDALE	B	BOWIE	B	BREMER	C
BLUFFCREEK	B	BONNET	C	BOWLAKE	C	BREMOND	D
BLUFFTON	C/D	BONNEVILLE	A	BOWLUS	B	BREMS	A
BLUFFORD	C	BONNICK	A	BOWMAN	C	BRENDA	C
BLUHOL	D	BONOLDEN	B	BOWMANSVILLE	B/D	BRENHAM	C
BLULA	A	BONSAI	D	BOWNS	C	BRENNAN	B
BLUM	C	BONSALL	D	BOWSTRING	A/D	BRENNER	D
BLY	B	BONWIER	C	BOX	A	BRENNYVILLE	C
BLYBURG	B	BONWIER	D	BOXELDER	C	BRENT, Dry	A
BLYTHE	D	BOOFUSS	C/D	BOXFORD	C	BRENT	D
BOARDBURN	B	BOOKOUT	C	BOXIRON	D	BRENTWOOD	B
BOARDFLOWER	C	BOOKWOOD	B	BOXJOE	A	BREQUITO	B
BOARDMAN	D	BOOMSTICK	D	BOXSPRING	D	BRESSA	C
BOARDTREE	C	BOOMTOWN	D	BOXVILLE	C	BREVATOR	C
BOASH	D	BOONDOCK	D	BOXWELL	B	BREVCO	B
BOAZ	C	BOONE	A	BOY	B	BREW	C
BOBERT	B/C	BOONESBORO	B	BOYD	D	BREWER	C
BOBILLO	B	BOONTLING	C	BOYERLAKE	C	BREWLESS	C
BOBKITTY	C	BOONVILLE	D	BOYKIN	B	BREWTON	C
BOBS	D	BOOTEN	C	BOYLESTON	B	BREZNIAK	D
BOBSGARDEN	B	BOOTLAKE	B	BOYLESTON, Gravelly Subsoil	C	BRIABBIT	B
BOBTAIL	C	BOOTS	A/D	BOYSEN	D	BRICKHAVEN	C
BOBTOWN	B	BOPLAIN	A	BOZE	B	BRICKMILL	C
BOCK	B	BOQUILLAS	C	BOZEMAN	B	BRICKTON	C
BOCOX	D	BORACHO	D	BRABAS	D	BRICKYARD	D
BODECKER	B	BORAH	A	BRABBLE	C	BRICO	C
BODIFORD	D	BORCO	A	BRACKETT	C	BRIDGECREEK	C
BODORUMPE	C	BORDA	D	BRACOS	B	BRIDGER	C
BOEL	A	BORDENGULCH	B	BRADBOLDT	B	BRIDGESON	C/D
BOEL, Overwash	C	BORDERLINE	B	BRADCO	C	BRIERY	C
BOERNE	B	BOREA	D	BRADDALE	B	BRIFOX	C
BOESEL, Protected	B	BOREALIS	D	BRADEN	B	BRIGGS	A
BOESEL	C	BOREHAM	B/C	BRADENTON	D	BRIGHTON	B/D
BOGA	B	BORFIN	C	BRADER	D	BRIGHTWOOD	B
BOGACHIEL	A	BORGEAU	B	BRADFIELD	C	BRILEY	B
BOGAN	C	BORGES	D	BRADGATE	B	BRILL	B
BOGGIANO	B	BORGSTROM	B	BRADSON	B	BRIILLIANT	B
BOGGS	C	BORIANA	D	BRADWAY, Thawed	C	BRIMHALL	B
BOGGY	C	BORID	D	BRADWAY	D	BRIMLEY	C
BOGUE	D	BORKY	C	BRADY	B	BRIMSON	C
BOGUSCREEK	B	BORLAND	D	BRADYVILLE	C	BRINGMEE	B
BOHICA	B	BORNSTEDT	C	BRAGG	C	BRINKERHOFF	D
BOHICKET	D	BORO	D	BRAGTON	D	BRINKLOW	B
BOHNA	B	BOROSAPRISTS	D	BRAILSFORD	C	BRINNUM	C/D
BOHNLY	D	BORPARK	B	BRAM	C	BRIONES	B
BOHNSACK	B	BORREGO	D	BRAMAN	B	BRISBANE	B
BOILER	C	BORREGUERO	C	BRAMARD	B	BRISCOT	C/D
BOISE	B	BORSKI	B	BRAMLETT	D	BRISKY	D
BOISTFORT	B	BORUNDA	C	BRANCHVILLE	A	BRISTOL	A
BOLACK	D	BOSA	D	BRANCROFT	C	BRISTOW	D
BOLD	B	BOSCO	B	BRAND	D	BRITTON	D
BOLENT	A	BOSKET	B	BRANDENBERRY	B	BRITWATER	B
BOLES	C	BOSLAND	C	BRANDENBURG	A	BROADHEAD	D
BOLES Loam Substratum	D	BOSLER	C	BRANDER	B	BROADHURST	D
BOLEY	D	BOSO	D	BRANDON	B	BROADKILL	D
BOLFAR	B/C	BOSONOAK	C	BRANDT	B	BROADLAND	C
BOLICKER	B	BOSQUE	B	BRANDYPEAK	B	BROADUS	B
BOLIO	D	BOSQUEJO, Overwash	C	BRANDYWINE	A	BROADWATER	A
BOLLIBOKKA	D	BOSQUEJO	D	BRANFORD	B	BROADWAY	B
BOLLING	C	BOSSBURG	C/D	BRANNAN	B	BROADWELL	B
BOLTON	B	BOSTON	C	BRANSCOMB	B	BROBETT	C
BOLTZ	C	BOSTRUM	C	BRANSON	B	BROCKATONORTON	D
BOLUDO	D	BOSTWICK	B	BRANSTAD	B	BROCKET	C
BOMAR	C	BOSVILLE	C	BRANTLEY	C	BROCKGULCH	B
BOMBAY	B	BOSWELL	D	BRANYON	D	BROCKLISS	B

## Exhibit A: Hydrologic Soil Groups for the United States

BROCKMAN	C	BUCKHILL	B	BURNEY	B	CALD	C
BROCKO	B	BUCKHOUSE	B	BURNSCREEK	B	CALDER	D
BROCKPORT	D	BUCKING	A	BURNSIDE	B	CALDERWOOD	D
BROCKROAD	C	BUCKINGHAM	C	BURNSVILLE	B	CALDWELL	B/C
BROCKSBURG	B	BUCKLAKE	D	BURNSWICK	A	CALEAST	C
BROCKWAY	B	BUCKLE	B	BURNT LAKE	A	CALEDONIA	B
BROCKWELL	B	BUCKLICK	B	BURNTCREEK	D	CALENDAR	C
BRODALE	C	BUCKMAN	D	BURNTHILL	B	CALERA	C
BRODEER	B	BUCKMEN	B	BURNTRIVER	B	CALFRANCH	B
BRODY	C	BUCKNDOE	B	BURPEAK	B	CALHI	B
BRODYK	B	BUCKNEY	B	BURR	D	CALICOTT	A
BROE	B	BUCKROCK	D	BURRANT	B	CALICREEK	B
BROGAN	B	BUCKSHOT	B	BURRFOOT	B	CALKINS	C
BROGDON	B	BUCKSKIN	C	BURROWSVILLE	C	CALLA	B
BROKENFINGER	B	BUCKTON	B	BURSLEY	D	CALLABO	C
BROKENHORN	D	BUCKWILDER	D	BURSON	C	CALLADITO	A
BROKIT	C	BUCYRUS	C	BURSTEADT	B	CALLAN	C
BROLAND	D	BUDE	C	BURWELL	C	CALLEGUAS	D
BROMAGLIN	B	BUENA VISTA	B	BURWILL	C	CALLISBURG	C
BROMER	C	BUFALO	B	BUSACCA	C	CALLISON	C
BROMIDE	B	BUFFCREEK	B	BUSHMAN	B	CALNAT	C
BROMO	B	BUFFMEYER	B	BUSHNELL	C	CALNEVA	C
BRONELL	B	BUFFSTAT, Channery	B	BUSHONG	C	CALODO	C
BRONSON	B	BUFFSTAT	C	BUSHVILLE	C	CALOOSA	C
BRONTE	C	BUFORD	B	BUSSY	C	CALPEAK	D
BROOKE	D	BUGCREEK	D	BUSTER	B	CALROY	B
BROOKLINE	B	BUGLEY	C/D	BUSTERBACK	B	CALVERTON	C
BROOKSHIRE	C	BUHL	C	BUSTI	C	CALVISTA	D
BROOKSVILLE	D	BUHLER	D	BUSYWILD	B	CALWOODS	D
BROOME	B	BUHRIG	B	BUTANO	C	CALZACORTA	D
BROPHY	A/D	BUICK	C	BUTCHERKNIFE	C	CAMAC	C
BROSE	D	BUKO	B	BUTLER	D	CAMAGUEY	D
BROSELEY	B	BUKO, Wet	C	BUTLERTOWN	C	CAMARGO	B
BROUGHTON	D	BUKREEK	B	BUTTECREEK	B	CAMARILLO	B/C
BROUILLETT	C	BULADEAN	B	BUTTERMILK	B	CAMASCREEK	D
BROWARD	C	BULGRAN	D	BUTTERS	B	CAMATTA	D
BROWER	B	BULL RUN	B	BUTTONCREEK	B	CAMBARGE	B
BROWNBEAR	B	BULL RUN, Hardpan	C	BUXIN	D	CAMBERN	C
BROWNEDELL	D	BULLARDS	B	BUZZTAIL	D	CAMILLUS	B
BROWNELL	B	BULLFLAT	B	BYBEE	D	CAMMASPATCH	D
BROWNFIELD	A	BULLFOR	C	BYGLAND	C	CAMOCCA	A/D
BROWNSBURG	B	BULLGULCH	C	BYINGTON	C	CAMPAIR	C
BROWNSCOMBE	C	BULLIS	D	BYLER	C	CAMPANA	B
BROWNSCREEK	B	BULLOCK	C	BYRAM	C	CAMPANILE	C
BROWNSDALE	C	BULLTOWN	B	BYWELL	D	CAMPBELL	B/C
BROWNSTONE	B	BULLVARO	B	CABINET	C	CAMPBELLTON	C
BROWNSTOWN	B	BULLVILLE	B	CABLON	B	CAMPSCREEK	C
BROWNSVILLE	C	BULLWINKLE	D	CABO ROJO	C	CAMPFOUR	B
BROWNTON	C/D	BULLY	B	CABOOL	B	CAMPIA	B
BROXON	B	BULOW	A	CABOOSE	B	CAMPONE	C
BRUBECK	D	BUMBOB	C	CABRILLO	C	CAMPRA	B
BRUCE	B/D	BUNANCH	C	CABSTON	B	CAMPSPASS	B
BRUELLA	B	BUNCELVOIR	D	CACHEBUTTE	B	CAMPSPASS, Deep	C
BRUELLA, Hard Substratum	C	BUNCETON	C	CACHECAN	C	CAMPTOWN	D
BRUFFY	B	BUNCHPOINT	C	CACHECREEK	B	CAMPUS	B
BRUHEL	B	BUNCOMBE	A	CACIQUE	D	CAMPWOOD	D
BRUJA	B	BUNDORA	B	CACTUSFLAT	D	CAMRODEN	C
BRULE	C	BUNDORF	D	CADDO	C	CANA	C
BRUNEEL	D	BUNDY	C	CADELAKE	D	CANADIAN	B
BRUNELDA	D	BUNDYMAN	C	CADELL	D	CANAL	C
BRUNSWICK	B	BUNGALOW	D	CADEVILLE	D	CANALOU	B
BRUSHCREEK	C	BUNKER	B	CADILLAC	A	CANASERAGA	C
BRUSHER	B	BUNKERHILL	D	CADIZ	B	CANCIENNE	C
BRUSHTON	B	BUNKUM	C	CADMUS	B	CANDELERO	C
BRUSHY	B	BUNKY	C	CADOMA	C	CANDERLY	B
BRUSSELS	C	BUNNELL	B	CADOTTE	B	CANDLESTICK	C
BRYARLY	D	BUNSELMEIER	B	CAESAR	A	CANE	C
BRYDE	C	BUNTING	A	CAFETAL	B	CANEADEA	D
BRYDEN	C	BUNTINGVILLE	C	CAFFEY	C	CANEAK	B
BRYSAL	B	BUNTLINE	D	CAGAS	C	CANELO	D
BRYWAY	C	BUNYAN	B	CAGEY	C	CANEST	D
BTREE	C	BURCHAM	B	CAHABA	B	CANEYHEAD	C
BUB	D	BURCO	D	CAHONA	B	CANEZ	B
BUCAN	D	BUREN	C	CAID	B	CANISTEO	D
BUCCANEER	D	BURFORD	C	CAINHOY	A	CANIWE	B
BUCHEL	D	BURGET	D	CAIRN	B	CANLON	D
BUCHENAU	B	BURGRAFF	B	CAJALCO	C	CANMER	B
BUCKBAY	C	BURKEMONT	C	CAJON	B	CANNELL	B
BUCKBERT	B	BURKETOWN	C	CALABAR	D	CANNING	B
BUCKBOARD	B	BURKEVILLE	D	CALABASAS	B	CANNON	B
BUCKCREEK	C	BURLESON	D	CALAMINE	D	CANONEROS	D
BUCKEAR	D	BURLINGTON	A	CALAMITY	D	CANOSIA	C
BUCKETLAKE	B	BURMAN	C	CALAMUS	A	CANOVA	B/D
BUCKEYE	C	BURNBOROUGH	B	CALAWAH	B	CANQUYA	D
BUCKHALL	B	BURNEL	C	CALCIO	A	CANTALA	B

# Exhibit A: Hydrologic Soil Groups for the United States

CANTEEN	B	CARRIZALES	A	CEBONE	C	CHARDOTON	C
CANTINA	C	CARROLLTON	C	CEBOYA	C	CHARDOTON, Hardpan	D
CANTLIN	A	CARRWASH	A	CEDAR BUTTE	D	CHARETTE	C
CANTON BEND	C	CARSITAS	B	CEDARAN	D	CHARGO	D
CANTRIL	B	CARSTAIRS	A	CEDARBLUFF	C	CHARITON	C
CANTUA	B	CART	B	CEDARCREEK	C	CHARITY	D
CANTUCHE	D	CARTAGENA	D	CEDARFALLS	A	CHARLEBOIS	B/C
CANWALL	C	CARTER	D	CEDARGROVE	B	CHARLESTON	C
CANYADA	D	CARTERET	D	CEDARLAKE	D	CHARLOS	B/D
CANYONCREEK	B	CARTERSVILLE	D	CEDARPASS	B	CHARLOTTE	B/D
CANYOUNG	B	CARTHAGE	B	CEDARROCK	D	CHARNOCK, Moderately Wet	B
CAPA	D	CARTWRIGHT	B	CEDARTOWN	A	CHARNOCK	C
CAPAC	C	CARVER	A	CEDONIA	B	CHARTERS	B
CAPE	D	CARVIX	B	CEDRIC	D	CHARWELL	D
CAPE FEAR	D	CARWALKER	C	CEDVAR	B	CHATBURN	B
CAPEBLANCO	B	CARWAY	D	CEEDEE	B	CHATCOLET	B
CAPEHORN	D	CARWILE	D	CEEJAY	D	CHATHAM	B
CAPERS	D	CARYTOWN	D	CEEK	C	CHATT	C
CAPERSON	D	CASABONNE	B	CELACY	C	CHATTERDOWN	B
CAPHEALY	B	CASAMERO	D	CELAVAR	B	CHATTERTON	A
CAPISTRANO	B	CASCILLA	B	CELAVAR, Loamy Surface	C	CHATTICUP	D
CAPITAN	D	CASE	B	CELESTE	D	CHATUGE	D
CAPLEN	D	CASEY	D	CELETON	D	CHAUMONT	D
CAPLES	C/D	CASEYLAKE	B	CELINA	C	CHAUNCEY	C
CAPOOSE	C	CASEYVILLE	B/C	CELIO	C	CHAUTAUQUA	C
CAPPS	B	CASHEL	C	CELT	C	CHAVIES	B
CAPSHAW	D	CASHIERS	B	CENCOVE	B	CHAWANAKEE	C
CAPSUS	C	CASHNER	B	CENIZA	B	CHAZNER	C
CAPTIVA	B/D	CASITO	D	CENTENARY	A	CHAZOS	C
CAPTOM	B	CASLO	C/D	CENTENNIAL	C	CHAZY	C
CARACARA	C	CASPIANA	B	CENTER	C	CHEAHA	D
CARACOLES	D	CASSAL	B	CENTER CREEK	A	CHECKER	C
CARADAN	D	CASSIA	B/C	CENTERBURG	C	CHEDATNA	B
CARALAMPI	C	CASSIDAY	C	CENTERVILLE, Gravelly Substratum	B	CHEDESKI	B
CARAMON	C	CASSOLARY	C	CENTERVILLE	D	CHEDESEY	C
CARBENGLE	B	CASSOPOLIS	B	CENTISSIMA	B	CHEEKTOWAGA	D
CARBERRY	B	CASTAIC	C	CENTRALIA	B	CHEESEMAN	B
CARBIKA	D	CASTAN	A	CENTRALIA, Loamy Surface	C	CHEESEMAN, Loamy Surface	C
CARBINE	D	CASTANA	B	CENTRALPEAK	C	CHEETHAM	B
CARBONDALE	A/D	CASTANEDA	C	CERBAT	D	CHEHALEM	C
CARBONTON	C	CASTEE	B	CERP	B	CHEHULPUM	D
CARDENAS	D	CASTELL	C	CERROCOSO	B	CHEKICA	D
CARDIFF	B	CASTELLEIA	B	CESARIO	B	CHELINA	B
CARDINAL	B	CASTEPHEN	C	CESSNA	B	CHELMO	D
CARDINGTON	C	CASTILE	B	CESTNIK	C	CHEMAWA	B
CARDON	D	CASTLE	D	CETRACK	B	CHEME	D
CARDSOUND	D	CASTLEPEAK	A	CETREPAS	D	CHENA	A
CAREFREE	D	CASTLEROCK	B	CEWAT	C	CHENAULT	B
CARETT	B	CASTLEROCK	D	CHABENEAU	B	CHENEGA	A
CAREY LAKE	B	CASTLEWOOD	C/D	CHACON	D	CHENOA	B
CARFALL	B	CASTO	C	CHACUACO	C	CHENOWETH	B
CARGENT	B	CASTROVILLE	B	CHAD	C	CHEOAH	B
CARGILL	C	CASVARE	D	CHAFFEE	D	CHEOSA	D
CARIB	D	CASWELL	B	CHAGRIN	B	CHEQUEST	C
CARIBEL	B	CATALINA	B	CHAIN	C	CHEROKEE	D
CARIBOU	B	CATALPA	C	CHAINLINK	D	CHERRYCREEK	B
CARIBOURIDGE	B	CATANO	A	CHAIRES	D	CHERRYHILL	B
CARIOCA	B	CATARACT	B	CHALKCREEK	B	CHESANING	B
CARIS, High Rainfall	B	CATAULA	A	CHALKFORD	B	CHESBROOK	D
CARIS	C	CATELLI	B	CHALKHILL	C	CHESNIMNUS	B
CARLAIN	B	CATH	C	CHALKVILLE	D	CHESTATEE	B
CARLIN	D	CATHARPIN	C	CHALLENGER	B	CHESTERTON	D
CARLITO	D	CATHEEN	B	CHALLENGER, Alkali	D	CHESTOA	B
CARLOS	A/D	CATHERINE	C	CHALLIS	C	CHESTONIA	D
CARLOTTA	B	CATHLAMET	B	CHALMERS	B/D	CHETASLINA	B
CARLSBAD	C	CATILLA	C	CHAMA	C	CHETCO	D
CARLSBORG	A	CATLA	D	CHAMATE	B	CHETEK	B
CARLSON	B	CATNIP	D	CHAMBEAM	B	CHETOMBA	B/D
CARLSTROM	C	CATPOINT	A	CHAMBERLAIN	B	CHEVAL	C
CARLTON	C	CATTICREEK	A	CHAMITA	C	CHEW	B
CARMAN	B	CATTO	D	CHAMOKANE	C	CHEWACK	B
CARMEL	C	CAULEY	B	CHAMPLAIN	A	CHEWAUCAN	C
CARMI	B	CAUSEWA	C	CHANAC	B	CHEWELAH	C
CARMINE	C	CAVANAUGH	C	CHANCELLOR	C	CHEYENNE	B
CARMODY	C	CAVENDISH	B	CHANNAHON	D	CHIA	D
CARNEGIE	C	CAVERNS	B	CHANTIER	D	CHIC	B
CARNERO	C	CAVINISS	B	CHANYBUCK	D	CHICANE	C
CAROLINE	C	CAVO	D	CHAPANOKE	C	CHICHAGOF	D
CAROLLO	D	CAX	B	CHAPARRAL	B	CHICHANTNA	D
CARON	A/D	CAYAGUA	C	CHAPEL	D	CHICKAMAN	B
CARPENTERVILLE	D	CAYO	B	CHAPETT	B	CHICKASAW	C
CARRACAS	D	CAYUGA	C	CHAPPELL	A	CHICKASHA	B
CARRCREEK	B	CAYUSE	B	CHAPPUIS	C	CHICO	B
CARRI	B	CAZADERO	B	CHARBONO	B	CHICOLETE	C
CARRICK	C	CEBOLIA	C	CHARCO	C	CHICONE	D

## Exhibit A: Hydrologic Soil Groups for the United States

CHICOTE	D	CHUMMY	D	CLIMAX	D	COLDSPRING	B
CHIDAGO	A	CHUNILNA	D	CLINE	D	COLEMAN	C
CHIEFLAND	B	CHUNKMONK	C	CLINEFALLS	A	COLEMANTOWN	C/D
CHIGLEY	C	CHUPE	A	CLINETOP	D	COLEPOINT	B
CHILAO	C	CHURCH	D	CLINGMAN	D	COLERIDGE	C
CHILCOTT	C	CHURCH SPRINGS	B	CLINKENBEARD	D	COLFAX	C
CHILDS	B	CHURCHVILLE	D	CLIPPER	C/D	COLFER	A
CHILGREN	C	CHURBUSCO	D	CLIQUOT	C	COLHILL	B
CHILHOWEE	B	CHUTE	A	CLITHERALL	B	COLIBRO	B
CHILICOTAL	B	CHUTUM	B	CLODINE	D	COLINAS	B
CHILLICOTHE	B	CIALES	D	CLOQUALLUM	C	COLLEGECREEK	B
CHILLIGAN	B	CIBEQUE	B	CLOQUET	B	COLLETT	C/D
CHILLUM	B	CID	C	CLOSKEY	C	COLLIER	A
CHILLYBU	D	CIDERMILL	B	CLOTHO	C/D	COLLINGTON	B
CHILOQUIN	D	CIDRAL	C	CLOUD PEAK	B	COLLINS	C
CHILSON	D	CIENEGA	B	CLOUDCROFT	D	COLLISTER	B
CHIMAY	D	CIENO	D	CLOUDLAND	C	COLMA	B
CHIME	C	CIERVO	C	CLOUDLESS	C	COLNEVEE	B
CHIMINET	D	CIFIC	C	CLOUGH	D	COLOMEX	B
CHIMNEY	A	CINCO	A	CLOVELLY	D	COLONVILLE	C
CHIMNEYROCK	B	CINDERHURST	D	CLOVER SPRINGS	B	COLORADO	B
CHINA	D	CINNAMON BAY	B	CLOVERCREEK	C	COLOROCK	D
CHINABUTTE	D	CINTRONA	D	CLOWERS	B	COLOROW	B
CHINAHAT	B	CIRCLE	B	CLOWERS	B/C	COLPIEN	B
CHINCAP	B	CIRCLEBACK	A	CLOWFIN	B	COLSAVAGE	C
CHINCOTEAGUE	D	CIRCLEBAR	C	CLOYD	D	COLUMBINE	A
CHINDE	C	CIRCLEVALLEY	B	CLUBCAF	D	COLUMBUS	C
CHINHILL	B	CIRCULAR	B	CLUNIE	D	COLUSA	C
CHINIAK	A	CISCO	B	CLUNTON	D	COLVARD	B
CHINKLE	D	CISPUS	B	COACHELLA	B/C	COLVILLE	C/D
CHINLINI	B	CITICO	B	COAHUILA	B	COLY	B
CHINO	B/C	CITRONELLE	D	COALDALE	D	COLYELL	C
CHINVAR	C	CITYPOINT	A/D	COALDRAW	D	COLYER	D
CHINWHISKER	A	CLACKAMAS	D	COALGATE	D	COMAR	C
CHIPENDALE	D	CLAMP	D	COAMO	C	COMBE	B
CHIPENHILL	D	CLANA	A	COARSEGOLD	C	COMBEST	B
CHIPLEY	C	CLANALPINE	C	COARSEWOOD	B	COMBS	B
CHIPOLA	A	CLAPHAM	C	COATSBURG	D	COMER	B
CHIPPENY	D	CLARA	B/D	COBATUS	C	COMETCRIK	D
CHIRENO	D	CLARA	D	COBB	B	COMFORT	D
CHISMORE	D	CLARENA	B	COBBLANK	D	COMFREY	D
CHISOLM	A	CLARENCE	D	COBEN	D	COMITAS	A
CHISPA	B	CLARENDON	C	COBERLY	B	COMO	A
CHISTNA	B	CLARESON	C	COBERLY, Low Rainfall	C	COMPASS	B
CHISTOCHINA	B	CLAREVILLE	C	COBEY	B	COMSTOCK	C
CHITA	B	CLARITA	D	COBLENTZ	C	COMUS	B
CHITINA	B	CLARK	B	COBLYNN	B	CONA	C
CHITTUM	C	CLARKIA	C	COBOC	C	CONABY	B/D
CHITWOOD	D	CLARKRANGE	C	COBRE	C	CONALB	B
CHIVATO	C	CLARKSDALE	C	COBSTONE	B	CONANT	C
CHIVATO, Elevation>8000	D	CLARKSTONE	B	COCHINA	D	CONATA	D
CHIWAUKUM	B	CLAUNCH	B	COCHRAN	C	CONBOY	D
CHIWAWA	B	CLAVERACK	C	COCKSCOMB	C	CONCEPCION	D
CHO	C	CLAYBANKS	C/D	COCOA	A	CONCHAS	C
CHOATES	C	CLAYCREEK	C	COCODRIE	C	CONCHOVAR	C
CHOCOLOCCO	B	CLAYHAM	B	COCOLALLA	C/D	CONCORD	D
CHOCK	D	CLAYHOLE	B	COCONINO	B	CONCORDIA	D
CHOCKTOOT	B	CLAYVILLE	C	COD	B	CONDA	D
CHOCORUA	D	CLAYTON	B	CODORUS	C	CONDIDO	D
CHOICE	D	CLE ELUM	D	CODQUIN	D	CONDIT	D
CHOKE	B	CLEARCREEK	D	CODYLAKE	B	CONDON	C
CHOOP	D	CLEARFORK	D	COE	A	CONECUH	D
CHORALMONT	A	CLEARLINE	B	COESSE	C/D	CONETOE	A
CHOSKA	B	CLEARRIVER	B	COFF	C	CONEWARD	A
CHOTEAU	C	CLEARVIEW	B	COFFEE	B	CONGAREE	B
CHOWAN	D	CLEAVMOR	D	COFFEEN	B	CONGLE	B
CHRIS	C	CLEGHORN	C	COFFEEPOT	B	CONICAL	B
CHRISHALL	B	CLEMENTINE	B/C	COFFTON	B	CONLEN	B
CHRISMAN	D	CLEMVILLE	B	COGHILL	C	CONLEY	C
CHRISTIANA	C	CLENAGE	C	COGLIN	C	CONNAH	D
CHRISTIANBURG	C	CLENDENEN	D	COHAGEN	C	CONNERIDGE	C
CHRISTINE	D	CLEONE	B	COHAGEN, Cool	D	CONNET	D
CHRISTOFF	C	CLEORA	B	COHAS	C	CONOSTA	C
CHRISTY	C	CLERGERN	B	COHOE	B	CONOTTON	B
CHROME	C	CLERMONT	D	COILE	D	CONOVER	C
CHRYSLER	C	CLEVELAND	C	COILS	C	CONOWINGO	C
CHUBBFLAT	C	CLEVESCOVE	B	COIT	D	CONPEAK	D
CHUCKANUT	B	CLEYMOR	B	COKATO	C	CONQUISTA	D
CHUCKRIDGE	D	CLICK	A	COKEDALE	C/D	CONRAD	A/D
CHUCKRIVER	D	CLIFF	B	COKER	D	CONSEJO	C
CHUFFA	B	CLIFFDELL	B	COKEVILLE	B	CONSER	D
CHUGCREEK	C	CLIFFFIELD	B	COLBE	D	CONSTABLE	A
CHUGTER	D	CLIFFFORD	C	COLBERT	D	CONSTANCE	D
CHUICHU	D	CLIFFSIDE	B	COLBURN	C	CONSTANCIA	D
CHUIT	B	CLIFTY	B	COLDENT	C	CONSUMO	B

# Exhibit A: Hydrologic Soil Groups for the United States

CONTACT	A	COSPERVILLE	C	CREDO	B	CUCAMUNGO	D
CONTEE	D	COST	D	CREEDMOOR	C	CUCHARAS	C
CONTENTION	D	COSTAVAR	C	CREEL	C	CUCHILLAS	C
CONTIDE	B	COTEAU	D	CREFORK	C	CUDEI	B
CONTO	B	COTHA	C	CREOLE	D	CUDJOE	D
CONVENT	C	COTITO	B	CRESAL	B	CUERBIO	B
COOERS	B	COTO	B	CRESKEN	B	CUERO	B
COOKCAN	D	COTT	B	CRESPIN	C	CUESTA	C
COOLBRITH	C	COTTER	B	CRESS	A	CUEVA	D
COOLVILLE	C	COTTON	C	CRESSLER	D	CUEVITAS	D
COOMBS	B	COTTONBEND	B	CREST	C	CUEVOLAND	B
COONSKIN	C	COTTONEVA	C	CRESTMEADE	D	CUJOB	D
COOPER	B	COTTONTHOMAS	B	CRESTVALE	C	CULBERTSON	B
COOPMONT	B	COTTONWOOD	C	CRESTWAY	B	CULDECOLE	B
COOSAW	B	COTTREE	B	CREVA	D	CULDESAC	B
COOSCANYON	B	COTTRELL	C	CREVISCREEK	C	CULLITAS	C
COOT	B	COTULLA	D	CREX	B	CULLIUS	D
COOTER	C	COUGARBAY	D	CRIMS	D	CULLOWHEE	B/D
COPALIS	C	COUGHANOUR	C	CRINKER	C	CULP	C
COPANO	D	COULTERVILLE	D	CRISFIELD	B	CULPEPER	C
COPASTON	D	COUNTRYMAN	C	CRISPIN	C	CULTUS	B
COPEAK	C	COUNTS	D	CRITCHELL	B	CULVING	C
COPELAND	B/D	COUPEE	B	CRITTENDEN	B	CULVOP	B
COPELAND, Depressional	D	COUPEVILLE	C/D	CROCAMP	B	CUMBERLAND	B
COPENHAGEN	D	COURSEY	C	CROCAN	D	CUMBRES	C
COPITA	B	COURT	B	CROCKETT	D	CUMLEY	C
COPPER RIVER	D	COURTNEY	D	CROFLAND	C	CUMMINGS	D
COPPERBASIN	D	COURTOIS	B	CROFTSHAW	B	CUMMISKEY	B
COPPERCAN	D	COURVASH	B	CROGHAN	B	CUNDICK	D
COPPERCREEK	B	COUSE	C	CROKE	B	CUNIFF	D
COPPEREID	D	COVEDALE	B	CRONESE	A	CUNNIFF	C
COPPERFIELD	B	COVEGAP	B	CRONKHITE	C	CUNNINGHAM	C
COPPLER	A	COVELAND	C/D	CRONKS	C	CUPCO	C
COPUS	C	COVERTFALLS	C	CROOKED	D	CUPEL	D
COQUAT	D	COVILLE	B	CROOKSFORD	B	CUPINE	C
CORA	D	COVING	C	CROOKSTON	B	CUPOLA	B
CORAL	C	COVINGTON	D	CROOM	C	CUPPER	B
CORAZONES	A	COWAN	A	CROPLEY	D	CUPPLES	C
CORBIN	B	COWBONE	D	CROQUIB	D	CUPPY	D
CORBLY	A	COWCREEK	B	CROSIER	C	CUPVAR	D
CORCEGA	C	COWCREEK, Protected	C	CROSSCREEK	B	CURABITH	A
CORDALE	B	COWDEN	D	CROSSEN	D	CURANT	B
CORDELL	D	COWEEMAN	D	CROSSETT	B	CURDLI	B
CORDES	B	COWHORN	B	CROSSNORE	B	CURRAN	C
CORDOVA	C/D	COWSPRING	B	CROSSPLAIN	C	CURRENT SPRING	C
CORDY	B	COWTRACK	A	CROSSTELL	D	CURRIER	A
CORIFF	B/D	COX	D	CROSSVILLE	B	CURRITUCK	D
CORINTH	C	COXIT	B	CROSWOOD	A	CURRY	C
CORKSTONE	D	COXLAKE	D	CROT	D	CURTIN	D
CORLENA	A	COXRANCH	C	CROW	C	CURTIS CREEK	D
CORLETT	A	COXVILLE	D	CROW CREEK	B	CURTIS SIDING	A
CORLEY	B/D	COXWELL	C	CROW HILL	C	CURTISTOWN	B
CORLISS	A	COY	D	CROWELL	A	CURTISVILLE	D
CORNELIA	A	COYANOSA	D	CROWERS	B	CUSHENBURY	B
CORNELIUS	C	COYATA	C	CROWFORK	A	CUSHING	B
CORNHILL	B	COYNE	B	CROWHEART	C	CUSHMAN	B
CORNICK	D	COYOTE	A	CROWLEY	D	CUSHOOL	B
CORNVILLE	B	COZETICA	A	CROWRIVER	B/D	CUSICK	D
CORNWALL	C	COZY	C	CROWSHAW	B	CUSTCO	B
COROLLA	D	CRABCREEK	B	CROZIER	C	CUSTER	C/D
CORONA	B	CRABTREE	C	CRUBAS	D	CUTCOMB	D
CORONACA	B	CRACKER	D	CRUCES	D	CUTHAND	B
COROZAL	C	CRACKERCREEK	B	CRUCKTON	B	CUTHBERT	D
COROZO	A	CRACKLER	B	CRUICKSHANK	C	CUTSHIN	B
CORRALCREEK	C	CRADLEBAUGH	D	CRUMARINE	B	CUTTOR	D
CORRALITOS, Silty Substratum	B	CRAFTON	C	CRUMLEY	B	CUTZ	D
CORRALITOS, Clayey Substratum	C	CRAGGEY, Organic Surface	A	CRUNKER	B	CUYAMA	B
CORRALRIDGE	B	CRAGGEY	D	CRUNKVAR	A	CUYAMUNGUE	A
CORRIGAN	D	CRAIG	B	CRUSTOWN	C	CUYON	A
CORSAIR	A	CRAIGEN	B	CRUTCH	C	CYAN	B
CORSICA	C/D	CRAMER	C	CRUTCHFIELD	B	CYCLONE	B/D
CORTA	D	CRAMONT	C	CRUZE	C	CYCLOPIC	C
CORTADA	B	CRANECREEK	C	CRYLUHA	C	CYNET	B
CORTARO	D	CRANFILL	B	CRYSTAL LAKE	B	CYMRIC	D
CORTELYOU	D	CRANNLER	B	CRYSTALCREEK	B	CYNTHIANA	D
CORTINA	A	CRANSTON	B	CRYSTALEX	B	CYPRESS	D
CORUM	C	CRASH	B	CRYSTALGYP	C	CYRIL	B
CORVUSO	C/D	CRATER LAKE	B	CRYUMBREPTS	B	CYVAR	D
CORWITH	B	CRATERMO	C	CUATE	C	CZAR	B
CORY	C	CRAVEN	C	CUBA	B	DAB	B
CORZUNI	B	CRAWFISH	D	CUBACREEK	C	DABNEY	A
COSAD	C	CRAWFORD	D	CUBDEN	C	DABOB	C
COSH	C	CRAWLEY	D	CUBERANT	B	DACKEY	C
COSLAW	D	CRAWLEYVILLE	B	CUBHILL	C	DACRON	B
COSMOS	C/D	CREASEY	C/D	CUBLAKE	A	DADE	A

