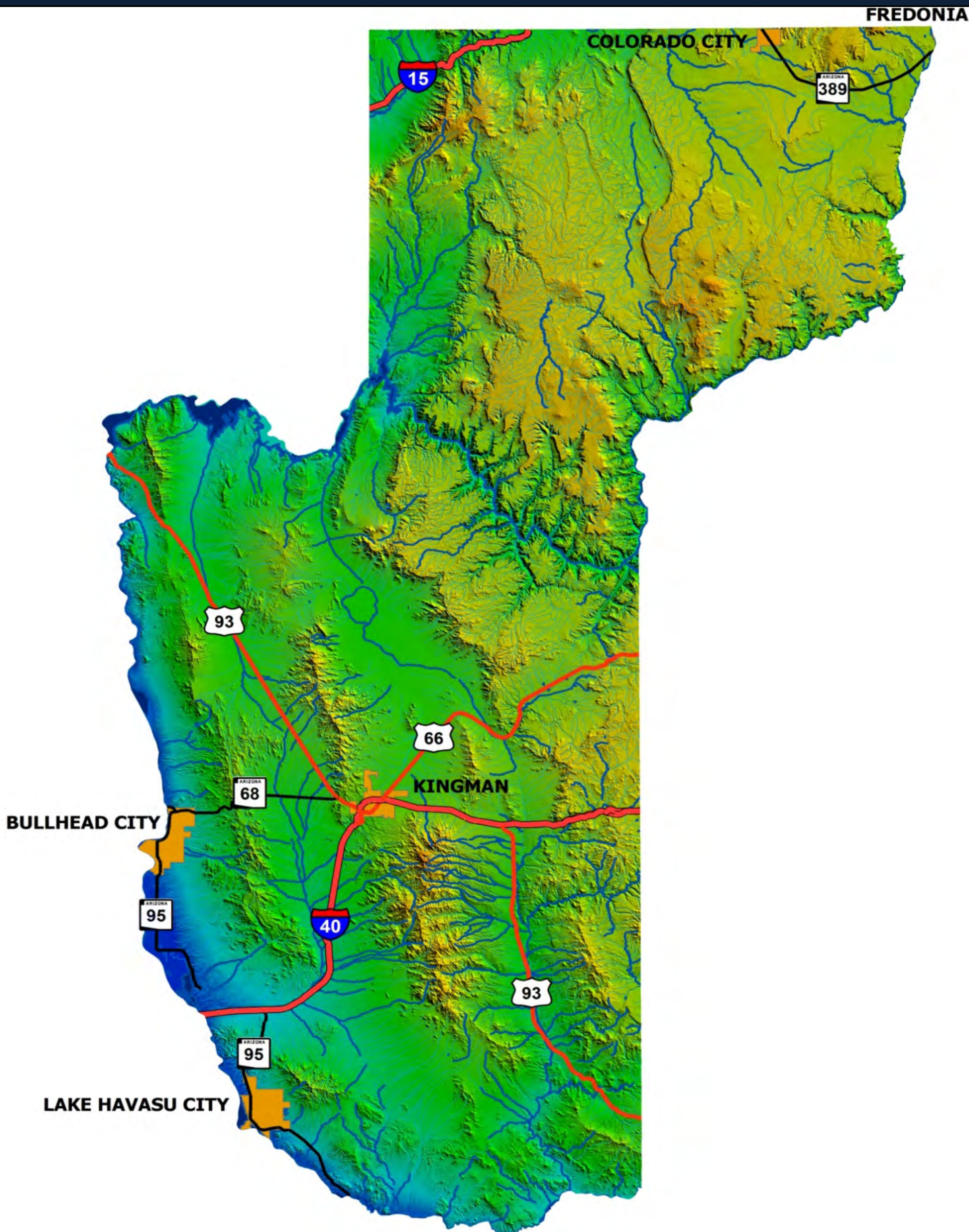
DRAINAGE DESIGN MANUAL FOR MOHAVE COUNTY

