SPRI RD-1 2014
Performance Standard for Retrofit Drains

DISCLAIMER

This standard is for use by architects, engineers, consultants, roofing contractors and owners of low slope roofing systems. This standard specifically does not address existing building drainage capacity or overflow drainage requirements and should not be used for those purposes. It is intended to provide data and guidance necessary to understand the implementation and use of retrofit drainage elements. Do not assume all existing buildings have code compliant drainage. SPRI, IT'S MEMBERS AND EMPLOYEES DO NOT WARRANT THAT THIS STANDARD IS PROPER AND APPLICABLE UNDER ALL CONDITIONS.

1. INTRODUCTION

This standard is a reference for those that design, specify, or install retrofit roof drains which are designed for installation in existing drain plumbing on existing roofs. This standard does not include consideration of all roof storm water drainage code requirements for specific building sites. Design is dictated by local code requirements. As such, this Standard shall be used in conjunction with local code and the installation specifications of the manufacturer of the specific retrofit roof drain.

2. DEFINITIONS

For the purposes of this Document, the following definitions apply:

2.1. Retrofit Drain

A factory fabricated drain, installed within an existing roof drain on an existing roof. Retrofit roof drains are installed from the roof surface and are provisional with a horizontal flashing flange for adhering membrane flashing materials, and coupling to provide a mechanical backflow compression seal to the existing plumbing. A *retrofit drain* is designed so that it may be installed without removing the existing roof *drain body* and plumbing.

2.2. Drain body

The basic drain, consisting of the *drain flange* and interconnected *drain stem*. There may be a sump between the flange and the stem.

2.3. Effective Drain Diameter

The least cross-sectional flow area between the *drain body* and the outlet of the *drain stem* expressed as a diameter.

2.4. Drain Flange

The part of the *drain body* that extends horizontally, in the plane of the roof. It is used for attachment of the drain to the roof deck and for clamping and sealing the roof membrane flashing plies to the drain.

2.5. Drain Stem

A part of the drain that is inserted through the existing roof drain bowl for connection to the existing roof drain plumbing. The *backflow seal* is integral to the stem.

2.6. Drain Flashing

The watertight connection(s) between the *retrofit drain* and the existing roofing system.

2.6.1. Clamping Ring

A component of the *retrofit drain* that creates a mechanical compression *seal* with the membrane flashing plies by clamping the membrane flashing plies between the c*lamping ring* and the *drain flange*.

2.6.2. Heat Welding

A method for creating a watertight *seal* between the electric heat-welded membrane flashing plies and the *drain flange***.**

2.7. Backflow Seal

The part of the *retrofit drain* that creates a watertight mechanical compression *seal* between the *drain stem* and the existing plumbing

2.8. Strainer

A component of the drain which minimizes amount of debris that enters the drain.

2.9. Available Inlet Area

The combined area of all the openings in the strainer.

3. GENERAL DESIGN CONSIDERATIONS

3.1. The drain manufacturer's installation instructions shall reference the information required for proper installation of the roof *drain body, backflow seal*, and *strainer dome* and shall include at least the following:

3.1.1. A requirement that all *retrofit drain* installations shall meet the requirements of this standard and the requirements of the local authorities having jurisdiction. Where local codes conflict with this standard, local codes shall have priority.

3.1.2. A description of the retrofit roof *drain body, backflow seal* and *strainer dome* and the equipment needed for proper assembly and installation.

3.1.3. Information regarding proper storage and handling of the retrofit roof drain materials prior to and during installation.

3.1.4. Description of all limitations, special installation instructions and design criteria associated with the performance of the *retrofit roof drain*.

3.2. The **Retrofit Roof Drain** size shall be the proper size to be compatible with the existing drain. It shall provide adequate performance based on the more stringent flow requirements of either, the governing building code, or the flow requirements as noted in Section 8. See Table 1 in the Commentary of this Standard.

3.3. Roofing Watertight Seal

The bond between the roof membrane and the *drain flange* shall provide a watertight *seal* using a manufacturer's approved water block adhesive and *clamping ring*, with bolts evenly cinched to membrane or by *heat welding* to the roofing membrane.

3.4. Backflow Seal shall extend below the top of the existing drain and be long enough to create a watertight connection with the properly prepared and cleaned interconnecting portion of the existing drain system.