## Exhibit A: Hydrologic Soil Groups for the United States

DADINA	D	DAXTY	C	DELEON	C	DESKAMP	B
DAGUAO	C	DAYBROOK	C	DELEPLAIN	D	DESKER	A
DAGUEY	C	DAYCREEK	A	DELETTE	C	DESMET	B
DAHAR	C	DAYSCHOOL	B	DELHEW	B	DESOLATION	B
DAHL	D	DAYTONA	B	DELICIAS	B	DESONS	C
DAILEY	B	DAYVILLE	C	DELISH	C	DESTER	C
DAINT	B	DAZE	D	DELKS	C/D	DETERSON	C
DAISY	B	DEACON	B	DELL	C	DETOUR	B
DAISYBAY	A	DEADFALL	C	DELLO	D	DETRITAL	B
DALBY	D	DEADFOOT	B	DELLS	C	DETROIT	C
DALCO	D	DEADHORSE	C	DELLWOOD	A	DEUCE	D
DALECREEK	B	DEADLINE	B	DELMITA	C	DEUCHARS	C
DALEROSE	B	DEADWOOD	D	DELMO	B	DEV	A
DALESBURG	B	DEADYON	B	DELNORTE	C	DEVARGAS	B
DALEVILLE	D	DEAM	C	DELOSS	B/D	DEVILFENCE	D
DALHART	B	DEANBURG	B	DELP	A	DEVILS	D
DALIG	B	DEANRAN	D	DELPHI	B	DEVILSCREEK	C
DALKENA	C	DEARYTON	C	DELPLAIN	D	DEVINE	C
DALLAM	B	DEATMAN	C	DELRAY	D	DEVISADERO	C
DALLARDSVILLE	C	DEAVER	C	DELRIDGE	B	DEVNOT	D
DALTON	C	DEBENGER	C	DELRIO	B	DEVOE	D
DALUPE	B	DEBEQUE	B	DELTAJO	C	DEVOIGNES	B
DALVORD	D	DEBOOK	B	DELUGE	C	DEVRIES	C
DAMASCUS	B/D	DEBORAH	D	DELVALLE	B	DEWBERRY	B
DAMEWOOD	C	DEBS	B	DELVAR	C	DEWEY	B
DAMON	D	DEBUTE	C	DELWAY	D	DEWEYVILLE	D
DAMORE	C	DECAN	C	DELWIN	A	DEWITT	C
DANABROOK	B	DECANTEL	D	DELYNDIA	A	DEWMINE	D
DANAVORE	B	DECATHON	C	DEMAYO	D	DEWRUST	C
DANCY	B/D	DECATUR	B	DEMENT	B	DEWVILLE	B
DANDAN	C	DECEPTION	B	DEMILL	B	DEXTER	B
DANDREA	C	DECHEL	D	DEMING	B	DEZELLEM	B
DANGULCH	D	DECKERVILLE	C/D	DEMKY	D	DIAFLATS	B
DANHUNT	B	DECORDOVA	B	DEMOGUL	B	DIAGULCH	B
DANIA	B/D	DEGRAM	C	DEMONA	C	DIAMOND	D
DANIELSON	C/D	DECY	B	DEMONTREVILLE	B	DIAMONDHIL	C
DANIELVIL	B	DEDAS	D	DEMOPOLIS	C	DIAMONKIT	C
DANJER	D	DEDMOUNT	C	DEMOPOLIS, cobbly	D	DIANEV	D
DANKO	D	DEDMOUNT, Lacustrine Substratum	D	DEMORY	D	DIANOLA	D
DANKWORTH	A	DEDRICK	D	DEMOSS	D	DIATEE	B
DANSKIN	B	DEE	C	DEMOX	B	DIAWELL	D
DANT	D	DEECREE	B	DEMPSEY	B	DIBOLL	D
DANUBE	B/D	DEEFAN	D	DEMPSTER	C	DICECREEK	C
DAPOIN	C	DEEMER	B	DENAUD	B/D	DICK	A
DARAS	B	DEEPCUT	D	DENBAR	C	DICKERSON	D
DARBONNE	B	DEEPEEK	D	DENBY	C	DICKEYPEAK	C
DARBY	C	DEEPWATER	B	DENCO	C	DICKLE	C
DARCO	A	DEEPWOOD	B	DENEKA	D	DICKSON	C
DARDANELLE	B	DEER PARK	A	DENIO	B	DIEBERT	B
DARDEN	A	DEERCUT	C	DENNIS	C	DIEHLSTADT	C
DARDOOW	B	DEERFIELD	B	DENNISVILLE	B	DIERSSEN	D
DARE	D	DEERHEART	C	DENOMIE	B	DIGBY	B
DARFUR	B/D	DEERHORN	C	DENROCK	D	DIGHTON	B
DARKCANYON	C	DEERRUN	C	DENT	B	DIGIORGIO	B
DARL	C	DEERWOOD	B/D	DENTDRAW	D	DILLARD	C
DARLAND	B	DEFENBAUGH	B	DENTON	D	DILLCOURT	B
DARLEY	C	DEFIANCE	D	DENURE	A	DILLEY	C
DARLINGTON	A	DEGATER	D	DENVACA	D	DILLINGHAM	A
DARLOW	C	DEGNER	B	DEPALT	D	DILLWYN	A
DAROW	C	DEGOLA	B	DEPCOR	B	DILMAN	C
DARR	B	DEGRAND	B	DEPEYSTER	C	DILTON	D
DARRAH	C	DEGREY	D	DEPNER	B	DILWORTH	D
DARROCH	C	DEHAVEN	B	DEPOE	D	DIMAL	C
DARROUZETT	D	DEHILL	B	DEPORT	D	DIME	B
DARSIL	C	DEHLINGER	B	DERAPTER	B	DIMEBOX	D
DART	A	DEIGHT	B	DERB	C	DIMO	B
DARTMOUTH	B	DEINACHE	A/D	DERBY	A	DINA	C
DARVEY	B	DEKALB, Stony	A	DERECHO	B	DINCO	B
DARWASH	B	DEKALB	B	DERMALA	B	DINES	B
DASHER	D	DEKAPEN	C	DEROIN	B	DINEVO	B
DASHIKI	A	DEKKAS	A	DEROUX	C	DINGLE	C
DASSEL	B/D	DEKOOM	B	DERR	C	DINGLISHNA	D
DATINO	B	DEKOVEN	D	DERRINGER	C	DINGMAN	C
DATINO	D	DELA	B	DERRYNANE	C	DINKEY	A
DATOM	D	DELACIT	D	DERWELL	B	DINZER	B
DATWYLER	C	DELAMAR	B	DES MOINES, Dry	B	DIOBSUD	C
DAVEGGIO	B	DELAMETER	A	DES MOINES, Cobby	C	DIPCREEK	D
DAVIDELL	B	DELAND	A	DESAN	A	DIPMAN	D
DAVIDSON	B	DELANO	B	DESATOYA	C	DIPSEA	B
DAVILLA	D	DELANO, Sandy	C	DESCALABRADO	D	DIQUE	B
DAWHOO	B/D	DELAWARE	B	DESCHUTES	B	DIREGO	D
DAWN	B	DELCOMB	D	DESERTLAKE	D	DIRTYHEAD	C
DAWNY	B/D	DELENA	D	DESFIREX	B	DISAGE	D
DAWSIL	A/D	DELENBAW	D	DESHA	D	DISAPPOINT	D
DAWTONIA	B			DESHASER	B	DISCO	B

# Exhibit A: Hydrologic Soil Groups for the United States

DISCOVERY	D	DOROTHEA	C	DUCKHILL	D	EAGLESPRING	B
DISHNER	D	DOROVAN	D	DUCKSTON	A/D	EAGLETON	D
DISHNO	C	DORRANCE	A	DUELM	A	EAGLEVIEW	A
DISHPAN	C	DORS	B	DUETTE	A	EAGLEVILLE	D
DISTELL	C	DORSET	B	DUFFAU	B	EAGLEWING	B
DISWOOD	D	DORVAL	A/D	DUFFERN	A	EAGLEYE	D
DITCHCAMP	C	DOSA	D	DUFFYMONT	C	EAGREEK	B
DITHOD	B	DOSAMIGOS	D	DUFFYMONT, Dry	D	EAKIN	B
DITNEY	C	DOSEWALLIPS	D	DUFUR	B	EALY	B
DIVIDE	C	DOSIE	C	DUGGINS	D	EAPA	B
DIVISION	D	DOSLOMAS	C	DUGUESCLIN	D	EARLE	D
DIVOT	C	DOSS	D	DUGWAY	C	EARLMONT	C/D
DIXALETA	D	DOSSMAN	B	DUKES	A	EARP	B
DIXBORO	B	DOTLAKE	D	DULA	D	EASBY	C
DIXIEJETT	B	DOTSERO	B	DULAC	C	EASLEY	C
DIXON	B	DOTSOLOT	D	DULANDY	B	EASPUR	B
DIXONVILLE	C	DOTY	B	DULCE	D	EAST LAKE	A
DOANE	B	DOUBLEDIA	D	DULEYLAKE	C	EASTABLE	B
DOBALT	B	DOUBLEO	D	DULLAXE	B	EASTCHOP	A
DOBBINS	C	DOUCETTE	D	DULLES	D	EASTHAM	D
DOBEL	D	DOUDLE	B	DUMAS	B	EASTPARK	D
DOBENT	C/D	DOUGAL	D	DUMFRIES	B	EASTPINE	B
DOBIE	B	DOUGAN	C	DUMONT	D	EASTWOOD	D
DOBSON	D	DOUGCITY	B	DUMPS, Tailings	B	EASYCHAIR	B
DOCAS	B	DOUGCLIFF	D	DUNBAR	D	EATONCREEK	D
DOCENA	C	DOUGHBOY	B	DUNBRIDGE	B	EAUCLAIRE	A
DOCKLAKE	B	DOUGHERTY	A	DUNC	C	EAUGALLIE	D
DOCPAR	B	DOUGHSPON	C	DUNCANNON	B	EBADLOW	B
DODD	D	DOUGHTY	B	DUNFORD	C	EBAL	B
DODES	B	DOUGLAS	B	DUNGAN	B	EBBERT	C/D
DODGE	B	DOUHIDE	B	DUNGENESS	B	EBBING	C
DODGECREEK	B	DOURO	B	DUNKIRK	B	EBBS	B
DODGEVILLE	C	DOUTHIT	C	DUNKLEBER	D	EBIC	D
DODSON	C	DOWAGIAC	B	DUNLATOP	B	EBODA	B
DODY	C/D	DOWDE	B	DUNMORE	B	EBODA, Stony	C
DOE	B	DOWELLTON	D	DUNNBOT	B	EBRO	D
DOEL	C	DOWNER	B	DUNSMUIR	B	ECHAW	A
DOGIECREEK	B	DOWNEY	B	DUNSMUIR, Nongravelly	C	ECHETA	C
DOGLAKE	A	DOWNEYGULCH	C	DUNTON	C	ECKERT	D
DOG MOUNTAIN	C	DOWNSOUTH	B	DUPLIN	C	ECKHART	B
DOGTOOTH	D	DOWNSVILLE	B	DUPO	C	ECKLUND	B
DOGUE	C	DOWPER	B	DUPREE	D	ECKMAN	B
DOKER	C	DOYLESTOWN	D	DURADOS	A	ECKRANT	D
DOLBEE, Sandy Substratum	B	DOYN	D	DURALDE	C	ECKVOLL	B
DOLBEE	C	DRAGSTON	C	DURAND	B	ECLETO	D
DOLEKEI	B	DRAKE	B	DURANGO	B	ECLIPSE	B
DOLEN	B	DRAKESFLAT	B	DURANT	D	ECOLA	C
DOLES	C	DRAKESPEAK	B	DURAZO	A	ECON	B
DOLLAR	C	DRAMMEN	A	DURBIN	D	ECONFINA	A
DOLLARD	C	DRANBURN	B	DURELLE	B	ECUR	B
DOLLARHIDE	D	DRASCO	C	DURKEE	C	EDA	A
DOLLYCLARK	C	DRAX	B/C	DURRSTEIN	D	EDALFRED	A
DOLMAN	C	DREKA	D	DURSTON	C	EDALGO	C
DOLUS	C	DRESDEN	B	DUSEN	B	EDDINGS	B
DOME	B	DREWING	D	DUSKPOINT	A	EDDS	B
DOMENGINE	C	DREWSEY	B	DUSLER	C	EDDY	C
DOMERIE	B	DREWSEY	B	DUSON	C	EDEMAYS	C
DOMERIE	B	DREWSEY	B	DUSTON	A	EDEMPOWER	D
DOMEZ	B	DREXEL	C	DUSTY	B	EDENTON	C
DOMINGUEZ	C	DRIFTWOOD	C/D	DUTCHATT	B	EDENVALLEY	B
DOMINSON	A	DRIGGS	B	DUTCHCANYON	B	EDGAR	B
DOMKEY	B	DRINO	C	DUTCHENRY	C	EDGEHILL	C
DOMO	B	DRIVER	C	DUTCHFLAT	C	EDGELEY	C
DOMPIER	C	DROEM	C	DUTCHJOHN	B	EDGEMERE	D
DONA ANA	C	DROVAL	D	DUTEK	A	EDGEWATER	C
DONAHUE	C	DRUM	B	DUTTON	C	EDGEWICK	C
DONALD	C	DRURY	B	DUVAL	B	EDGINGTON	C/D
DONALDSON	C	DRY LAKE	C	DUZEL	C	EDINBURG	C/D
DONEGAN	C	DRYADINE	C	DWARF	D	EDISTO	C
DONERAIL	C	DRYBED	B	DWORSHAK	B	EDJOBE	C
DONICA	B	DRYBUCK	B	DYE	D	EDMINSTER	D
DONKEHILL	D	DRYBURG	B	DYERHILL	B	EDMORE	D
DONLONTON	C	DRYCK	A	DYLAN	D	EDMUNDSTON	B
DONNEL	B	DRYDEN	B	DYNAL	A	EDOM	C
DONNELSVILLE	B	DRYFALLS	B	EACHUS	B	EDROY	D
DONNING	D	DRYHOLLOW	B	EAD	C	EDSON	C
DONNYBROOK	D	DRYN	C	EAGAR	B	EDWARDS	B/D
DOOH	B	DUART	C	EAGLECAP	B	EDWARDSVILLE	B/D
DOOLIN	D	DUBACH	B	EAGLECONE	B	EDWIN	B
DOONE	B	DUBAY	B	EAGLECREEK	B	EELCOVE	D
DORA	B/D	DUBBS	B	EAGLELAKE	B	EELWEIR	C
DORERTON	B	DUBBS, Flooded	C	EAGLEPOINT	D	EENREED	B
DORITTY	B	DUBINA	C	EAGLEROCK	C	EFP	C
DORNA	B	DUBLON	B	EAGLESNEST	C	EFFIE	C
DORNA, Thin	C	DUCKABUSH	B	EAGLESON	C	EFFINGTON	C
DOROSHIN	D	DUCKCLUB	C				

## Exhibit A: Hydrologic Soil Groups for the United States

EGAM	C	ELMER	C	EREMIS	B	EXETER	B
EGAN	B	ELMINA	C	ERICSON	B	EXTEND	C
EGANROC	C	ELMONT	B	ERIG	B	EXUM	C
EGGLAKE	C/D	ELMRIDGE	C	ERIN	B	EXWAY	B
EGGLESON	B	ELMVILLE	B	ERMABELL	A	EYAK	C
EGHELM	C	ELMWOOD	C	ERMATINGER	B/D	EYERBOW	C
EGLIN	A	ELNORA	B	ERNBET	C	EYLAU	C
EGLIRIM	C	ELOCHOMAN	B	ERNO	B	EYOTA	A
EGUAJE	B	ELOCIN	D	ERRAMOUSPE	C	EZEL	B
EGYPT	D	ELON	B	ERVIDE	C	EZELL	C
EGYPTCREEK	C	ELOSO	D	ESAU	A	FABIUS	B
EICKS	C	ELPAM	D	ESCAMBIA	C	FACEVILLE	B
EIGHTLAR	C	ELPASO	B/D	ESCANABA	A	FACEY	B
EIGHTMILE	D	ELRED	B/D	ESCANO	C	FACTORY	B
EILERTSEN	B	ELRIN	B	ESCARLO	B	FADDIN	D
EINE	D	ELROSE	B	ESCONDIDO/ Thick Solum	B	FADOLL	B
EITZEN	B	ELSIE	B	ESCONDIDO	C	FAGAN	C
EKAH	C	EL SINBORO	B	ESEL	B	FAGASA	C
EKAL	D	ELTOPIA	C	ESHA	B	FAGES	D
EKIM	C	ELTSAC	D	ESHAMY	B	FAHNESTOCK	B
EKOMS	B	ELVERS	B/D	ESKA	B	FAIM	B
EKRUB	D	ELVIRA	B/D	ESMERALDA	B	FAIRANGEL	B
EL PECO	C	ELWELL	C	ESMOD	D	FAIRBERG	C
ELAM	A	ELWHA	C	ESPARTO	B	FAIRBIRCH	C
ELAM, Hard Substratum	B	ELWOP	B	ESPELIE	B/D	FAIRBURN	D
ELANDCO	B	ELY	B	ESPERANZA	C	FAIRCHILD	C
ELBA	C	ELYSIAN	B	ESPII	D	FAIRFAX	B
ELBAVILLE	B	EMACHAYA	D	ESPIAL	A	FAIRHAVEN	B
ELBERT	D	EMAGERT	B	ESPINOSA	B	FAIRLESS	B
ELBON	B	EMBAL	B	ESPIINT	D	FAIRLIE	D
ELBOW	C	EMBERTON	C	ESPY	B	FAIRLO	B
ELBOWLAKE	B	EMELINE	D	ESRO	D	FAIRMOUNT	D
ELBUCK	B	EMERALDA	D	ESSEN	C	FAIRPLAY	D
ELBUTTE	D	EMERSON	B	ESTACION	B	FAIRSMITH	B
ELCANEJO	B	EMERY	B	ESTATE	C	FAIRYDELL	C
ELCAPITAN	B	EMIGHA	B	ESTELLE	B	FAIRYLAWN	D
ELD	B	EMIGHA, Alkaline	C	ESTELLINE	B	FAJADA	C
ELDADO	B	EMILY	B	ESTER, Thawed	C	FAJARDO	C
ELDER HOLLOW	D	EMMA	C	ESTER	D	FALAYA	D
ELDERON, Stony	A	EMMERT	A	ESTERO	D	FALBA	D
ELDERON	B	EMOT	B	ESTESLAKE	D	FALERIA	B
ELDRIDGE	C	EMPIRE	B	ESTO	B	FALFA	C
ELEMENTS	B	EMYD	B	ETACH	C	FALFURRIAS	A
ELENORE	D	ENBAR	B	ETHEL	C	FALK	C
ELEROY	B	ENBAR, Stony	C	ETHELMAN	B	FALKIRK	B
ELEVASIL	B	ENBAR, Wet	D	ETHETE	B	FALKNER	C
ELEVATOR	C	ENCANTADO	A	ETHETE, Saline	C	FALLBROOK	B
ELFCREEK	C	ENCHANTED	B	ETIL	A	FALLCREEK	C
ELFLINT	B	ENCICADO	C	ETOILE	D	FALLERT	B
ELGEE	A	ENCINA	B	ETOWAH	B	FALLON	B
ELGIN	C	ENCROW	D	ETOWN	B	FALLSINGTON	B/D
ELIAS	C	ENDERSBY	B	ETTER	B	FALSEN	A
ELIZABETH	B	ENERGY	B	ETTRICK	B/D	FANAL	C
ELK HOLLOW	B	ENFIELD	B	EUCHRAND	D	FANCHER	C
ELKADER	B	ENGADINE	B/D	EUCHRE	C	FANDOW	D
ELKHEIGHT	C	ENGLE	B	EUCLID	C	FANNO	C
ELKHEIGHTS	B	ENKO	A	EUDY	C	FANSHAW	B
ELKHORN	B	ENKO, Overblown	B	EUER	B	FANTZ, High Rainfall	B
ELKINSVILLE	B	ENLOE	D	EUFULA	A	FANTZ	C
ELKINTON	B	ENNING	D	EUHARLEE	C	FANU	B
ELKMOUND	D	ENOCHVILLE	C/D	EULONIA	C	FARBER	B
ELKPRAIRIE	B	ENOLA	B	EUNOLA	C	FARDRAW	B
ELKRIDGE	B	ENOREE	D	EUREKA	D	FARDRAW, Dark Surface	C
ELKTON	C/D	ENOS	C	EUSBIO	C	FARISITA	D
ELKWALOW	D	ENOSBURG	C	EUSTIS	A	FARLOW	C
ELLA	B	ENSENADA	B	EUTAW	D	FARMERSTOWN	C
ELLEN	B	ENSTROM	B	EUTROBORALFS	B	FARMINGTON	C
ELLENA	C	ENTENTE	B	EVA	B	FARMTON	D
ELLETT	D	ENTERO	D	EVADALE	D	FARNHAMTON	C
ELLICOTT	A	ENTERPRISE	B	EVANGELINE	C	FARNUF	C
ELLIJAY	B	ENVILLE	C	EVANOT	B	FARQUAR	B
ELLINGTON	B	ENVOL	D	EVANSHAM	D	FARRAGUT	C
ELLINOR	C	ENZIAN	D	EVANT	D	FARRENBURG	B
ELLIOTT	C	EODY	C	EVART	D	FARRINGTON	B
ELLIS	D	EOJ	D	EVELETH	C	FARROT	C
ELLISTON	C	EOLA	D	EVENDALE	C	FARRY	B
ELLISVILLE	B	EPHRATA, Cool	A	EVERETT	B	FARSHIDE	B
ELLOREE	D	EPHRATA	B	EVERGLADES	B/D	FARSON	C
ELLSBURG	C/D	EPITAPH	D	EVERGREEN	D	FARVA	C
ELLUM	C	EPLY	C	EVERMAN	C	FARVANT	D
ELLWOOD	C	EPOT	B	EVERY	B	FARVIEW	D
ELLZEY	B/D	EPSOM	B/D	EVICK	A	FARWAY	B
ELM LAKE	A/D	EPVIP	D	EWAN	D	FASHING	D
ELMDALE	B	ERAM	C	EXCLOSE	B	FASKIN	B
ELMENWOOD	D	ERD	D	EXEL	C	FATIMA	B

# Exhibit A: Hydrologic Soil Groups for the United States

FATTIG	C	FIRCREEK	C	FLYCREEK	C	FRAILEY	B
FAUNCE	A	FIREBALL	B	FLYNN	B	FRAILTON	D
FAUNSDALE	D	FIREBAUGH	C	FLYVALLEY	C	FRANCIS	A
FAVORETTA	D	FIRESTEEL	B	FOAD	C	FRANCISQUITO	C
FAVRET	C	FIRESTONE	C	FOARD	D	FRANCITAS	D
FAWCETT	B	FIRETOWER	B	FOGGYFLAT	B	FRANCONIA	B
FAWIN	B	FIRMAGE	C	FOGLAKE	C	FRANEAU	D
FAWNSPRING	C	FIROKE	B	FOLAVAR, Elevation 6000-7400	A	FRANKCREEK	B
FAYETTEVILLE	B	FIRTH	B/C	FOLAVAR	B	FRANKENMUTH	C
FE	D	FISHAVEN	C	FOLDAHL	B	FRANKENSTEIN	C
FEAGINRANCH	D	FISHBERRY	D	FOLEY	D	FRANKFORT	C
FEARS	B	FISHERHILL	B	FOLLET	D	FRANKIRK	C
FEATHER	B	FISHERMAN	D	FOMSENG	C	FRANKLIN	B
FEATHERSTONE	D	FISHHOOK	D	FONDA	D	FRANKTOWN	D
FEDJI	A	FISHLAKE	D	FONDILLAS	D	FRAVAL, Gravelly	B
FEDORA	B/D	FISHPOT	C	FONNER	B	FRAVAL	C
FELDA	D	FISHROCK	D	FONS	B	FRAZERTON	B
FELDHAUSER	B	FISHWAY	B	FONTAFLOA	A	FRED	C
FELDTMAN	A	FISK	B	FONTAINE	B	FREDA	D
FELICIANA	B	FITZHUGH	B	FONTANA	B	FREDENSBORG	C
FELICITY	A	FITZWIL	B	FOOLHEN, Stony, Cool	B	FREDERICKTOWN	B
FELIPE	D	FIVEBLOCK	C	FOOLHEN	D	FREDONYER	C
FELIX	D	FIVEMILE	B	FOOTHILL	C	FREDRIKSDAL	D
FELKER	C	FIVEMILE, Saline	B	FOPIANO	D	FREE	B/D
FELLA	B/D	FIVES	C	FORAKER	D	FREEBURG	C
FELOR	B	FIVESPRINGS	C	FORBAR	D	FREECE	D
FELT	B	FLACKVILLE	C	FORBES	C	FREEHOLD	B
FELTA	C	FLAGG	B	FORBESVILLE	C	FREELAND	C
FELTNER	D	FLAGSTAFF	D	FORBING	D	FREELS	B
FENELON	C	FLAMBEAU	B	FORDBUTTE	B	FREEMAN	C
FEPS	D	FLAMEN	B	FORDCREEK	B	FREEMANVILLE	B
FERA	C	FLAMING	A	FORDICE	B	FREEON	B
FERBALL	C	FLANAGAN	B	FORDNEY	A/C	FREER	C
FERD	C	FLANDREAU	B	FORDSTERROR	C	FREESOIL	B
FERDELFOORD	C	FLANE	C	FORDTOWN	B	FREEST	C
FEREBEE	C	FLANK	D	FORDTRAN	C	FREESTONE	C
FERGIE	C	FLANLY	B	FORELAND	D	FREETPEAK	B
FERGUS	B	FLANNERY	B	FORELEFT	B	FREEWATER	B
FERGUSON	B	FLARM	C	FORESTBURG	A	FREEZENER	B
FERN	B	FLAT HORN	B	FORESTCITY	B/D	FREEZEOUT	B
FERN CLIFF	B	FLATCREEK	D	FORESTDALE	D	FRELSBURG	D
FERN CREEK	D	FLATHEAD	B	FORESTER	C	FREMCKLE	C
FERNDALE	B	FLATIRONS	C	FORESTON	C	FRENCH	C
FERNHAVEN	B	FLATONIA	D	FORK	C	FRENCHJOHN	C
FERNOW	B	FLATSTONE	C	FORKHORN	B	FRENCHMAN	B
FERNPOINT	B	FLATTOP	D	FORLORN	B	FRENCHMILL	B
FERNWOOD	B	FLATWOODS	C	FORMADER	C	FRENCHHOLLOW, Moist	C
FERRELO	B	FLAXTON	B	FORMDALE	B	FRENCHHOLLOW	D
FERROBURRO	D	FLEAK	C	FORNOR	B	FRESHWATER	D
FERTEG	C	FLEAK, cool	D	FORSEER	C	FRESNO, Thick Solum	C
FESSLER	B	FLEENER	B	FORSGREEN	B	FRESNO, Saline Alkali	D
FESTINA	B	FLEER	D	FORSGREEN	C	FREWA	B
FETCH	D	FLEISCHMANN	D	FORT MEADE	A	FREWSBURG	C
FETERITA	D	FLEMING	C	FORT MOTT	A	FREYA	A/D
FETT	D	FLEMINGTON	D	FORT ROCK	A	FRIANA	D
FETZER	C	FLETCHER	B	FORTBENTON	C	FRIBERG	B/D
FEZ	C	FLEWSIE	B	FORTBOIS	A	FRICABA	B
FEZIP	D	FLINK	B	FORTESCUE	C/D	FRIEDLANDER	C
FIANDER	C/D	FLINTCREEK	D	FORTTRAN	B	FRIENDLY	D
FIAT	C	FLO	A	FORTSAGE	B	FRIENDS	C
FIBRE	B/D	FLOER	D	FORTUNA	D	FRIES	D
FICO	B	FLOKE	C	FORTYONE	B	FRINDLE	C
FIDALGO	C	FLOMATON	A	FOSS	B	FRINES	C
FIDDLETOWN	B	FLOMOT	B	FOSSILON	D	FRINT	C
FIDDYMENT	D	FLOODWOOD	B	FOSTERBURG	D	FRIO	B
FIDISIX	B	FLORAHOME	A	FOSTORIA	B	FRIONA	C
FIELD CREEK	B	FLORALA	C	FOUNTAIN	D	FRIOTON	C
FIELDING	B	FLORAS	C	FOUNTAINVILLE	C	FRIPP	A
FIELDON	B/D	FLORAVILLE	D	FOUR STAR	B/C	FRISITE	B
FIFESRIDGE	B	FLORENCE	C	FOURCHE	B	FRITSLAND	B
FIFIELD	C	FLORESVILLE	C	FOURCORNERS	D	FRIZZELL	C
FIG	B	FLORIDANA	B/D	FOURLOG	D	FRODO	D
FIGARO	C	FLORIN	C	FOURME	B	FROHMAN	C
FIKEL	C	FLORIS	B	FOURSIXES	C	FROLIC	B
FILBERT	D	FLOTAG	B	FOURWHEEL	D	FRONDORF	B
FILION	D	FLOTT	B	FOXCAN	D	FRONTENAC	B
FILIRAN	D	FLOUTIER	B	FOX CREEK	C/D	FRONTIER	C
FINAL	D	FLOYD	B	FOXHOME	B	FRONTON	D
FINCHFORD	A	FLUE	C	FOXLAKE	C	FROZARD	C
FINDOUT	D	FLUE, Gravelly	D	FOX MOUNT	C	FRUITA	B
FINLAND	C	FLUETSCH	B	FOXVILLE	D	FRUITFIELD	A
FINN	D	FLUKER	C	FOXVIRE	B	FRUITLAND	B
FINNEY	B	FLUMECREEK	B	FOXWORTH	A	FRUITVALE	C
FINOL	C	FLUMEVILLE	B	FRADDLE	B	FRYINGPAN	D
FINROD	C	FLUVAQUENTS	D	FRAGUNI	B	FRYMIRE	C

## Exhibit A: Hydrologic Soil Groups for the United States

FRYREAR .....	B	GARFAN .....	D	GHOLSON .....	B	GOATROCK .....	B
FT. DRUM .....	C	GARHILL .....	D	GHORMLEY .....	C	GOATROCKS .....	B
FUEGO .....	C	GARIPER .....	D	GIANELLA .....	B	GOBAR .....	B
FUEGOSTA .....	D	GARLAND .....	B	GIARCH .....	D	GOBLER .....	B
FUGAWEE .....	B	GARLIC .....	A	GIBBONSCREEK .....	C	GOVERNADOR .....	D
FULCHER .....	C	GARLIN .....	D	GIBNEY .....	C	GODDE .....	D
FULCRUM .....	C	GARLOCK .....	C	GIBRALTAR .....	C	GODECKE .....	C
FULDA .....	D	GARMON .....	C	GIBSONVILLE .....	D	GODECKE, Clay Substratum .....	D
FULLER .....	D	GARMORE .....	B	GIBWELL .....	C	GODWIN .....	D
FULMER .....	C/D	GARNE .....	B	GICHIGAMI .....	C	GOEMMER .....	C
FULSHEAR .....	C	GARNEL .....	D	GIDEON .....	C	GOESSEL .....	D
FULTS .....	D	GARNER .....	D	GIDWIN .....	D	GOFFPEAK .....	B
FUNMAR .....	C	GARNES .....	B	GIELOW .....	C	GOGOMAIN .....	B/D
FUNTER .....	D	GARO .....	D	GIESE .....	D	GOL .....	C
FURLONG .....	A	GARR .....	D	GIGGER .....	C	GOLD CREEK .....	D
FURNISS .....	D	GARRETT .....	B	GILBERT .....	D	GOLDAHO .....	D
FURSHUR .....	D	GARROCHALES .....	D	GILBOA .....	B	GOLDBEACH .....	C
FURY .....	C/D	GARSID .....	C	GILEAD .....	C	GOLDCORD .....	D
FUSULINA .....	D	GARTON .....	C	GILES .....	B	GOLDEAGEL .....	C
FUSUVAR .....	D	GARVIN .....	D	GILFORD .....	D	GOLDEN .....	D
GABBS .....	C	GARWOOD .....	D	GILLAND .....	C	GOLDFINCH .....	C
GABEL .....	C	GASPER .....	B	GILLENDER .....	D	GOLDHEAD .....	B/D
GABINO .....	D	GASQUET .....	B	GILLIAM .....	C	GOLDHILL, Loamy Substratum .....	C
GABRIEL .....	C	GASSAWAY .....	D	GILLIGAN .....	B	GOLDHILL .....	D
GACIBA .....	D	GASSVILLE .....	C	GILLS .....	C	GOLDVIDE .....	B
GADDES .....	C	GASTON .....	C	GILLSBURG .....	D	GOLDLAKE .....	B
GADONA .....	B	GASTROW .....	C	GILMAN .....	D	GOLDMAN .....	C
GADWELL .....	C	GASUP .....	D	GILMORE .....	D	GOLDMIRE .....	C
GAGEBY .....	B	GAT .....	B	GILROY .....	C	GOLDSBORO .....	B
GAGETOWN .....	B	GATCHEL .....	B	GILT EDGE .....	D	GOLDSMITH .....	B
GAHEE .....	B	GATERIDGE .....	C	GILWOOD .....	B	GOLDSTON .....	C
GAIA .....	B	GATESON .....	C	GIMLETT .....	D	GOLDSTREAM, Thawed .....	B
GAIBSON .....	D	GATEWALL .....	B	GINAT .....	D	GOLDSTREAM .....	D
GAILA .....	B	GATLIN .....	B	GINEX .....	D	GOLDVALE .....	C
GAINESVILLE .....	A	GATTON .....	B	GINGER .....	D	GOLDVEIN .....	C
GAKONA .....	B	GAULD .....	B/D	GINI .....	B	GOLDYKE .....	D
GALATA .....	D	GAULDY .....	B	GINSBERG .....	B	GOLETA .....	B
GALBRETH .....	D	GAUSE .....	C	GIRARD .....	D	GOLIAD .....	C
GALCHUTT .....	C	GAVEL .....	B	GIRARDOT .....	D	GOLIME .....	C
GALESTINA .....	C	GAVERS .....	C	GIST .....	D	GOLLAHER .....	D
GALEY .....	B	GAVILAN .....	C	GITABYTE .....	C	GOLONDRINA .....	B
GALIENTE .....	C	GAVINS .....	D	GITAKUP .....	C	GOLTRY .....	A
GALILEE .....	C	GAY .....	B/D	GITAM .....	D	GOLVA .....	B
GALLEGOS .....	B	GAYHART .....	C	GIVEOUT .....	C	GOMERY .....	B
GALLEN .....	B	GAYLORD .....	C	GIVIN .....	C	GOMEZ .....	B
GALLIA .....	B	GAYVILLE .....	D	GLADDICE .....	C	GOMINE .....	D
GALLIME .....	B	GAZELLE .....	D	GLADEVILLE .....	D	GONZALES .....	D
GALLIMORE .....	B	GAZWELL .....	D	GLANCE .....	B	GOODINGTON .....	D
GALLION .....	B	GEARHART .....	A	GLASGOW .....	C	GOODLAND .....	B
GALLIPOLIS .....	C	GED .....	D	GLASSNER .....	D	GOODLOW .....	B
GALLUP .....	B	GEE .....	C	GLAWE .....	B/D	GOODNESS .....	B
GALTSMILL .....	B	GEEBURG .....	C	GLAZE .....	B	GOODPASTER .....	D
GALVESTON .....	A	GEEMORE .....	C	GLEN .....	B	GOODRICH .....	B
GALVEZ .....	C	GEERTSEN .....	B	GLENBLAIR .....	C	GOODSON .....	C
GALVIN .....	D	GEISEL .....	B	GLENCARB .....	C	GOODVIEW .....	D
GALZUNI .....	C	GEISERCREEK .....	B	GLENCOE .....	C/D	GOODWILL .....	B
GAMBOA .....	B	GELSINGER .....	C	GLENDENNING .....	C	GOODWIN .....	B
GAMBOGY .....	B	GEM .....	C	GLENDEPERSON .....	B	GOOLAWAY .....	C
GAMELAKE .....	B	GEM, Stony .....	D	GLENDIVE .....	C	GOOSE CREEK .....	C
GAMM .....	D	GEMELO .....	B	GLENDO .....	B	GOOSEBURY .....	B
GANADO .....	D	GEMSON .....	B	GLENEDEN .....	D	GOOSENAWT .....	B
GANAFLAN .....	C	GENATS .....	D	GLENEYRE .....	D	GOOVAL .....	D
GANHONA .....	C	GENEVA .....	B	GLENHAM .....	B	GORDONPOINT .....	B
GANIS .....	D	GENTILLY .....	D	GLENMEN .....	B	GORE .....	D
GANO .....	B/D	GENTRY .....	D	GLENMORA .....	C	GOREEN .....	D
GANSNER .....	C	GEOCONDA .....	C	GLENOMA .....	B	GORESVILLE .....	B
GANY .....	B	GEORGEANYON .....	B	GLENPOOL .....	A	GORGONIO .....	B
GAP .....	B	GEORGEANYON .....	B	GLENRIO .....	D	GORHAM .....	B/D
GAPBUTTE .....	B	GERBANA .....	D	GLENROSS .....	D	GORIN .....	C
GAPCOT .....	D	GERBER .....	D	GLENSTED .....	D	GORMAN .....	C
GAPHILL .....	B	GERLACH .....	D	GLENTON .....	C	GORUS .....	B
GAPO .....	C/D	GERLANE .....	B	GLENTOSH .....	A	GOSHAWK .....	B
GARCENO .....	C	GERMANO .....	B	GLENVIEW .....	B	GOSIL .....	A
GARCIA .....	C	GERMANTOWN .....	B	GLENWOOD .....	B	GOSINTA .....	C
GARCITAS .....	C	GERRER .....	C	GLENYON .....	B	GOSNEY .....	C
GARDELLA .....	D	GERRARD .....	B	GLIDE .....	B	GOSPER .....	B
GARDENCAN .....	B	GERSTLE .....	B	GLOHM .....	C	GOTCHELL .....	D
GARDENCREEK .....	D	GESSNER .....	B/D	GLOIN .....	C	GOTEBO .....	B
GARDENISLE .....	B	GESTRIN .....	B	GLORIA .....	D	GOUGEVILLE .....	A/D
GARDENS .....	D	GETA .....	B	GLYNN .....	C	GOULDER .....	B
GARDENVALE .....	B	GETCHELL .....	C	GLYPHS .....	B	GOULDSBORO .....	D
GARDINER .....	A	GETRAIL .....	D	GNAWBONE .....	B	GOURDIN .....	C
GARDNER'S FORK .....	B	GETZVILLE .....	D	GNOJEK .....	D	GOURLEY .....	C
GARECK .....	B	GEWTER .....	C	GOATBUTTE .....	B	GOVERNEUR .....	D
GAREY .....	B	GEYSEN .....	C	GOATJOE .....	A	GOVE .....	B

## Exhibit A: Hydrologic Soil Groups for the United States

GOVEY	C	GREENVILLE	B	GUBE	C	HALFWAY	D
GOWDY	B	GREENVINE	D	GUDGEL	C	HALII	B
GOWEN	B	GREENWAY	B	GUDGREY	B	HALIIMAILE	B
GOWKER	C	GREENWICH	B	GUERIN	D	HALLCREEK	A
GOWTON	B	GREGGO	D	GUERO	C	HALLECK	B
GOZEM	D	GREGORY	D	GUERRERO	A	HALLENTON	D
GRACOT	A	GREGSON	C	GUEST	C	HALLETTSVILLE	D
GRADCO	C	GRELL	D	GUEYDAN	D	HALLIHAN	B
GRADON	C	GREMMERS	D	GUFFIN	D	HALLISON	C
GRAFF	D	GRENET	A	GUGUAK	D	HALLORAN	C
GRALIC	B	GRENNAN	B	GUIJARRAL	B	HALLSBLUFF	D
GRAN	D	GRENOBLE	B	GUISER	B	HALSO	D
GRANATH	B	GRESHAM	C	GULCH	B	HALVERSON	B
GRANBUL	D	GRETDIVID	B	GULF	B/D	HALVERT	D
GRAND	C	GRETOR	C	GULKANA	B	HAMACER	A
GRANDAD	B	GRETTUM	A	GULLIED LAND	D	HAMAKUAPOKO	B
GRANDBEND	B	GREWINGK	C	GULLION	C	HAMBLÉN	C
GRANDFIELD	B	GREYBEAR	C	GULLROCK	B/D	HAMBONE	B
GRANDJEAN	D	GREYBO	B	GULNARE	D	HAMBROOK	B
GRANDMESA	C	GREYBROOK	B	GUMBOOT	C/D	HAMBURG	B
GRANDMORE	B	GREYCLIFF	C	GUNCLUB	C/D	HAMBURN	B
GRANDPON	B	GREYLOCK	C	GUNDY	C	HAMBURY	C
GRANDVIEW	B/C	GREYS	B	GUNNEL	D	HAMDEN	B
GRANDWASH	D	GREYSTOKE	B	GUNNINGS	B	HAMEL	B/D
GRANER	B	GRIBBLE	D	GUNNUK	C	HAMILTON	B
GRANFLAT	A	GRIDELL	D	GUNSONE	D	HAMLET	B
GRANGE	C	GRIDLEY	C	GUNSTOCK	C	HAMMACK	B
GRANGEMONT	C	GRIER	D	GUNTER	B	HANMAHAMMA	C
GRANGEVILLE	C	GRIFFITH	D	GURDANE	C	HAMMERSLEY	C
GRANIPEAK	B	GRIFTON	D	GURDON	C	HAMMOND	C
GRANITEPASS	B	GRIMM	B	GURLEY	C	HAMPLAIN	B
GRANMOUNT	C	GRINDALL	D	GURNEY	B	HAMPSHIRE	C
GRANSHAW	B	GRINDSTONE	C	GUSTIN	D	HAMPSON	C
GRANTCENTER	B	GRINK	D	GUSTSPRING	B	HAMRE	C/D
GRANTFORK	D	GRISDALE	B	GUTPORT	D	HAMRUB	B
GRANTHAM	D	GRISMAR	A	GUVO	D	HANA	A
GRANTSBURG	C	GRISWOLD	B	GUYAN	C	HANAGITA	D
GRANTSDALE	B	GRITNEY	C	GUYANDOTTE	B	HANAKER	C
GRANTURK	D	GRIVER	B/D	GWENA	D	HANAMAULU	B
GRANVILLE	B	GRIZZLE	D	GWINNER	C	HANCEVILLE	B
GRANYON	B	GRIZZLY	B	GWINNETT	B	HAND	B
GRANZAN	B	GRIZZLYBLUFF	B	GYBERG	C	HANDKE	A
GRAPELAND	A	GROESBECK	B	GYPLA	D	HANDOFF	B
GRASMERE	B	GROMES	D	HAAR	D	HANDBORO	D
GRASSHOPPER	B	GROOM	C	HAARVAR	D	HANEY	B
GRASSTON	B	GROSS	C	HACCKE	C	HANGAARD	A/D
GRASSVAL	D	GROSSCHAT	D	HACHITA	C	HANGDO	B
GRASSVALLEY	D	GROTON	A	HACKBERRY	B	HANGROCK	D
GRASSYCAN	D	GROTTO	A	HACKERS	B	HANGTOWN	B
GRASSYCONE	A	GROUNDHOUSE	B	HACKNEY	D	HANIPOE	C
GRASSYKNOB	B	GROUSECREEK	B	HACREEK	B	HANIS	C
GRASSYLAKE	C	GROUSEHAVEN	D	HADAR	B	HANKS	B
GRASSYTRAIL	B	GROUSEVILLE	C	HADENCREEK	C	HANKSVILLE	C
GRAUFELS	C/D	GROUSLOUS	D	HADLEY	B	HANLON	B
GRAVELTON	B/D	GROVE	A	HADSELVILLE	D	HANN	B
GRAVES	D	GROVENA	B	HAFLINGER	A	HANNA	B
GRAVEYA	B	GROVETON	B	HAGATA	D	HANNAHATCHEE	B
GRAVEYARD	B	GROWDEN, Shaly Substratum	B	HAGEN	B	HANNAWA	D
GRAYBERT	B	GROWDEN	C	HAGENSVILLE	C	HANNEGAN	D
GRAYFORD	B	GROWLER	B	HAGER	B	HANNON	D
GRAYLOCK	B	GROWLER, Sandy Substratum	C	HAGERMAN	B	HANS	B
GRAYMONT	B	GROWSET	D	HAGGA	C	HANTHO	B
GRAYPOINT	B	GRUBBS	D	HAGGARD	D	HAOZOUS	B
GRAYROCK	C	GRUBE	B	HAGSTADT	C	HAPJACK	D
GRAYSILL	C	GRUBROB	B	HAGUE	A	HAPNEY	D
GRAYSTONE	B	GRUBSTAKE	B	HAIG	C/D	HAPPLE	B
GRAYWOLF	B	GRUENE	D	HAIGHT	C	HAPPUS	A
GRAZANE	C	GRULLA	D	HAIGHTS	B	HAPPYHOME	C
GRAZER	C	GRUMBLÉN	D	HAIGLER	C	HAPUR	D
GREANEY	C	GRUNDELEIN	B	HAIKU	B	HARAHILL	C
GREDGE	D	GRUVER	C	HAILESBORO	C	HARBESON	D
GREEN BLUFF	B	GRYTAL	B	HAINES	C	HARBOR	C
GREEN CANYON	B	GSCHWEND	B	HAIRE	D	HARBORD	B
GREENBRIAR	B	GUADALUPE	B	HAKKER	C	HARCO	B
GREENCREEK	B	GUAM	D	HAL	B	HARCOT	B/D
GREENDALE	B	GUAMANI	B	HALACAN	D	HARDEMAN	B
GREENE	C	GUANABANO	C	HALAWA	B	HARDESTY	B
GREENFIELD	C	GUANAJIBO	C	HALBERT	D	HARDHART	B
GREENGULCH	C	GUANICA	C	HALDER	C	HARDISTER	B
GREENHORN	D	GUANO	D	HALE	C/D	HARDOL	B
GREENLEE	B	GUARDLAKE	A	HALEY	B	HARDSCRABBLE	D
GREENMAN	C	GUAYABO	A	HALF MOON	B	HARDTRIGGER	B
GREENOUGH	B	GUAYABOTA	D	HALFADAY	A	HARDWICK	C
GREENSCOMBE	B	GUAYAMA	D	HALFCIRCLE	B	HARDY	C
GREENTIMBER	C	GUAYNAKA	D	HALFOSS	B	HARDZEM	C