4. MATERIALS

Retrofit roof drains shall be constructed of polymeric or metal materials or any combination of metals and polymeric materials that have been judged to perform satisfactorily in the rooftop environment. Manufacturers shall be contacted to determine membrane system compatibility.

5. TESTING

Retrofit roof drain manufacturers shall test samples that are representative of standard production per the RF-1 test specified in this section.

5.1. Leakage

Drain bodies with *backflow seals* shall withstand a continuous test pressure under the equivalent of a 10-foot head of water or 4.33 lbf/in^2 (30 kPa) above the elevation of the *backflow seals* without any visible leakage after 24 hours. Laboratory test method RF-1 shall be used to test the *backflow seals*.

Test RF-1:

Setup

Insert a representative *retrofit drain* into a vertical plumbing pipe large enough to receive the *retrofit drain* stem and the *backflow seals*. Seal the existing plumbing pipe below the d*rain stem*-to-plumbing pipe juncture. Affix a vertical pipe at least 10 feet long (3.05 m), but of any convenient diameter that can be sealed to the *drain body* so that water can flow through the pipe and into the *seal* between the plumbing and the backflow gasket.

Method

Fill the pipe with water to a height of 10 feet (3.05 m) above the *backflow seal***.** The test shall be conducted for a minimum of 24 hours -0/+1 hour during which the 10-foot head of water shall be maintained.

Test Results

The drain shall be acceptable if there is no visible leakage at the *backflow seal*.

6. Strainers

Strainer domes shall extend not less than 4 inches (100 mm) above the surface of the roof immediately adjacent to the roof drain. To facilitate normal flow of water *strainer domes* shall have an *available inlet area*, above roof level, of not less than one and one-half times the inside cross-sectional area of the Drain Diameter.

7. Installation

The *retrofit drain* shall be installed in compliance with the drain manufacturer's instructions. The roof cover tie-in shall be completed in compliance with the roof cover manufacturer's instructions.

8. Flow requirements

Flow capacity calculations shall be based on the *effective drain diameter*. There shall be a sufficient drainage to accommodate a one-hour rainfall rate base on a 100-year return period or the local code, whichever number is greater. Local code requirements for overflow requirements shall be confirmed with a local building code representative. Consult Commentary Figure 1 or local weather stations for local statistics.

Where separate roof sections are drained independently, flow calculations shall be performed on each section. Each section shall have at least one drain. Drain capacities shall be determined from the applicable plumbing code. See Commentary Table 1. Pipe diameter shall be the inside diameter of the retrofitted *drain stem*, not the original drain diameter.

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Commentary

This Commentary consists of explanatory and supplementary material designed to help designers, roofing contractors and local building authorities in applying the requirements of the preceding Standard. It is intended to create an understanding of the requirements through brief explanations of the reasoning employed in arriving at these requirements.

This Standard addresses the design of retrofit primary drains. Note that local codes may also require a secondary or overflow drain and this secondary drain may be required to have greater flow capacity than the primary drain

Flow requirements

Flow capabilities are addressed in the Standard. There should be sufficient total cross-section area of drains to drain the entire roof area. Drain rates in Table 1 can be approximated using the following formula:

$$A = 464 \times D^{2.66} \div r$$

in which:
***A*=area drained in square feet,**
***D*=Drain Diameter in inches and**
***r*=rainfall rate in inches/hour**

The International Code Council/International Plumbing Code Formula (ICC/IPC) (Q = 0.0104 x A x i) will produce slightly different values.

Q = Volumetric Flow Rate (gal/min)
A = Roof Area (ft^2)
i = Rainfall rate (in./hour)

Existing drain capacities frequently exceed requirements**.** When more drain capacity is needed, consult with the *retrofit drain* manufacturer for a compatible solution.

Alternative Drain Specification Method

Table 2 may be used to check to see if sufficient drains exist on the retrofit roof. Pipe diameter is that of the retrofitted drain, not the original drain diameter.

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Table 1
Roof Areas (ft^2) Drained vs. Drain Diameter and Rainfall Rates

Rainfall in./hr.	Drain Diameter (inches)					
	2	3	4	5	6	8
.08	3,670	10,780	23,170	41,950	68,130	146,440
1.0	2,930	8,620	18,540	33,560	54,500	117,150
1.2	2,440	7,190	15,450	27,960	45,420	97,620
1.4	2,090	6,160	13,240	23,970	38,930	83,680
1.6	1,830	5,390	11,580	20,970	34,060	73,220
1.8	1,630	4,790	10,300	18,640	30,280	65,080
2.0	1,470	4,310	9,270	16,780	27,250	58,570
2.5	1,170	3,450	7,410	13,420	21,800	46,860
3.0	980	2,870	6,180	11,190	18,170	39,050
3.5	840	2,460	5,300	9,590	15,570	33,470
4.0	730	2,160	4,630	8,390	13,630	29,290
4.5	650	1,920	4,120	7,460	12,110	26,030
5.0	590	1,720	3,710	6,710	10,900	23,430

Drainage areas in Table 1: Vertical façades (walls), that can shed wind-driven rain onto roof sections, should be accounted for when determining effective roof areas. Tributary vertical façade areas are generally considered to be 50% effective – that is, the tributary wall area is reduced by 50% to determine the equivalent effective tributary roof area which is then added to the roof section drainage area to determine the total effective roof drainage area.

Table 1 may be interpolated for intermediate effective pipe diameters and rainfall rates. Drainage areas assume roof conditions will allow sufficient water flow to the drain.

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Table 2
Minimum Number of Drains
per Thousand Squares (100,000 ft^2)

Rainfall in./hr.	Drain Diameter (inches)					
	2	**3**	**4**	**5**	**6**	**8**
0.8	28	10	5	3	2	1
1.0	35	12	6	3	2	1
1.2	41	14	7	4	3	2
1.4	48	17	8	5	3	2
1.6	55	19	9	5	3	2
1.8	62	21	10	6	4	2
2.0	69	24	11	6	4	2
2.5	86	29	14	8	5	3
3.0	103	35	17	9	6	3
3.5	120	41	19	11	7	3
4.0	137	47	22	12	8	4
4.5	154	53	25	14	9	4
5.0	171	58	27	15	10	5

Drain sizing tables should be used with care. Roof design may not be capable of conducting rain from a very large area (ex: 40,000 square feet), to a single drain even if the drain could handle the water flow.