## Exhibit A: Hydrologic Soil Groups for the United States

HARECREEK	B	HAWICK	A	HENCO	B/D	HIGHLAND	C
HARGILL	B	HAWKEYE	A	HENDAP	D	HIGHPOINT	D
HARGREAVE	B	HAWKSNEST	C/D	HENDERSON	B	HIGHSPLINT	B
HARJO	D	HAWKSPRINGS	B	HENDON	C	HIGHTOWER	C
HARKEN	C	HAWKSTONE	B	HENDRICKS	B	HIGHUP	C
HARL	B	HAWLEY	B	HENDY	C	HIGHVALLEY	B
HARLAKE	D	HAWTHORNE	B	HENKIN	B	HIHIMANU	B
HARLESTON	C	HAXBY	C	HENKLE, Extremely Cobby	B	HILAIRE	B
HARM	D	HAYCRIK	C	HENKLE	C	HILDEBRECHT	C
HARMILLER	B	HAYES	B	HENLEY	C	HILDRETH	D
HARNEY	B	HAYESTON	B	HENLINE	C	HILEA	D
HARPER	D	HAYESVILLE	B	HENMEL	C	HILES	B
HARPERSVILLE	D	HAYESVILLE, Stony	C	HENNEWAY	B	HILGRAVE	B
HARPEH	B	HAYFORD	C	HENNING	B	HILINE	D
HARPOLE	A	HAYLAND	C	HENRIETTA	B/D	HILKEN	C
HARPOLE	B	HAYNAP	A	HENRY	D	HILLBRICK	D
HARPS	C	HAYNER	C	HENRYSFORK	C	HILLCITY	B
HARPT	B	HAYNESS	B	HENRYSLAKE	D	HILLCO	B
HARRAH	B	HAYRACK	C	HEPPSIE	D	HILLCREEK	B
HARREL	B	HAYRIVER	B	HERAKLE	D	HILLEMANN	C
HARRIMAN	C	HAYSPUR	D	HERBEL	A	HILLIARD	B
HARRINGTON	C	HAYSTACK	B	HERBERT	B	HILLIARD, Moderately Well Drained	C
HARRIS	D	HAYSTORE	C	HERBMAN	A	HILLSDALE	B
HARRISBURG	D	HAYSUM	B	HERBOLD	C	HILLTISH	B
HARRISON	B	HAYTI	D	HERCULES	C	HILLTO	C
HARROD	B	HAYWIRE	C	HERDCAMP	D	HILLTOPPE	C
HARSLOW	C	HAZELAIR	D	HERITO	C	HILLVIEW	B/D
HARSTINE	C	HAZELCAMP	B	HERJUN	B	HILLWOOD	B
HART	C	HAZEN	B	HERLONG	D	HILMAR	B/D
HARTER	C	HAZLEHURST	C	HERMANTOWN	C	HILO	A
HARTFORD	A	HAZTON	D	HERMERING	B	HILTABIDEL	D
HARTLAND	B	HEADLEY	B	HERMIT	C	HINDES	C
HARTLESS	B	HEADQUARTERS	B	HERMSHALE	B	HINDMAN	B
HARTNIT	C	HEAKE	D	HERNANDEZ	B	HINESBURG	C
HARTOP	B	HEALDTON	D	HERNDON	B	HINGHAM	B
HARTSELLS	B	HEALING	B	HERO	B	HINKER	C
HARTSHORN	B	HEAPO	B	HEROD	D	HINKLE	D
HARTWELL	D	HEAPO	C	HERRICK	B	HINMAN	C
HARTWICK	A	HEARNE	D	HERSEY	C	HINSDALE	D
HARTZ	B	HEATH	D	HERSH	B	HINTERLAND	D
HARVESTER	B	HEATHCOAT	D	HERTY	D	HINTON	B
HARVEY	C	HEATLY	A	HESHOTAUTHLA	D	HIRAMSBURG	C
HASKILL	B	HEATON	A	HESPER	B	HIRSCHDALE	C
HASLIE	A/D	HEBBRONVILLE	B	HESS	B	HISEGA	C
HASSEE	D	HEBER	A	HESELBERG	D	HISNA	D
HASSELL	C	HEBO	D	HESSING	B	HISTOSOLS	D
HASSLER	C	HECETA	D	HESSLAN	C	HITCHCOCK	B
HASSMAN	D	HECHTMAN	D	HETLAND	C	HITILLO	A
HASTE	B	HECKER	B	HETTINGER	C/D	HITT	B
HAT	C	HECKISON	D	HEUSSER	C	HIWOOD	A
HATBORO	D	HECKLY	C	HEUVELTON	C	HOADLY	C
HATCH	D	HEDGE	D	HEVERLO	B	HOBAN	B
HATCHERY	C	HEDSTROM	B	HEWITT	D	HOBBES	B
HATCHET	B	HEDVILLE	D	HEWOLF	B	HOBBY	C
HATCHIE	C	HEELAND	D	HEXT	B	HOBE	A
HATERMUS	D	HEELY	B	HEYDER	B	HOBIT	C
HATERTON	C	HEESER	B	HEYDLAUFF	D	HOBONNY	D
HATFIELD	C	HEFED	B	HEYTOU	B	HOBSON	C
HATHAWAY	B	HEFLIN	B	HEYTO, Stony, Cool	C	HOBUCKEN	D
HATKNOLL	B	HEGGE	D	HIARC	C	HOCAR	D
HATLIFF	C	HEGLAR	B	HIATHA	D	HOCKINSON	B/D
HATMAKER	C	HEIDEL	B	HIBAR	C	HOCKINSO, Moderately Wet	C
HATRANCH	D	HEIGHTS	B/D	HIBBARD	C	HOCKLEY	C
HATSPRING	C	HEIL	D	HIBBING	C	HOCKLE, Graded	D
HATTON	C	HEINSAW	C	HIBLER	C	HODEDO	C
HATU	D	HEINZ	B	HIBRITEN	B	HODENPYL	B
HATUR	C	HEISLER	B	HIBSAW	D	HODGSON	C
HATWAI	C	HEISSPITZ	D	HICKEY	B	HOEHNE	A
HAUBSTADT	C	HEITT	C	HICKIWAN	D	HOFFMAN	B
HAUG	B/D	HEIZER	D	HICKS	B	HOFFMANVILLE	C
HAUGAN	B	HELEMANO	B	HICKSVILLE	C	HOFSTAD	D
HAUGEN	B	HELLGATE	B	HICORIA	B/D	HOGADERO	B
HAULINGS	D	HELLMAN	C	HICOTA	B	HOGAN	C
HAUZ	C	HELLWIG	C/D	HIDATSA	B	HOGCREEK	C
HAVA	C	HELM	D	HIDEAWAY	D	HOGENSBORG	D
HAVANA	B	HELMER	C	HIDEWOOD	B/D	HOGHEAVEN	B
HAVELOCK	B/D	HELMET	C	HIDVALLE	B	HOGMALAT	D
HAVEN	B	HELMICK	D	HIGGINS	D	HOGRANCH	B
HAVENSNECK	B	HELVETIA	C	HIGGINSVILLE	C	HOGRIIS	B
HAVERDAD	C	HELY	C	HIGH GAP	C	HOGRIIS, Extremely Cobby	D
HAVERHILL	D	HEMAN	D	HIGHBANK	C	HOH	B
HAVERMOM	B	HEMCROSS	B	HIGHCAMP	B	HOHMANN	C
HAVERSID	B	HEMINGFORD	B	HIGHCREEK	B	HOKO	C
HAVERTEL	B	HEMPHILL	D	HIGHHORN	B	HOLBORN	C
HAVILAND	B	HEMPSTEAD	B	HIGHLAND	B		

# Exhibit A: Hydrologic Soil Groups for the United States

HOLCOMB	D	HOREB	C	HUGUSTON	D	IDWAY	B
HOLDEN	B	HORNBECK	D	HUICHICA	C/D	IFFGULCH	D
HOLDERMAN	C	HORNELL	D	HUILEPASS	B	IFTEEN	B
HOLDERTON	B	HORNELLSVILLE	D	HULDA	D	IGERT	C
HOLDINGFORD	C	HORNER	A	HULDERMAN	D	IGNORD	C
HOLINROCK	C	HORNER, Graavelly Substratum	B	HULETT	B	IGUALDAD	D
HOLKAT	B	HORNEYBUCK	C	HULLIGAN	B/D	IHLEN	B
HOLLACE	D	HORNICK	C	HULLS	C	IJAM	D
HOLLANDLAKE	B	HORNING	A	HULLSGULCH	B	IKE	D
HOLLISTER	D	HORNITOS	D	HULLT	B	IKIT	D
HOLLOMEX	B	HORNSBORO	D	HULUA	D	IKSGIZA	D
HOLLOW	C	HORNSBY	C	HUMACAO	B	ILACHETOMEL	D
HOLLOWTREE	C	HORNSVILLE	C	HUMATAS	C	ILDECARB	B
HOLLY	B/D	HORROCKS	C	HUMBARGER	B	ILILI	D
HOLLYBROOK	C	HORSECAMP	D	HUMBARSPPRINGS	B	ILLABOT	C
HOLLYWOOD	D	HORSEHEAD	B	HUMBUG	B	ILLAHEE	B
HOLMAN	A	HORSEPRAIRIE	A	HUME	C	ILLER	B
HOLMDEL	C	HORSLEY	D	HUMMINGTON	C	ILLIANO	D
HOLMQUIST	D	HORTONVILLE, Limestone		HUMSKEL	C	ILLITO	D
HOLMZIE	C	Substratum	B	HUNCHBACK	D	ILTON	C
HOLOHAN	B	HORTONVILLE	C	HUNDRAW	D	ILWACO	B
HOLOMUA	B	HOSFORD	D	HUNGRY	C	IMBLER	B
HOLSINE	B	HOSKAY	C	HUNGRYGULCH	B	IMLAY	D
HOLSTEIN	B	HOSLEY	D	HUNSINGER	B	IMMANUEL	C
HOLSTON	B	HOSMER	C	HUNTDALE	B	IMMIANT	C
HOLT	B	HOSPAH	D	HUNTERS	B	IMMOKALEE	D
HOLTER	B	HOSSICK	C	HUNTERSSCOVE	C	IMNAHA	C
HOLTVILLE	D	HOSTA, Loamy Surface	B	HUNTIMER	C	INCELL	D
HOMA	C	HOSTA	D	HUNTLEY	D	INCHELIUM	B
HOMELAKE	B	HOSTAGE	B	HUNTMOUNT	B	INCY	A
HOMELAND	C	HOT LAKE	C	HUNTROCK	B	INDART	C
HOMEN	B	HOTAW	B	HUNTSBURG	D	INDEX	A
HOMESTEAD	B	HOTCREEK	B	HUOT	B	INDIAHOMA	D
HOMEWOOD	C	HOTEL	C	HURDS	B	INDIANOLA	A
HOMME, Moderately Wet	B	HOTSPOT	D	HURLBUT	C	INDIANPASS	B
HOMME	C	HOTSPRINGS	B	HURLOCK	B/D	INDIANTOWN	D
HOMOSASSA	D	HOTTIS	D	HURRYBACK	B	INDLETON	B
HONAUNAU	C	HOUCTOWN	B	HUSE	D	INEL	D
HONDEE	B	HOUGHTON	D	HUSKA	D	INEZ	D
HONEYCREEK	B	HOUK	C	HUSSA	B/C	INFERNO	C
HONEYDEW	C	HOULA	B	HUSSELL	B	INGALLS	C
HONEYVILLE	C	HOULKA	D	HUSSEY	B	INGENIO	B
HONGA	D	HOURLGLASS	C	HUSTONTOWN	C	INGERSOLL	B
HONLAK	C	HOUSEROCK	D	HUSUM	B	INGLEDOVE	B
HONOBIA	C	HOUSTENADER	D	HUTCHINSON	C	INGLESIDE	B
HONOKAA	A	HOUSTON	D	HUTSON	B	INKOM	C/D
HONOLUA	B	HOUSTON BLACK	D	HUTT	D	INKOSR	D
HONOMANU	A	HOVDE	D	HUXLEY	C	INLOW	C
HONONEGAH	A	HOVEN	D	HUYSINK	B	INMACHUK	D
HONOLIULI	D	HOVERT	D	HYALL	C	INDEPENDENCE	B
HONTAS	B	HOWARD	A	HYANNIS	B	INSAK	D
HONTOON	B/D	HOWARDSVILLE	A	HYAS	B	INSIDENT	D
HONJAUULU	A	HOWCREE	C	HYATTS	C	INSKIP	C
HOOD	B	HOWE	C	HYATTSTOWN	D	INVERNESS	B
HOOD CANAL	C	HOWELL	C	HYATTVILLE	C	INVERSHIEL	C
HOODVIEW	B	HOWMEADOWS	D	HYDABURG	D	IO	B
HOOGDAL	C	HOWSON	C	HYDE	B/D	IOGOON	B
HOOKSAN	A	HOXIE	D	HYDELAND	B/D	IOLEAU	C
HOOKTON	C	HOYLETON	C	HYDRO	C	ION	B
HOOLEHUA	B	HOYLETON, Mines Sinks	D	HYE	B	IONA	B
HOOLY	C	HOZHO	D	HYLOC	D	IONIA	B
HOOP	B	HOZOMEEN	D	HYNES	B	IOTA	D
HOOPAL	D	HUACHUCA	D	HYPRAIRIE	C	IOTLA	B
HOOPPOLE	B/D	HUALAPAI	C	HYSHAM	D	IPANO	C
HOOSAN	B	HUB	B	HYSHOT	D	IPAVA	B
HOOSEGOW	B	HUBBELL	B	HYZEN	D	IPISH	C
HOOSIERVILLE	C	HUBERLY	D	IAO	B	IPSOOT	A
HOOSKANADEN	D	HUBERT	B	IARGO	C	IRAAN	B
HOOTEN	D	HUBLERSBURG	B	IBERIA	D	IRAK	D
HOOTENTOWN	B	HUCKLEBERRY, High Rainfall	B	IBEX	B	IRASBURG	C
HOOTER	C	HUCKLEBERRY	C	IBOLA	C	IRENE	B
HOOVERS	D	HUCKRIDGE	B	ICACOS	D	IRIS	B
HOOVERTON	C	HUDDLE	B	ICARIA	D	IRMA	B
HOPBURN	B	HUDNUT	B	ICEBERG	D	IROCK	C
HOPCO	C	HUDSPETH	C	ICESLEW, Cool	C	IRON BLOSSOM	C
HOPDRAW	A	HUECO	C	ICESLEW	D	IRONA	D
HOPKINS	B	HUEL	A	ICHBOD	D	IRONBRIDGE	D
HOPLAND	B	HUEY	D	ICHETUCKNEE	D	IRONCITY	B
HOPLEY	B	HUFFLING	D	IDABEL	B	IRONDALE	C
HOPPERS	C	HUFFMAN	B	IDAHOME	B	IRONDYKE	B
HOPPS	D	HUFFTON	B	IDAMONT	B	IRONGATE	B
HOPPSWELL	B	HUFMAN	C	IDEE	C	IRONGOLD	D
HOQUIAM	B	HUGGINS	C	IDLEWILD	C/D	IRONRUN	B
HORCADO	A	HUGHES	B	IDMON	B	IRONSPPRINGS	B
HOREB, Gravelly Substratum	B	HUGHESVILLE	C	IDMONTON	C	IROQUOIS	B/D

## Exhibit A: Hydrologic Soil Groups for the United States

IRRAWADDY	C	JARDAL	C	JOLAN	C	KAIMU	A
IRRIGON	C	JARDIN	D	JOLIET	D	KAINALIU	A
IRVINE	D	JAREALES	D	JOLLIES	D	KAINTUCK	B
IRVINGTON	C	JARITA	C	JONATHAN	B	KAIPOIOI	B
ISAAC	C	JAROSO	B	JONCA	C	KAITO	B
ISCHUA	B	JARRE	B	JONDA	B	KAIWIKI	A
ISELLA	B	JARRON	D	JONES	B	KALAE	B
ISHI PISHI	B	JASCO	D	JONESBORO	C	KALALOECH	B
ISHMAEL	C	JASSEK	C	JONESVILLE	B	KALAMA	C
ISIDOR	D	JAUCAS	C	JONLAKE	D	KALAMAZOO	B
ISKNAT	D	JAURIGA	B	JONNIC	C	KALAMBACH	B
ISLAMORADA	D	JAWBONE	D	JONPOL	C	KALAPA	B
ISLAND	B	JAY	C	JOPPA	B	KALAUPAPA	D
ISLANDLAKE	A	JAYAR	C	JORDY	C	KALEETAN	B
ISLANDPARK	B	JAYEL	D	JORGE	B	KALEETAN, Till Substratum	C
ISLES	A/D	JAYHAWKER	D	JORGENSEN	B	KALIFONSKY	D
ISLOTE	B	JAYNES	D	JORN	C	KALIGA	B/D
ISMAY	B	JAYPE	C	JORNAHAM	B	KALIHU	D
ISTOKPOGA	B/D	JAYPEAK	B	JORSTED	C	KALLIO	C
ITANO	C	JAYWI	B	JOSHUA	C	KALMARVILLE	B/D
ITASCA	B	JEAGER	C	JOSIE	B	KALO	C
ITAT	B	JEALOUSY	C	JOSLIN	B	KALOKO	D
ITHACA	C	JEAN LAKE	B	JOSSET	C	KALONA	C
ITMANN	C	JEANERETTE	D	JOTAVA	C	KALSIN	C
ITSWOOT	B	JEBE	B	JOURDANTON	B	KAMAKOA	B
IUKA	C	JEBO	A	JOVEATCH	D	KAMAOLE	B
IULUS	B	JEBO	B	JOVINE	B	KAMAY	D
IVA	C	JEDBURG	C	JOWEC	D	KAMELA	C
IVAN	B	JEDDO	C/D	JOYCE	B	KAMIE	B
IVANELL	C	JEFFERS	B/D	JUANA DIAZ	B	KAMM	B
IVANHOE	D	JEFFLAKE	C	JUANDEFUCA	B	KAMPVILLE	C
IVANPATCH	B	JEKLEY	C	JUBILEE	B/D	KANACKEY	D
IVER	B	JELLICO	C	JUBIN	A	KANAKA	B
IVERSEN	C	JEMERSON	B	JUDA	B	KANARANZI	B
IVES	D	JENA	B	JUDD	C	KANASKAT	B
IVIE	A	JENERA	B	JUDGETOWN	B	KANCAN	B
IVORY	C	JENEVA	B	JUDICE	D	KANDALY	A
IWAIT	B	JENKINS	A	JUG	B	KANDIK	B
IWELA	B	JENKINSON	D	JUGHANDLE	B	KANDIYOHI	C/D
IWICA	C	JENKS	B	JUGSON	C	KANEBREAK	C
IXIAN	C	JENOR	C	JUGTOWN	C	KANELOA	B
IZAGORA	C	JERAG	D	JULIN	D	KANEOHE	B
IZEE	C	JERKTAIL	C	JUMBLE	B	KANEPUU	B
JABU	B/C	JEROME	D	JUMBO	B	KANER	A
JACAGUAS	B	JERUSALEM	A	JUMPCREEK	C	KANESPRINGS	D
JACANA	D	JESBEL	D	JUMPER	C	KANG	C
JACEE	C	JESKE	C	JUMPMORE	B	KANGAS	A
JACINTO	B	JESSIETOWN	B	JUMPOFF	C	KANIKSU	B
JACK CREEK	A	JESSUP	C	JUNALUSKA	B	KANKAKEE	B
JACKLAND	D	JESTER	A	JUNCAL	C	KANORADO	C
JACKMAN	B	JETCOP	D	JUNCOS	D	KANOTIN	A/D
JACKPORT	D	JETMINE	D	JUNEBEE	B	KANTISHNA	D
JACKPOT	C	JETSTER	C	JUNGO	B	KANUTCHAN	D
JACKSBACK	C	JEVETS	C	JUNIPERO	B	KANZA	D
JACKSBORO	D	JEVNE	C	JUNIUS	C	KAPAA	B
JACKSON	B	JIGSAW	B	JUNQUITOS	C	KAPAPALA	B
JACOBSEN	D	JILSON	D	JUNTURA	D	KAPAPALA, Bedrock Substratum	C
JACOBY	C	JIM	C	JURVANNAH	C	KAPLAN	D
JACONITA	A	JIMBEE	D	JUSTIN	B	KAPPEES	B
JACQUITH	C	JIMBLUFF	B	KAALUALU	A	KAPUHIKANI	D
JACRATZ	D	JIMCOMLATE	B	KAB	D	KARAMIN	A
JADIS	B	JIMCREEK	C	KABEAR	B	KARANKAWA	D
JADPOR	B	JIMEK	C	KABOOM	D	KARBANA	C
JAFAL	C	JIMENEZ	C	KACHEMAK	B	KARHEEN	D
JAGERSON	C	JIMGREEN	D	KACHESS	B	KARLAN	C
JAGON	D	JIMLAKE	B	KACKLEY	C	KARLO	D
JAGUEYES	B	JIMSAGE	B	KADLETZ	B	KARLOFF	B
JAHAHNT	D	JIMTOWN	C	KADOKA	C	KARLSBOURG	C
JAHJO	D	JIVAS	B	KAENA	D	KARLSRUHE	A
JALMAR	A	JOBOS	C	KAFFUR	D	KARLSTAD	A
JAM	B	JOBPEAK	D	KAFING	B	KARLUK	D
JAMES CANYON	B/D	JOEBALDY	B	KAHALUU	D	KARMA	B
JAMESTON	C/D	JOEBAS	D	KAHANA	B	KARNES	B
JAMESTOWN	C	JOEMRE	B	KAHANUI	C	KARNEY	D
JANELEW	C	JOENEY	D	KAHLOTUS	B	KAROC	B
JANESBURG	D	JOEVAR	B	KAHMAH	B	KARPP	D
JANILE, Bouldery	C	JOHNS	C	KAHN	B	KARS	A
JANISE, Overblown, Drained	B	JOHNSBURG	C/D	KAHNEETA	A	KARS/ Loamy Substratum	B
JANKOSH	C	JOHNSBUTTE	C	KAHOLA	C	KARSHNER	D
JANNEY	C/D	JOHNSTON	D	KAHOOLAWA	B	KARTA	C
JANSITE	B	JOHNSTOWN	B	KAHUA	D	KASEBERG	D
JANUDE	C	JOHNTOM	D	KAI	C	KASHWITNA	B
JARAB	D	JOICE	D	KAIDERS	B	KASIANA	D
JARBIDGE	D	JOINER	A	KAIKLI	D	KASKELA	D
JARBOE	D	JOKODOWSKI	D	KAILUA	A	KASOTA	C

## Exhibit A: Hydrologic Soil Groups for the United States

KASPAL	C	KENOTRAIL	C	KINCO	A	KLAWATTI	C
KASSON	C	KENRAY	A	KINDANINA	D	KLAYENT	C
KATAMA	B	KENRIDGE	C	KINDER	C	KLICKIMA	D
KATELANA	B	KENSAL	B	KINDIG	B	KLICKO	B
KATEMICY	C	KENSINGTON	C	KINDY	C	KLIENPETER	B
KATHER	C	KENSPUR	B	KINESAVA	C	KLINGE, Cobbly	B
KATKA	B	KENTLAND	A/D	KINGCO	D	KLINGE, Protected	C
KATLON	C	KENTUCK	B/D	KINGDON	B	KLINGER	B
KATPA	B	KENUSKY	D	KINGFISHER	B	KLIPSTEIN	B
KATSEANES	D	KEO	B	KINGILE	C	KLISKON	C
KATULA	C	KEOKUK	B	KINGINGHAM	C	KLONDIKE	D
KATY	D	KEOSAUQUA	B	KINGMAN	D	KLOOQUEH	B
KATYBLAY	B	KEOTA	B	KINGMONT	B	KLOOTCH	C
KAUDER	D	KEOWNS	B/D	KINGS	D	KLOSSNER	D
KAUKAUNA	C	KEPHART	B	KINGSBURY	D	KLOTEN	D
KAUPO	A	KERBER	B	KINGSDOWN	B	KLUG	B
KAUPPI	B	KERBY	B/C	KINGSFERRY	B/D	KLUMP	B
KAVON	B	KERHAYDEN	B	KINGSLAND	A/D	KLUNA DEEP	B
KAWAH	A	KERMIT	A	KINGSLEY	B	KNAPPA	B
KAWAIHAE	C	KERNAN	C	KINGSPOINT	B	KNAPPTON	B
KAWEETA	B	KERR	B	KINGSRIVER	B/D	KNEELAND	C
KAWKAWLIN	C	KERRDAM, Moderate Perm	B	KINGSTON	B/D	KNEFF	C
KAYMINE	C	KERRDAM	C	KINGTUT	D	KNEP	C
KAYO	D	KERRFIELD	C	KINKEAD	C	KNICKERBOCKER	A
KEALIA	D	KERRICK	B	KINKEL, Gravelly	B	KNIFEHILL	C
KEANSBURG	D	KERRVILLE	C	KINKEL	C	KNIFFIN	C
KEARL	C	KERSHAW	A	KINKORA	D	KNIGHT	B/D
KEARNSAR	B	KERSTON	A/D	KINLEY	B	KNIK	B
KEATING	C	KERT	C	KINMAN	C	KNIKLIK	B
KEAUALALO	B	KESHENA	B	KINNEAR	B	KNIPPA	C
KEAUKAHA	D	KESSON	D	KINNICK	B	KNOB HILL	B
KEAWAKAPU	B	KETCHLY	B	KINNICK	C	KNOBBY	D
KEBA	B	KETLAND	C	KINOCKITY	D	KNOLLE	B
KEBLER	B	KETTLEBELLY	B	KINSMAN	C	KNOSS	D
KECKSROAD	C	KETTLEMAN, Gravelly	B	KINSTON	B/D	KNOWLES	B
KEDA	B	KETTLEMAN	C	KINTA	D	KNOWLTON	C
KEECHI	C	KETTNER	D	KINTON	C	KNOX	B
KEEFA	D	KEUTERVILLE	B	KINUSTA	D	KNOXDALE	B
KEEI	D	KEVANTON	C	KINZEL	B	KNULL	B
KEEKEE	B	KEVILAR	B	KINZUA	B	KOBARTER	C
KEEL	C	KEWACH	C	KIOMATIA	A	KOCH	C/D
KEELDAR	B	KEWAKE	A	KIOTE	B	KODAK	B
KEELE	B	KEYLARGO	D	KIOUS	D	KODAK, Nonflooded	C
KEENE	C	KEYNER	B	KIPER	B	KODIAK	B
KEENER	B	KEYOLE	B	KIPLING	D	KODRA	C
KEESE	D	KEYPORT	C	KIPSON	D	KOEHLER	C
KEETER	C	KEYSTONE	A	KIRBYVILLE	B	KOELE	B
KEEWATIN	C	KEYVACA	D	KIRKENDALL	C	KOERLING	C
KEG	B	KEYWEST	D	KIRKLAND	D	KOETHER	D
KEGEL	C/D	KEZAR	B	KIRKSEY	C	KOFFGO	C
KEGLER	B	KIAN	C	KIRKVILLE	C	KOGISH	D
KEGONSA	C	KIAWAH	B/D	KIRLEY	C	KOHALA	B
KEHAR	D	KIBESILLAH	C	KIRVIN	C	KOHATK	D
KEHENA	C	KICHATNA	A	KIRVIN, Graded	D	KOKEE	B
KEHOE	B	KICKERVILLE	B	KISATCHIE	D	KOKERNOT	C
KEIFFER	C	KICKINGHORSE	B	KISCOVE	D	KOKO	B
KEISER	B	KIDAMI	B	KISHWALK	D	KOKORUDA	B
KEITHVILLE	C	KIDWELL	B	KISHWAUKEE	B	KOKOSING	C
KEKAKE	D	KIESEL	C	KISRING	C/D	KOLAR	D
KELL	B	KIETZKE	D	KISSICK	C	KOLBERG	C
KELLER	C	KILAUEA	B	KISTIRN	B	KOLEKOLE	C
KELLERBUTTE	B	KILDOR	C	KITCARSON	B	KOLLIN	C
KELLISON	D	KILGORE	C	KITCHEN CREEK	B	KOLLUTUK	D
KELLOGG	A	KILLARNEY	C	KITI	D	KOLOA	C
KELLOGGS	C	KILLBUCK	C/D	KITKUN	D	KOLOB	C
KELLY	D	KILLET	B	KITSAP	C	KOLOMOKI	B
KELSEY	B	KILLEY	C	KITSILI	B	KOMONDOR	B
KELSO	C	KILLINGTON	D	KITTERLL	D	KOMRO	A
KELSTRUP	B	KILLMASTER	C	KITTERMAN	C	KONA	D
KELTYS	B	KILMANAGH	C	KITTITAS	C/D	KONAWA	B
KELVIN	C	KILMER	C	KITTLESON	B	KONERT	C/D
KEMAH	D	KILMERQUE	C	KITTSOON	C	KONNAROCK	C
KEMAN	B	KILOA	A	KIYI	C	KONNER	C/D
KEMMERER	D	KILOHANA	A	KIZHUYAK, Modeately Wet	B	KONOCTI, Stony	B
KEMOO	B	KILOWAN	C	KIZHUYAK	D	KONOCTI	C
KEMP	C	KILTABAR	C	KLABER	C/D	KONSIL	B
KENAI	C	KILWINNING	D	KLACKING	A	KONZA	D
KENDRICK	A	KIM	C	KLADNICK	A	KOOCH	C
KENEFICK	B	KIMBLE	B	KLADNICK, Stony	B	KOOLAU	C
KENESAW	B	KIMBLES	D	KLAHOWYA	C	KOONICH	A
KENILWORTH	C	KIMMELL	C	KLAMATH	D	KOOSKIA	C
KENMOOR	B	KIMPTON	C	KLANELNEECHENA	D	KOOTENAI	B
KENNEY	A	KIMROSE	D	KLAPOT	B	KOPIE	D
KENNY LAKE	B	KINA	D	KLASI	D	KOPPERL	B
KENO	D	KINCHELOE	D	KLAUS	C	KOPPES	A

## Exhibit A: Hydrologic Soil Groups for the United States

KORNMAN	C	LA GRANDE	C	LAMINE	D	LASVAR	C
KOROBAGO	C	LA POSTA	B	LAMINGTON	D	LATAH	D
KORONIS	B	LA ROSE	B	LAMKIN	B	LATAHCO	D
KORTTY	B	LABELLE	D	LAMOILLE	B	LATANIER	D
KOSETH	B	LABETTE	C	LAMOTTE	B	LATCH	A
KOSMOS	D	LABKEY	B	LAMPASAS	D	LATES	C
KOSSE	B	LABLUE	D	LANARK	B	LATEX	C
KOSSUTH	B/D	LABORCITA	B	LANCASTER	B	LATHER	D
KOST	A	LABOU	D	LANCE	B	LATIERRA	B
KOTO	D	LABRE	B	LAND	B/C	LATIGO	B
KOTZMAN	B	LABSHAFT	D	LANDAVASO	B	LATIMER	D
KOUNTER	D	LABU	D	LANDCO	C	LATINA	D
KOURY	B	LABYRINTH	A	LANDINGHAM	B	LATIU	D
KOYNIK	D	LACERDA	D	LANDMAN	B	LATONIA	B
KOYOKEE	C	LACEYCREEK	B	LANDO	C	LATOUCHE	D
KOYUKTOLIK	D	LACKSCREEK	C	LANDUSKY	A	LATOUR	B
KRACKLE	B	LACLEDE	B	LANEVILLE	B	LATOURELL	B
KRADE	B	LACONNER	C	LANEXA	D	LATRASS	D
KRAKON	D	LACOOCHEE	D	LANEY	B	LATTAS	D
KRAKOW	B	LACOSTE	C	LANFAIR	B	LAUBY	B
KRAM	D	LACOTA	B/D	LANGDON	A	LAUDERDALE	D
KRANSKI	B	LACRESCENT	B	LANGELLAIN	D	LAUDERHILL	B/D
KRANZBURG	B	LACROL	D	LANGER	A	LAUER	C/D
KRAUSE	B	LADERLY	C	LANGLADE	B	LAUGENOUR	C
KREAMER	C	LADNER	D	LANGLESS	C	LAURAMIE	B
KREBS	B	LADO	B	LANGLOIS	D	LAUREL	D
KREFT	C	LADRON	B	LANGOLA	C	LAURELWOOD	B
KREM	A	LADUE	B	LANGSPRING	B	LAUREN	B
KRENKA	B	LADYBIRD	B	LANGSTON	B	LAVALLEE	B
KRESSON	C	LADYCOMB	D	LANGWELL	D	LAVEAGA	C
KREYENHAGEN	B	LADYSMITH	D	LANIER	A	LAVELGA	B
KREZA	D	LAFAYETTE	B	LANIP	B	LAVENDER	B
KRIER	D	LAFE	D	LANKBUSH	B	LAVENTANA	C
KRIEST	B	LAFOLLETTE	B	LANOAK	B	LAVEY	D
KROME	A	LAGITOS	C	LANONA	B	LAVINA	D
KRON	D	LAGLORIA	B	LANSDOWNE	C	LAVODNAS	C
KROTO	B	LAGO	C	LANTERN	B	LAWAI	B
KRUBATE	B	LAGONOT	C	LANTIS	B	LAWEN	B
KRUEGER	C	LAGRANGE	D	LANTON, Low Rainfall	C	LAWNDALE	B
KRUM	D	LAGROSS	A	LANTON	D	LAWNES	D
KRUTAR	B	LAGUNITA	C	LANTONIA	B	LAWNWOOD	B/D
KUBE	B	LAHAINA	B	LANTRY	B	LAWRENCE	C
KUBLER	C	LAHOUESS	B	LANTZ	D	LAWRENCEVILLE	C
KUBLI	D	LAHOOD	B	LANYON	C/D	LAWSON	C
KUCKUP	A	LAHRITY	C	LAOLAO	B	LAWVER	B
KUDLAC	C	LAHTIDA	C	LAONA	B	LAX	C
KUKAIAU	A	LAINAND	B	LAPARITA	C	LAXTON	C
KUKAIAU, Bedrock Substratum	B	LAIRDSVILLE	D	LAPHAM	A	LAYCOCK	B
KUKVEY	A	LAKASH	B	LAPLATTA	C	LAYTON	B
KULA	B	LAKASKIA	D	LAPOINTE	C	LAZAN	D
KULLIT	B	LAKE	A	LAPON	D	LAZBUDDIE	D
KULSHAN	C	LAKE, Clayey Surface	C	LAPPANS	A	LE BAR	B
KUNAYOSH	A	LAKE CHARLES	D	LAPWAI	B	LEA	C
KUNCEIDER	A	LAKEBEDDER	B	LARA	B	LEADER	B
KUNIA	B	LAKEFIELD	B	LARCHMOUNT	C	LEADORE	B
KUNUWEIA	C	LAKELAND	A	LARCHPOINT	C	LEADPOINT	C
KUPREANOF	B	LAKEPARK	B/D	LARES	C	LEADVALE	C
KUPREANOF, Moderately Wet	C	LAKESHORE	B	LARIAT	B	LEAF	D
KUREB	A	LAKESHORE	D	LARIC	D	LEAFLAKE	B
KURK	C	LAKESOL	B	LARIM	B	LEAGUE	D
KURO	D	LAKETON	C	LARIMER	B	LEAGUEVILLE	B/D
KURSTAN	B	LAKewood	A	LARIOSCAMP	D	LEAKEY	D
KURTEN	D	LAKIN	A	LARMINE	D	LEAKSVILLE	D
KURTH	C	LAKOMA	D	LAROQUE	B	LEANDER	B
KURTZ	C	LAKOTA	D	LAROSE	D	LEANNA	D
KUSAL	C	LAKRIDGE	C	LAROSS	B	LEATHAM	C
KUSDRY	C	LALAAU	A	LARPENTEUR	B	LEATHERBARK	C
KUSHNEAHIN	D	LALINDA	B	LARRY	C/D	LEATHERS	B
KUSKOKWIM	D	LALOS	B	LARTON	A	LEATHERWOOD	B
KUSLINA	D	LAM	D	LARUE	A	LEAVENWORTH	C
KUSLINAD	D	LAMA	C	LARUSH	B	LEBAM	B
KUSSHI	B	LAMADRE	B	LARVIE	D	LEBEAU	D
KUTLER	C	LAMANGA	C	LARWOOD	C	LEBEC	B
KUVASZ	C	LAMAR	B	LAS FLORES	D	LEBRON	D
KUY	A	LAMARSH	C	LAS LUCAS	B	LECKMAN	B
KVICHAK	B	LAMARTINE	C	LAS VEGAS	D	LECOMA	B
KWAKINA	B	LAMATH	D	LASAC	A	LECRAG	D
KWATAHEIN	B	LAMAWA	B	LASALLE	D	LEDFORD	B
KWEO	A	LAMBERJACK	B	LASAUSES	D	LEDGER	D
KYBURZ	B	LAMBMAN	C	LASERE	C	LEDOW	B
KYDAKA	D	LAMBRANCH	D	LASH	B	LEDRU	D
KYGER	B	LAMBUTTE	B	LASKA	B	LEDWITH	B/D
KYLE	D	LAMEDEER	B	LASSEL	C	LEECREEK	D
KZIN	D	LAMESA	D	LASSITER	B	LEEDSVILLE	B
LA FARGE	B	LAMESHUR	A	LASTANCE	B	LEEFIELD	C

## Exhibit A: Hydrologic Soil Groups for the United States

LEELANAU	A	LIBERAL	D	LITRO	D	LONELY	C
LEEMONT	D	LIBERTY	B	LITTLE HORN	C	LONEMAN	B
LEEMORRIS	C	LIBRARY	D	LITTLEAXE	B	LONEOAK	C
LEEN	B/D	LIBUSE	C	LITTLEBALD	B	LONEPINE	B
LEEPER	D	LICK	B	LITTLEFAWN	C	LONERANCH	B
LEERAY	D	LICKCREEK	B	LITTLEFIR	C	LONESOME	B
LEERCO	D	LICKING	C	LITTLEHAT	B	LONEWOOD	B
LEESVILLE	B	LICKSKILLET	C	LITTLEJOHN	C	LONGBAR	B
LEGALL	B	LIDA	B	LITTLEMO	B	Longbell	A
LEGAULT	A	LIDAN	C	LITTLEMUD	C	Longbilly	D
LEGGETT	C	LIDDELL	B/D	LITTLERED	B	Longbranch	C
LEIDIG	B	LIDDIEVILLE	B	LITTLESALMON	A	Longhike	C
LEILEHUA	B	LIDOS	B	LITTLESAND	B	Longhope, Pondered	D
LEISY	B	LIEBER	C	LITTSAN	C	Longjohn	B
LEITER	C	LIEBERMAN	B	LIVAN	A	Longlois	B
LEMAH	A	LIESNOI	D	LIVCO	D	Longmare	C
LEMBOS	C	LIGAI	C	LIVENGOOD	B	Longmarsh	D
LEMCAVE	B	LIGHTNING	D	LIVERMORE	B	Longmont	C
LEMCO	C	LIGNUM	C	LIVIA	D	Longort	B
LEMETA	D	LIGNUMVITAE	D	LIVONA	B	Longpen	B
LEMHI	D	LIGOCKI	C	LIZARDHEAD	B	Longpine	D
LEMING	C	LIGURTA	B	LIZARDLAKE	D	Longs	B
LEMM	B	LIHUE	B	LIZE	B	Longshoal	D
LEMMON	C	LILAH	A	LIZZIE	B	Longsiding	B
LEMOLO	D	LILBERT	D	LIZZYSPRINGS	C	Longval	B
LEMONEX	C	LILBOURN	B	LLANOS	C	Longview	C
LEMOORE	C	LILLE	B	LOARC	B	Longigan, Cobbly Substratum	C
LEMOYNE	B	LILLINGS	B	LOBAT	B	Lonjon	B
LEMPIRA	B	LILLINGTON	B	LOBEISNER	B	Lonniebee	B
LEMROI	D	LILLIS	D	LOBERT	B	Lonoke	B
LENA	A/D	LILLIWAUP	B	LOBO	D	Lonon	B
LENACREEK	B	LILLYLANDS	C	LOBURN	D	Lonti	D
LENAPAH	D	LILSHEEP	C	LOCEY	C	Loonlake	B
LENAPE	D	LILSNAKE	C	LOCHLOOSA	C	Loony	C
LENAWEE	D	LILTEN	C	LOCHSA	B	Lopeno	A
LENBERG	C	LILYLAKE	D	LOCKDOWN	D	Loper	B
LENGBY	B	LIM	C	LOCKE	B	Lopez	D
LENNEP	C	LIMBERJIM	B	LOCKERBY	D	Lopwash	B
LENOIR	D	LIMECREEK	B	LOCKHART	B	Lorack	B
LENORAH	C	LIMINGA	A	LOCKNEY	D	Loradale	C
LENZLO	B	LIMKING	B	LOCKPORT	D	Loray	A
LENZWHEEL	B	LIMON	D	LOCKSPRINGS	C	Loreauville	C
LEOLA	B	LIMONES	B	LOCKTON	B	Lorenzo	B
LEONARD	D	LIMPY	D	LOCO	C	Lorhunt	D
LEONARDO	B	LINCO	B	LOCOBILL	B	Loring	C
LEONARDTOWN	D	LINDALE	C	LOCUST	C	Lorman	D
LEOPOLD	C	LINDELL	C	LODALLEY	D	Lorraine	B
LEPNER	C	LINDEN	B	LODE	B	Los Alamos	C
LEQUIEU	D	LINDER	B	LODICO	D	Los Osos	C
LEQUIRE	D	LINDQUIST	A	LOEB	C	Los Tanos	C
LEROUX	C	LINDSTROM	B	LOEMSTONE	C	Losantville	C
LEROY	B	LINDY	C	LOFFTUS	C	LOSEGATE	C
LESBUT	A	LINGANORE	B	LOFTON	D	Loslobos	B
LESIER	B	LINGUA	D	LOGDELL	B	Losmarios	C
LESON	D	LINHART	D	LOGGERT	B	Lostbasin	C
LESPATE	C	LININGER	B	LOGHILL	B	Lostcove	B
LESWILL	B	LINKLETTER	C	LOGHILL, Very Deep	C	Lostcreek	B
LETAVARIA	D	LINKSTERLY	B	LOGHILL, Thick Solum	D	Losthorse	D
LETHENT	C	LINLITHGO	B	LOGSDEN	B	Lostine	B
LETNEY	A	LINNE	C	LOGSPRINGS	C	Lostpoint	D
LETON	D	LINNEUS	B	LOHSMAN	D	Lostspring	B
LETORT	B	LINO	A	LOIRE	B	Lostvalley	B
LETRI	B/D	LINPEAK	B	LOKEN	C	Lostwells	B/C
LETTIA	B	LINSLAW	D	LOKERN	C	Lotex	D
LEVAC	D	LINTON	B	LOKOSSE	B/D	Lothair	C
LEVASSEUR	A	LINVELDT	B	LOLALITA	B	Lott	C
LEVELTON	C/D	LIONHEAD	B	LOLEKAA	B	Lotus	C
LEVENGOOD	B	LIONWOOD	B	LOLETA	C	Lou	B
LEVENMILE	B	LIPKE	D	LOLITE	D	Loudon	C
LEVERETT	C	LIPPITT	C	LOLON	B	Loudonville	C
LEVNIK	D	LIRIOS	B	LOLOPEAK	A	Louella	B
LEVY	D	LISBON	B	LOMAKI	B	Loughboro	C
LEVYVILLE	B	LISBON, Silty Clay Loam Substratum	C	LOMALTA	D	Louiecreek	B
LEWDLAC	D	LISCUM	D	LOMART	B	Louin	D
LEWELLEN	B	LISK	D	LOMAX	B	Louis	B
LEWHAND	D	LITAG	B	LOMBARD	C	Louris	B
LEWIS	D	LITCHEE	B	LOMETA	C	Louscot	C
LEWISBURG	C	LITCHY	D	LOMILL	D	Lovedale	B
LEWISVILLE	B	LITEN	A	LOMIRA	B	Lovejoy	C
LEWKALB	B	LITEN, Till Substratum	B	LOMOND	B	Lovelace	B
LEWNOT	C	LITHEE	C	LOMPICO	B	Lovelady	B
LEXINGTON	B	LITHGOW	C	LONCAN	C	Loveland	D
LEXTON	B	LITHIC HAPLUSTALFS, L,M,M	D	LONDO	D	Lovell	D
LEYBA	B	LITIMBER	B	LONEBEAR	D	Lovelock	D
LIART	D	LITLE	D	LONECONE	B	Loveness	B

## Exhibit A: Hydrologic Soil Groups for the United States

LOVETT	B	LYNXCREEK	B	MALLOPASS	B	MARIMEL	B/D
LOVLINE	C	LYONMAN	B	MALMESA	D	MARINA	B
LOWASSIE	D	LYRA	D	MALMESBURY	C	MARINE	C
LOWDER	C	LYSTAIR	B	MALMO	D	MARION	D
LOWE	B/D	LYTELL	B	MALO	B	MARIOSA	D
LOWERBLUFF	D	LYTLE	B	MALONEY	C	MARISCAL	D
LOWERCREEK	A	LYX	B	MALOTERRE	D	MARJANE	C
LOWLEIN	B	MABANK	D	MALSTROM	B	MARKER	B
LOWNDES	A	MABEN	C	MALTESE	D	MARKES	D
LOWRY	B	MABI	D	MAMALA	D	MARKESAN	B
LOWS	B/D	MACAREENO	C	MANADA	D	MARKEY	D
LOWVILLE	B	MACE	B	MANAHAWKIN	C	MARKLAKE	C
LOX	C	MACEDONIA	B	MANANA	C	MARKLEPASS	D
LOYAL	C	MACHETE	C	MANARD	C	MARKSBUTTE	B/D
LOYALTON	D	MACHIAS	B	MANARY	C	MARKTON	C
LOYPLACE	D	MACHONE	B	MANASHTASH	C	MARLA	D
LOYSVILLE	D	MACHUELO	D	MANASSAS	B	MARLEY	C
LOZANO	B	MACIVER	B	MANATEE	B/D	MARLTON	C
LOZEAU	C	MACKERRICHER	A	MANAWA	C	MARMARTH	C
LUANA	B	MACKINAC	B	MANBURN	D	MARNA	C/D
LUBBOCK	B	MACKLYN	C	MANCHESTER	A	MAROTZ	C
LUBKIN	B	MACKSBURG	B	MANCO	C	MARPA	C
LUBRECHT	C	MACLAREN	B	MANCOS	C	MARPLEEN	D
LUCE	C	MACOMB	B	MANDARIN, Flooded	B/D	MARQUAND	C
LUCEDALE	B	MACON	B	MANDARIN	C	MARQUETTE	A
LUCILE	B/C	MACREEING	B	MANDERSON	C	MARQUEZ	C
LUCKENBACH	C	MACYFLET	D	MANGUM	D	MARR	B
LUCKETTS	C	MADAWASKA	B	MANHATTAN	A	MARRIOTT	B
LUCKIAMUTE	D	MADDEN	C	MANI	C	MARSDEN	B
LUCKYFUSE	B	MADELIA	B/D	MANIKAN	B	MARSH	B
LUCKYRICH	B	MADERBAK	C	MANILA	D	MARSHDALE	C/D
LUCY	A	MADGE	B	MANITA	C	MARSHFIELD	B/D
LUDINGTON	B	MADILL	B	MANITOWISH	B	MARSHILL	B
LUFKIN	D	MADONNA	C	MANKOMEN	D	MARSING	B
LUGERT	B	MADRAK	C	MANN	B/D	MARSITE	D
LUGOFF	B	MADUREZ	B	MANNINGTON	D	MART	B
LUKE	C	MAES	B	MANNIXLEE	D	MARTEE	D
LUKIN	C	MAGDALENA	D	MANSIC	B	MARTEL	D
LULA	B	MAGENS	B	MANSKER	B	MARTELLA	C
LULUDE, High Rainfall	B	MAGGIE	D	MANSON	B	MARTILLO	D
LULUDE, Short FFS	C	MAGGIN	C	MANTECA	C	MARTIN PENA	D
LUMAN	B	MAGIC	D	MANTON	B	MARTINEZ	D
LUMBEE	B/D	MAGNET	C	MANU	C	MARTINSBURG	B
LUMMI	C/D	MAGNETIC	D	MANVEL	C	MARTINSON	C
LUMMUS	C	MAGOTHA	D	MANZANITA, Gravelly	B	MARTINTON	C
LUNCH	C	MAGROC	C	MANZANITA	C	MARTIS	B
LUNDER	D	MAGUAYO	C	MANZANST	D	MARTY	B
LUNDGREN	A	MAHAFFEY	C	MAPLE HOLLOW	C	MARUMSCO	C
LUNDLAKE	B/D	MAHAN	C	MAPLECREEK	C	MARVELL	B
LUNSFORD	D	MAHANA	B	MAPLECREST	B	MARVYN	B
LUNT	C	MAHASKA	B	MAPLEHILL	C	MARYSTOWN	C
LUPCHO	B	MAHKONCE	C	MAPLEHURST	C	MARYSVILLE	B
LUPE	B	MAHO BAY	D	MAPLEWOOD	C	MASARYK	A
LUPINE	B	MAHOGAN	C	MARA	B	MASCARENAS	C
LUPINTO	C	MAHOOSUC	A	MARACK	C	MASCHEHAH	B
LUPOYOMA	B	MAHTOWA	C/D	MARAGUEZ	B	MASCOTTE	B/D
LUPPINO	D	MAIDENPEAK	A	MARANA	B	MASCOUTAH	B/D
LUPTON	D	MAILE	A	MARBIE	C	MASEEYA	B
LURAY	C/D	MAILTRAIL	C	MARBLECREEK	C	MASET	B
LURNICK	C	MAJIK	B	MARBLEHEAD	C	MASHAM	D
LUSETTI	B	MAJUBA	C	MARBLEMOUNT	B	MASHEL	B
LUSK	C	MAJURO	A	MARBLEMOUNT, Channery	C	MASHULAVILLE	B/D
LUTA	D	MAKAH	B	MARBLETOWN	B	MASKELL	B
LUTAK	B	MAKALAPA	D	MARCADO	D	MASON	B
LUTHER	B	MAKAPILI	B	MARCEL	C	MASONFORT	D
LUTIE	B	MAKAWAO	B	MARCELINAS	D	MASONTOWN	D
LUTZCAN	D	MAKAWELI	B	MARCELLON	C	MASSACK	B/C
LUTZKE	B	MAKENA	B	MAR CETTA	B	MASSADONA	C
LUVAR	B	MAKI	C	MARCLAY	D	MASSADONA	D
LYBRAND	C	MAKIKI	B	MARCOLA	C	MASSANETTA	B
LYCURGUS	B	MAKLAK	A	MARCONI	C	MASSBACH	B
LYDICK	B	MAL	C	MARCOU	B	MASSIE	D
LYERLY	D	MALA	B	MARCUS	B/D	MASTERTSON	B
LYFORD	C	MALACHY	B	MAREMMA	B	MASTLY	B
LYKAL	C	MALAMA	A	MARENGO	C/D	MATA	C
LYKENS	C	MALARDI	B	MARESUA	B	MATAGORDA	D
LYKORLY	C	MALARGO	B	MARGERUM	B	MATAMOROS	C
LYMANSON	B	MALAYA	D	MARGIE	C	MATANUSKA	B
LYNCH	D	MALBIS	B	MARGO	B	MATANZAS	B
LYNDEN	B	MALCOLM	B	MARIANA	C	MATAWAN	C
LYNN HAVEN	B/D	MALDEN	A	MARIAVILLE	D	MATCHER	A
LYNNBOW	D	MALEZA	B	MARIACAO	B	MATECUMBE	D
LYNNE	B/D	MALHEUR	C	MARIEL	D	MATFIELD	C
LYNNVILLE	C	MALIBU	D	MARIETTA	C	MATHERS	B
LYNNWOOD	A	MALJAMAR	B	MARILLA	C	MATHERTON	B

## Exhibit A: Hydrologic Soil Groups for the United States

MATHERTON, Clay Substratum ..	C	MCCUE .....	C	MECOSTA .....	A	METANOB .....	B
MATHIAS .....	B	MCCULIGAN .....	D	MEDFRA .....	D	METCALF .....	D
MATHISTON .....	C	MCCULLAN .....	B	MEDICI .....	A	METH .....	C
MATHON .....	B	MCCUMBER .....	B	MEDICINE .....	B	METIGOSHE .....	B
MATILO .....	B	MCCUNE .....	D	MEDLAKE .....	A	METOLIUS .....	B
MATMON .....	D	MCCURDY .....	C	MEDLAVAL .....	D	METONGA .....	B
MATOON .....	D	MCCUTCHEN .....	D	MEDLEY .....	B	METRE .....	D
MATOY .....	C	MCDANIELAKE .....	B	MEDO .....	A/D	METSER .....	C
MATQUAW, Dry .....	B	MCDERMOTT .....	B	MEDOC .....	C	MEXICO .....	D
MATQUAW .....	C	MCDOLE .....	B	MEDRICK .....	B	MEXISPRING .....	D
MATTAMUSKEET .....	D	MCDONALDSVILLE .....	C/D	MEEGERNOT .....	B	MEXTANK .....	B
MATTAN .....	D	MCDOUG .....	B	MEENON .....	C	MEYSTRE .....	B
MATTAPEX .....	C	MCDUFF .....	C	MEGONOT .....	C	MEZZER .....	B
MATTERHORN .....	A	MCELMO .....	D	MEGUIN .....	B	MICANOPY .....	C
MATTEX .....	C	MCEWEN .....	B	MEHURIN .....	C	MICAVILLE .....	B
MATTIX .....	B	MCFAIN .....	C	MEIKLE .....	D	MICCO .....	B/D
MATUNUCK .....	D	MCFARLAND .....	B	MEISS .....	D	MICCOSUKEE .....	C
MAU .....	C	MCF Faul .....	C	MEKINOCK .....	D	MICKEY .....	D
MAUDE .....	B	MCGAFFEY .....	B	MELAKWA .....	C	MICROSPEECH .....	D
MAUKEY .....	C	MCGARVEY .....	C	MELBOURNE .....	B	MICROCY .....	C
MAUMEE .....	D	MCGEHEE .....	C	MELBY .....	B	MIDAS .....	C
MAUNABO .....	D	MCGILVERY .....	D	MELD .....	C	MIDCO .....	A
MAUPIN .....	C	MCGINN .....	B	MELDER .....	B	MIDDLEBOX .....	B
MAURY .....	B	MCGINNIS .....	C	MELFA .....	D	MIDDLEBROOK .....	C
MAVCO .....	C	MCGIRK .....	C	MELGA .....	D	MIDDLEBURG .....	B
MAVERICK .....	C	MCGIRK, Low Rainfall .....	D	MELHOMES .....	D	MIDDLEBURY .....	B
MAVIE .....	B/D	MCGOWAN .....	B	MELHORN .....	B	MIDDLEHILL .....	C
MAVREESO .....	B	MCGRATH .....	B	MELLING .....	D	MIDDLEWOOD .....	B
MAWAE .....	A	MCGRAVEY .....	B	MELLOTT .....	B	MIDELIGHT .....	B
MAWER .....	B	MCGUFFEY .....	D	MELLOWMOON .....	B	MIDESSA .....	B
MAXEY .....	C	MCGUIRE .....	B	MELOCHE .....	D	MIDFORK .....	B
MAXTON .....	B	MCHANDY .....	D	MELOZA .....	C	MIDO .....	B
MAY .....	B	MCINTOSH .....	C	MELROSE .....	C	MIDPEAK .....	B
MAYBELL .....	A	MCIVOR .....	D	MELRUDE .....	C/D	MIDVALE .....	C
MAYBESO .....	D	MCKAMIE .....	D	MELTON .....	D	MIERHILL .....	C
MAYBID .....	D	MCKAY .....	C	MELVINA .....	C	MIERUF .....	B
MAYDOL .....	B	MCKEE .....	D	MEMALOOSE .....	C	MIFFLIN .....	B
MAYES .....	D	MCKEETH .....	B	MEMMOTT .....	B	MIGERN .....	B
MAYFLOWER .....	C	MCKENNA .....	C/D	MENA .....	C	MIGUEL .....	D
MAYGAL .....	D	MCKENTON .....	D	MENAN .....	B	MIJAY .....	C
MAYGER .....	C	MCKINLEY .....	B	MENARD .....	B	MIKADO .....	C
MAYHEW .....	D	MCKINNEY .....	C	MENBAR .....	C	MIKIM, Wet Substratum .....	C
MAYMEAD .....	B	MCKNIGHT .....	B	MENDEBOURE .....	C	MIKIM, Saline-Alkali, Wet .....	D
MAYNARD LAKE .....	A	MCLAIN .....	C	MENDELTA .....	D	MILAN .....	B
MAYO .....	B	MCLANGOR .....	D	MENDENHALL .....	D	MILBY .....	B
MAYQUEEN .....	B	MCLAURIN .....	B	MENDI .....	B	MILCAN .....	C
MAYSPPRINGS .....	B	MCLEAN .....	D	MENDNA .....	D	MILDRED .....	D
MAYSWELL .....	D	MCLENNAN .....	C	MENDON .....	B	MILES .....	B
MAYTAG .....	D	MCLEOD .....	B	MENDOTA .....	B	MILITARY .....	B
MAYTOWN .....	C	MCLOUGHLIN .....	B	MENFRO .....	B	MILKWEED .....	C
MAYVILLE .....	B	MCMANUS .....	C	MENINIK .....	D	MILL .....	D
MAZARN .....	C	MCMEEEN .....	C	MENO .....	C	MILLADORE .....	C
MAZASKA .....	C/D	MCMILLAN .....	A	MENOKEN .....	C	MILLAN .....	B
MAZDALE .....	B	MCMILLE .....	B	MENOMIN .....	B	MILLBORO .....	D
MAZIE .....	D	MCMURDIE .....	B	MENTO .....	C	MILLBURNE .....	B
MAZUMA .....	C	MCMURRAY .....	C/D	MENTONE .....	C	MILLDAM .....	C
MCADOO .....	B	MCNAB .....	D	MENTZ .....	D	MILLECOQUINS .....	C
MCALEE .....	C	MCNARY .....	C	MENZEL .....	B	MILLERDITCH .....	C
MCALLEN .....	B	MCNEELY .....	A	MEQUITHY .....	B	MILLERFLAT .....	B
MCALLISTER .....	B	MCNULTY .....	B	MEQUON .....	C	MILLERPOINT .....	B
MCARTHUR .....	B	MCNYE .....	B	MER ROUGE .....	B	MILLERSBURG .....	B
MCBAIN .....	B	MCPAN .....	C	MERCER .....	C	MILLERTON .....	D
MCBIGGAM .....	C	MCQUEEN .....	C	MERCEY .....	C	MILLERVILLE .....	A/D
MCCAFFERY .....	A	MCRAE .....	B	MEREDITH .....	B	MILLHEIM .....	C
MCCALEB .....	B	M CRAVEN .....	C	MERIMOD .....	B	MILLHI .....	D
MCCALLY .....	D	MCTAGGART .....	B	MERINO .....	D	MILLICH .....	D
MCCAMMON .....	C	M CVAR .....	A	MERIT .....	B	MILLIGAN .....	C
MCCANN .....	B	M CVICKERS .....	C	MERKLEY .....	B	MILLING .....	D
MCCASH .....	B	MCWATT .....	B	MERMENTAU .....	D	MILLOX, Nonsaline .....	C
MCCAY .....	B	MEAD .....	D	MERNA .....	B	MILLOX, Saline-Sodic .....	D
MCCLANAHAN .....	D	MEADOWBANK .....	B	MEROS .....	A	MILLPAW .....	C
MCCLAVE .....	C	MEADOWLAKE .....	C	MERRILL .....	C	MILLPAW, Sandy Subsoil .....	D
MCCELLEN .....	B	MEADOWPASS .....	C	MERRILLAN .....	C	MILLPOCKET .....	D
MCCLLOUD .....	C	MEADOWPEAK .....	C	MERRIMAC .....	A	MILLPOND .....	B
MCCLUNG .....	B	MEADOWPORT .....	C	MERRYVILLE .....	D	MILLPOND .....	C
MCCLURE .....	C	MEADOWS .....	C	MERSON .....	C	MILLPOT .....	B
MCCOIN .....	D	MEADOWVILLE .....	B	MERTON .....	B	MILLRACE .....	B
MCCOLL .....	D	MEANS .....	C	MERWIN .....	A/D	MILLROCK .....	A
MCCOMAS .....	C	MEARES .....	D	MESABA .....	C	MILLSAP .....	D
MCCONAUGHY .....	B	MEATON .....	C	MESCAL .....	C	MILLSDALE .....	C/D
MCCORNICK .....	C	MECAN .....	B	MESCALERO .....	C	MILLSITE .....	B
MCCOY .....	C	MECHANICSBURG .....	C	MESEI .....	D	MILLSITE, Stony .....	C
MCCREE .....	B	MECKLENBURG .....	C	MESSER .....	C	MILLSTADT, Drained .....	C
MCCRORY .....	D	MECKLING .....	B	MET .....	B	MILLSTONE .....	B
MCCROSKET .....	B	MECLO .....	D	METALLAK .....	B	MILLSTREAM .....	B

## Exhibit A: Hydrologic Soil Groups for the United States

MILLWARD	B	MODYON	C	MOONSTONE	C	MOUNTZION	B
MILLWOOD	D	MOE	B	MOONVILLE	B	MOUZON	D
MILNER	B	MOENKOPIC	B	MOORETOWN	C/D	MOVIEFLAT	C
MILTON	C	MOENTRIA	D	MOORHEAD	C	MOVILLE	C
MILVAR	C	MOFFSPRING	C	MOOSE RIVER, Moderately Wet	C	MOWAKO	B
MINA	B	MOGG	D	MOOSE RIVER	D	MOWATA	D
MINALOOSA	B	MOGLIA	C	MOOSECREEK	B	MOWBRAY	B
MINCHUMINA	D	MOGOLLON	B	MOOSED	C	MOWICH	D
MINCO	B	MOGOTE	C	MOOSED, Sandy	D	MOYERS	C
MINDEN	B	MOHAT	B	MOOSEFLAT	D	MOYINA	D
MINEOLA	A	MOHLER	B	MOOSEHEAD	B	MT. AIRY	A
MINERAL, Dry	B	MOHOCKEN	C	MOOSELAKE	A/D	MT. HOOD	B
MINERAL	C	MOHON	C	MOOSHAUNEE	C	MT. OLIVE	C
MINERAL MOUNTAIN	D	MOIESE	B	MOPANA	D	MT. VERNON	C
MINERSVILLE	B	MOINES	C	MOPANG	B	MT. ZION	C
MINERVA	B	MOINGONA	B	MOPPET	B	MTSTERLING	B
MINESINGER	C	MOJO	C	MOQUAH	D	MUCKALEE	D
MINGO	C	MOKAAC	A	MORADO	C	MUDBUZ	B
MINGPOINT	B	MOKENA	C	MORALES	C	MUDCO	D
MINKLER	D	MOKIAK	C	MORANCH	B	MUDCREE	C
MINKWELL	B	MOKINS	D	MORANVILLE	B	MUDLAKE	C
MINLITH	D	MOKULEIA	B	MORBENCH	B	MUDLAVIA	B
MINNEHA	C	MOLALLA	B	MORCLAY	D	MUDPOT	D
MINNEHAHA	B	MOLAND	B	MORCOM	C	MUELLER	C
MINNEISKA	B	MOLAS	D	MORCONICK	B	MUES	B
MINNETONKA	C/D	MOLENA	A	MOREGLADE	B	MUGATU	C
MINNIEPEAK	A	MOLION	D	MOREHEAD	C	MUGGINS	B
MINNIEVILLE	C	MOLLCO	D	MORET	D	MUGHUT	C
MINNIMAUD	C	MOLLICY	C	MOREY	D	MUIRKIRK	B
MINNYE	B	MOLOKAI	B	MORGAMINE	C	MUKILTEO	C/D
MINO	C	MOLTKE	B	MORGANFIELD	B	MULA	B
MINOA	C	MOLTONER	C	MORGANHILLS	D	MULAT	D
MINOCQUA	B/D	MOLTONER, Silty Clay Loam		MORIAH	B	MULDOON	B
MINONG	D	Substratum	D	MORIAH, Clayey Subsoil	C	MULDROW	D
MINWELLS	C	MONA	B	MORICAL	C	MULE	B
MIPPON	B	MONACAN	C	MORIMOUNT	D	MULETT	D
MIRABAL	B	MONACHE	B	MORITZ	C	MULHALL	B
MIRACLE	B	MONAHANS	B	MORLING	D	MULHOLLAND	B
MIRAGE	C	MONARCH	D	MORMON MESA	D	MULKEY	C
MIRAMAR	B	MONASTERIO	C	MORMOUNT	D	MULLERS	D
MIRASOL	B	MONAVILLE	B	MORNINGSTAR	B	MULLICA	C
MIREROCK	D	MONBUTTE	C	MOROCCO	B	MULLIG	B
MIRES	A	MONCHA	B	MORPH	B/D	MULLINS	D
MIRES, Stony	B	MONCISCO	A	MORPHEY	D	MULLYON	D
MISENHEIMER	C	MONEE	D	MORRISVILLE	C	MULSTAY	C
MISERY	C	MONGLE	C	MORSE	D	MULT	C
MISFIRE	B	MONGO	D	MORTENSON	D	MULTEY	B
MISHAK	C/D	MONIDA	B	MORTIMER	D	MULTORPOR	A
MISHAKAL	C	MONIDA	C	MORVEN	C	MULVEY	C
MISHAWAKA	A	MONITOR	C	MOSBY	C	MUMFORD	D
MISKOAKI	D	MONJEAU	D	MOSEL	C	MUNCIE	C
MISLATNAH	B	MONORIDGE	C	MOSHANNON	B	MUNDALITE	C
MISPILLION	D	MONOX	B	MOSHEIM	D	MUNDELEIN	B
MISSION	D	MONPARK	D	MOSHUP	C	MUNDEN	B
MISSISQUOI	A	MONSE	C	MOSLANDER, Elevation 7000-9000	B	MUNDOS	B
MISSISSINEWA	C	MONSERATE	C	B		MUNDT	C
MISSLER	B	MONSERATE, Thin Surface	D	MOSLANDER	D	MUNI	D
MISSOULA	D	MONTBORNE	C	MOSMAN	D	MUNSET	D
MISTEGUAY	D	MONTCALM	A	MOSO	B	MUNSON	D
MITCH	C	MONTCAN	B	MOSQUITO	D	MUNUSCONG	B/D
MITCHELLPOINT	B	MONTE CRISTO	D	MOSROC	D	MURAD	B
MITIWANGA	C	MONTEAGLE	B	MOSSBACK	B	MURANCH	C
MITKOF	C	MONTEGRANDE	D	MOSSCREEK	B	MURDO	B
MITRE	C	MONTELLO	C	MOSSYROCK	B	MUREN	B
MITRING	C	MONTEOCHA	D	MOSWELL	D	MURHUT	B
MITTEN	B	MONTEROSA	C	MOTARK	B	MURKEN	C
MIZEL	D	MONTESA	C	MOTEN	C	MUROC	D
MIZPAH	D	MONTEVALLO	D	MOTLEY	B	MURPHILL	D
MOANO	D	MONTEZ	B	MOTT	B	MURPHY	C
MOAPA	C	MONTEZUMA	A	MOTTO	D	MURRAY	B
MOAULA	A	MONTIETH	B	MOULTRIE	D	MURRIETA	D
MOBATE	D	MONTONIA	B	MOUNDHAVEN	A	MURRSTEAD	D
MOBEETIE	B	MONTOSO	B	MOUNDPRAIRIE	B/D	MURVILLE	A/D
MOBERG	B	MONTOUR	D	MOUNDVILLE	A	MUSCATUNE	B
MOBL	B	MONTROSS	C	MOUNTADAMS	B	MUSE	C
MOCA	D	MONTVERDE	B/D	MOUNTAINBOY	D	MUSGRAVE	D
MOCAREY	D	MONTWEL	B	MOUNTAINEER	C	MUSGROVE	B
MOCKLEY	C	MONVERO	A	MOUNTAINVILLE	C	MUSHEL	B
MOCKSVILLE	B	MONZA	C	MOUNTEMILY	B	MUSKELLUNGE	D
MOCO	B	MONZINGO	B	MOUNTHAT	B	MUSKOGEE	C
MOCTILEME	C	MOOERS	B	MOUNTMCDULL	D	MUSOFARE	C
MODALE	C	MOOHOO	B	MOUNTMCD	C	MUSQUIZ	C
MODESTY	C	MOOLACK	A	MOUNTOM	D	MUSSENTUCHIT	B
MODJESKA	B	MOONLIGHT	B	MOUNTPLEASANT	B	MUSSENTUCHIT, Dry	C
MODOC	B	MOONSHINE	D	MOUNTPOOR	C	MUSSERHILL	C

## Exhibit A: Hydrologic Soil Groups for the United States

MUSSEY	B/D	NARU	C	NEMOURS	C	NICELYTOWN	C
MUSTANG	A/D	NASH	B	NENNO	C	NICHOLFLAT	D
MUSTANG	D	NASHMEAD	B	NEOLA	D	NICHOLIA	D
MUSTINKA	C/D	NASHVILLE	B	NEOPIT	B	NICHOLSON	C
MUSTY	C	NASHWAUK	C	NEOTOMA	B	NICHOLVILLE	C
MUTNALA	B	NASKEAG	C	NEOTSU	C	NICKEL	C
MUTT	C	NASON, Gravelly	B	NEPONSET	C	NICKERSON	B
MUTTON	B	NASON	C	NEPTUNE	A	NICKIN	B
MYATT	D	NASS	D	NERELNA	B	NICKLUND	B
MYERS	D	NASSAU	C	NERESON	B	NICKOLNA	B
MYFORD	D	NASSAWANGO	B	NERWOODS	B	NICODEMUS	B
MYOMA	A	NATAANI	B	NESBITT	B	NICOLAS	A
MYOMA, Wet	B	NATAGA	A	NESDA	A	NIDAROS	D
MYRA	C	NATAL	D	NESHOBA	C	NIDIX	B
MYRICK	C	NATALBANY	D	NESIKA	B	NIDO	C
MYRTLE	B	NATAPOC	B	NESIUS	A	NIELSVILLE	C/D
MYRTLECREEK	B	NATCHEZ	B	NEKOWIN	C	NIKAL	B
MYSOL	C	NATCHITOCHE	D	NESO	D	NIKFUL	D
MYSTEN	A	NATHALE	C	NESS	D	NIKISHKA	B
NAALEHU	B	NATHROP	C	NESSSEL	B	NIKLAVAR	D
NAALEHU, Bedrock Substratum	C	NATI	C	NESTLEY	B	NIKWASI	B/D
NABB	C	NATIONAL	B	NETARTS	B	NILE	B
NABESNA	D	NATKIM	B	NETAWAKA	B	NILER	D
NABOR	B	NATOMAS	B	NETOMA	B	NILRAP	B
NACHES	B	NATROY	D	NETRAC	A	NIMERICK	C
NACHUSA	B	NATURITA	B	NETTLETON	C	NIMMO	D
NACIMIENTO	C	NAUKATI	D	NEUBERT	B	NIMROD	B
NACLINA	D	NAUMBURG	C	NEVARC	C	NIMS	C
NACO	C	NAUVOO	B	NEVAT	B	NINCH	B
NACONICHE	D	NAVACA	D	NEVENS	C	NINEPIPE	B
NADA	D	NAVAN	D	NEVILLE	C	NINEVEH	B
NADEAU	B	NAVASAN	A	NEVO	D	NINIGRET	B
NADRA	D	NAVIDAD	B	NEVTAH	C	NINOT	B
NAEGELIN	D	NAVINA	B	NEVU	C	NIOBRARA	D
NAGEEZI	B	NAVO	D	NEWALBIN	B/D	NIOTA	D
NAGLE	B	NAWAKWA	C	NEWALLA	D	NIPE	B
NAHA	B	NAWT	D	NEWANNA	C	NIPINTUCK	D
NAHA	C	NAYE	C	NEWAUKUM	B	NIPISSING	B
NAHUNTA	C	NAYFAN	C	NEWAYGO	B	NIPPENO	D
NAILKEG	B	NAYPED	B	NEWBERN	C	NIPSUM	C
NAIWA	B	NAYRIB	D	NEWCO	D	NIRAC	C
NAKAIBITO	B	NAYTAHWAUSH	B	NEWCOMER	B	NIRE	C
NAKINA	B/D	NAZATON	B	NEWDALE	B	NIRLING	C
NAKNEK	D	NEABSCO	D	NEWDEAL	D	NISENE	B
NAKOCHNA	D	NEAH	B	NEWFLAT	D	NISHNA	C/D
NAKWASINA	D	NEALY	B	NEWFOLDEN	C	NISHNA, Poned	D
NALAKI	C	NEARL	C	NEWFORK	D	NISHON, Warm	C/D
NALDO	B	NEBGEN	D	NEWFOUND	C	NISHON	D
NALIVAG	B	NEBISH	B	NEWGLARUS	B	NISQUALLY	A
NALL	D	NEBONA	D	NEWGLARUS, Severely Eroded	C	NISULA	B
NAMEOKI	D	NECESSITY	C	NEWHAN	A	NITCHA	B
NAMMOTH	C	NECHE	C	NEWHAVEN	B	NITCHE	B
NAMUR	C	NECHES	C	NEWHORN	B	NITCHLY	B
NANA	D	NECKROCK	B	NEWHOUSE	B	NITER	C
NANAMKIN	A	NECONDA	C	NEWKIRK	D	NITPAC	D
NANIAK	D	NECTAR	C	NEWLANDS	C	NIU	B
NANICH	A	NEDA	C	NEWLANG	A/D	NIULII	C
NANNYTON	B	NEDHILL	B	NEWLIN	B	NIVA	D
NANSEMOND	C	NEEDHILL	B	NEWLONDON	C	NIWANA	B
NANSEPSEP	C	NEEDLE PEAK	C	NEWMARC	C	NIXON	B
NANTAHALA	B	NEEDMORE	C	NEWNAN	C	NIXONTON	B
NANTICOKE	D	NEEL	D	NEWRY	B	NIZHONI	D
NAPIER	B	NEELEY	B	NEWSKAH	B	NOAH	B
NAPOLEON	A/D	NEEN	B/C	NEWSROCK	B	NOBLE	B
NAPOLEON	D	NEEN, Wet	D	NEWSTEAD	C	NOBLETON	C
NAPOLI	C	NEEPER	B	NEWTMAN	D	NOBOCO	B
NAPPANEE	D	NEESES	C	NEWTONIA	B	NOBSCOT	A
NAPTOWNE	B	NEHALEM	B	NEWULM	B	NOBUCK	C
NARANJITO	C	NEHALEM, Flooded	C	NEWVIENNA	B	NOCKAMIXON	C
NARANJO	C	NEHAR	C	NEWVILLE	D	NOCKEN	C
NARBONA	B	NEHASNE	B	NEYGAT	D	NODHILL	B
NARCISSE	B	NEICE	B	NEZ PERCE	C	NODINE	B
NARD	C	NEISSENBERG	C	NEZ PERCE, Friable Substratum	D	NODMAN	B
NARDINE	C	NEKIA	B	NGARDMAU	B	NODUR	D
NARDMONT	B	NEKIA, Stony	C	NGARDOK	B	NOELKE	D
NAREA	A	NEKKEN	B	NGERSUUL	C	NOHILI	D
NAREL	B	NEKOMA	B	NGERUNGOR	D	NOKASIPPI	B/D
NARGAR	B	NELLSRING	D	NIARADA	B	NOKHU	C
NARGON	C	NELSCOTT	C	NIBBS	B	NOLAVA	C
NARK	C	NELSE	B	NIBEN	B	NOLTEN	C
NARLON	D	NELSON	C	NIBLACK	D	NOMARA	C
NARNETT	B	NEMADJI	B	NIBLEY	C	NOMBERVILLE	B
NARRAGUINNEP	D	NEMAH	C/D	NIBSON	D	NOME	D
NARROWS	D	NEMICO	D	NICANOR	D	NOMRAH	B
NARTA	D	NEMOTE	A	NICELY	C	NONAME	D