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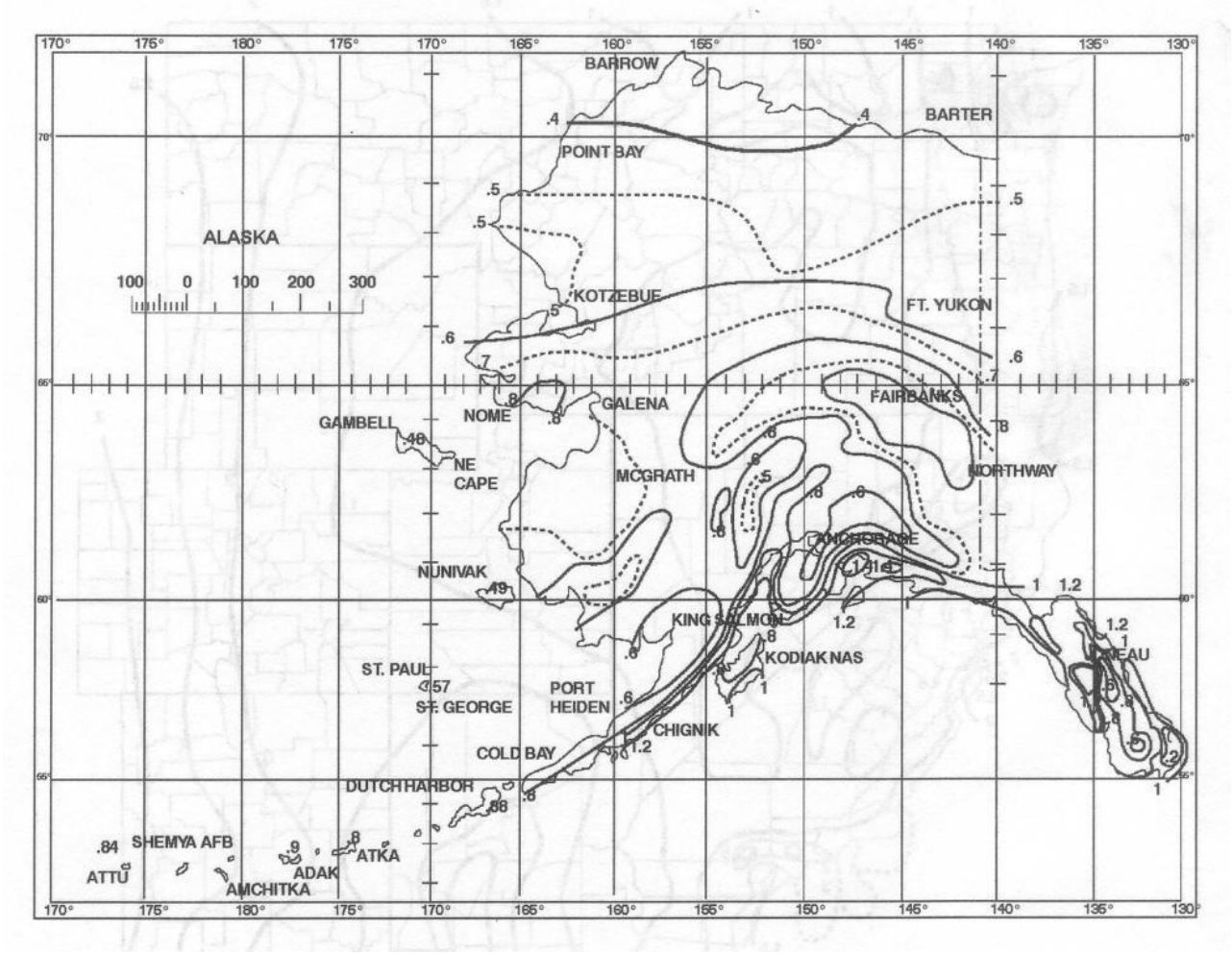
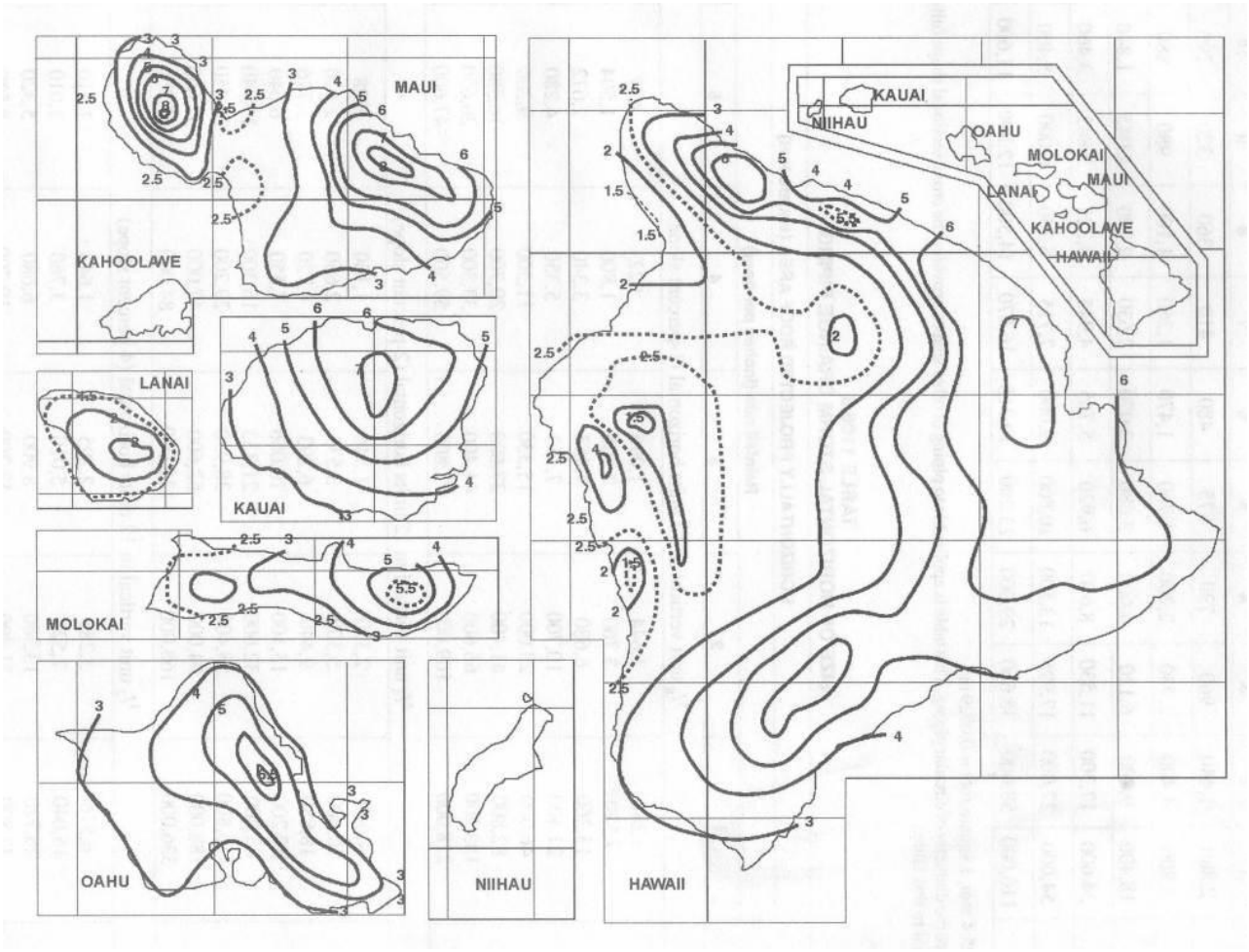
One-Hour 100-year Return Rainfall Rates[1]
Figure 1b: For Alaska