## Exhibit A: Hydrologic Soil Groups for the United States

NONAMELAKE	C	NUSIL	A	OHTOG, Wet	C	ONECO	B
NONAMEWASH	B	NUSMAG	D	OHTWO	C	ONEIL	C
NONDALTON	B	NUTREEAH	C	OIDEM	A	ONEONTA	B
NONOPAHU	D	NUTTER	B	OJATA	C	ONKEYO	D
NONPAREIL	D	NUTVAL	B	OJIBWAY	C	ONVILLE	C
NOOBAB	C	NUTZAN	C	OJITO	C	ONSLow	B
NOOK	C	NUVALDE	B	OKAN	B	ONSTAD	B
NOOKSACK	C	NYAK	B	OKAY	B	ONTKO	D
NOPAH	C	NYALA	B	OKEE	B	ONTRAIL	B
NORA	B	NYE	B	OKEECHOBEE	B/D	OOKALA	A
NORA VARIANT	B	NYMAN	C	OKEELALA	B	OOKEN	A
NORAD	B	NYMORE	A	OKEELANTA	B/D	OPALOCKA	D
NORAX	B	NYSERVA	B	OKEETEE	D	OPIE	D
NORBERT	D	NYSSATON	B	OKEMAH	C	OPIHKAO	D
NORBORNE	B	NYSWONGER	D	OKERLAND	B	OPLIN	C
NORDBY	B	NYTHAR	D	OKIOTA	D	OPNISH	C
NORDHOUSE	A	O'BRIEN	B	OKLARED	B	OPOLIS	C
NORENE	C	O'NEILL	B	OKLARK	B	OPPIO, Stony	C
NORFOLK	B	OAHE	B	OKLAWAHA	B/D	OPPIO	D
NORGE	B	OAK GROVE	B	OKO	C	OPTIMA	A
NORGO	D	OAKALLA	B	OKOBOJI	D	OQUIN	C
NORIA	D	OAKBORO	C	OKOLONA	D	QUOSSOC	D
NORKOOL	B	OAKCITY	C	OKREEK	D	ORA	C
NORMA	C/D	OAKCREEK	B	OKRIST	B	ORAGRAN	D
NORMAL	B	OAKDALE	B	OKTAHA	B	ORAD	C
NORMANDY	B/D	OAKHURST	D	OLALLIE	D	ORAMEL	C
NORMANGEE	D	OAKLAND	C	OLANCHA	B	ORAN	B
NORMANIA	B	OAKLET	C	OLAND	B	ORANGEVALE	B
NORMANNA	C	OAKMETER	C	OLANTA	B	ORCADIA	D
NOROD	C	OAKTON	B	OLASHES	B	ORDNA	D
NORPEL	C	OAKWOOD	B	OLATHE	D	ORDNANCE	C
NORRIS	D	OAKY	D	OLATON	B	ORDWAY	D
NORTE	C	OANAPUKA	B	OLBUT	D	OREANNA	B
NORTH POWDER	C	OATUU	D	OLDBUTTE	C	ORENDA	B
NORTHBEND	C	OBAN	C	OLDMAN	C	OREOKE	B
NORTHCASTLE	C	OBARO	B	OLDS	D	ORHOOD	D
NORTHCOVE	B	OBIE	B	OLDSMAR	D	ORIF	A
NORTHFIELD	D	OBISPO	D	OLDSPAN	B	ORINOCO	C
NORTHFORK	B	OBNOT	D	OLDTRAIL	B	ORIO	B/D
NORTHMORE	C	OBRAY	C	OLDWOLF	B	ORION	C
NORTHMOUND	B	OBRIEN	C	OLEAN	B	ORITA	B
NORTHPOINT	D	OBSCURITY	B	OLELO	B	ORIZABA	B/C
NORTHRUP	C	OBURN	D	OLEMAN	B	ORLA	B
NORTHVILLE	C	OCCIDENTAL	D	OLEMAN	D	ORLANDO	A
NORTHWAY	A/D	OCCUM	B	OLENO	D	ORLIE	B
NORTON	C	OCCUR	C	OLENTANGY	A/D	ORMSBY	C
NORWEST	B	OCEANET	D	OLEO	A	ORNBAUN	B
NORWIDGE	B	OCEANO	A	OLEPHANT	B	ORNEA	B
NORWOOD	B	OCHLOCKONEE	B	OLEQUA	B	ORO FINO	B
NOSAL	C	OCHO	D	OLETE	C	ORONOCO	B
NOSLO	C	OCHOPEE	B/D	OLETHA	D	ORONTO	C
NOSONI	B	OCOEE	B/D	OLEX	B	ROSE	C
NOSSER	D	OCONALUFTEE	B	OLF	D	ORPARK	C
NOTCHER	B	OCONEE	C	OLGUN	B	ORR	C
NOTI	D	OCONTO	B	OLI	B	ORSET	B
NOTNED	D	OCQUEOC	A	OLIAGA	C	ORSINO	A
NOTSTEW	D	OCQUEOC, Moderately Wet	B	OLIN	B	ORTEGA	A
NOTTAWA	B	OCUD	D	OLINDA	B	ORTELLCREEK	C
NOTUS	B/C	ODANAH	D	OLIVE	D	ORTHENTS, Maat47-53	C
NOUQUE	D	ODAS	D	OLIVENHAIN	D	ORTING	D
NOVACAN	D	ODEM, Overwash	A	OLIVIER	C	ORTIZ	C
NOVAK	B	ODEM	B	OLLA	B	ORTON	B
NOVARK	B	ODENSON	D	OLLEI	D	ORTONVILLE	B
NOVARY	D	ODERMOTT	B	OLLIERIVAS	D	ORUPA	B
NOVINA	B	ODESSA	D	OLMITO	D	ORWET	A/D
NOWATA	B	ODIN	C	OLMITZ	B	ORWIG	B
NOWEN	B/D	ODONNELL	C	OLMOS	C	OSAGE	D
NOWOY	B	OESTERLE	C	OLOAVA	B	OSBORN	C
NOYES	C/D	OFFENBACHER	C	OLOKUI	D	OSCAR	D
NOYO	C	OFU	B	OLOMOUNT	C	OSCEOLA	B
NOYSON	C	OGDEN	C	OLOMPALI	D	OSCO	B
NUAHS	B	OGDENSBURG	C	OLPE	C	OSDITCH	B
NUBY	D	OGEMAW	C/D	OLYIC	B	OSGOOD	C
NUC	C	OGILVIE	B/D	OLYMPUS	A	OSHAWA	D
NUCKOLLS	B	OGLE	B	OMAHALING	C	OSHONE	D
NUCLA	B	OGLES	B	OMAK	C	OSHOTO	C
NUECES	C	OGLESBY	D	OMENA	B	OSITO	C
NUFFEL	B	OGRAL	B	OMIO	B	OSKA	C
NUFFER	C	OGTNA	B	OMRO	C	OSMUND	B
NUKA	D	OHACO	C	OMSTOTT	C	OSO	C
NUKRUM	D	OHANA	C	OMULGA	C	OSOLL	D
NULEY	B	OHMAN	A	ONASON, Nongravelly	C	OSOLO	A
NUMA	C	OHOP	C	ONASON	D	OSSIEN	B/D
NUPART	D	OHSCOW	B	ONATE	A	OSSIPEE	D
NUPPER	D	OHTOG	B	ONDABA	B	OSSMER	C

# Exhibit A: Hydrologic Soil Groups for the United States

OST	B	PADEN	C	PANMOD	C	PATRICIA	B
OSTIN	A	PADIGAN	D	PANOLA	D	PATRICK	B
OSTRANDER	B	PADINA	B	PANOR	B	PATRICKSBURG	D
OSWALD	D	PADONIA	C	PANORAMA	B	PATROLE	C
OTANYA	B	PADRES	B	PANTANO, Gravelly	C	PATTANI	D
OTEEN	C	PADRONES	B	PANTANO	D	PATTEE	B
OTEGO	B	PADUCAH	B	PANTEGO	B/D	PATTENBURG	B
OTERODRY	B	PADWET	B	PANTERA	B	PATTERSON	C
OTHELLO	C/D	PADWOOD	B	PANTEX	C	PATTIWAY	C
OTHELLO, Very Wet	D	PAGARI	B	PANTON	D	PAULDING	D
OTISVILLE	A	PAGELAND	C	PAOLA	A	PAULSON	B
OTOE	D	PAGESPRINGS	D	PAPAA	D	PAUMALU	B
OTOMO	D	PAGINA	C	PAPAC	C	PAUPACK	D
OTOOLE	C	PAHLOW	B	PAPAGUA	C	PAUSANT	B
OTTERHOLT	B	PAHOKEE	B/D	PAPAI	A	PAUWELA	B
OTTERSON	A	PAHRANGE	C	PAPALOTE	C	PAVAIAI	C
OTTMAR	B	PAHROC	D	PAPASPILA	C	PAVELEK	D
OTTMAR, Very Deep	C	PAHRUMP	C	PAPEEK	D	PAVER	B
OTTOKEE	A	PAHSIMEROI	B	PAPINEAU	C	PAVER, Fan	C
OTTOSEN	B	PAHTO	C	PAQUIN	A	PAWCATUCK	D
OTTUMWA	D	PAHUK	A	PARA	B	PAWHUSKA	D
OTWAY	D	PAIA	B	PARADISE	C	PAWLING	B
OTWIN	C	PAIGES	C	PARADISE SPRING	D	PAWTOOT	C
OUACHITA	C	PAILO	B	PARADOX, Clayey	C	PAX	B
OUARD	D	PAINESVILLE	C	PARADOX, Wet	D	PAXVILLE	B/D
OULA	D	PAINT	D	PARAGON	C	PAYNE	C
OUPICO	C	PAINTBRUSH	C	PARAGONAH	D	PAYPOINT	B
OURAY, Cool	A	PAISANO	D	PARAJE	B	PEACHSPRINGS	B
OURAY, Sandy Loam Surface	B	PAJARA	C	PARANAT, Drained, Saline	B	PEAHKE	B
OUSELFAL	D	PAJUELA	B	PARASOL	B	PEARCE	D
OUSLEY	C	PAKA	B	PARCELAS	D	PEARL	B
OUTLAW	D	PAKINI	B	PARCHIN	C	PEARL HARBOR	D
OUTLET	C	PALACID	B	PARDEE	D	PEARLWISE	B
OUTLOOK	C/D	PALACIOS	D	PARDEEVILLE	B	PEARNE	D
OUTPOST	C	PALAFIX	C	PARIATO	D	PEARSONCREEK	B
OVALL	C	PALANUSH	C	PARIDA	B	PEASLEY	D
OVAN	D	PALAPALAI	B	PARISIAN	D	PEASPEAR	D
OVERCUP	D	PALATINE	B	PARKALLEY	B	PEAVINE	B
OVERLAKE	A	PALAU	B	PARKDALE	B	PEAWICK	D
OVERLOOK	B	PALAZZO	B	PARKFIELD	C	PEBBLEPOINT	C
OVERSHUE	B/D	PALERF	C	PARKINSON	B	PECATONICA	B
OVERSIGHT	B	PALINOR	D	PARKS	B	PECKHAM	C
OVIATT	B	PALISADE	B	PARKVIEW	B	PECKISH	D
OVIDCREEK	C	PALISADE, wet	C	PARKVILLE	C	PEDEE	C
OVINA	B	PALIX	B	PARKWOOD	B/D	PEDERNALES	C
OVINGTON	B	PALLS	C	PARLE	C/D	PEDIGO	B/D
OWANKA	C	PALM	C	PARMELE	C	PEDLEFORD	C
OWENTOWN	B	PALM BEACH	A	PAROD	D	PEDREGAL	B
OWINZA	D	PALMAR	D	PARREGO	C	PEDRICK	B
OWLCAN	B	PALMAREJO	C	PARRITA	C	PEDRICKTOWN	D
OWLHOLE	D	PALMER CANYON	B	PARSIPPANY	C/D	PEDRO	C
OWLROCK	D	PALMERDALE	B	PARSNIP	D	PEEBLES	C
OWLSRING	C	PALMETTO	B/D	PARSONS	D	PEEDEE	A
OWSEL	B	PALMICH	B	PARTLOW	D	PEEKO	D
OWYHEE	B	PALMONT	A	PARTOV	D	PEEL	C
OXBOW	C	PALO	D	PARTRIDGE	B	PEERLESS	B
OXFORD	B	PALOBIA	B	PARVIS	B	PEETZ	A
OXHEAD	D	PALODURO	B	PASAGSHAK	C	PEGLEG	C
OXLEY	C	PALOMARIN	B	PASCACK, Moderately Well Drained	B	PEJI	A
OXMAN	B	PALOMAS	B	PASCACK, Smowhat Poorly Drained	C	PEKAY	C
OXY	C	PALOMINO	D	PASCO	C/D	PELAHATCHIE	C
OYHUT	C	PALOS VERDES	C	PASHUA	C	PELAN	B
OYLEN	B	PALOS VERDES, Dry	D	PASO SECO	D	PELATO	D
OZAN	D	PALSGROVE	B	PASQUETTI	D	PELELIU	D
OZETTE	C	PALUXY	B	PASQUOTANK	B/D	PELICAN	B
OZIAS	D	PAMISON	B	PASSAIC	D	PELION	B/D
PAAIKI	B	PAMOA	B	PASTIK	D	PELKIE	A
PAALOA	B	PAMSDEL	C	PASTORPEAK	B	PELLEJAS	B
PAAUHAU	A	PANA	B	PATAHA	C	PELLICER	D
PABLO	D	PANAWEA	D	PATBURN	C	PELTON	B
PACER	B	PANAK	B	PATCHIN	D	PEMBERTON	B
PACHAPPA	D	PANAMAKER	A	PATE	C	PEMI	C
PACHEL	B	PANAMAKER, Flooded	B	PATEL	C	PEN ARGYL	B
PACHNEUM	B	PANAMINT	B	PATELZICK	D	PENAGUL	D
PACIFICO	C	PANDO	B	PATEMOS	B	PENALOSA	C
PACKARD	B	PANDOAH	C	PATENT	B	PENASCO	D
PACKMO	B	PANDORA	B/D	PATEROS	B	PEND OREILLE	B
PACKSADDLE	C	PANDURA	D	PATHFINDER	A	PENDARVIS	C
PACKTRAIL	C	PANE	B	PATILAS	B	PENDEN	B
PACKWOOD	D	PANHANDLE	B	PATILLO	A	PENDER	C
PACO	C	PANHILL	B	PATIOS	A	PENDERGRASS	D
PACTOLUS	A	PANIN	B	PATOS	C	PENDOLA	B
PADDY	D	PANIOTUE	C	PATOUTVILLE	C	PENELAS	D
PADDYKNOB, Stony	A	PANKY	B	PATOUZA	C	PENEY	D
PADDYKNOB	C	PANKY, Clayey	C			PENGILLY	B/D

## Exhibit A: Hydrologic Soil Groups for the United States

PENGRA	C	PETTUS	C	PINEISLAND	C	PLUMCREEK	B
PENINSULA	B	PETTY	B	PINELLAS	B/D	PLUMFIELD	C
PENLAW	C	PETTYJON	B	PINENUT	D	PLUSH	B
PENNARGYL	B	PEVELY	B	PINEOLA	B	PLUTOS	B
PENNEKAMP	D	PEVETO	A	PINERUN	B	POACHIE	B
PENNELL	B	PHALANX	B	PINESPRING	C	POALL	C
PENNEY	A	PHANTOM	C	PINETOP	C	POALL, Cool	D
PENNICHUCK	B	PHAROAH	D	PINETUCKY	B	POARCH	B
PENNING	B	PHEBA	C	PINETUCKY, Graded	C	POBER	B
PENNYCREEK	D	PHELAN	D	PINEVILLAGE	B	POCALLA	A
PENTHOUSE	C	IPHERSON	B	PINEYNECK	B	POCASSET	B
PENWELL	A	PHIFERSON	C	PINEYWOODS	D	POCATELLO	B
PENWOOD	A	PHILBON	D	PINEZ	B	POCATY	D
PENZANCE	C	PHILIPPA	C	PINGREE	D	POCKER	C
PEOH	C/D	PHILIPSBURG	B	PINHOOK	B/D	POCOLA	D
PEOLA	C	PHILLCHER	B	PINICON	B	POCUM	D
PEONE	C/D	PHILLIPS	C	PINKEL	C	PODEN	B
PEORIA	D	PHILLIPSBURG	B	PINKHAM	A	PODMOR	C
PEOTONE	C/D	PHILOMATH	D	PINNEBOG	A/D	PODUNK	B
PEP	B	PHILOMONT	B	PINNOBIE	B	PODUS	C
PEPAL	B	PHING	C	PINNTANK	C	POE	C
PEPIN	B	PHLISS	D	PINONES	D	POGAL	C
PEPOON	D	PHLYNSPA	B	PINOTY	B	POHAKUPU	B
PEPPER	D	PHOEBE	B	PINRIDGE	B	POHOCCO	B
PEPPERBOX	B	PHOENIX	D	PINSRING	C	POINSETT	B
PEPTON	D	PHYS	B	PINTAS	B	POINT	C
PEQUAYWAN	B	PIANKESHAW	B	PINTO	C	POINT ISABEL	C
PEQUEA	B	PIANOHILL	C	PINWHEEL	D	POINTLA	C
PERCELL	B	PIAR	B	PIOCHE	D	POISONHOL	C
PERCHAS	D	PIASA	D	PIONEER	D	POJO	C
PERCHE	B	PICACHO	C	PIPEFLAT	A	POKEGEMA	B
PERCHLAKE	B	PICANTE	D	PIPELINE	D	POKER	C
PERCILLA	D	PICARD	B	PIPPIN	A	POKEY	C
PERCOUN	C	PICEANCE	C	PIPPOD	A	POLALLIE	C
PERDIDO	B	PICKAWAY	C	PIRAPEAK	B	POLANDER	B
PERECHENEY	B	PICKENS	D	PIRD	B	POLAR	B
PERFA	D	PICKETPIN	B	PIRKEY	C	POLAWANA	A/D
PERGRIN	B	PICKNEY	A/D	PIRODEL	B	POLECAT	B
PERICO	B	PICKTON	A	PISCASAW	B	POLETA	C
PERIDA	B	PICKWICK	B	PISCOE	B	POLETAD	B
PERIDGE	B	PICOSA	C	PISGAH	C	POLICH	C
PERIL	D	PICTURE	D	PISMO	D	POLKING	D
PERING	C	PIDCOKE	D	PISTOL	C	POLLARD, High Rainfall	B
PERINOS	C	PIDINEEN	D	PISTOLRIVER	B	POLLARD	C
PERITSA	C	PIE CREEK	D	PITCHER	B	POLLASKY	B
PERKINS	D	PIEDAWN	B	PITCO	D	POLLUX	C
PERKS	A	PIEDMONT	D	PITNEY	C	POLO, Moderate Perm	B
PERLOR	D	PIEGON	B	PITTSGROVE	B	POLO, Moderately Slow Perm	C
PERN	B	PIERCEPARK	B	PITTVILLE	B	POLSON	B
PERNITAS	C	PIERIVER	C	PITVAR	D	POLUM	B
PERQUIMANS	D	PIERKING	D	PITZER	C	POLUMAR	B
PERREAU	B	PIERPONT	C	PIUMPSHA	B	POLVADERO	C
PERRIN	B	PIERRE	D	PIVOT	A	POMAN	C
PERRINE	B/D	PIERRON	D	PIXLEY	D	POMAT, Dry	B
PERRY	D	PIERSONTE	A	PIZENE	B	POMAT	C
PERRYGULCH	D	PIERZ	B	PLACEDO	D	POMERENE	C
PERSANTI	C	PIETOWN	B	PLACER	B	POMERENING	A
PERSAYO	C	PIEZON	B	PLACID	B/D	POMME	B
PERSIS	B	PIGEONROOST	B	PLACK	D	POMO	B
PERSONVILLE	B	PIGTAIL	D	PLAINBO	A	POMONA	B/D
PERT	D	PIKADEN	A	PLAINS	A	POMPONIO	C
PERVINA	B	PIKE	B	PLAINTANK	A	PONCA	B
PESCADO	D	PIKEVILLE	B	PLAINVIEW	A	PONCENA	D
PESCAR	C	PILABO	B	PLANK	C	PONCHA	A
PESHTIGO	C	PILCHUCK	A	PLANKINTON	D	PONCIANO	C
PESKAH	B	PILEUP	B	PLANTATION	B/D	POND CREEK	B
PESO	C	PILGRIMS	B	PLASKETT	D	PONDER	D
PESOWYO	C	PILLERY	B	PLATEA	C	PONDEROSA	B
PETACA	D	PILLIKEN	B	PLATO	C	PONE	B/D
PETAL	C	PILLOT	B	PLATSHER	C	PONINA	D
PETAN	D	PILONI	A	PLATTVILLE	B	PONTOTOC	B
PETCAN	C	PILOT PEAK	D	PLAYMOOR	C/D	PONYCREEK	A/D
PETERMAN, Sandy Substratum, Alkali	C	PILOT ROCK	C	PLAZA	C	PONZER	D
PETERMAN	D	PILOTWELL	B	PLEASANT	C	POOBAA	C
PETERS	D	PILTZ	C	PLEDGER	D	POOCHAM	B
PETERSON	B	PINAL	D	PLEINE	D	POOKALOO	D
PETESCREEK, Stony	B	PINBIT	B	PLEIOVILLE	C	POOKU	B
PETESCREEK, Gravelly	C	PINCHER	C	PLEITO	B	POOLEVILLE	C
PETRIE	C	PINCHOT	B	PLEMONS	B	POORCAL	B
PETROF	B	PINE FLAT	B	PLEV	B	POORHOUSE	D
PETROS	D	PINEAL	D	PLEVNA	D	POORMA	B
PETSPRING	D	PINEDA	D	PLINCO	B	POORMAN	B
PETTIGREW	D	PINEGAP	B	PLOVER	C	POORMAN	D
PETTIJOHN	B	PINEGUEST	B	PLUCK	C	POOSE	D
		PINEHILL	B	PLUMBROOK	B	POPASH	D

## Exhibit A: Hydrologic Soil Groups for the United States

POPHERS	C	PRESA	B	PUROB	D	QUITTER	B
POPLE	B/D	PRESHER	B	PURSLEY	B	QUIVER	B/D
POPSON	B	PRESNAL	B	PUSHMATAHA	C	QUIVERA	C
POQUITA	B	PRESTO	B	PUSTOI	B	QUOMUS	B
PORONTO	C	PREUSS	C	PUTCO	B	QUONAL	B
PORRETT	D	PREUSSRANGE	C	PUTNAM	D	QUOPANT	D
PORRONE	B	PRICE	B	PUTNEY	B	QUOSATANA	D
PORTAGEVILLE	D	PRICECREEK	D	PUTT	C	RABBS	B
PORTAL	B	PRICETOWN	B	PUU LAI	D	RACE	B
PORTALES	B	PRIDHAM	D	PUU MOIWI	B	RACING	D
PORTALTO	B	PRIESTLAKE	B	PUU OO	A	RACKER	A
PORTDICK	B	PRILL	D	PUU OPAE	B	RADER	D
PORTER	B	PRIM	D	PUUKALA	D	RADFORD	B
PORTERFIELD	D	PRIMEAUX	C	PUUONE	C	RADIUM	A
PORTERSPRINGS	B	PRIMGHAR	B	PUYE	C	RADLEY	B
PORTGRAHAM	B	PRINCETON	B	PUZZLECREEK	B	RADNOR	C
PORTHILL	D	PRINEVILLE	C	PYBURN	D	RAFTRIVER	C
PORTIA	C	PRINSBURG	B/D	PYEATT	B	RAFTVILLE	B
PORTILLO	B	PRISONEAR	C	PYLE	B	RAGAMUFFIN	B
PORTINO	C	PRISSEL	A	PYLON	D	RAGGULCH	C
PORTLAND	D	PRITCHARD	C	PYOTE	A	RAGNAR	B
PORTMOUNT	B	PROBERT	B	PYRADY	C	RAGPIE	D
PORTSMOUTH	B/D	PROMONTORY	D	PYRAMID	D	RAHAL	C
PORTVILLE	C	PRONG	C	PYRENEES	C	RAHM	C
PORUM	D	PROPER	A	PYRMONT, Bedrock Substratum	C	RAHWORTH	B
POSEY	B	PROPHETSTOWN	B/D	PYRMONT	D	RAIL	D
POSEYVILLE	C	PROTIVIN	C	PYSHT	C	RAILCITY	A
POSKIN	C	PROUT	C	QENI	C	RAILROAD	C
POSO	B	PROVIDENCE	C	QUADRIA	D	RAINBOLT	C
POSOS	C	PROVIG	C	QUAFENO	C	RAINEY	C
POSSUMTROT	B	PROW	D	QUAGLE	B	RAINIER	C
POST	D	PRUCREE	C	QUAILPRAIRIE	C	RAINO	D
POTAGANNISSING	D	PRUDY	B	QUAILRIDGE	B	RAINS	B/D
POTAMUS	B	PRUE	B	QUAKERTOWN	C	RAINS, Flooded	D
POTATOLAKE	B	PRUITTON	B	QUAKING	B	RAINSBORO	C
POTAWATOMI	C	PRUNIE	D	QUALLA, Dry	B	RAINSVILLE	B
POTCHUB	C	PRYOR	C	QUALLA	C	RAINTUF	B
POTEET	C	PSAMMAQUENTS	D	QUAM	B/D	RAISIO	C
POTELL	B	PSAMMENTS	A	QUANAH	B	RAKANE	C
POTH	C	PSUGA	B	QUANTICO	B	RALDRIDGE	B
POTLATCH	C	PSUYAAH	C	QUARDERER	B	RALORE	D
POTOSI	D	PTARMIGAN	C	QUARLES	D	RALPH	B
POTRATZ	C	PUAPUA	D	QUARTELES	D	RALPHSTON	D
POTRERO	A/D	PUAULU	A	QUARTERBACK	B	RALSEN	D
POTRILLO	B	PUCKUM	D	QUARTERMASTER	C	RAMADERO	B
POTRMOUND	C	PUEBLO	B	QUARTZVILLE	B	RAMAH	B
POTTER	C	PUELZMINE	D	QUATAMA	C	RAMBLA	C
POTTERSVILLE	C	PUERCO	D	QUAY	B	RAMMEL	C
POTTINGER	B	PUGET	C	QUEALMAN	B/C	RAMONA	C
POTTSBURG	C	PUGSLEY, Dry	B	QUEALY	D	RAMOTH	B
POUDRE	D	PUGSLEY	C	QUEBRADA	C	RAMPART	B
POUJADE	B	PUHI	B	QUEENY	D	RAMSDELL	C
POULSBO	D	PUHIMAU	D	QUEETS	B	RANA	D
POUNCEY	D	PUICE	C	QUEMADO	C	RANACKER	D
POVERTY	D	PULA	C	QUENCHEROO	B	RANCE	C
POVERTYFLAT	B	PULANTAT	C	QUENZER	D	RANCHOSECO	D
POVIRT	D	PULASKI	C	QUERC	C	RANCO	D
POWDERHORN	C	PULCAN	B	QUETICO	D	RANDADO	C
POWDERWASH	C	PULEXAS	B	QUEZCAN	C	RANDALL	D
POWEEN	C	PULLMAN	D	QUIBURI	B	RANDCORE	D
POWELL	C	PULLUP	A	QUICKSELL	C	RANDMAN	D
POWER	B	PULPIT	D	QUICKSILVER	D	RANDOLPH	C
POWLEY	D	PULSIPHER	C	QUIDEN	B	RANDS	C
POWLOW	D	PULTNEY	C	QUIENSABE	C	RANDBURG	D
POWMENT	C	PUMEL, Nongravelly	C	QUIERO	C	RANGEE	D
POWVAL	B	PUMEL	D	QUIETUS	C	RANGER	C
POWWAHKEE	B	PUMPHOUSE	B	QUIGG	D	RANKOR	B
POWWATKA	C	PUMPHOUSE, Clayey Subsoil	C	QUIHI	C	RANRUFF	D
POYGAN	D	PUMPKIN	B	QUILCENE	C	RANSECT	C
POZEGA	C	PUNA	A	QUILLAMOOK	B	RANSLO	D
POZO BLANCO	B	PUNALUU	D	QUILLAYUTE	B	RANSOM	B
PRADE	D	PUNG	C	QUILLIAN	C	RANSTEIN	B
PRAIRIE	A	PUNOHU	A	QUIMA	B	RANTOUL	D
PRAIRIECREEK	C	PUNSIT	C	QUIMERA	C	RAPADO	C
PRAIRIEVILLE	B	PUNTA	B/D	QUINAULT	D	RAPATEE	D
PRAMISS	C	PUNTILLA	C	QUINBINS	C	RAPELJE	B
PRATHER	D	PURCELLVILLE	B	QUINCREEK	C	RAPH	B
PRATLEY	C	PURCHASE	C	QUINCY	B	RAPHO	B
PRATT	A	PURCHES	C	QUINLIVEN	C	RAPIDAN	B
PREAKNESS	B/D	PURDIN	C	QUINN	B/D	RAPPAHANNOCK	D
PREATORSON	B	PURETT	B	QUINNEY	C	RAPSON	B
PREGO	A	PURGATORY	C	QUINTO	D	RAQUETTE	B
PRELO	B	PURGATORY, Cool Dry	D	QUIRK	C	RARICK	C
PREMIER	B	PURNELL	D	QUITERIA	B	RARITAN	C
PRENTISS	C	PURNER	D	QUITMAN	C	RASSER	B

## Exhibit A: Hydrologic Soil Groups for the United States

RASSET	B	REDO	A	RENTZEL	C	RINCON	C
RASTER	A	REDPEAK	B	RENVERS	D	RINCONFLAT	B
RASTUS	C	REDPEN	B	RENWASH	B	RINDGE, Drained	C
RATIOPEAK	B	REDPORT	B	RENWICK	B	RINEARSON	B
RATLAKE	D	REDRIDGE	B	REPARADA	D	RINEY	B
RATLEFLAT	B	REDRIM	B	REPKIE	B	RINGLE	B
RATLIFF	B	REDROB	C	REPMIS	C	RINGO	D
RATROOT	D	REDSLIDE	B	REPP	B	RINGWOOD	B
RATSNEST	D	REDSPEAR	D	REPPART	B	RINKER	C
RATSOW	C	REDSPOON	C	RESOOT	C	RINQUIN	C
RATTLER	C	REDSPRINGS	B	RESOTA	A	RIO ARRIBA	D
RATTO	C	REDSPRINGS, Graded	D	RESTON	D	RIO DIABLO	C
RAUB	C	REDSTOE	B	RET, High Elevation	C	RIO FRIO	B
RAUS	C	REDSUN	D	RET	D	RIO GRANDE	B
RAUSTER	C	REDTHAYNE	B	RETAW	D	RIO KING	C
RAUZI	B	REDUN	B	RETEP	B	RIO LAJAS	A
RAVALLI, Bedrock Substratum	B	REDVALE	C	RETSOVER	C	RIO PIEDRAS	B
RAVALLI	D	REDVIEW	C	RETTIB	B	RIOBLANCHO	C
RAVEENWASH	A	REDVINE	C	RETTIB LOAM	B	RIOLINDA	C
RAVEN	A	REDWASH	D	REUTER	C	RIOLOMAS	B
RAVENELL	D	REDWATER	B	REVA	D	RIONUTRIA	C
RAVENNA	C	REED	D	REVEL	C	RIOVISTA	A
RAVENSROOST	B	REEDER	C	REVERE	B/D	RIPGUT	C
RAVIA	C	REEDPOINT	D	REVIT	C	RIPLEY	C
RAWAH	C	REEDSBURG	C	REVLING	B	RIPON	B
RAWLES	B	REEDSCREEK	B	REWOR	D	RIPPLE	B
RAWSON	B	REEDSLAKE	B	REWARD	B	RISBECK	B
RAYBURN	D	REEDWEST	C	REXFORD	C	RISLEY	C
RAYCREEK	B	REEDY	C	REXOR	B	RISUE	D
RAYFORD	C	REEFRIDGE	D	REYAB	B	RISWOLD	B
RAYLAKE	D	REELFOOT	C	REYCREEK	C	RITA	D
RAYNAL	C	REEPO	C	RHEA	D	RITCHEY	D
RAYNOLDSON	B	REESE	C	RHOAMETT	D	RITIDIAN	D
RAYOHILL	C	REESER	C	RHYLOW	B	RITNER	C
RAYPOL	C	REESVILLE	C	RHYMES	A	RITO	B
RAZORBA	B	REEUP	C	RIB	B/D	RITTEL	C
RAZORBACK	D	REFLECTION	B	RIBERA	C	RITTER	B
RAZSUN	D	REGAL	B/D	RIBHILL	B	RITZ	C/D
READLYN	B	REGER	B	RIBRIVER	B	RITZCAL	B
REALLIS	B	REGGAD	A	RICCO	D	RIVALIER	B
REAM	B	REGNAPS	C	RICEBORO	B/D	RIVERBY	A
REAP	D	REGRACIC	D	RICELAKE	B	RIVERDALE	A
REARDAN	C	REHBURG	C	RICES	C	RIVERLOST	B
REAVILLE	C	REHFIELD	B	RICETON, Sandy Substratum	A	RIVEROAD	C
REAVIS	B	REHM	C	RICETON	B	RIVERSIDE	A
REBA	C	REHOBETH	D	RICEVILLE	C	RIVERTON	B
REBECCA	B	REICESS	B	RICH	C	RIVERVIEW	B
RECK	D	REILLY	A	RICH, Wet	D	RIVERWASH	A
RECKLOR	C	REINACH	B	RICHARDVILLE	B	RIVIERA, Limestone Substratum	B/D
RED BAY	B	REINECKE	B	RICHFIELD	C	RIVIERA	D
RED BLUFF	B	REINER	B	RICHFORD	A	RIXON	C
RED HILL	B	REINHART	D	RICHSUM	B	RIZ	D
RED HOOK	C	REIS	D	RICHVIEW	C	RIZNO	A
RED SPUR	B	REK	C	RICHWOOD	B	ROACHA	C
REDARROW	D	REKIMA	D	RICKETTS, Nonstony	B	ROADMASTER	D
REDBELL	B	RELAN	B	RICKETTS	C	ROANE	C
REDBIRD	B	RELEEP	B	RICKMAN	C	ROANHIDE	C
REDBOW	C	RELFE	A	RICKMORE	C	ROARING	B
REDBUD	C	RELIZ	D	RICKREALL	D	ROATCAP	B
REDCAMERON	D	RELYEA	B	RICKS	A	ROBAGO	B
REDCANYON	B	REMBERT	D	RICOT	C	ROBANA	B
REDCAP	B	REMEDIOS	C	RIDENBAUGH	D	ROBBS	D
REDCHIEF	C	REMLAP	C	RIDGE	B	ROBBS CREEK	C
REDCLOUD	B	REMMEL	B	RIDGELAND	B/D	ROBOCO	C
REDCO	D	REMMIT	B	RIDGELAWN, wet	D	ROBER	C
REDCREEK	C	REMOUNT	A	RIDGELITE	D	ROBERTSDALE	C
REDDALE	D	REMSEN	D	RIDGEVIEW	D	ROBERTSVILLE	D
REDDIES	B	REMUS	B	RIDGEWOOD	C	ROBINETTE	B
REDFIELD	B	REN	D	RIDIT	C	ROBINLEE	C
REDFIELD, Wet	C	RENCALSON	C	RIDLEY	C	ROBOLATA	C
REDFIST	C	REND	B	RIEDEL	C	ROCHELLE	C
REDFLAME	B	RENOVY	B	RIEDTOWN	C	ROCHEPORT	B
REDFLAT	B	RENEGADE	D	RIESEL	C	ROCHER	B
REDHOOK	A	RENFROW	D	RIFT	C	ROCHPAH	D
REDIG	B	RENHA	C	RIGA	D	ROCK OUTCROP	D
REDLAKE	D	RENICK	D	RIGDON	C	ROCKABIN	C
REDLEVEL	C	RENNER	B	RIGGSVILLE	C	ROCKBLUFF	A
REDLOCK	B	RENNIE	D	RIGOLETTE	C	ROCKCASTLE	D
REDLODGE	D	RENOX	B	RILEY	B	ROCKCUT	B
REDMANSON	B	RENSHIGH	B	RILLA	B	ROCKDALE	A
REDMORE	C	RENSSELAER	C	RILLOSO	A	ROCKDAM	A
REDMOUNT	B	RENTHIN	D	RIMINI	A	ROCKERS	C
REDNIK	B	RENTILL	B	RIMROCK	D	ROCKFIELD	B
REDNIK, Nonstony	C	RENTON	C/D	RIMTON	C	ROCKFORD	B
REDNUN	C	RENTSAC	C	RIN	B		