[1] Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington D.C.

Commentary

One-Hour 100-year Return Rainfall Rates[2]
Figure 1c: For Hawaii



[2] Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington D.C.

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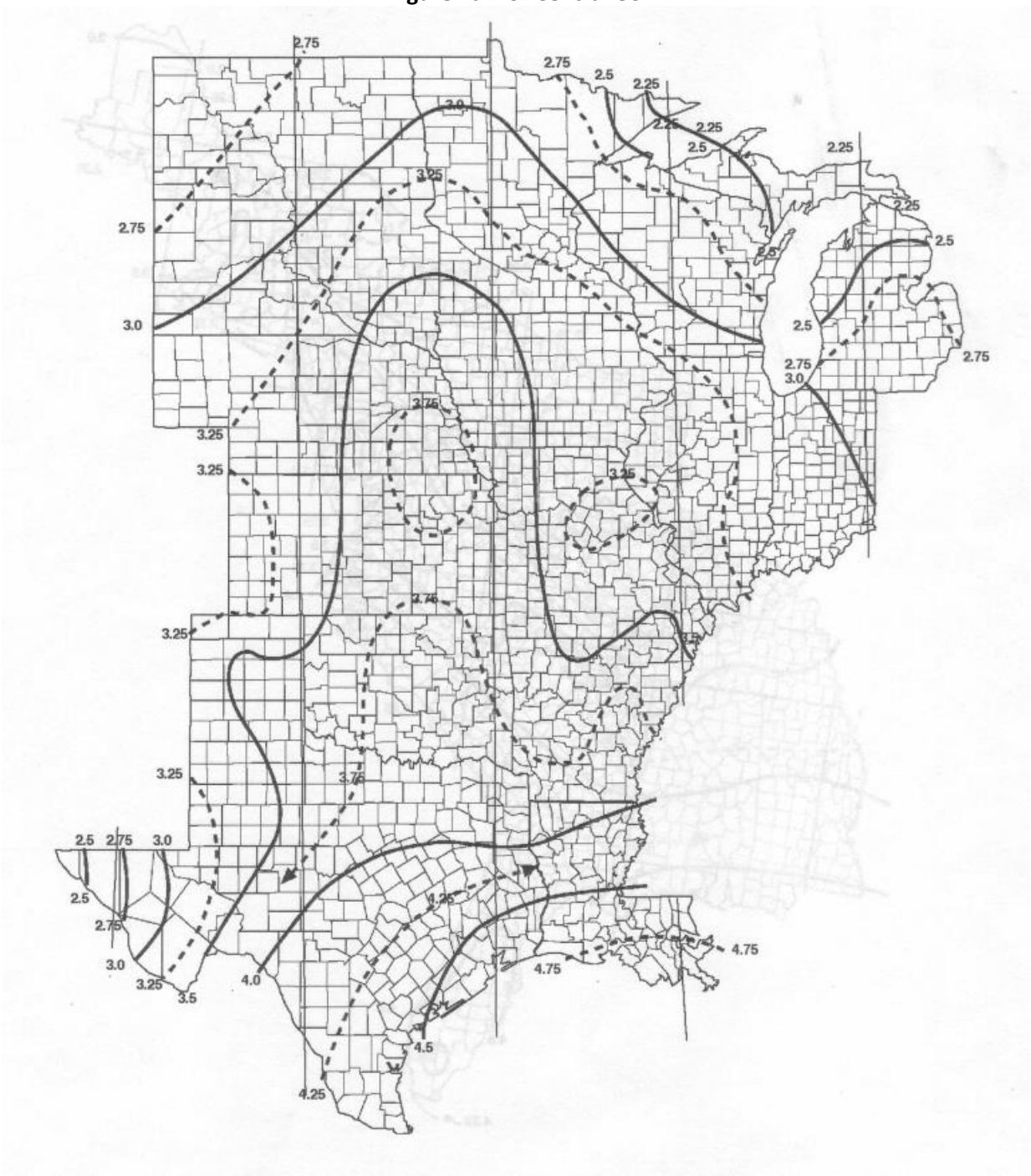
One-Hour 100-year Return Rainfall Rates[3]
Figure 1d: For Central US



[3] Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington D.C.

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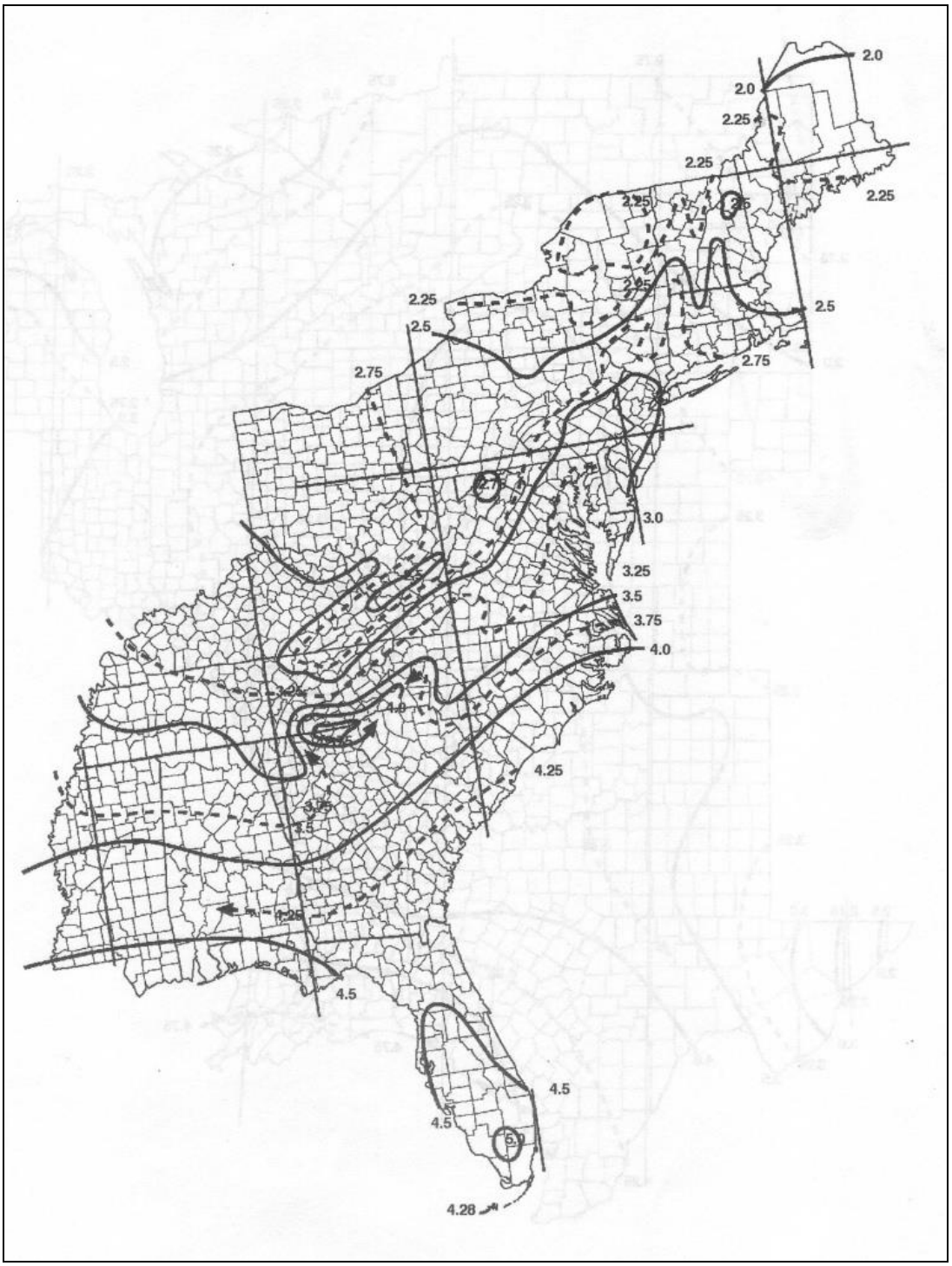
One-Hour 100-year Return Rainfall Rates[4]
Figure 1e: For Eastern US



[4] Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington D.C.