## Exhibit A: Hydrologic Soil Groups for the United States

ROCKHILL	D	ROSELLE	C	RUNGE	B	SALERNO	B/D
ROCKHOUSE	A	ROSENBROCK	D	RUNLETT	B	SALGA	C
ROCKLIN	D	ROSENDALE	D	RUPLE	C	SALINAS	D
ROCKMILL	C/D	ROSENWALL	C	RUPLEY	A	SALINE=SODIC	A
ROCKO	B	ROSESPRING	B	RUPRECHT	D	SALISBURY, High Elevation	D
ROCKOA	B	ROSEWOOD	D	RUSBACH	A	SALIX	B
ROCKPENS	B	ROSHE SPRINGS	C/D	RUSHCREEK	B	SALKUM	B
ROCKRUN	B	ROSHOLT	B	RUSHFORD	B	SALLYANN	C
ROCKSAN	C	ROSINE	B	RUSHLAKE	A	SALMON	B
ROCKY FORD	C	ROSLYN	B	RUSHMORE	B/D	SALONIE, Moderately wet	C
ROCKYBAR	B	ROSMAN	B	RUSHRIVER	B/D	SALT CHUCK	A
ROCKYBROOK	B	ROSS	B	RUSHTOWN	A	SALT FLAT	D
RODAD	D	ROSSMOOR	B	RUSHVILLE	D	SALTCREEK	C
RODELL	D	ROSSMOYNE	C	RUSKTOWN	B	SALTERY	D
RODEN	D	ROSSPEAK	B	RUSO	B	SALTILLO	C
RODEO	D	ROSSVILLE	B	RUSSLER	C	SALTINE	C
RODESSA	D	ROSWELL	A	RUSTIGATE	C	SALTON	D
RODIE	B	ROSY	B	RUSTLERPEAK	C	SALUDA	C
RODNEY	D	ROTAMER	B	RUSTY	B	SALVISA	C
RODROF	D	ROTAN	C	RUSTYBUTTE	B	SALZER, Protected	C
ROELLEN	D	ROTHICAN	B	RUTERSVILLE	C	SAMARIA	B
ROEMER	C	ROTHSAY	B	RUTHERFORD	C	SAMBA	D
ROGAN	B	ROTNOM	B	RUTLAND	C	SAMBRITO	B
ROGERSON	D	ROTTULEE	C	RYALLEN	D	SAMINIAGO	C
ROGGER	B	ROTURA	B	RYAN	D	SAMOIST	D
ROGRUBE	B	ROUEN	B	RYARK	B	SAMOR	D
ROHAN	D	ROUGH CREEK	D	RYCO	D	SAMSIL	D
ROHNERVILLE	B	ROUND BUTTE	D	RYDOLPH	C	SAN ANDREAS	B
ROHONDA	C	ROUNDBOUT	C	RYEGATE	C	SAN ANTON	B
ROHRBECK	B	ROUNDBARN	B	RYELL	D	SAN ANTONIO	C
ROHRERSVILLE	D	ROUNDHEAD	B/D	RYER	C	SAN BENITO	B
ROJO	C	ROUNDOR	C	RYKER	B	SAN GERMAN	D
ROLETTE	C	ROUNDUP	C	RYORP	C	SAN ISABEL, Stony	A
ROLFE	C/D	ROVAL	D	RYUS	B	SAN ISABEL, Cobbly	B
ROLIE	D	ROWDEN	C	SAAR	C	SAN MIGUEL	D
ROLLA	C	ROWDY	B	SABANA	D	SAN RAFAEL	B
ROLLAWAY	D	ROWE	D	SABANA SECA	D	SAN SEBASTIAN	B
ROLLINGSTONE	C	ROWEL	D	SABENYO	B	SAN SIMEON	D
ROLLINS	A	ROWENA	C	SABIES	C	SAN YSIDRO	D
ROLO	B	ROWLAND	C	SABINA	C	SANBEE, Thin	A
ROMAN	B	ROWLEY	C	SABINE	A	SANBEE	B
ROMANOSE	D	ROXAL	D	SACATAR	B	SANBORG	D
ROMBERG	C	ROXANA	B	SACH	C	SANBORN	C
ROMBO	D	ROXER	B	SACKETT	B	SANBURN	B
ROME	B	ROXTON	D	SACO	D	SANCAJO	C
ROMEO	D	ROYCE	C	SACTUS	D	SANDBERG	A
ROMGAN	C	ROYERTON	B	SACVILLE	D	SANDBRANCH	B
ROMINE	B	ROYSTONE	B	SADDLEBUNCH	D	SANDBUR	A
ROMINELL	C	ROZARA	D	SADDLEBUTTE	D	SANDCREEK	D
ROMNELL	B/D	ROZELLVILLE	B	SADDLEPEAK	B	SANDERSON	B
ROMONA	D	ROZLEE	C	SADIE	C	SANDHILL	B
ROMOUND	C	RUBBLE LAND	A	SADLER	C	SANDIA	B
ROMSTOCK	B	RUBICITY	B	SADORUS	D	SANDOSE	A
RONAN	D	RUBIO	C/D	SAEMO	B	SANDOVER	A
ROND	C	RUBSON	B	SAFETY	B	SANDOW	C
RONDELL	B	RUBY	B	SAGANING	A/D	SANDRIDGE, Alkali	A
RONEY	C	RUBYCREEK	B	SAGASER	B	SANDSPRING	B
RONNEBY	C	RUBYLAKE, Strongly Saline	C	SAGE	D	SANDUN	B
RONSON	B	RUBYLAKE	D	SAGECREEK	B	SANDUSKY	D
ROOKS	B	RUCHEZ	C	SAGEDALE	C	SANDVIEW	B
ROONEY	D	RUCKER	B	SAGEHEN	D	SANDWASH	C
ROOP	B	RUDDLEY	D	SAGERTON	C	SANDWICK	B
ROOSET	C	RUDEEN	C	SAGEVALLEY	B	SANDY POINT	D
ROOSTERCOMB	C	RUDO	B	SAGLE	C	SANFECO	C
ROOT	B/D	RUDYARD	D	SAGLEY	B	SANFELIPE	B
ROOTEL	C	RUEDLOFF	B	SAGO	D	SANGO	C
ROPER	B/D	RUELLA	B	SAGOUSPE	B/C	SANHEDRIN	B
ROQUES	D	RUESH	B	SAHALIE	B	SANHUD	B
ROSALIE	B	RUGAR	C	SAHAPTIN	D	SANILAC	B
ROSAMOND	C	RUGLES	B	SAHKAHTAY	B	SANJE	B
ROSARIO	C	RUINS, Thick Surface	A	SAHUARITA	B	SANKEY	C
ROSCED	B	RUINS	C	SAID	B	SANKLUNA	B
ROSCHENE	C	RUIZ	A	SAILBOAT	B/C	SANLOREN	B
ROSE VALLEY	D	RUMA	B	SAILES	B	SANOSTEE	C
ROSEBERRY, Sandy Substratum	C	RUMBO	C	SAIN	B	SANPITCH	C
ROSEBERRY, Drained	D	RUMFORD	B	SAKAKAWEA	B	SANSARC	D
ROSEBRIAR	D	RUMLEY	B	SAL	D	SANTA	C
ROSEBURG	B	RUMNEY	C	SALADAR	D	SANTA CLARA	C
ROSEDALE	A	RUMPAH	D	SALAL	C	SANTA ISABEL	D
ROSEDHU	B/D	RUMPELTEASER	D	SALAMANCA	B	SANTA LUCIA	C
ROSEGLEN	B	RUMPLE	C	SALAMATOF	D	SANTA MARTA	C
ROSEHAVEN	B	RUMSEY	B	SALANDER	B	SANTANELA, Alkali	D
ROSEHILL	D	RUMUNG	C	SALCO	B	SANTAQUIN	A
ROSELAND	B	RUNCLINT	C	SALCREEK	C	SANTAROSA, Flooded	B
ROSELLA	D	RUNE	C	SALEM	B	SANTEE	D

## Exhibit A: Hydrologic Soil Groups for the United States

SANTEETLAH	B	SAYNER	A	SEBAGO	D	SHADELEAF	C
SANTIAGO, Moderate Perm	B	SCALEROCK	C	SEBASTIAN	D	SHADEVILLE	B
SANTIAM	C	SCALLEY	B	SEBASTOPOL	C	SHADILTO	D
SANTO	B	SCALPCREEK	B	SEBBO	B	SHADOVAL	D
SANTONI	D	SCAMMAN	D	SECCA	C	SHADY	B
SANTOP	B	SCANDARD	C	SECHLER	B	SHADYGROVE	C
SANTUC	C	SCAPONIA	B	SECO	C	SHADYPASS	A
SANWELL	B	SCAR	B	SECONDCREEK	D	SHAFFTON	B
SANYON	D	SCAREDMAN	B	SECREPASS	D	SHAFTER	D
SAPEHA	B	SCARFACE	B	SECRET	C	SHAG	D
SAPINERO, Cool	B	SCARPER	C	SECRET CREEK	B	SHAGNASTY	C
SAPKIN	C	SCARUL	B	SECTION	B	SHAKAMAK	C
SAPPHO	B	SCATLAKE	D	SED	C	SHAKAN	C
SARA	D	SCATTERSVILLE	D	SEDALE	D	SHAKESPEARE	C
SARAGOSA	B	SCHAFFER	D	SEDALIA	C	SHAKOPEE	C
SARAGOTE	C	SCHAFFER	C	SEDFIELD	C	SHALAKE	C
SARAHSVILLE	D	SCHALLER	A	SEDGWICK	D	SHALBA	D
SARAZAN	B	SCHALOW	B	SEDONA	D	SHALCLEAV	D
SARBO	B	SCHATTEL	C	SEDROWOLLEY	C	SHALONA	B
SARCILLO	D	SCHAINER	A	SEEBURG	A	SHALPER	D
SARDINIA	C	SCHERRARD	D	SEEDSKADEE	D	SHAM	D
SARDIS	C	SCHIEFFLIN	D	SEEG	B	SHAMEL	B
SARGEANT	D	SCHILLER	B	SEELEZ	A	SHAMIZO	A
SARILDA	C	SCHISLER	C/D	SEELOVERS	C	SHAMOCK	C
SARITA	A	SCHLOMER	C	SEES	C	SHANDEP	B/D
SARKAR	D	SCHNEBLY	D	SEEWEE	B	SHANE	D
SARNOSA	B	SCHNOORSON, Drained	C	SEFERINO	B	SHANGHAI	B/C
SARTELL	A	SCHNORBUSH	B	SEGNO	C	SHANGLAND	B
SARUCHE	D	SCHODSON	C	SEGUIN	B	SHANKBA	D
SASALAGUAN	C	SCHOER	C	SEGUNDO	B	SHANKLER	A
SASPAMCO	B	SCHOLTEN	C	SEHARNEY	D	SHANKS	C
SASSER	B	SCHOODIC	D	SEHOME	C	SHANLEY	B
SATAGO	D	SCHOOLCRAFT	B	SEIS	C	SHANNONDALE	C
SATANKA	C	SCHOOLER	D	SEJITA	D	SHANTOWN	A
SATATTON	D	SCHOOLEY	D	SEKIL	B	SHANTY	D
SATELLITE	C	SCHOOLHOUSE	D	SEKIU	D	SHAR	C
SATILLA	D	SCHOONER	D	SELBIT	B	SHARATIN	B
SATIN	C	SCHRIEVER	D	SELDEN	C	SHARESNOUT	C
SATSOP	B	SCHROCK	B	SELDOVIA	B	SHARLAND	B
SATSUMA	C	SCHULENBURG	B	SELFRIDGE	B	SHARON	B
SATT	C	SCHULINE	B	SELIA	C	SHARPS	C
SATURDAY	B	SCHUTZ	B	SELLE	B	SHARPSHOOTER	B
SATURN	D	SCHWACHEIM	D	SELLERS	B/D	SHARPTOWN	C
SAUCEL	B	SCHWALBE	B	SELMAN	B	SHARROTT	D
SAUCIER	C	SCIOTA	C	SELON	B	SHARVANA	C
SAUCITO	D	SCIOTOVILLE	C	SELOW	D	SHASER	B
SAUCON	B	SCIPIO	D	SELT	B	SHASKIT	C
SAUGATUCK	C	SCITICO	C	SELWAY	B	SHASTA	B
SAUGUS	B	SCLOME	C	SEMIAMMOO	C/D	SHASTACOSTA	C
SAUK	B	SCOAP	B	SEMINOLE	D	SHASTINA	B
SAUM	B	SCOBA	B	SEMPER	C	SHATTA	C
SAURIN	C	SCOGGIN	D	SEN	B	SHATTUCK	B
SAUTER	B	SCONSIN	B	SENACHWINE	B	SHAVASH	C
SAUVIE, Protected	B	SCOTAL	D	SENGTOWN	B	SHAVER	B
SAUVIE, Moderately Wet	C	SCOTCH	D	SENLAR	C	SHAWA	C
SAUVIE	D	SCOTCO	A	SENTINEL	B	SHAWANO	A
SAUVOLA	C	SCOTMONT	B	SEQUATCHIE	B	SHAWAVE	B
SAUXHEAD, Very Stony	D	SCOTT LAKE	B	SEQUIM	A	SHAWMOUNT	B
SAUZ	B	SCOTTCAS	B	SEQUITE	D	SHAWTOWN	B
SAVAGETON	D	SCOTTSBURG	C	SEQUOIA	C	SHAYLA	D
SAVANNAH	C	SCOTTSVILLE	C	SERDEN	A	SHEBANG	D
SAVAR	B	SCRANTON	A/D	SEROCO	A	SHEBEON	C
SAVENAC	C	SCRIVER	B	SERPEN	C	SHEDD	C
SAVO	C	SCROGGIN	C	SERPENTANO	B	SHEDDENBROOK	A
SAVOIA	B	SCUFFE	C	SERPOD	C	SHEEK	B
SAVONA	C	SCUPPERNONG	D	SERRANO	D	SHEEPCAN	B
SAW	B	SEABOARD	B	SESAME	C	SHEEPSKIN	B
SAWABASH	B/D	SEABROOK	C	SESPE	C	SHEFFLEIN	B
SAWABE	D	SEAFIELD	B	SESSIONS	B	SHELBYVILLE	B
SAWATCH, Gravelly	B/D	SEAFORTH	B	SESSUM	D	SHELD	B
SAWBUCK, Shale Substratum	C	SEAGATE	A/D	SETILL	C	SHELLBLUFF	B
SAWCREEK	C	SEAGOVILLE	D	SETNUM	C	SHELLCREEK	C
SAWDUST	B	SEAGRAVES	B	SETTERS	C	SHELLDRAKE	A
SAWLIT	C	SEALY	B	SETTERS	D	SHELLROCK	A
SAWPEAK	B	SEAQUEST	B	SETTLEMAYER	B	SHELLWOOD	B
SAWTELL	C	SEAR	B	SEVAL	C	SHELTER	D
SAWTELPEAK	D	SEARCH	B	SEVAR	C	SHELTON	C
SAWTOWN	C	SEARCHLIGHT	B	SEVENOAKS	A	SHENA	D
SAWYER	C	SEARCY	C	SEVERN	B	SHENANDOAH	D
SAX	D	SEARING	B	SEWANEE	B	SHENANGO	C
SAXON	C	SEARVAR	B	SEWELL	C	SHENON	B
SAY	B	SEASIDE	D	SEYMOUR	C	SHEP	B
SAYDAB	C	SEATTLE	C/D	SEZNA	D	SHEPAN	C
SAYERS	A	SEAVERSON	D	SHAAK	C	SHERAR	C
SAYLES	D	SEAWILLOW	B	SHACK	B	SHERBURNE	C

## Exhibit A: Hydrologic Soil Groups for the United States

SHERLOCK	B	SHULLSBURG	C	SIRRETTA	C	SLOCUM, Moist	D
SHERM	D	SHUMBEGAY	B	SISKIYOU	B	SLODUC	D
SHERMORE	B	SHUMLA	B	SISLEY	B	SLUICE	C
SHERMOUNT	D	SHURLEY	A	SISSABAGAMA	A	SLUKA	C
SHEROD	C	SHUSHUSKIN	C	SISSETON	B	SLY	B
SHERRY	B/D	SI	C	SITAR	B	SMACKOUT	B
SHERRY, Stony	D	SIBANNAC	D	SITKA	B	SMALLCONE	D
SHERRYL	B	SIBELIA	B	SIWASH	D	SMEDLEY	D
SHERVAL	C	SIBLEY	B	SIWELL	C	SMELTER	C
SHERWIN	D	SIBLEYVILLE	B	SIXES	B	SMESTAD	C
SHERWOOD	B	SIBOLD	C	SIXMILE, Loamy	B	SMIDALE	B
SHEVA	C	SICKLES	B/D	SIXMILE, Stony	C	SMILEYVILLE	D
SHEZA	C	SICKLESTEETS	B	SKAGEN	C	SMINA	C
SHIAWASSEE	C	SIEBERELL	B	SKAGIT	D	SMITH	B
SHIELDS	C	SIEBERT	A	SKAGWAY	C	SMITHBORO	D
SHIFFER	B	SIECHE	C	SKAMANIA	B	SMITHDALE	B
SHILLA	B	SIEGEL	C	SKAMO	C	SMITHLAND	B/D
SHILLING	B	SIERRA	B	SKEEL	B	SMITHNECK	B/C
SHILLY	C	SIERRAVILLE	B	SKEIN	D	SMITHTON	D
SHIMA	C	SIERRAVISTA	B	SKELIDA	B	SMITHVILLE	B
SHIMMON	C	SIESTA	D	SKELLOCK	B	SMITHWICK	D
SHINAKU	D	SIEVERS	C	SKELTER	B	SMOKEY	B
SHINANDO	D	SIGBIRD	D	SKELTON	B	SMOKEYHILL	C
SHINBONE	B	SIKESTON	B/D	SKETERVILLE	C	SMOLAN	C
SHINDLER	C	SILAWA	B	SKIBO	B	SMOTHERS	C
SHINER	C	SILCAT	D	SKIDMORE	B	SMOUT	B
SHINGLEMILL	D	SILCOX	B	SKILAK	B	SMYRNA	B/D
SHINGLETOWN	B	SILENT	D	SKIME	A	SNACREEK	C
SHINGLETOWN	C	SILER	B	SKINNER	B	SNAG	B
SHINKEE	C	SILERTON	B	SKINWOOD	B	SNANOPISSH	B
SHINNPEAK	D	SILESCA	C	SKIPANON	B	SNAKE	C
SHIOYA	A	SILETZ	B	SKIPEAK	B	SNAKEJOHN	B
SHIPLEY	C	SILEX	D	SKIPOPA	D	SNAKELUM	B
SHIPPA	D	SILHOUETTE	B	SKIYOU	B	SNAKER	D
SHIPS	D	SILICO	D	SKOKOMISH	C/D	SNAPPEED	C
SHIPSHE	B	SILKIE	D	SKOLY	B	SNAPILL	B
SHIRCLIFF	C	SILSBEE	B	SKOOKER	B	SNAVEE	B
SHIRED	D	SILSTID	A	SKOOKUM	C	SNEFFELS	C
SHIRK	C	SILVA	C	SKOOKUMHOUSE	B	SNELBY	C
SHIRLEY	B	SILVER CREEK	D	SKOVEN	D	SNELLMAN	B
SHIRLEYBASIN	B	SILVERBELL	C	SKOWHEGAN	B	SNETTISHAM	D
SHIRO	C	SILVERCITY	B	SKRANKA	B	SNIDER	C
SHIRTS	C	SILVERDALE	A	SKULL CREEK	C	SNIDERPEAK	B
SHIRTTAIL	B	SILVERHILL	B	SKULLGULCH	C	SNILEC	B
SHIVA	B	SILVERHORN	C	SKULLWAK	D	SNILLOC	B
SHIVLUM	B	SILVERKING	B	SKUNKFARM	D	SNOOK	D
SHOAT	C	SILVERLAKE	C	SKYBERG	C	SNOPOC	B
SHOBA	D	SILVERN	A	SKYHAVEN	C	SNOQUALMIE	C
SHOBAN	B	SILVERSTRIKE	C	SKYHAWK	C	SNOTOWN	B
SHODDY	D	SILVERTON	C	SKYLIGHT	D	SNOWBRIER	C
SHOEBEND	B	SIMANNI	B	SKYLINE	D	SNOWCREEK	C
SHOEGAME	B	SIMCOE	C	SKYMOR	C	SNOWDANCE, Moderately Wet	B
SHOEMAKER	B	SIMEON	A	SKYROCK	D	SNOWDANCE	D
SHOEPAC	C	SIMESCREEK	A	SKYTOP	B	SNOWDON	C
SHOEPEG	C	SIMITARQ	D	SKYUKA	B	SNOWLAKE	B
SHOHOLA	C	SIMMONT	C	SKYVIEW	C	SNOWFLOW	B
SHOKEN	D	SIMONA	D	SLAB	D	SNOWSHOE	B
SHONGO	C	SIMONIN	B	SLABTOWN	B	SNOWVILLE	D
SHONKIN	D	SIMPARK	D	SLACREEK	B	SOAKPAK	B
SHONTIK	C	SIMPATICO	B	SLACWATER	B/D	SOAPCREEK	C
SHOOFLIN	D	SIMPER	C	SLAPJACK	B	SOBEGA	C
SHOOFLY	D	SIMSFIELD	C	SLATEGOAT	B	SOBSON	C
SHOOKER	C	SINAMOX	B	SLATERY	C	SOCAGEE	D
SHORE	B	SINBAD	D	SLATTER	D	SOCO	B
SHOREEK	C	SINCLAIR	C	SLAUGHTER	C	SODA LAKE	C
SHORT CREEK	C	SINDION	B	SLAUGHTERVILLE	B	SODABAY	B
SHORTBREAD	A	SINGERTON	B	SLAWHA	C	SODACREEK	B
SHORTCUT	C	SINGH	B	SLAYTON	D	SODASPRING	B
SHORTHAIR	D	SINGLETON	D	SLEEPER	C	SODERVILLE	A
SHORTHORN	D	SINGLETREE	B	SLEETH	B	SOELBERG	B
SHOSHONE	C	SINKER	C	SLICKEAR	B	SOEN	C
SHOTGUN	C	SINONA	B	SLICKLOG	B	SOFA	C
SHOWALTER	B	SINTON	B	SLICKPOO	B	SOFTBACK	B
SHOWLOW	D	SINUK	D	SLICKSPOTS	D	SOGI	C
SHREE	B	SION	B	SLIDE	B	SOJOURN	D
SHREWDER	B	SIOMUXCREEK	C	SLIDECAMP	C	SOJUR	D
SHREWSBURY	C/D	SIouxON	B	SLIDECREEK	B	SOKOLOF	A
SHROE	C	SIPAPU	D	SLIDELL	D	SOLARVIEW	D
SHROUTS	D	SIPHONCAN	D	SLIDYMTN	D	SOLDATNA	B
SHROYTON	A	SIPHONLAKE	B	SLIGHTS	C	SOLDIER	C
SHRUBCREEK	B	SIPPLE	B	SLIMBUTTE	B	SOLDIERCREEK	B
SHUBUTA	C	SIPSEY	B	SLIMLAKE	B	SLODUC	B
SHUE	C	SIRDRAK	A	SLINGER	B	SOLIER	D
SHUKSAN	C	SIREN	C	SLOCAGE	D	SOLIS	C
SHULE	C	SIRREF	D	SLOCUM	C	SOLITE	B/D

## Exhibit A: Hydrologic Soil Groups for the United States

SOLITUDE	D	SPIKE	B	STAINKY	B	STIVERSVILLE	B
SOLLEKS	C	SPILLCO	B	STAKE	C	STOCKDRIVE	C
SOLLER	D	SPILLER	C	STALEY	B	STOCKEL	D
SOLNESS	C	SPILOCK	D	STALLARD	D	STOCKHOLM	C
SOLO	C	SPILYAY	C	STALLINGS	C	STOCKLAND	B
SOLSBERY	C	SPINDLETOP	D	STAMFORD	D	STOCKPEN	D
SOLVAY	D	SPIRES	B	STANDISH	C	STOHLMAN	D
SOMA	D	SPIRES	D	STANDISH	D	STOKES	D
SOMBORDORO	D	SPIRO	B	STANDUP	B	STOKLY	B
SOMBRERO	C	SPLANOD	D	STANEY	D	STONEBERGER	D
SONAHNPIL	B	SPLAWN	C	STANFLOW	C	STONEBURG	B
SONNETT	D	SPLENDORA	C	STANHOPE	C	STONEHEAD	C
SONOCAN	C	SPLIT	C	STANISLAUS	C	STONEHILL	C
SONOMA, Stratified Substratum	D	SPLITBUTTE	C	STANISLAUS, Wet	D	STONELAKE	A
SONORA	B	SPLITROCK	B	STANROD	C	STONER	B
SONSELA	B	SPLITTOP	C	STAPALOOP	B	STONEVILLE	B
SONTAG	D	SPLITTER	D	STARGLUCH	B	STONEWALL	C
SONYOK	D	SPOKEL	B	STARHOPE, Low Elevation	C	STONEWELL	A
SOO	C/D	SPONIKER	B	STARHOPE	D	STONO	B/D
SOOLAKE	B	SPONIKER, Warm	C	STARICHKOF	D	STONYBROOK	B
SOONAHBE	B	SPONSOR	B	STARKE	D	STOOKMOOR	C
SOONAKER	C	SPOOL	C	STARKEY	C	STOPATOE	C
SOONER	B	SPOONER	C/D	STARLAKE	D	STORMKING	B
SOOPER	D	SPOONERHILL	A	STARLITE	B	STORNETTA	D
SOOSAP	C	SPORLEY	B	STARR	C	STOTT	C
SOPELA	D	SPOT	A/D	STARVEOUT	B	STOUGH	C
SOPER	C	SPOTSYLVANIA	C	STASER	B	STOVALL	B
SOPERTON	B	SPOTTEDHORSE	C	STASH	D	STOVEPIPE	D
SOPHER	C	SPOTVILLE	B	STATE	B	STOVHO	C
SOQUEL	B	SPRABAT	B	STATELINE	D	STOWELL	D
SORENSEN	B	SPRAUER	C	STATEMEADOW	B	STOY	C
SORF	C	SPRAY	B	STATION	C	STRABER	C
SORTER	D	SPRECKELS	C	STATLER	B	STRADDLEBUG	C
SORUM	D	SPRING	C	STATZ	D	STRAHLE	D
SOSA	C	SPRINGCOVE	C	STAVELY	B	STRAIGHT	C
SOSTIEN	D	SPRINGCREEK	C	STAYTON	D	STRANDLINE	B
SOUDAN	C	SPRINGERTON	B/D	STEADMAN	C	STRANDQUIST	B/D
SOURDOUGH	B	SPRINGFIELD	D	STEAMBOAT	B	STRAWBCREK	B
SOUTHAM	D	SPRINGGULCH	B	STEAMBURG	B	STRAYHOSS	B
SOUTHFORK	D	SPRINGHILL	B	STEARNS	D	STREATOR	B/D
SOUTHGATE	D	SPRINGHOLLOW	C	STECOAH	B	STRELL	D
SOUTHHAVEN	B	SPRINGLAKE	A	STECUM	C	STRELSA	C
SOUTHMOUNT	B	SPRINGSTEEN	C	STEED	B	STREULING	D
SOUTHPAC	B	SPRINGWARM	C	STEEDMAN	C	STRICKER	B
SOUTHPLAINS	D	SPRINGWATER	C	STEEKEE	C	STRICKLAND	C
SOUTHRIDGE	B	SPRINGWOOD	B	STEELE	C	STRINGLEY	B
SOUTHWELLS	A	SPRINKLER	C	STEESE	B	STRINGTOWN	B
SOUTHWEST	C/D	SPRIPAR	D	STEEVER	B	STRINGTOWN, Graded	C
SOUTIN	B	SPROUL	D	STEFF	C	STROLE	C
SOWARD	B	SPRUCEDALE	D	STEGALL	C	STROM	C
SOWCAN	C	SPUD	C	STEILACOOM	C	STROMAL	B
SPADE	B	SPUKWUSH	B	STEIN	C	STRONGHOLD	C
SPADRA	B	SPUR	B	STEINHATCHEE	B/D	STRONGHURST	B
SPAINHOWER	C	SPURGER	C	STEINSBURG	B	STROUPE	C
SPANAN	D	SPURLOCK	B	STEIWER	C	STROUT	C
SPANG	B	SQUALICUM	B	STELLA	C	STROZI	C
SPANGLER	C	SQUALLY	B	STEMLEY	C	STRUGGLE	A
SPANPEAK	B	SQUAMSCOTT	C	STENGEL	B/D	STRYKER	C
SPANTARA	B	SQUAWCAVE	B	STEPHEN	C	STU	C
SPARGUS	B	SQUAWCREEK	D	STERLING	A	STUBBS	C
SPARKS	C	SQUAWTIP	C	STERLINGTON	B	STUBENVILLE	B
SPARTA	B	SQUAWVAL	C	STERRETT	D	STUCK	C
SPAASSKI	D	SQUIRES	C	STETSON	B	STUDEBAKER	B
SPEAKER, High Rainfall	B	SREDNIC	C	STETTER	D	STUKEL, Cobbly	B
SPEAKER	C	ST. ANDREWS	C	STEUBEN	B	STUKEL, Sandy	C
SPEAR	C	ST. ANTHONY	B	STEVENSON	B	STUKEL	D
SPEARHEAD	B	ST. AUGUSTINE	B	STEVIE	B	STULTZ	C
SPEARMAN	B	ST. ELMO	A	STEWART	D	STUMOUNT	D
SPEARVILLE	C	ST. HELENS	B	STICES	B	STUMPP	D
SPECTACLE	C	ST. IGNACE	D	STIDHAM	B	STUNTZ	C
SPECTER	C	ST. JOHNS	D	STIEN	B	STURGEON	B
SPEED	C	ST. LUCIE	A	STIGLER	D	STURGES	D
SPEEDWELL	B	ST. MARTIN	D	STILES	C	STURGILL	D
SPEELYAI	D	ST. NICHOLAS	D	STILGAR	B	STURKIE	B
SPEER	B	ST. ONGE	B	STILLWELL	B	STUTTART	D
SPEIGLE	B	ST. PAUL	B	STILSKIN	C	STUTZMAN	C
SPELLACY	B	ST. MARYS	B	STILSON	B	STUTZMAN, Wet	D
SPELVIN	B	STABBART	D	STIMSON	D	STYERS	D
SPERRY	C/D	STABLER	B	STINE	D	STYLITE	C
SPESSARD	A	STACHER	B	STINESVILLE	B	STYX	B
SPEXARTH	C	STACKER	B	STINGAL	B	SUAK	C
SPICERTON	D	STACKYARDS	B	STINGER	B	SUBACO	D
SPICEWOOD	C	STACY	B	STINKCREEK	D	SUBLETTE, Elevation 7000-9000	A
SPICKERT	C	STAFFORD	C	STIPE	C	SUBLETTE	B
SPIDERCREEK	A/D	STAHL	C	STIRUM	D	SUBLIGNA	B

# Exhibit A: Hydrologic Soil Groups for the United States

SUBRAN	C	SUTPHEN	D	TAFUYA	C	TASCOSA	B
SUBWELL	B	SUTRO	C	TAFU	C	TASSEL CREEK	A
SUCARNOOCHEE	D	SUTTLE	A	TAFTOWN	B	TASSELLMAN	D
SUCCOR	D	SUVER	D	TAFUNA	A	TASSI	D
SUCHES	B	SVERDRUP	B	TAGUM	B	TASSO	B
SUCKERFLAT	B	SWAFFORD	C	TAGUS	B	TATAI	C
SUDLEY	B	SWAGER	C	TAHKENITCH	B	TATERPA	B
SUDPEAK, Nonflooded	C	SWAHLEN	B	TAHOULA	D	TATLUM	D
SUDPEAK, Flooded	D	SWAINTON	B	TAHQUATS	B	TATOUCHE	B
SUEPERT	C	SWALECREEK	B	TAINÉ	D	TATTON	D
SUEY	B	SWAMP CREEK	D	TAINTOR	C/D	TAUMSAUK	D
SUFFIELD	C	SWAMPOODLE	C	TAJO	C	TAUNCAL	C
SUFFOLK	B	SWAMPYDRAW	B	TAKOTNA	B	TAVER	D
SUGAKOOL	B	SWAN	D	TAKPOCHAO	D	TAVERNIER	D
SUGAR BEACH	D	SWANBERGER	D	TALAG	D	TAWAH	B
SUGARBOWL	B	SWANLAKE	B	TALANTE	D	TAWCAW	C
SUGARBUSH	B	SWANNER	D	TALAPUS	B	TAYLOR CREEK	C
SUGARCREEK	C	SWANPOND	C	TALCO	D	TAYLORSFLAT	C
SUGARDEE	B	SWANSON	C	TALLA	C	TEAGARD	D
SUGARTOWN	D	SWANTON	C/D	TALLADEGA	C	TEAGO	A
SUGLO	B	SWANTOWN	D	TALLCREEK	B	TEAGULF	C
SUILOTEM	C	SWANWICK	D	TALLEYVILLE	B	TEAKEAN	B
SUISUN	D	SWARTZ	D	TALLOWBOX	C	TEALSON	D
SUKOI	D	SWAYNE	C	TALLULA	B	TEALWHIT	D
SULA	B	SWEAGERT	B	TALMAGE	B	TEAMONT	D
SULLIVAN	B	SWEATBEE	B	TALMAKS	B	TEARNEY	D
SULOAF	B	SWEATBEE, Wet	C	TALMOON	C	TEASDALE	B
SULPHURA	B	SWEATMAN	C	TALMOON, Depressional	D	TEBAY	B
SULPHURA	D	SWEDE	B	TALOKA	D	TEBO	B
SULSAVAR	B	SWEDEGROVE	B/D	TALQUIN	B/D	TECHICK	B
SULTZ	A	SWEDEHEAVEN	B	TALUWIK	B	TECHICKNOT	B
SUMAN	B/D	SWEDESBORO	B	TAMAHA	D	TECKLA	B
SUMATRA	B	SWEDNA	D	TAMALCO	D	TECO	B
SUMAVA	B	SWEETAPPLE	B	TAMALPAIS	C	TECOPA	D
SUMMERFIELD	D	SWEETBRIAR	B	TAMARA	B	TECTAH	B
SUMMERFORD	C	SWEETBUTTE	B	TAMARACK	B	TECUMSEH	B
SUMMERMUTE	B	SWEETGRASS	B	TAMARACKCANYON	C	TECZUNI	C
SUMMERS	B	SWEETWATER	C	TAMARRON	C	TEDDY	C
SUMMERTON	B	SWEITBERG	D	TAMBA	D	TEEBAR	D
SUMMIT	C	SWENSON	D	TAMELY	B	TEEBONE	C
SUMMITVILLE	C	SWIFT CREEK	B	TAMFLAT	D	TEEDOWN	B
SUMPF	D	SWIFTCURRENT	B	TAMFORD	D	TEEGARDEN	C
SUMPLEY	C	SWIFTON	B	TAMIAMI	D	TEEMAT	B
SUMTERVILLE	C	SWIMLEY	C	TAMMANY	B	TEETERS, Protected	C
SUMYA	D	SWIMS	B	TAMMING	B	TEETERS	D
SUNBURG	B	SWINK	D	TAMP	B	TEFTON	C
SUNBURY	B	SWINOMISH	C	TAMRED	C	TEHRAN	A
SUNCITY	D	SWINT	B	TANACROSS	D	TEIGEN	C
SUNCOOK	A	SWIPKIN	B	TANAHA	C	TEJA	D
SUND	C	SWISBOB	D	TANAMA	D	TEJABE	D
SUNDANCE	B	SWISS	C	TANANA, Thawed	B	TEJANA	B
SUNDAY	A	SWISSVALE	D	TANANA, Moderately Wet	C	TEKAPO	D
SUNEV	B	SWITCHBACK	C	TANAZZA	B	TEKENINK	B
SUNKEN	D	SWITZERLAND	B	TANDY	D	TEKISON	C
SUNLIGHT	D	SWORMVILLE	C	TANEUM	C	TEKLANIKA	A
SUNNY	C	SWYGERT	C	TANGI	C	TEKOA	B
SUNNYHAY	D	SYBIL	B	TANGLE	C	TELA	B
SUNNYSIDE	B	SYBILLE	B	TANGLENOOK	D	TELAQUANA	B
SUNRAY	B	SYBLON	C	TANKERVILLE	C	TELAY	B
SUNRIVER	C	SYCAN	A	TANNAWASHA	B	TELCHER	B
SUNSTROKE	D	SYCLE	B	TANNER	C	TELECAN	B
SUNSWEEP	C	SYCREEK	C	TANNER, Low Rainfall	D	TELEFONO	C
SUNTRANA	D	SYKES	B	TANOAN	B	TELEMON	D
SUP	B	SYLACAUGA	D	TANOB	B	TELESCOPE	A
SUPOSO	C	SYLVA	B/D	TANSEM	B	TELFAIR	C
SUPPAH	A	SYLVANIA	C	TANTALUS	A	TELFERNER	D
SUR	C	SYLVANIAM	C	TANTILE	C/D	TELL	B
SURFSIDE	D	SYLVESTER	B	TANWAX	C/D	TELLER	B
SURGEM	C	SYLVIA	C	TANYARD	C	TELLICO	B
SURPLUS	C	SYMCO	C	TAOPI	B	TEMBLOR	D
SURRETT	C	SYNAREP	B	TAPAWINGO	C	TEMDILLE	A
SURVEYORS	B	SYRETT	B	TAPICITOES	D	TEMESCAL	D
SURVYA	C	SYRUPCREEK	C	TAPPAN	B/D	TEMVIK	B
SURYON	B	TABECHEDING	C	TARA	B	TENAHA	B
SUSANNA	C/D	TABERNASH	B	TARAL	B	TENAS	C
SUSANNABERG	D	TABLER	D	TARHOLLOW	C	TENDOY	D
SUSANVILLE	D	TABLEROCK	D	TARKIO	D	TENEB	D
SUSIVAR	C	TABOOSE	A	TARLOC	B	TENEX	B
SUSQUEHANNA	D	TABOOSE, Gravelly Substratum	B	TARLTON	C	TENINO	C
SUTA	B	TABOR	D	TARNAV	B	TENMILE	C
SUTHER	C	TACHI	D	TARRETE	D	TENNCO	C
SUTHERLAND, Gravelly	C	TACODA	C	TARRYALL	C	TENNECO	B
SUTHERLAND	D	TACOOSH	B/D	TARRYTOWN	C	TENOT	C
SUTHERLIN	C	TADLOCK	B	TASAJAL	B	TENPIN	D
SUTLEY	B	TAFFOM	B	TASAYA	C	TENRAG	B

## Exhibit A: Hydrologic Soil Groups for the United States

TENSAS	D	THREEK	C	TINTON	A	TOMOKA	B/D
TENSED	C	THREEMILE	B	TINTSON	A	TOMOTLEY	B/D
TENSLEEP	B	THREERIV	D	TINYTOWN	B	TOMS	C
TENVORRD	D	THREETREES	B	TIOGA	B	TOMSHERRY	C
TENWALTER	C	THRIFTON	C	TIONESTA	A	TOMTY	D
TENWELL	C	THROCKMORTON	B	TIPLER	B	TONATA	D
TEOCULLI	B	THULEPAH	C	TIPNAT	B	TONEY	D
TEQUESTA	B/D	THUNDER	B	TIPPAH	C	TONIO	B
TERADA	B	THUNDERBAY	D	TIPPECANOE	B	TONKAVAR	A
TERBIES	B	THUNDEREGG	C	TIPPER	C	TONKAWA	A
TERCA	D	THURBER	D	TIPPIPAH	B	TONKIN	B
TERESA	D	THURLONI	C	TIPPO	C	TONKIN, Moderately Wet	C
TERLINGUA	D	THURLOW	B	TIPSAW	C	TONKS	C
TERMO	D	THWOOP	C	TIPTON	B	TONOR	B
TEROMOTE	B	TIAGOS	B	TIPTONVILLE	B	TONOWEK	B
TEROUGE	D	TIAK	C	TIPTOP	B	TONRA	B
TERRA CEIA	B/D	TIBBCREEK	C	TIRO	C	TONSINA	B
TERRABELLA	D	TIBBITTS	B	TIROD	B	TONUCO	D
TERRACECREEK	C	TIBKEY	B	TISBURY	B	TOOLES	B/D
TERRAD	C	TIBURONES	D	TISDALE	C	TOOLESBORO	B
TERRAROSSA	D	TICANOT	D	TISHAR	B	TOONE	B
TERRETON	C	TICELL	D	TISMID	C	TOOTERVILLE	D
TERRO	B	TICESKA	C	TISONIA	D	TOPAWA	B
TERT	D	TICONIC	A	TITCHENAL	B	TOPAWA, Very Gravelly	C
TESSFIVE	D	TIDERISHI	C	TITIACK	B	TOPEMAN	D
TETHEROW	A	TIDEWATER	D	TITUSVILLE	C	TOPETAUL	C
TETILLA	B	TIDINGS	B	TIVOLI	A	TOPIA	D
TETLIN	D	TIEFORT	B	TIVY	C	TOPKNOT	D
TETONIA	B	TIERRANEGRA	B	TOA	B	TOPO	D
TETONVILLE, Gravelly	C	TIESIDE	D	TOADLAKE	B	TOPOCK	D
TETONVILLE	D	TIETON	B	TOADLENA	D	TOPPENISH	C/D
TETOTUM	C	TIEVILLE	D	TOBA	B	TOPPER	B
TEVAL	B	TIFF	C	TOBINSPOURT	B	TOPSEY	C
TEVIS	B	TIFFANY	C	TOBOSA	B	TOQUIMA	C
TEWFEL	C	TIFTON	B	TOBY	B	TOREX	B
TEX	B	TIGER CREEK	B	TOCALOMA	C	TORHUNTA	C
TEXANA	D	TIGIT	C	TOCAN	B	TORNEY	D
TEXASCREEK	B	TIGIWON	B	TOCCOA	B	TORNILLO	B
TEXLA	D	TIGON	D	TOCITO	B	TORNING	B
TEXLINE	B	TILDEN	B	TOCK	C	TORODA	B
TEXROY	B	TILK	A	TOCOI	B/D	TORONTO	C
THADER	C	TILLEDA	B	TODACHEENE	B	TOROX	B
THAGE	C	TILLICUM	B	TODDSTAV	D	TORPEDO LAKE	D
THATCHERFLATS	D	TILLMAN	D	TODDVILLE	B	TORREON	D
THAYNE	B	TILLMONT	B	TODOS	C	TORRES	A
THEBES	B	TILLOU	C	TOECANE	B	TORRY	B/D
THEBO	D	TILMA	D	TOEFOOT	B	TORULL	D
THEECAN	C	TILSIT	C	TOGCHA	B	TOSP	B
THENARROWS	D	TILTON	B	TOGUS	D	TOTAVI	B
THENAS	C	TILVERN	D	TOHATIN	B	TOTEM	B
THENIPEL	B	TIMBALIER	D	TOHOBIT	C	TOTIER	C
THEODOR	D	TIMBERBUTTE	B	TOIMI	C	TOTNESS	D
THERESA	C	TIMBERG	C	TOINE	B	TOTO	B/D
THERMO	D	TIMBERHEAD	B	TOISNOT	B/D	TOTTEN	C/D
THETFORD	A	TIMBERLY	B	TOISNOT, Ponged	D	TOTTLES	C
THETIS	B	TIMBLIN	D	TOKAY	B	TOTZ	D
THIBAUT	D	TIMBUCTOO	C	TOKEEN	C	TOUCHET	C
THIEFRIVER	B/D	TIMGULCH	D	TOKIO	B	TOULA	C
THIKE	D	TIMHILL	D	TOKLAT	D	TOURN	C
THIMBLE	C	TIMHUS	B	TOKO	C	TOURNQUIST	B
THIRST	D	TIMKEN	D	TOKOSITNA	B	TOUTLE	B
THIRSTYGULCH	D	TIMMERCREK	B	TOKUL	C	TOWAVE	B
THISTLEBURN	B	TIMMONS	B	TOLANY	B	TOWERVILLE	B
THISTLEDEW	B	TIMOR	A	TOLER	C	TOWNSEND	C
THOENY	D	TIMPAHUTE	D	TOLFORK	B	TOWNSHIP	B
THOMAS	B/D	TIMPER	D	TOLICHA	D	TOWOSAHGY	B
THOMASFORK	C	TIMPIE	C	TOLIUS	B	TOXAWAY	B/D
THOMHILL	B	TIMULA	B	TOLKE	B	TOY	D
THOMS	D	TINA	C	TOLLGATE	B	TOZE	B
THOR	B	TINAJA	B	TOLMAN	C	TRACE	B
THORN	D	TINAJA, Cool	C	TOLNA	B	TRACK	C/D
THORNCREEK	C	TINAMOU	C	TOLONIER	B	TRACKLER	C
THORNDALE	D	TINCAN	D	TOLOVANA	B	TRACOSA	D
THORNOCK	D	TINCUP	B	TOLSONA	D	TRACTUFF	D
THORNTON	D	TINDAHAY	A	TOLUCA	B	TRACYLEE	B
THOUT, Gravelly Surface	B	TINE	B	TOMAHAWK	A	TRADELAKE	C
THOUT	C	TINEMAHA	B	TOMALES	D	TRAEER	B/D
THOW	B	TINEMAN	C	TOMARIZO	D	TRAHAM	C
THRASH	B	TINIAN	C	TOMASAKI	C	TRAHERN	D
THREADGILL	B	TINKER	C	TOMAST	C	TRAIL	B
THREEBEAR	C	TINN	D	TOMBEALL	D	TRAILAMP	D
THREEBUCK	C	TINNIN	A	TOMEK	B	TRAILCREEK	C
THREECHOP	B	TINPAN	D	TOMERA	C	TRAILHEAD	B
THREECREEKS	C	TINT	A	TOMERA, Cemented Substratum	D	TRAINER	B
THREEFORKS	B	TINTERO	B	TOMODO	B	TRAITORS	D