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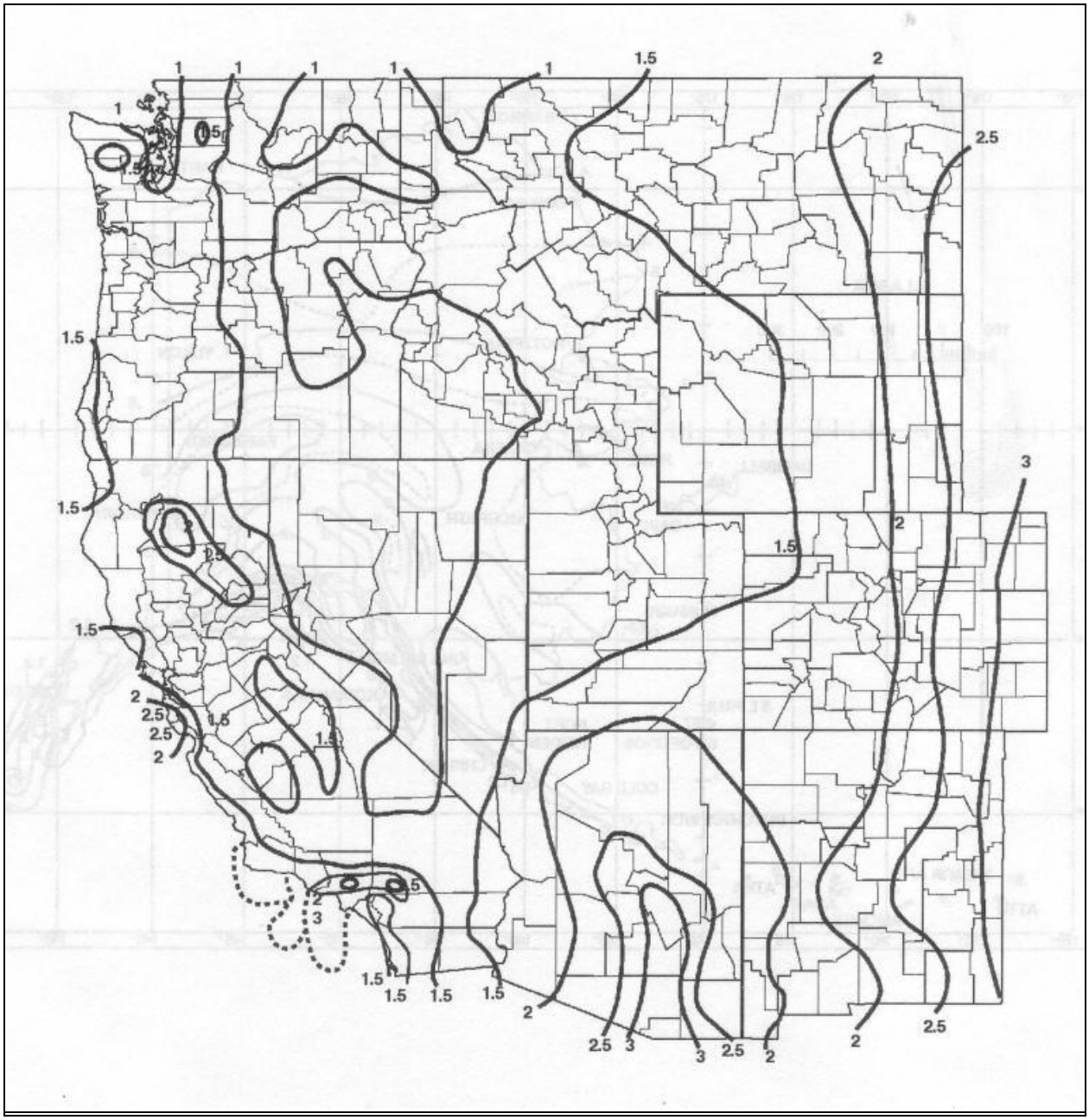
One-Hour 100-year Return Rainfall Rates[5]
Figure 1f: For Western US



[5] Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington D.C.