# Exhibit A: Hydrologic Soil Groups for the United States

TRALEY	B	TSCHAMMAN	D	TWEBA, Drained	C	UPCREEK	C
TRAMWAY	B	TSCHICOMA	B	TWEEDY	C	UPDEGRAFF	B
TRANSFER	D	TSEBITAI	B	TWELVEMILE	B	UPSATA	B
TRANSQUAKING	D	TSETTA	A	TWENTY DAY	B	UPSEL	A
TRANSYLVANIA	B	TSIRKU	C	TWICK	D	UPSON	C
TRAPPER	B	TUCANNON	C	TWIG	D	UPSTEER	B
TRAPPERCREEK	B	TUCES	D	TWINBUTTES	A	URBANA	C
TRASK	C	TUCKAHOE	B	TWINING	C	URBO	D
TRAUNIK	B	TUCKERDOWNS	B	TWINMOUND	A	URBODEN	B
TRAVER	B	TUCSON	B	TWISSELMAN	C	UREAL	D
TRAVERTINE	C	TUCSON, saline-Alkali	C	TWOBTUTE	B	URGESTEIN	B
TRAVILAH	C	TUCUMCARI	B	TWOCABIN	B	URICH	C/D
TRAZUNI	B	TUFFIT	C	TWOMILE	C/D	URIPNES, Gravelly	C
TREATY	B/D	TUFON	B	TWOTOP	D	URIPNES	D
TREBLOC	D	TUGAS	A	TYBO	D	URLAND	C
TREBOR	C	TUKEY	C	TYDEN	D	URMAFOT	D
TREEBUTTE	D	TUKUHNIAK	C	TYEE	D	URSA	C
TREEKOR, nonstony	C	TUKWILA	C/D	TYENDE	B	URSINE	D
TREEKOR	D	TULANA, Moderately Drained	C	TYGH	C	URWIL	C
TREEN	D	TULANA	B/D	TYLER	D	USAL, Gravelly	B
TREFRY	B	TULARGO	B	TYLERPEAK	B	USAL	C
TREGO	C	TULAROSA	B	TYMOSLING	C	USEFUL	C
TREGONING	C	TULCH	B	TYNDALL	B/C	USINE	A
TREHARNE	C	TULE	B	TYNER	A	USKABWANKA	A
TRELONA, Moist	C	TULEBASIN	D	TYONEK	D	USTARENTS, Loamy	B
TRELONA	D	TULECAN	C	TYRE	A/D	USTIBUCK	D
TREMBLES	C	TULIA	B	TYSON	B	USTIDUR	D
TREMENTINA	B	TULIK	B	UANA	D	USTORTMENTS, Sandy	A
TREMONA	C	TULIP	C	UBANK	D	UTALINE	C
TREMONT	B	TULLAHASSEE	C	UBAR	D	UTE	D
TREMPE	A	TULLOCK, Dry	A	UBEHEBE	C	UTLEY	B
TREMPEALEAU	B	TULLOCK, Warm	B	UCHEE	A	UTUADO	B
TRENHOLM	D	TUMARION	B	UCOPIA	B	UTURIN	C/D
TRENTON	C	TUMBLETON	C	UDAHO	B	UVADA Loamy Surface	C
TREOFF	D	TUNAWEE	C	UDARENTS	B	UVALDE	B
TREON	D	TUNEHILL	D	UDECIDE, Cobbly	B	UVER	A
TREP	B	TUNELCREEK	B	UDECIDE	C	UWALA	B
TRESTLE	B	TUNIS	D	UDEL	D	UWELL	C
TRETEN	B	TUNITCHA	B	UDELOPE, Bouldery	B	UZANEVA	D
TREVLAC	B	TUNKCREEK	A	UDELOPE	D	VABBING	B
TREY	A	TUNNEL	B	UDIPSAMMENTS, Flooded	A	VABEM	C
TRIANGLE	D	TUOMI	B	UGAK	D	VADAHO	D
TRIBBEY	C	TUPELO	D	UHL	B	VADER	B
TRICART	B	TUPPER	A	UHLAND	B	VAEDA	D
TRICERA	A	TUPOKNUK	D	UHLORN, Cool	B	VAIDEN	D
TRICON	C	TUQUE	B	UHLORN	C	VAILTUN	B
TRID, Nonstony	B	TURBA	D	ULA	C	VALBY	C
TRID	C	TURCOTTE	B	ULANDO	B	VALCO	C
TRIGGER	D	TURIST	D	ULHALF	B	VALCREEK	B
TRIGO	D	TURK	C	ULLOA	B	VALCREST	C
TRIMMER	C	TURKEY	A	ULMET	C	VALDOSTA	A
TRIMONT	B	TURKEYSPRINGS	B	ULRANT	B	VALE	B
TRINIDAD	D	TURKEYTRACK	C	ULRIC	C	VALENA	D
TRIO	D	TURLIN	B	ULTO	B	VALENCIA, Saline, Flooded	C
TRIOMAS	B	TURLOCK	D	ULTRA	D	VALERA	C
TRIPIT	C	TURMOUND	D	ULTRAMONT	B	VALHALLA	A
TRIPLEN	B	TURNBACK	C	ULUPALAKUA	B	VALKARIA	B/D
TRIPLETT	D	TURNBULL	D	ULY	B	VALKARIA, Depressional	D
TRIPOLI	B/D	TURNERCREST	B	UMA	A	VALLAN	D
TRISTAN	B	TURON	A	UMAPINE	C/D	VALLE	B
TRITON	D	TURRAH	C	UMATILLA	B	VALLEONO	B
TRIVAR	B	TURRET	B	UMBARG	B	VALLERS	D
TRIX	C	TURRIA	C	UMIAT	D	VALLETTA	B
TROMP	C	TURZO	C	UMPA	B	VALLEYCITY	D
TRONSON	B	TUSCARAWAS	C	UMPUMP	B	VALMAR	C
TROOK	C	TUSCAWILLA	D	UMTANUM	C	VALMONT	C
TROSKY	B/D	TUSCOSSO	B	UNAKA	B	VALPAC	C
TROUP	A	TUSCUMBIA	D	UNAKWIK	D	VALTON	B
TROUTER	C	TUSIP	B	UNCAS	D	VALTON, Severely Eroded	C
TROUTLAKE	B	TUSLER	A	UNCOMPAGRE	D	VALVERDE	B
TROUTMEADOWS	B	TUSLER	B	UNDERWOOD	B	VAMER	B
TROVE	B	TUSSY	D	UNDUSK	B	VAMONT	D
TRUCKEE	B/C	TUSTELL	C	UNGENE	A	VAN HORN	B
TRUEFISSURE	B	TUSUNE	C	UNICOI	C	VANBRUNT, Warm	B
TRUHOY	D	TUTE	B	UNICORN	B	VANBRUNT	C
TRULAE	D	TUTKA	B	UNION	C	VANCE	C
TRUMBULL	D	TUTNI	B	UNIONGROVE	B/D	VANCECREEK	B/D
TRUMP	D	TUTNI, Loamy Substratum	C	UNIONVILLE	B	VANDAMINE	B
TRUSCREEK	B	TUTTLE	B	UNIQUE	B	VANDAMME	B
TRUSSUM	C/D	TUTUILLA	C	UNIUS	D	VANDAMORE	B
TRUXTON	B	TUTWILER	B	UNIVEGA	D	VANDERBILT	B
TSADAKA	B	TUWEEP	B	UNIVERSITY	A	VANDERBILT, Moderately Wet	C
TSALI	C	TUXEKAN	B	UNKEE	B	VANDERGRIFT	C
TSANA	B	TUZIGOOT	C	UNLIC	B	VANDERPOOL	B
TSAYA	D	TWEBA, Modeately Wet	B	UNSON	B	VANEPPS	C

## Exhibit A: Hydrologic Soil Groups for the United States

VANGOE	C	VIBO	B	WAAS	B	WALLUSKI	C
VANGUARD	C	VIBORAS	D	WABANICA	C	WALNETT	C
VANLUE	C	VICK	C	WABASSO	D	WALNUT	B
VANMETER	C	VICKSBURG	B	WABEDO	C	WALONG	B
VANNOY	C	VICTORVILLE	B	WABUN	A/D	WALPOLE	C
VANOCKER	B	VICTORY	B	WACAHOOTA	D	WALREES	B
VANOSS	B	VICU	C	WACCASASSA	D	WALSEY	B
VANPETTEN	B	VIDA	B	WADDINGTON	A	WALTERS	B
VANSICKLE	D	VIDAURI	D	WADDOUPS	B	WALTHAM	D
VANSTEL	B	VIDRINE	D	WADECREEK	C	WALUM	B
VANWYPER	D	VIEJA	D	WADELL	B	WALVAN	B
VANZANDT	C	VIENNA	B	WADENILL	B	WALVILLE	B
VANZILE	B	VIEQUES	B	WADESPRINGS	C	WAMBA	C/D
VAQUERO	D	VIEWPOINT	D	WADLEIGH	D	WAMBOLT	B
VARELUM	B	VIGAR	C	WADLEY	A	WAMEGO	C
VARELUM, Clay Loam Substratum	C	VIGIA	D	WADMALAW	D	WAMIC	B
VARGAS	C	VIGILANTE	C	WADSWORTH	C	WAMPEE	C
VARICK	D	VIGNOLO	C	WAEOLDER	B	WAMPOO	C
VARRO	B	VIGO	C	WAFLA	B	WAMPSVILLE	B
VARWASH	A	VILLA	B	WAGNER	D	WANAGAN	B
VARYSBURG	B	VILLARD	D	WAGONBED	B	WANDO	A
VASA	B	VILLEDRY	C	WAGONBOW	D	WANETTA	B
VASSETT	B	VILLEGREEN	C	WAGONBOX	D	WANILLA	C
VASTINE, Map>16	B	VILLMEAGHER	C	WAGONHOUND	C	WANNACOTT	B
VASTINE	D	VILLSPRINGS	C	WAGONJACKET	B	WANOGA, Elevation>4000	A
VAUGHAN	D	VILLY	B/D	WAGONTIRE	D	WANOGA	B
VAUGHNSVILLE	C	VILLOT	C	WAGONTOWN	B	WANOMIE	B
VAYAS	D	VIMVILLE	D	WAGORE	B	WANSER, Drained	C
VEAL	B	VINCOM	C	WAGRAM	A	WAPAHANI	C
VEATCH	C	VINDICATOR	D	WAGSTAFF	D	WAPAL	B
VECONT	C	VINEGARROON	C	WAHEE	C	WAPELLO	B
VEEDUM	D	VINELAND	A	WAHGUYHE	D	WAPI	D
VEGA ALTA	B	VINELAND, Wet	B	WAHIAWA	B	WAPINITIA	B
VEGA BAJA	C	VINGO	B	WAHKEENA	B	WAPITI	A
VELASCO	D	VINITA	C	WAHLSTEN	C	WAPPINGER	B
VELDA	B	VINLAND	D	WAHLUKE	B	WAPPO	D
VELDKAMP	B	VINSAD	C	WAHOO	D	WAPSHILLA	B
VELOW	B	VINSON	B	WAHPETON	C	WAPTUS	C
VENA	C	VINTON	A	WAHREKDAM	C	WARDA	B
VENAGRO	B	VIOLA	D	WAHSTAL	D	WARDBAY	A
VENAPASS	D	VIPONT	C	WAHTUM	D	WARDBORO	B
VENATOR, Channery	B	VIRDEN	B/D	WAHWEP	D	WARDELL	C
VENATOR	C	VIRGIN RIVER	C	WAI HONU	B	WARDWELL	C
VENETA	D	VIRKULA	C	WAIALEALE	C	WARE	B
VENEZIA	D	VIRTUE	C	WAIAWA	D	WAREAGLE	B
VENICE	C	WISE	B	WAIHUNA	D	WARHORSE	D
VENLO	A/D	VISTA	B	WAIKALOA	B	WARM SPRINGS	D
VENNOB	D	VISTULA	A	WAIKANE	B	WARMAN	A/D
VENSON	B	VITERBO	D	WAIKAPU	B	WARMINSTER	C
VENSORA	C	VITRINA	B	WAIKOMO	D	WARNOCK	B
VENUM	D	VITROFF	B	WAILUKU	B	WARNUIT	D
VERBOORT	D	VITZTHUM	B	WAINEE	B	WARRENTON	D
VERCLIFF	C	VIUM	D	WAINOLA	B	WARRIOR	B
VERDEL	D	VIVES	B	WAIPAHU	C	WARROAD	C
VERDIGRE	C	VIVI	B	WAITS	B	WARSING	B
VERDUN	D	VIVIAN	B	WAITSFIELD	B	WARWICK	A
VERENDRYE	B/D	VIXEN	B	WAKAMO	D	WASA	D
VERGENNES	C	VIZCAINO	D	WAKE	D	WASDA	B/D
VERHART	B	VIZCAPOINT	D	WAKEEN	D	WASHINGTON	C
VERICK	C	VIZCAYA	D	WAKELEY	B	WASHPASS	B
VERIDGE	B	VLASATY	C	WAKEMAN	C	WASKISH	D
VERJELES	D	VOCA	C	WAKENDA	B	WASKOM	C
VERLOT	D	VOCK	D	WAKEPISH	B	WASNOT	C
VERMILLION	C	VODA	C	WAKETICKEH	D	WASSON	D
VERNADO	D	VODERMAIER	B	WAKEVILLE	B	WATAB	C
VERNAL	B	VOELKER	B	WAKITA	D	WATAHALA	A
VERNDALE	B	VOIGHT	B	WAKONDA	B	WATAUGA	B
VERNIA	A	VOLADORA	B	WAKONDA, Till Substratum-	C	WATCHABOB	C
VERNONIA	B	VOLASH	B	WAKULLA	A	WATCHES	B
VERO	D	VOLCO	D	WALBERT	C	WATERFALL	D
VERSHAL	D	VOLENTE	C	WALCO	B	WATERFLAT	C
VERSON	C	VOLINIA	B	WALCOTT	B	WATERFORD	B
VERSTOVIA	D	VOLLMER	C	WALDECK	C	WATERGATE	B
VERTEL	D	VOLMONT	B	WALDEN	D	WATERTOWN	B
VERTINE	D	VOLNEY	B	WALDO	D	WATHENA	B
VERTREES	B	VOLSTEAD	B	WALDORF	C/D	WATKINS	B
VESEY	B	VONALF	B	WALDROUP	D	WATNE	B
VESPER	D	VONASON	B	WALKERSVILLE	B	WATONGA	D
VESTA	B	VONDERGREEN	C	WALKINSHAW	D	WATONY	A
VETAGRANDE	B	VOORHIES	C	WALKON	C	WATOOPAH	B
VETEADO	C	VOSSET	B	WALKOVER	B	WATROUS	C
VIA	B	VOTAW	B	WALL	B	WATSEKA	B
VIAN	B	VOYAGER	B	WALLKILL	B/D	WATSONIA	D
VIBLE	A	VULCAN	C	WALLOWA	C	WATTON	C
		VYCKYL	D	WALLROCK	C	WATUSI	C

# Exhibit A: Hydrologic Soil Groups for the United States

WAUBERG	D	WENOTA	D	WHITE STORE	D	WILLIAMSVILLE	C
WAUCHULA	B/D	WENZEL	B	WHITE SWAN	D	WILLIMAN	B/D
WAUCHULA, Depressional	D	WEOGUFKA	D	WHITEARTH	C	WILLISTON	C
WAUCOBA	D	WEOTT	D	WHITEBIRD	D	WILLOSIPPI	C
WAUCONDA	B	WEPO	C	WHITECAP	D	WILLOW CREEK	B
WAUKENA	D	WERELD	B	WHITECLOUD	B	WILLOWDALE	B
WAUKENABO	B/D	WERITO	C	WHITEDEER	B	WILLOWFORK	D
WAULD	C	WERNOCK	B	WHITEFACE	D	WILLSPRINGS	C
WAURIKA	D	WESFIL	D	WHITEFIELD	D	WILLYNAT	B
WAUTOMA	B/D	WESIX	D	WHITEFORD	B	WILMA	C
WAVELAND	B/D	WESKA	D	WHITEHALL	B	WILMER	C
WAVELAND	D	WESLEY	D	WHITEHORN	D	WILMONT	B
WAWAKA	B	WESPAC, Sandy Substratum Alkali	C	WHITEHORSE	B	WILMONTON	B
WAWASEE	B	WESPAC, Alkali	D	WHITEKNOB	B	WILPAR	C
WAWINA	A	WESSEL	C	WHITEMARSH	C/D	WILPOINT	D
WAX	C	WESTBEND	B	WHITEOAK	B	WILSALL	D
WAXPOOL	D	WESTBORO	D	WHITEPEAK	D	WILSHIRE	A
WAYCUP	B	WESTBROOK	D	WHITEPINE	D	WILSON	D
WAYLAND	C/D	WESTBUTTE	B	WHITERIVER	C	WILSONGULCH	B
WAYMET	B	WESTVILLE	B	WHITEROCK	D	WILSONVILLE	D
WAYMOR	B	WESTFORK	D	WHITESBORO	C	WILSOR	B
WEA	A	WESTGATE	C	WHITESBURG	C	WILSPRING	C
WEALTHWOOD	A/D	WESTINDIAN	C	WHITESIDE	B	WILST	C
WEASH	C	WESTLAKE, Thin Surface	C	WHITSON	D	WILT	B
WEATHERFORD	B	WESTLAKE	D	WHITETHORN	B	WILTON	B
WEATHERWAX	D	WESTMION	D	WHITEWATER	D	WIMPEY	C
WEAVER	C	WESTMORE	C	WHITEWOOD, Nonflooded	B/D	WINADA	C
WEAVERVILLE	B	WESTOLA	B	WHITEWOOD	C/D	WINBERRY	C
WEBB	C	WESTON	B	WHITEWRIGHT	C	WINBLOW	C
WEBBRIDGE	B	WESTOVER	D	WHITEYE	D	WINCHUCK	C
WEBBTOWN	C	WESTPHALIA	B	WHITING	B	WIND RIVER	B
WEBFOOT	C	WESTPLAIN	D	WHITINGER	C	WINDCOAT	D
WEBILE	C	WESTPORT	A	WHITLEY	B	WINDCOMB	D
WECHECH	D	WESTPORT, Thin Surface	B	WHITNEY	C	WINDEGO	B
WEDDERBURN	B	WESTSHORE	D	WHITSON	D	WINDER	D
WEDGE	A	WESTSIDE	C	WHITTEMORE	C/D	WINDERE	B
WEDGEMONT	B	WESTSUM	D	WHITVIN	D	WINDERNOT	B
WEEDING	D	WESTVACO	C	WHITWELL	C	WINDICREEK	A
WEEDMARK	B	WESTVIEW	B	WHORLED	C	WINDLASS	C
WEEDPATCH	C	WESTVILLE	B	WICHITA	C	WINDMILL	B
WEEDZUNIT	B	WESTWEGO	D	WICKAHONEY	D	WINDRY	D
WEEKIWACHEE	D	WESTWIND	C	WICKENBURG	D	WINDTHORST	C
WEEKS	C	WESWOOD	B	WICKERSHAM	B	WINDWHISTLE	B
WEENA	D	WETA	D	WICKETT	C	WINDYBUTTE	B
WEEPAAH	C	WETBETH	C	WICKIUP	C	WINDYHOLLOW	C
WEESATCHE	B	WETHEY	A/C	WICKSBURG	B	WINDYPOINT	B
WEETOWN	B	WETHEY	C	WICKWARE	B	WINEDALE	D
WEEZWEEED	B	WETSAW	C	WICUP	C	WINEG	B
WEGERT	A	WETTERDON	B	WIDEN	C	WINEGAR	C
WEGLIKE	A	WETZEL	D	WIDOWSPRING	B	WINEVADA	C
WEIDER	B	WEWELA	B	WIERGATE	D	WINFALL	B
WEINBACH	C	WEWOKA	C	WIFFO	B	WINFIELD	B
WEIR	D	WEYANOKE	C	WIFTON	B	WING	D
WEIRMAN	D	WEYMOUTH	B	WIGTON	A	WINGATE	B
WEISBURG	C	WHAKANA	B	WILAHA	B	WINGDALE	D
WEISSENFELS	C	WHALESHEAD	B	WILBANKS	D	WINGINA	B
WEITAS	B	WHALEY	D	WILBUR	B	WINGINAW	D
WEITCHPEC	C	WHATCOM	C	WILCO	C	WINGROCK	B
WELAKA	A	WHATELY	D	WILCOX	D	WINGVILLE	D
WELCH	B	WHEATBELT	D	WILCOXSON	C	WINKLEMAN	D
WELCHLAND	B	WHEATON	B	WILDALE	C	WINKLER	B
WELCOME	B	WHEATWOOD	B	WILDCAT	D	WINKLO	C
WELDA	C	WHEELER	B	WILDER	A	WINLER	D
WELEETKA	D	WHEELERPEK	D	WILDGEN	B	WINLO	D
WELLESLEY	B	WHEELERVILLE	B	WILDHILL	C	WINN	C
WELLIE	A	WHEELON, Cool	B	WILDHORSE	A	WINNEBAGO	B
WELLINGTON	D	WHEELON	D	WILDMESA	C	WINNEMUCCA	C
WELLMAN	B	WHEELRIDGE	A	WILDORS	C	WINNETT	C
WELLROCK	B	WHEELS	B	WILDROSE	C	WINNETT	D
WELLS	B	WHERRY	D	WILE	C	WINNIPEG	B
WELLSBENCH	B	WHETSOON	C	WILHOIT	B	WINNSBORO	C
WELLSCREEK	B	WHETSTONE	C	WILKESON	B	WINOM	D
WELLSDAM	C	WHICHMAN	B	WILL	B/D	WINOOSKI	B
WELLSSED	C	WHIDBEY	C	WILLABY	C	WINOPEE	B
WELLSFORD	D	WHILPHANG	D	WILLAKENZIE	C	WINRIDGE	D
WELOY	C	WHIPP	D	WILLAMETTE	C	WINSAND	B
WELSUM	D	WHIPPANY	C	WILLANCH	D	WINSTON	B
WELTER	D	WHISK	D	WILLAPA	C	WINT	D
WEMPLE	B	WHISKEY	B	WILLARD	B	WINTERCANYON	C
WENAS	C/D	WHISKEYCREEK	C	WILLETTE	A/D	WINTERIM	C
WENATCHEE	C	WHISKLAKE	C	WILLHILL	C	WINTERMUTE	C
WENDANE	B/C	WHISPERING	C	WILLHO	D	WINTERS	C
WENDELL	C	WHISTLE	B	WILLIAMSBURG	B	WINTERSBURG	B
WENGLER	A			WILLIAMSPORT	C	WINTERSET	C
WENONAH	B			WILLIAMSTOWN	C	WINTLEY	B

## Exhibit A: Hydrologic Soil Groups for the United States

WINTON	C	WOODVILLE	D	YAD	D	YORK	C
WINTONER	B	WOODWARD	B	YAGGY, Protected	B	YORKSHIRE	C
WINU	C	WOODWEST	D	YAGGY	C	YORKTOWN	D
WINWELL	C	WOOFUS	C	YAHANA	D	YORKTREE	C
WISBEY	B	WOOLLY	B	YAHARA	C	YOSEMITE	B
WISBY	B	WOOLPER	C	YAHMORE	B	YOST	C/D
WISCOW	D	WOOLSEY	B	YAHNE	C	YOTES	B
WISCOY	C	WOOLSTALF	B	YAHOO	D	YOUGA, Sandy Substratum	D
WISE	C	WOOLSTED	B	YAINAX	B	YOUJAY	D
WISEMAN	A	WOOLWICH	B	YAKOBI	D	YOUMAN	C
WISFLAT	D	WOONOCKET	B	YAKUS	D	YOUNGSTON, Wet	C
WISHARD	C	WORCESTER	C	YAKUTAT	A	YOURAME	B
WISHBONE	B	WORFSTONE	C	YALELAKE	B	YOU TLKUE	B
WISHEYLU	C	WORKMAN	C	YALESVILLE	C	YOUMPA	D
WISHKAH	C/D	WORLAND	C	YALLANI	B	YPSI	C
WISKAN	C	WORLEY	D	YAMHILL	C	YRIBARREN	D
WISKISPRINGS	D	WORMCREEK	B	YAMSAY	D	YTURBIDE	A
WISNER	B/D	WORMET	B	YANA	B	YTURRIA	A
WISTER	C	WORMSER	C	YANCY	D	YUCCA	B
WISTONA	B	WORSHAM	D	YANKEE	D	YUKON	D
WITCHER	B	WORSWICK	C	YANKEEFORK	B	YUNES	D
WITHAM	D	WORTHENTON	D	YANKTON	B	YURM	D
WITHEE	C	WORTMAN	A	YAP	B	YUTAN	B
WITHERBEE	A/D	WORWOOD	C	YAPOAH	A	YUTRUE	D
WITHERELL	D	WOVOKA	D	YAQUI	B	YUZARRA	B
WITHERS	C	WRANGELL	D	YAQUICAN	D	ZAAR	D
WITTEN	D	WRAYHA	C	YAQUINA	C/D	ZABA	B
WITTENBERG	B	WRAYS	B	YATA	C	ZABOROSKY	B
WIVILLE	B	WREDAH	B	YATAHONEY	C	ZACA	D
WIX	C	WREFORD	D	YATAHONEY, Stony	D	ZACHARY	C
WIXOM	B	WRENCOE	D	YATAMA	B	ZADE	B
WIZARD	C	WRENGART	C	YATES	C	ZADOG	A/D
WOCKLEY	C	WRENMAN	C	YAUCO	D	ZADVAR	D
WOCKUM	B	WRENTHAM	C	YAUHANNAH	B	ZAFOD	B
WODA	D	WRIGHTMAN	C	YAUPON	D	ZAGG	C
WODAVAR	D	WRIGHTSBORO	C	YAWHEE	B	ZAIDY	C
WODEN	D	WRIGHTSVILLE	D	YAWKEY	B	ZAKME	D
WODOMONT	D	WRIGHTWOOD	B	YAWKOLA	C	ZALCO	A
WODSKOW	B/C	WUKOKI	B	YAXING	B	ZALEA	B
WOHLY	B	WUKSI	A	YEAGER	A	ZALESKA	D
WOLCO	C	WULFERT	D	YEARIAN	D	ZALLA	A
WOLDALE	C/D	WUNABUNA	C/D	YEARY	C	ZALVIDEA	B
WOLFCREEK	B	WUNJEY	B	YEATON	C	ZAMORA	B
WOLFER	B	WUPATKI	D	YECROSS	A	ZANBUR	B
WOLFESON	C	WURTSMITH	A	YEDLICK	B	ZANE	B
WOLFESON, Wet	D	WUTCHUMNA	D	YEGUAS	C	ZANGO	D
WOLFEY	C	WYALUSING	D	YELLOW HORSE	D	ZAPA	C
WOLFPEAK	B	WYANDOTTE	D	YELLOWBANK	D	ZAPATA	C
WOLFPEN	A	WYANT	C	YELLOWBAY	B	ZAQUA	D
WOLFFEVER	C	WYARD	B	YELLOWDOG	A	ZARK	C
WOLFVAR	B	WYARNO	B	YELLOWHILLS	B	ZASTER	C
WOLLARD	C	WYATT	C	YELLOWLARK	C	ZAU	C
WOLLENT	D	WYCOLO	C	YELLOWMULE	C	ZAVALA	B
WOLOT	B	WYEAST	D	YELLOWRIVER	B	ZAVCO	C
WOLVERTON	B	WYECREEK	B	YELLOWROCK	B	ZAYANTE	A
WOMACK	C	WYETH	B	YELLOWSTONE	D	ZBART	D
WOODBECK	B	WYEVILLE	C	YELLOWWASH	D	ZEALE	B
WOODBINE	B	WYICK	D	YELM	C	ZEB	B
WOODBURN	C	WYKOFF	B	YELTON	C	ZEE	B
WOODBURY	D	WYLO	D	YENNICK	B	ZEEBAR	B
WOODCANYON	C	WYNHOFF, Moist	B	YENSUS	B	ZEEGEE	D
WOODCHOPPER	B	WYNHOFF	C	YEOPIM	B	ZEEKA	C
WOODCUTTER	D	WYNN	B	YERBA	D	ZEELAND	C
WOODCUTTERS, Stony	B	WYNNVILLE	C	YERINGTON	A	ZEELNOT	B
WOODFORD	D	WYNONA	C	YESUM	B	ZEEMAL	D
WOODHURST	C	WYNOOSE	D	YIGO	B	ZEGRO	C
WOODIN	C	WYNTOON	B	YIKES	A	ZEIBRIGHT	B
WOODINGTON	B/D	WYOMINGCREEK	C	YILG	C	ZEKIAH	D
WOODINVILLE	C/D	WYOTITE	B	YNOT	B	ZELA	D
WOODLAWN	B	WYRICK	B	YOAKRAN	A	ZELDA	D
WOODLEAF	C	WYSOCKING	C/D	YOCHUM	C	ZENDA	C
WOODLY	B	WYVA	D	YODAL	B	ZENIFF	B
WOODMANSIE	B	XANA	B	YODER	B	ZENITH	B
WOODMERE	B	XANADU	B	YODY	C	ZENOBIA	B
WOODMONT	C	XANKEY	B	YOGAVILLE	D	ZENORIA	C
WOODPASS	B	XAVIER	B	YOHN	B	ZEOMONT	A
WOODROCK	C	XERTA	C	YOKAYO	D	ZEPH	D
WOODS	D	XERXES	D	YOKUT	B	ZEPHYR	D
WOODSFIELD	C	XICA	C	YOLLABOLLY	D	ZEPOL	B
WOODSIDE	B	XINE	C	YOLOGO	D	ZERKEL	B
WOODSLAKE	D	XIPE	D	YOMONT	B	ZERKER	B
WOODSON	D	XMAN	D	YONCALLA	C	ZEUGIRDOR	B
WOODSPOINT	B	XOBOBO	B	YONNA	D	ZIBATE	D
WOODSTOCK	D	YABAMAR	D	YORBA	D	ZIBETOD	D
WOODTEX	D	YACHATS	B	YOREL	B	ZIEGENFUSS	D

## Exhibit A: Hydrologic Soil Groups for the United States

ZIEGLER .....	C
ZIGGY .....	B
ZILABOY .....	D
ZILLAH .....	C/D
ZILWAUKEE .....	D
ZIMMER .....	D
ZIMWALA .....	C
ZING .....	C
ZIPPEL .....	B/D
ZIRAM .....	D
ZITA .....	B
ZITTAU .....	C
ZITZIANA .....	B
ZOAR .....	C
ZOATE .....	D
ZODA .....	C
ZOE .....	D
ZOLFO .....	C
ZOMAX .....	B
ZONO .....	A
ZORRA .....	D
ZOZOBRA .....	B
ZUBER .....	C
ZUFELT .....	C
ZULCH .....	D
ZUMAN, Protected .....	C/D
ZUMAN .....	D
ZUMBRO .....	A
ZUMMO .....	D
ZUNALEI .....	B
ZUNDELL .....	C
ZUNHALL .....	C
ZUNI, Gravelly .....	C
ZUNI .....	D
ZUNIVEN .....	B
ZUNKER .....	B
ZWAGG .....	B
ZWICKER .....	C
ZWIEFEL .....	C
ZWINGLE .....	D
ZYMER .....	B
ZYNBAR .....	B
ZYNBAR Till Substratum .....	C
ZYPLAR .....	D
ZYZYL .....	B
ZYZZI .....	D
ZYZZUG .....	D

## Appendix B

# Synthetic Rainfall Distributions and Rainfall Data Sources

The highest peak discharges from small watersheds in the United States are usually caused by intense, brief rainfalls that may occur as distinct events or as part of a longer storm. These intense rainstorms do not usually extend over a large area and intensities vary greatly. One common practice in rainfall-runoff analysis is to develop a synthetic rainfall distribution to use in lieu of actual storm events. This distribution includes maximum rainfall intensities for the selected design frequency arranged in a sequence that is critical for producing peak runoff.

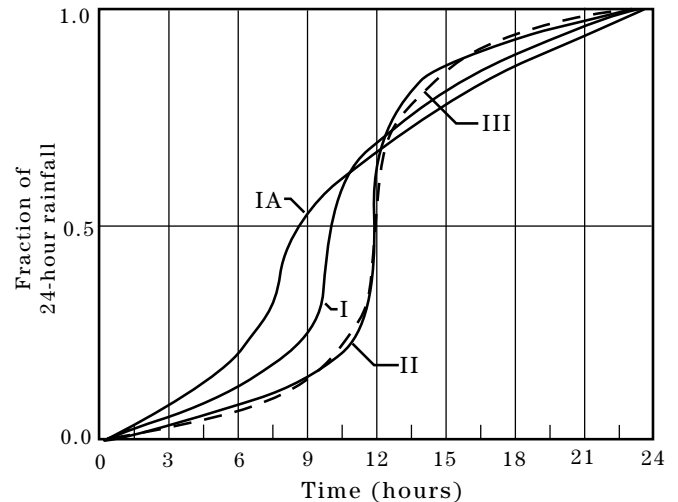
### Synthetic rainfall distributions

The length of the most intense rainfall period contributing to the peak runoff rate is related to the time of concentration ( $T_c$ ) for the watershed. In a hydrograph created with NRCS procedures, the duration of rainfall that directly contributes to the peak is about 170 percent of the  $T_c$ . For example, the most intense 8.5-minute rainfall period would contribute to the peak discharge for a watershed with a  $T_c$  of 5 minutes. The most intense 8.5-hour period would contribute to the peak for a watershed with a 5-hour  $T_c$ .

Different rainfall distributions can be developed for each of these watersheds to emphasize the critical rainfall duration for the peak discharges. However, to avoid the use of a different set of rainfall intensities for each drainage area size, a set of synthetic rainfall distributions having “nested” rainfall intensities was developed. The set “maximizes” the rainfall intensities by incorporating selected short duration intensities within those needed for longer durations at the same probability level.

For the size of the drainage areas for which NRCS usually provides assistance, a storm period of 24 hours was chosen the synthetic rainfall distributions. The 24-hour storm, while longer than that needed to determine peaks for these drainage areas, is appropriate for determining runoff volumes. Therefore, a single storm duration and associated synthetic rainfall distribution can be used to represent not only the peak discharges but also the runoff volumes for a range of drainage area sizes.

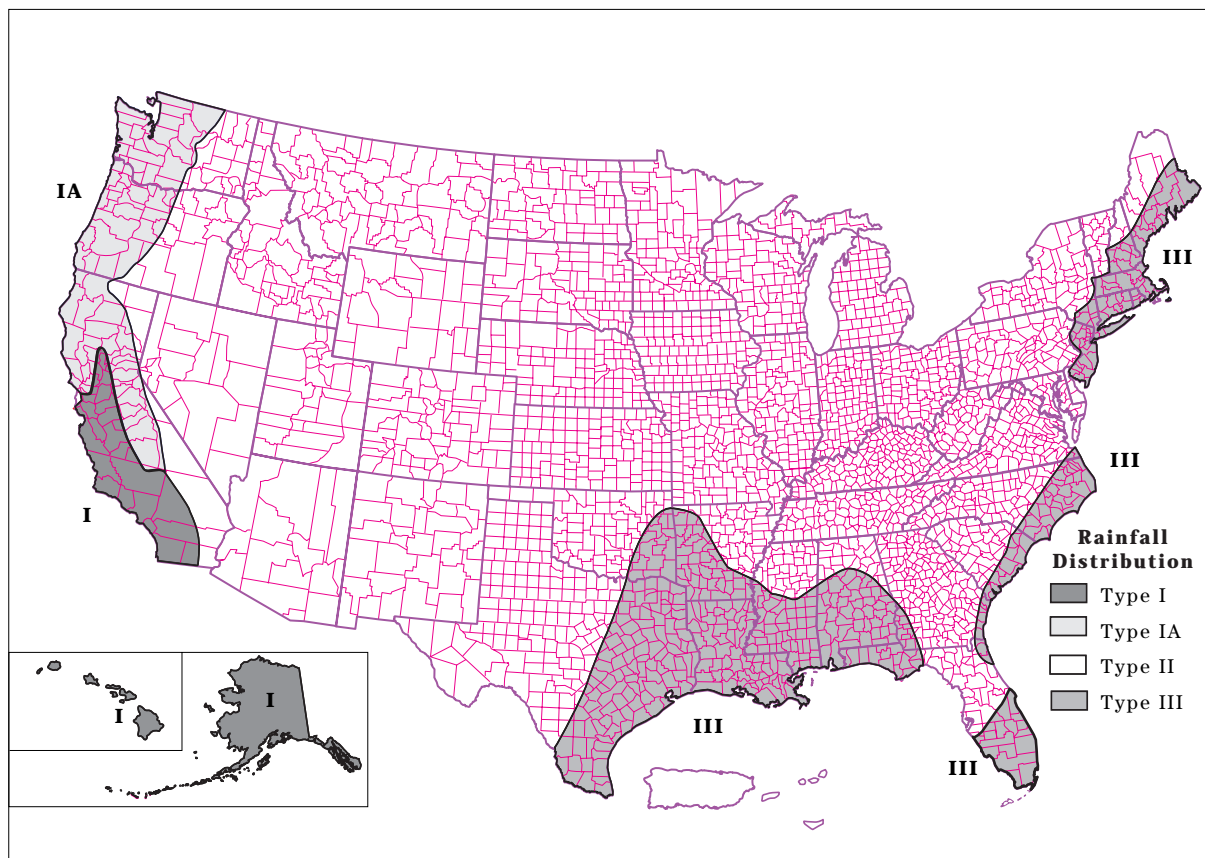
**Figure B-1** SCS 24-hour rainfall distributions



The intensity of rainfall varies considerably during a storm as well as geographic regions. To represent various regions of the United States, NRCS developed four synthetic 24-hour rainfall distributions (I, IA, II, and III) from available National Weather Service (NWS) duration-frequency data (Hershfield 1061; Frederick et al., 1977) or local storm data. Type IA is the least intense and type II the most intense short duration rainfall. The four distributions are shown in figure B-1, and figure B-2 shows their approximate geographic boundaries.

Types I and IA represent the Pacific maritime climate with wet winters and dry summers. Type III represents Gulf of Mexico and Atlantic coastal areas where tropical storms bring large 24-hour rainfall amounts. Type II represents the rest of the country. For more precise distribution boundaries in a state having more than one type, contact the NRCS State Conservation Engineer.

**Figure B-2** Approximate geographic boundaries for NRCS (SCS) rainfall distributions



## Rainfall data sources

This section lists the most current 24-hour rainfall data published by the National Weather Service (NWS) for various parts of the country. Because NWS Technical Paper 40 (TP-40) is out of print, the 24-hour rainfall maps for areas east of the 105th meridian are included here as figures B-3 through B-8. For the area generally west of the 105th meridian, TP-40 has been superseded by NOAA Atlas 2, the Precipitation-Frequency Atlas of the Western United States, published by the National Ocean and Atmospheric Administration.

### East of 105th meridian

Hershfield, D.M. 1961. Rainfall frequency atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 40. Washington, DC. 155 p.

### West of 105th meridian

Miller, J.F., R.H. Frederick, and R.J. Tracey. 1973. Precipitation-frequency atlas of the Western United States. Vol. I Montana; Vol. II, Wyoming; Vol. III, Colorado; Vol. IV, New Mexico; Vol. V, Idaho; Vol. VI, Utah; Vol. VII, Nevada; Vol. VIII, Arizona; Vol. IX, Washington; Vol. X, Oregon; Vol. XI, California. U.S. Dept. of

Commerce, National Weather Service, NOAA Atlas 2. Silver Spring, MD.

### Alaska

Miller, John F. 1963. Probable maximum precipitation and rainfall-frequency data for Alaska for areas to 400 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. of Commerce, Weather Bur. Tech. Pap. No. 47. Washington, DC. 69 p.

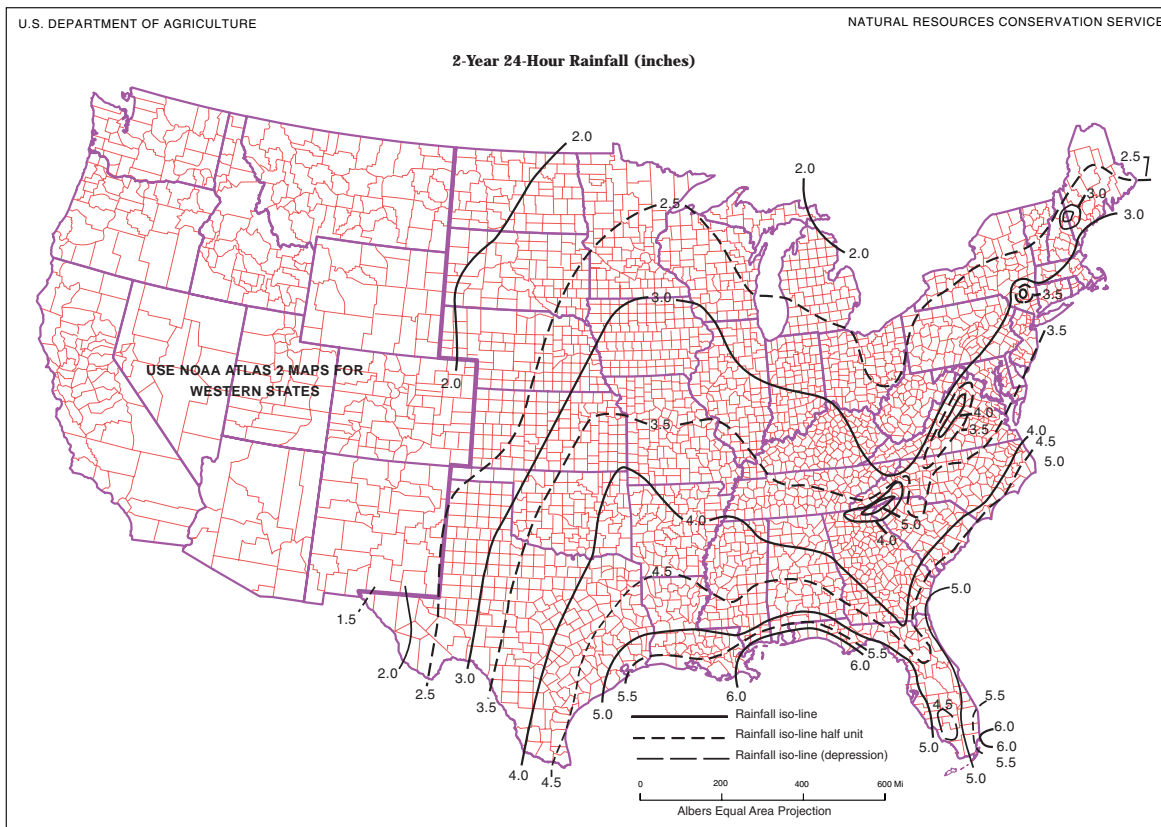
### Hawaii

Weather Bureau. 1962. Rainfall-frequency atlas of the Hawaiian Islands for areas to 200 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 43. Washington, DC. 60 p.

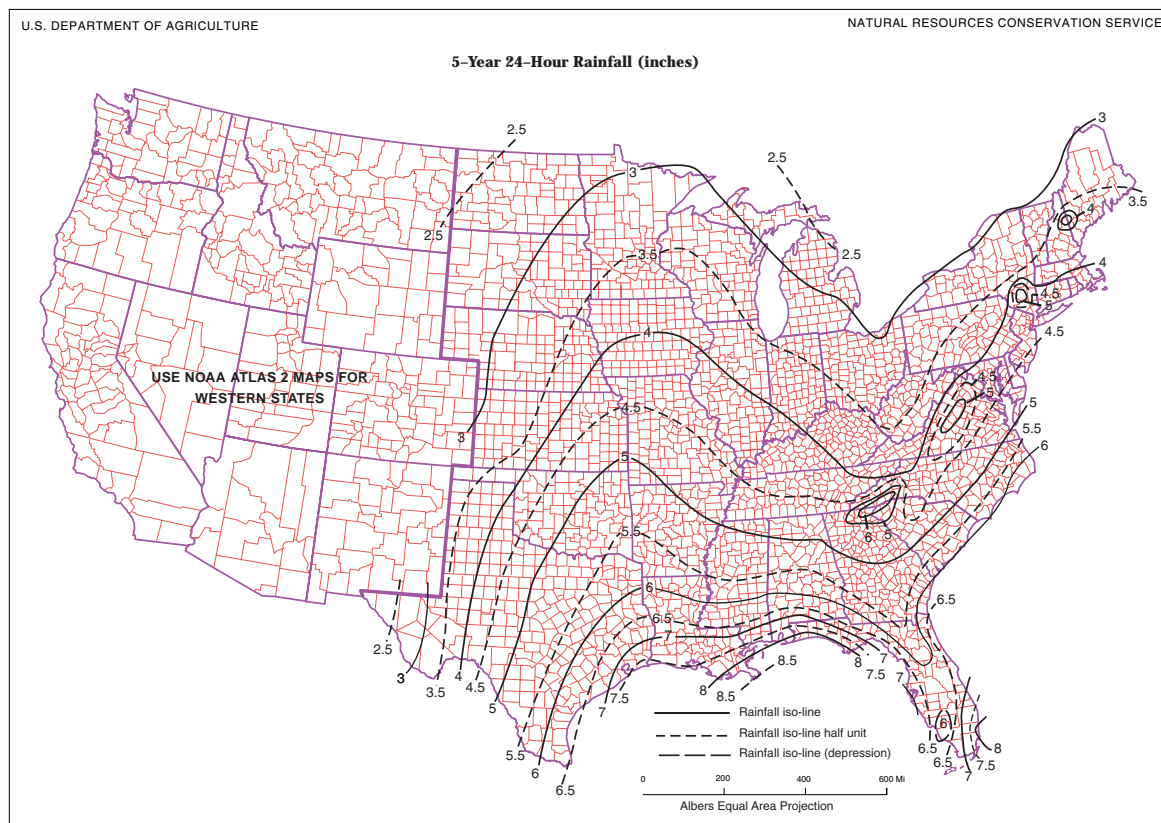
### Puerto Rico and Virgin Islands

Weather Bureau. 1961. Generalized estimates of probable maximum precipitation and rainfall-frequency data for Puerto Rico and Virgin Islands for areas to 400 square miles, durations to 24 hours, and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 42. Washington, DC. 94 p.

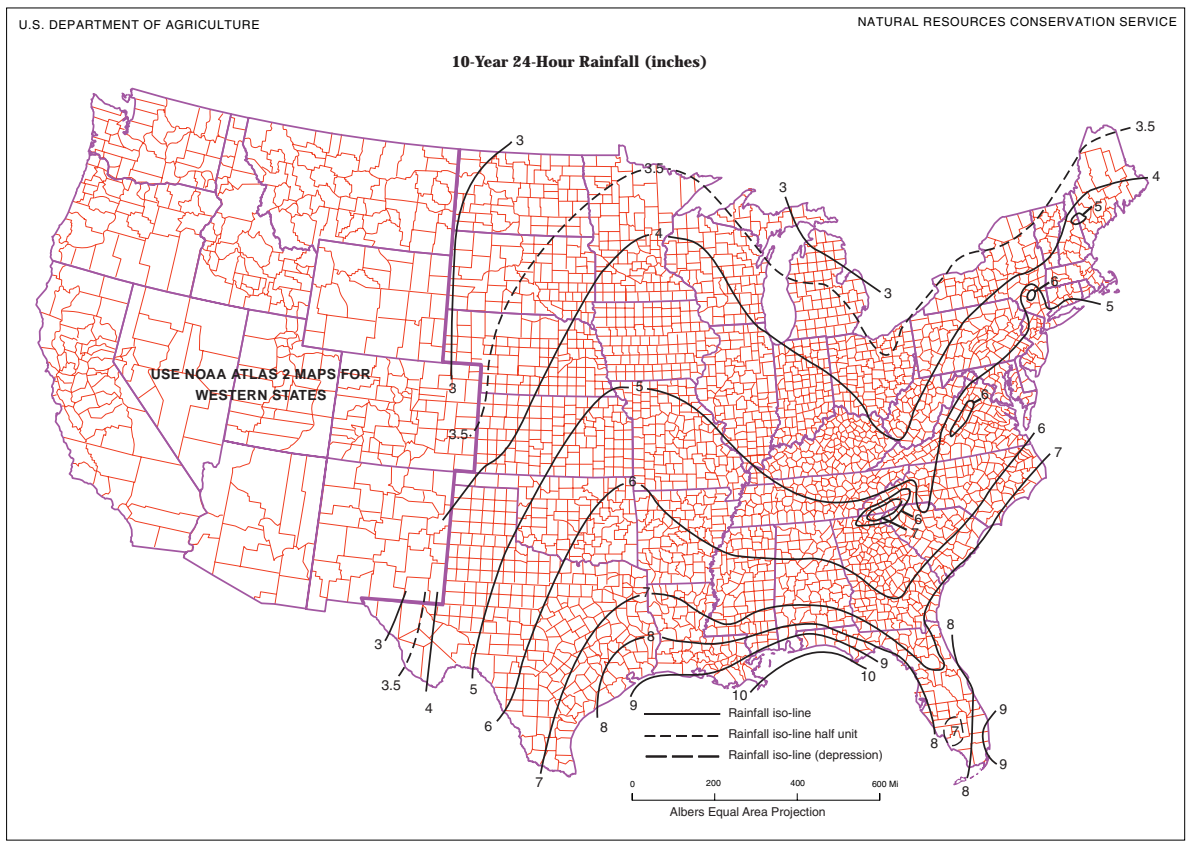
**Figure B-3** 2-year, 24-hr rainfall



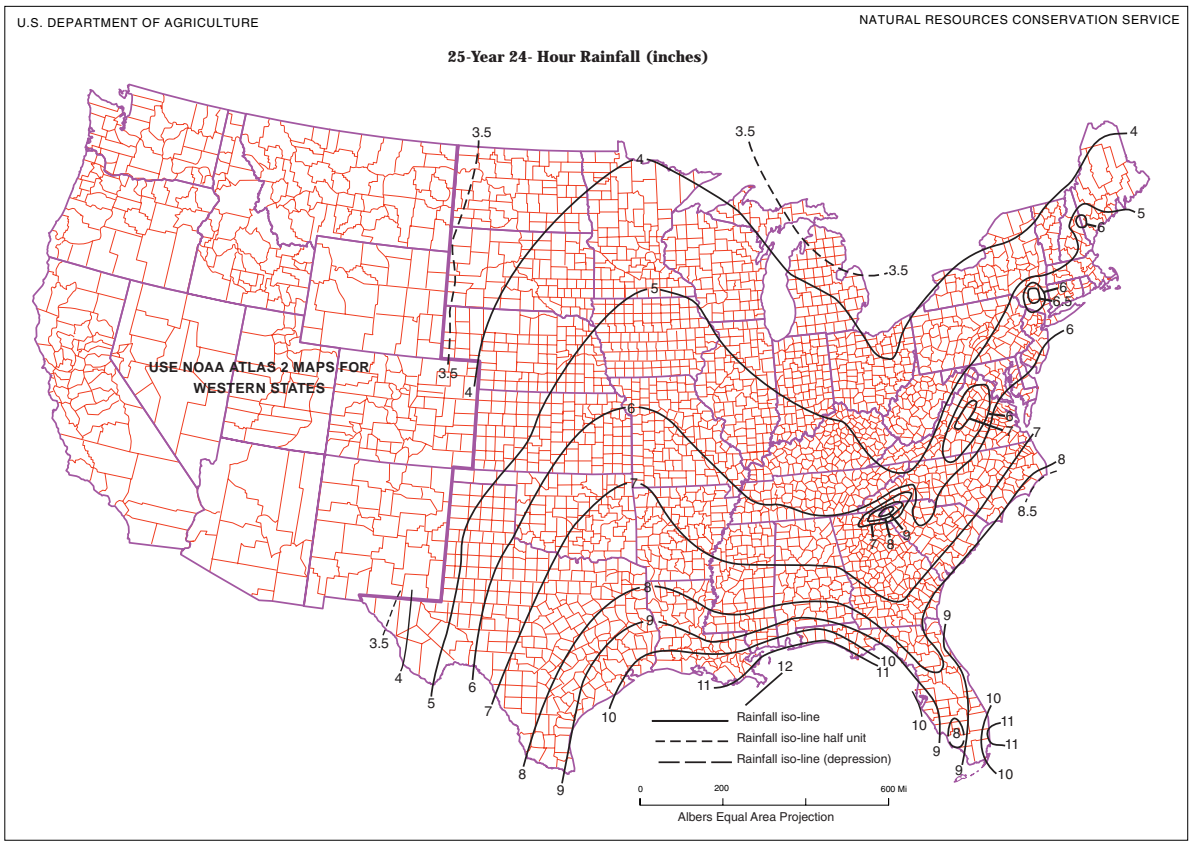
**Figure B-4** 5-year, 24-hour rainfall



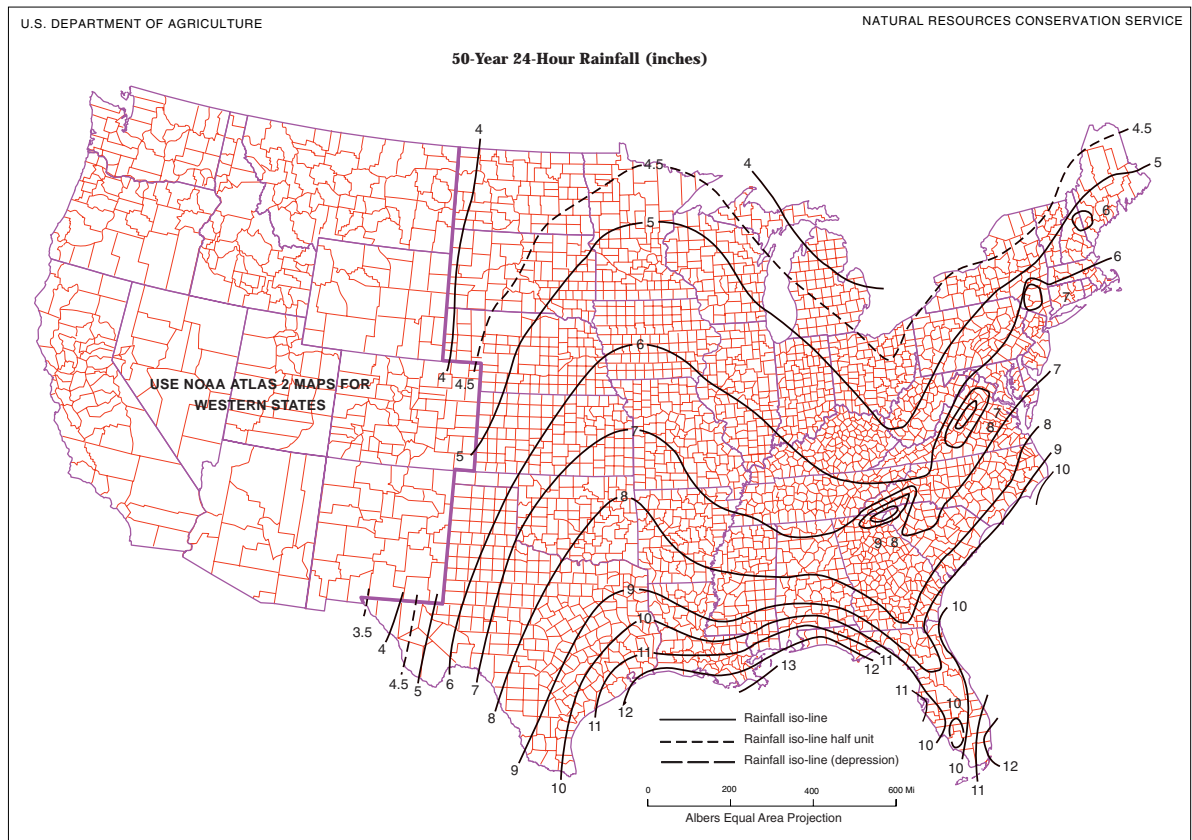
**Figure B-5** 10-year, 24-hour rainfall



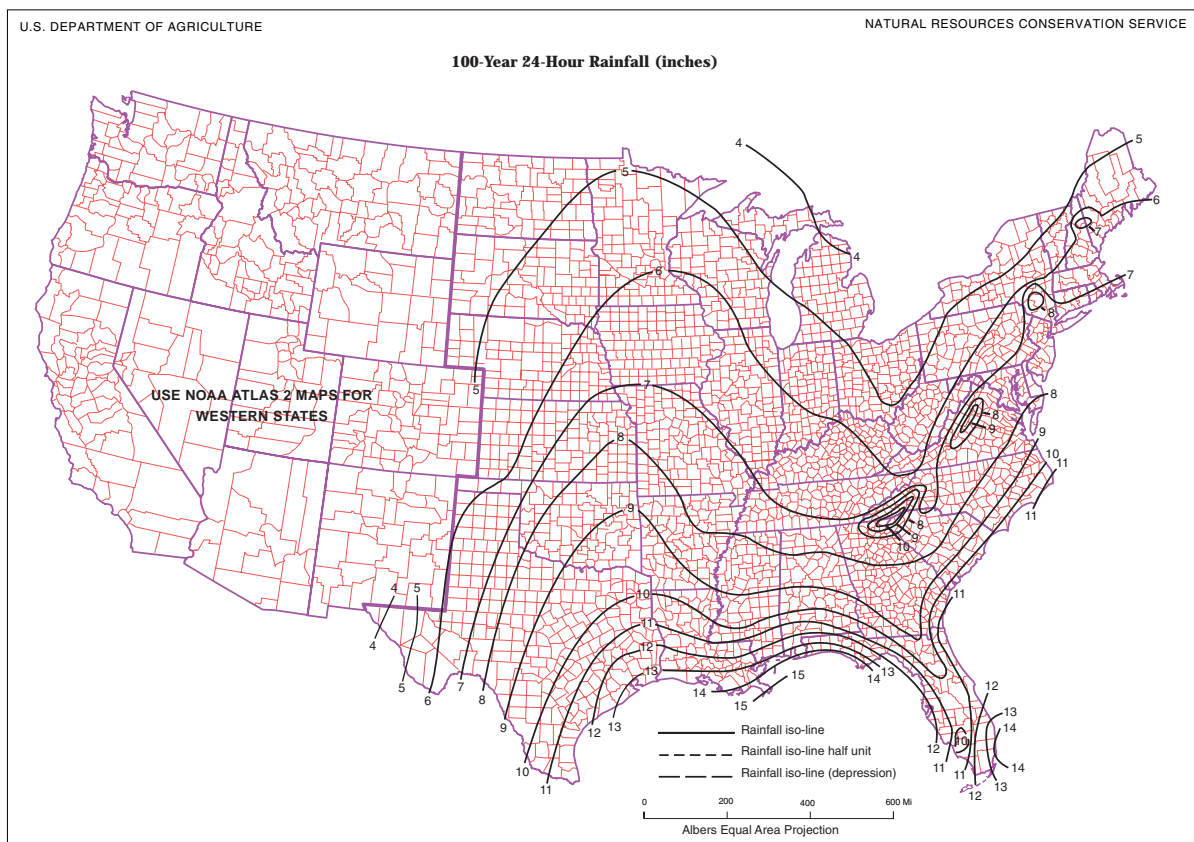
**Figure B-6** 25-year, 24-hour rainfall



**Figure B-7** 50-year, 24-hour rainfall



**Figure B-8** 100-year, 24-hour rainfall





The TR-55 procedures have been incorporated in a computer program. The program, written in BASIC, requires less than 256K memory to operate and was developed for MS-DOS operating system. Users of the program, however, still need to be familiar with the procedures in this TR. Features of the program include the following:

- The full screen (24 lines, 80 columns) is used to enter data. Flexibility of coding allows movement about the screen for quick data modifications.
- Function keys provide menu power to different modules (TR-55 chapters) within the program. Some keys are permanently defined while others vary by module.
- Help screens provide pertinent information to the program. Two types of information are included: (1) define system operation and (2) describe input parameters.
- User files provide for optional entry of local data, such as rainfall-frequency, graphic peak discharge equation coefficients, and tabular hydrographs for other rainfall distributions.

Copies of the program can be obtained from—

National Technical Information Service  
U.S. Department of Commerce  
5285 Port Royal Road  
Springfield, VA 22161  
Telephone (703) 487-4650



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# Appendix D

# Worksheets

This appendix contains seven worksheets that can be reproduced for use with chapters 2 through 6. There is no worksheet for chapter 1.

Chapter	Worksheet
2	2
3	3
4	4
5	5a, 5b
6	6a, 6b

# Worksheet 2: Runoff curve number and runoff

Project	By	Date
Location	Checked	Date

Check one:  Present  Developed

## 1. Runoff curve number

Soil name and hydrologic group <small>(appendix A)</small>	Cover description  <small>(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)</small>	CN <sup>1/</sup>			Area  <input type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		

<sup>1/</sup> Use only one CN source per line

**Totals** ➡

CN (weighted) =  $\frac{\text{total product}}{\text{total area}}$  = \_\_\_\_\_ = \_\_\_\_\_ ;

**Use CN** ➡

## 2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			

(Use P and CN with table 2-1, figure 2-1, or equations 2-3 and 2-4)

# Worksheet 3: Time of Concentration (T<sub>C</sub>) or travel time (T<sub>t</sub>)

Project	By	Date
Location	Checked	Date

Check one:  Present  Developed

Check one:  T<sub>C</sub>  T<sub>t</sub> through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.  
Include a map, schematic, or description of flow segments.

## Sheet flow (Applicable to T<sub>C</sub> only)

	Segment ID			
1. Surface description (table 3-1) .....				
2. Manning's roughness coefficient, n (table 3-1) .....				
3. Flow length, L (total L † 300 ft) ..... ft				
4. Two-year 24-hour rainfall, P <sub>2</sub> ..... in				
5. Land slope, s ..... ft/ft				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T <sub>t</sub> ..... hr		+		= <input style="width: 40px;" type="text"/>

## Shallow concentrated flow

	Segment ID			
7. Surface description (paved or unpaved) .....				
8. Flow length, L .....ft				
9. Watercourse slope, s ..... ft/ft				
10. Average velocity, V (figure 3-1) ..... ft/s				
11. $T_t = \frac{L}{3600 V}$ Compute T <sub>t</sub> ..... hr		+		= <input style="width: 40px;" type="text"/>

## Channel flow

	Segment ID			
12. Cross sectional flow area, a ..... ft <sup>2</sup>				
13. Wetted perimeter, p <sub>w</sub> ..... ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ..... ft				
15. Channel slope, s ..... ft/ft				
16. Manning's roughness coefficient, n .....				
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V .....ft/s				
18. Flow length, L ..... ft				
19. $T_t = \frac{L}{3600 V}$ Compute T <sub>t</sub> ..... hr		+		= <input style="width: 40px;" type="text"/>
20. Watershed or subarea T <sub>C</sub> or T <sub>t</sub> (add T <sub>t</sub> in steps 6, 11, and 19) ..... Hr				= <input style="width: 40px;" type="text"/>

# Worksheet 4: Graphical Peak Discharge method

Project	By	Date
Location	Checked	Date

Check one:  Present  Developed

**1. Data**

Drainage area .....  $A_m =$  \_\_\_\_\_  $\text{mi}^2$  (acres/640)

Runoff curve number .....  $CN =$  \_\_\_\_\_ (From worksheet 2)

Time of concentration .....  $T_c =$  \_\_\_\_\_ hr (From worksheet 3)

Rainfall distribution ..... = \_\_\_\_\_ (I, IA, II III)

Pond and swamp areas spread throughout watershed ..... = \_\_\_\_\_ percent of  $A_m$  ( \_\_\_\_\_ acres or  $\text{mi}^2$  covered)

	Storm #1	Storm #2	Storm #3
2. Frequency ..... yr			
3. Rainfall, P (24-hour) ..... in			
4. Initial abstraction, $I_a$ ..... in (Use CN with table 4-1)			
5. Compute $I_a/P$ .....			
6. Unit peak discharge, $q_u$ ..... csm/in (Use $T_c$ and $I_a/P$ with exhibit 4- _____ )			
7. Runoff, Q ..... in (From worksheet 2) Figure 2-6			
8. Pond and swamp adjustment factor, $F_p$ ..... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)			
9. Peak discharge, $q_p$ ..... $\text{ft}^3/\text{s}$  ( Where $q_p = q_u A_m QF_p$ )			



## Worksheet 5b: Basic watershed data

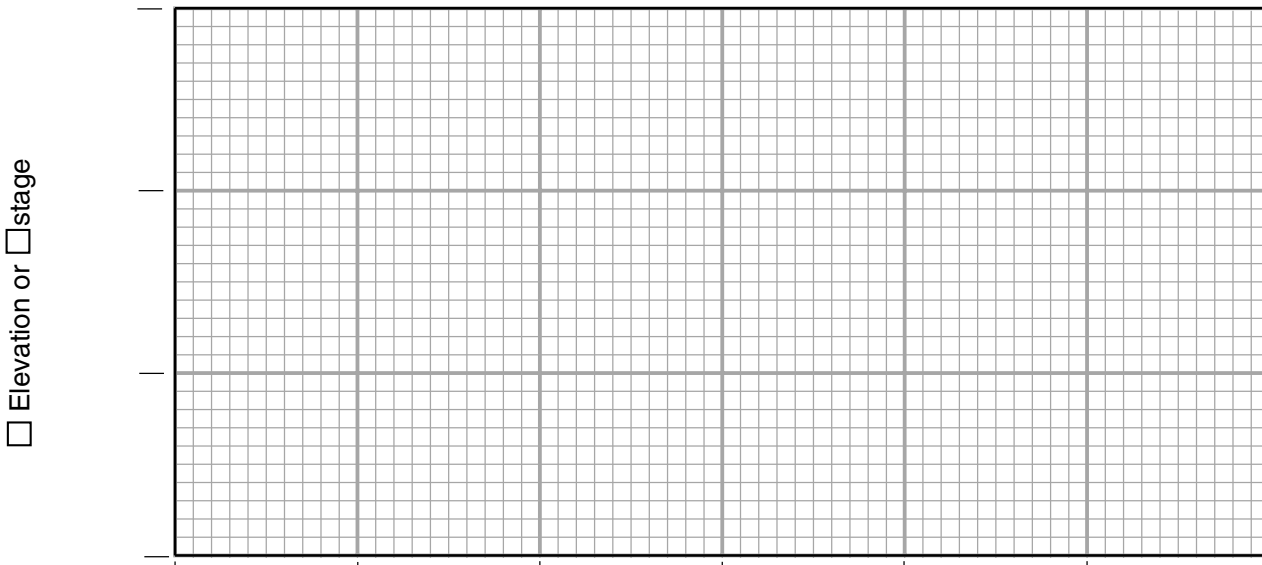
Project		Location				By				Date							
Check one: <input type="checkbox"/> Present <input type="checkbox"/> Developed		Frequency (yr)				Checked				Date							
Subarea name	Basic watershed data used <sup>1/</sup>				Select and enter hydrograph times in hours from exhibit 5-II <sup>2/</sup>												
	Subarea $T_c$ (hr)	$\Sigma T_t$ to outlet (hr)	$I_a/P$	$A_mQ$ (mi <sup>2</sup> -in)													
					Discharges at selected hydrograph times <sup>3/</sup> (cfs)												
Composite hydrograph at outlet																	

<sup>1/</sup> Worksheet 5a. Rounded as needed for use with exhibit 5.  
<sup>2/</sup> Enter rainfall distribution type used.  
<sup>3/</sup> Hydrograph discharge for selected times is  $A_mQ$  multiplied by tabular discharge from appropriate exhibit 5.

# Worksheet 6a: Detention basin storage, peak outflow discharge ( $q_o$ ) known

Project	By	Date
Location	Checked	Date

Check one:  Present  Developed



Detention basin storage ( acre feet )

1. Data:

Drainage area .....  $A_m =$  \_\_\_\_\_  $mi^2$   
 Rainfall distribution type ( I, IA, II, III) = \_\_\_\_\_

1st Stage	2nd Stage
-----------	-----------

2. Frequency ..... yr 

--	--

3. Peak inflow discharge  $q_i$  .....  $ft^3/s$ 

--	--

  
 (from worksheet 4 or 5b)

4. Peak outflow discharge  $q_u$  .....  $ft^3/s$ 

--	--

<sup>1/</sup>

5. Compute  $\frac{q_o}{q_i}$  ..... 

--	--

6.  $\frac{V_s}{V_r}$  ..... 

--	--

  
 ( Use  $\frac{q_o}{q_i}$  with figure 6-1)

7. Runoff, Q ..... in 

--	--

  
 ( From worksheet 2)

8. Runoff volume  $V_r$  ..... ac ft 

--	--

  
 ( $V_r = QA_m 53.33$ )

9. Storage volume,  $V_s$  ..... ac-ft 

--	--

  
 ( $V_s = V_r ( \frac{V_s}{V_r} )$ )

10. Maximum storage  $E_{max}$  (from plot) 

--	--

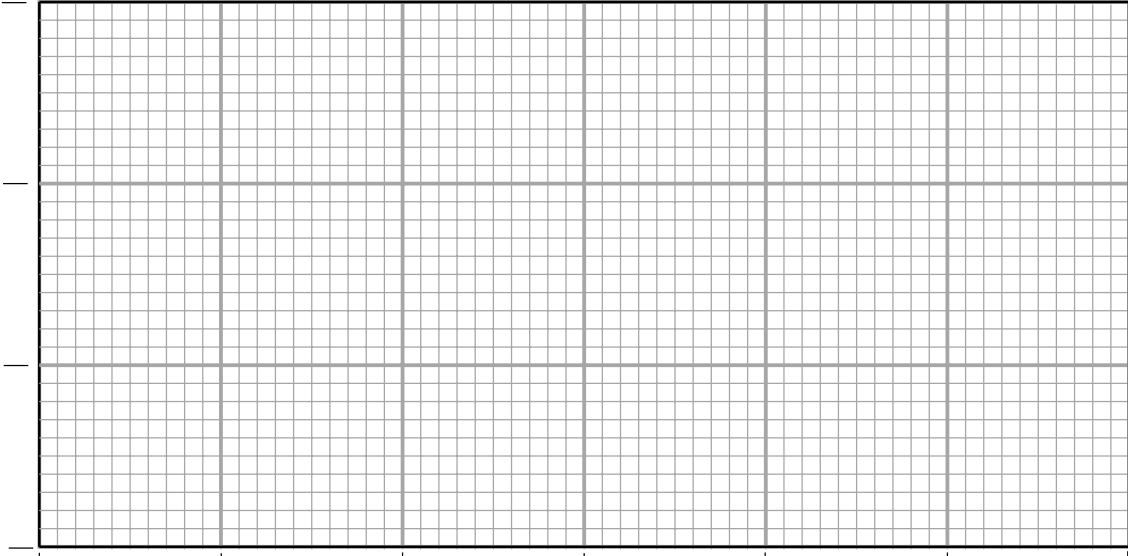
<sup>1/</sup> 2nd stage  $q_o$  includes 1st stage  $q_o$ .

## Worksheet 6b: Detention basin storage, storage volume ( $V_s$ ) known

Project	By	Date
Location	Checked	Date

Check one:  Present  Developed

Elevation or stage



Detention basin storage

**1. Data:**

Drainage area .....  $A_m =$  \_\_\_\_\_  $mi^2$   
 Rainfall distribution type ( I, IA, II, III) = \_\_\_\_\_

1st Stage	2nd Stage
-----------	-----------

2. Frequency ..... yr

3. Storage volume  $V_s$  ..... ac-ft

4. Runoff,  $Q$  ..... in    
 (from worksheet 2)

5. Runoff volume ..... ac-ft    
 ( $V_r = QA_m 53.33$ )

1/ 2nd stage  $q_o$  includes 1st stage  $q_o$ .

6. Compute  $\frac{V_s}{V_r}$  .....

7.  $\frac{q_o}{q_i}$  ..... in    
 ( Use  $\frac{V_s}{V_r}$  with figure 6-1)

8. Peak inflow discharge  $q_i$  ..... in    
 ( From worksheet 4 or 5b)

9. Peak outflow discharge  $q_o$  .....  $ft^3/s$     
 ( $q_o = q_i ( \frac{q_o}{q_i} )$ )

10. Maximum storage  $E_{max}$  (from plot)

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## Appendix E

## References

- Brakensiek, D.L. and W.J. Rawls. 1983. Green-Ampt infiltration model parameters for hydrologic classification of soils. *In* John Borrelli, Victor R. Hasfurther, and Robert D. Burman (ed.) *Advances in irrigation and drainage surviving external pressures*. Proceedings of Am. Soc. Civ. Eng. specialty conference. New York, NY. p.226-233.
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- \_. 1985. *National engineering handbook. Section 4-Hydrology*. Washington, DC.



This appendix presents the equations used in procedure applications to generate figures and exhibits in TR-55.

Figure 2-1 (runoff equation):

$$Q = \frac{\left[ P - .2 \left( \frac{1000}{CN} - 10 \right) \right]^2}{P + 0.8 \left( \frac{1000}{CN} - 10 \right)}$$

where

Q = runoff (in)

P = rainfall (in)

CN = runoff curve number

Figure 2-3 (composite CN with connected impervious area):

$$CN_c = CN_p + \left( \frac{P_{imp}}{100} \right) (98 - CN_p)$$

where

CN<sub>c</sub> = composite runoff curve number

CN<sub>p</sub> = pervious runoff curve number

P<sub>imp</sub> = percent imperviousness.

Figure 2-4 (composite CN with unconnected impervious areas and total impervious area less than 30%):

$$CN_c = CN_p + \left( \frac{P_{imp}}{100} \right) (98 - CN_p) (1 - 0.5R)$$

where

R = ratio of unconnected impervious area to total impervious area.

Figure 3-1 (average velocities for estimating travel time for shallow concentrated flow):

Unpaved  $V = 16.1345 (s)^{0.5}$

Paved  $V = 20.3282 (s)^{0.5}$

where

V = average velocity (ft/s)

s = slope of hydraulic grade line  
(watercourse slope, ft/ft)

These two equations are based on the solution of Manning's equation (eq. 3-4) with different assumptions for n (Manning's roughness coefficient) and r (hydraulic radius, ft). For unpaved areas, n is 0.05 and r is 0.4; for paved areas, n is 0.025 and r is 0.2.

Exhibit 4 (unit peak discharges for SCS type I, IA, II, and III distributions):

$$\log(q_u) = C_o + C_1 \log(T_c) + C_2 [\log(T_c)]^2$$

where

q<sub>u</sub> = unit peak discharge (csm/in)

T<sub>c</sub> = time of concentration (hr)

(minimum, 0.1; maximum, 10.0)

C<sub>0</sub>, C<sub>1</sub>, C<sub>2</sub> = coefficients from table F-1

Figure 6-1 (approximate detention basin routing through single- and multiple-stage structures for 24-hour rainfalls of the indicated type):

$$\frac{V_s}{V_r} = C_o + C_1 \left( \frac{q_o}{q_i} \right) + C_2 \left( \frac{q_o}{q_i} \right)^2 + C_3 \left( \frac{q_o}{q_i} \right)^3$$

where

V<sub>s</sub>/V<sub>r</sub> = ratio of storage volume (V<sub>s</sub>) to runoff volume (V<sub>r</sub>)

q<sub>o</sub>/q<sub>i</sub> = ratio of peak outflow discharge (q<sub>o</sub>) to peak inflow discharge (q<sub>i</sub>)

C<sub>0</sub>, C<sub>1</sub>, C<sub>2</sub>, C<sub>3</sub> = coefficients from table F-2

**Table F-1** Coefficients for the equation used to generate exhibits 4-I through 4-III

Rainfall type	I <sub>a</sub> /P	C <sub>0</sub>	C <sub>1</sub>	C <sub>2</sub>
I	0.10	2.30550	-0.51429	-0.11750
	0.20	2.23537	-0.50387	-0.08929
	0.25	2.18219	-0.48488	-0.06589
	0.30	2.10624	-0.45695	-0.02835
	0.35	2.00303	-0.40769	0.01983
	0.40	1.87733	-0.32274	0.05754
	0.45	1.76312	-0.15644	0.00453
	0.50	1.67889	-0.06930	0.0
IA	0.10	2.03250	-0.31583	-0.13748
	0.20	1.91978	-0.28215	-0.07020
	0.25	1.83842	-0.25543	-0.02597
	0.30	1.72657	-0.19826	0.02633
	0.50	1.63417	-0.09100	0.0
II	0.10	2.55323	-0.61512	-0.16403
	0.30	2.46532	-0.62257	-0.11657
	0.35	2.41896	-0.61594	-0.08820
	0.40	2.36409	-0.59857	-0.05621
	0.45	2.29238	-0.57005	-0.02281
	0.50	2.20282	-0.51599	-0.01259
III	0.10	2.47317	-0.51848	-0.17083
	0.30	2.39628	-0.51202	-0.13245
	0.35	2.35477	-0.49735	-0.11985
	0.40	2.30726	-0.46541	-0.11094
	0.45	2.24876	-0.41314	-0.11508
	0.50	2.17772	-0.36803	-0.09525

**Table F-2** Coefficients for the equation used to generate figure 6-1

Rainfall distribution (appendix B)	C <sub>0</sub>	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>
I, IA	0.660	-1.76	1.96	-0.730
II, III	0.682	-1.43	1.64	-0.804