APPENDICES



3rd Edition, May 2018

3250 E. Kino Avenue, Kingman, AZ 86402 (928) 757-0925

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

The 3rd Edition of this document prepared by:

Arid Hydrology & Hydraulics, LLC
Payson, Arizona
tom@aridhh.com

A. HYDROLOGY EXAMPLES

A.1 RAINFALL EXAMPLES

A.1.1 D-D-F AND I-D-F DATA FOR USE WITH THE RATIONAL METHOD

The Depth-Duration-Frequency (D-D-F) and Intensity-Duration-Frequency (I-D-F) data for use with the Rational Method can be generated in three ways.

Manually using Figure B.1 through Figure B.60.
Using the manual method within the DDMSW computer program.
Using ESRI ArcMap Shape files within the DDMSW computer program.
The use of each method will be demonstrated for the following problem:
Problem: A D-D-F and an I-D-F are needed for a small project in Kingman, AZ. The site is located in the west half of Section 9, T21N, R16W, G and SRM, and overlaps into Section 8.

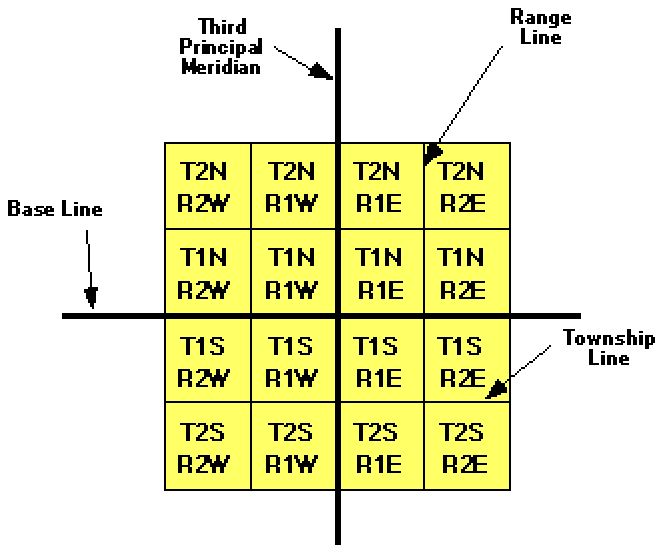
A.1.1.1 Example Using the Manual Method

Solution: The first step is to assemble copies of Figure B.1 through Figure B.60. Then the site must be located on each figure. Sites are located on the figures by use of world coordinates or by use of the Federal Township and Range System. A world coordinate graticule grid (latitude and longitude) with a 30-second resolution is shown on each figure. Also shown are the grid of township and range lines from the Federal Township and Range System. As a refresher, a basic graphical representation of the Federal Township and Range System is shown on Figure A.1. Using this information, a site can be located within the level of positional accuracy of the NOAA Atlas 14 point rainfall data depicted on the figure.

The T21N and R16W grid cell can be easily located on each figure. Then the location of Section 9 can be estimated visually by understanding where Section 9 is located using the standard system shown on Figure A.1. The example site location is identified on the Figure B.2 2-year 10-minute isopluvial map as shown on Figure A.2. Interpolating the isopluvial lines at the site location, the 2-year 10-minute point precipitation is estimated at 0.39 inches. This value is then entered in the appropriate cell in Table A.1. This same process was duplicated for the fifty-nine (59) other isopluvial maps and the estimated point precipitation values tabulated in Table A.1.

Figure A.1 Federal Township and Range System

The largest grouping is the township which is named in reference to a Principal Meridian (P.M.) and a Baseline. T2N, R1E refers to Township 2 North (of the Baseline), Range 1 East (of the Principal Meridian). Surveys in Arizona are governed by the Gila and Salt River Base Line and Meridian. The Initial Point is at the intersection of these two lines. The Base Line runs east and west though this point and the Meridian runs north and south through the point. Land descriptions and property boundaries are governed by and identified by this point.



Within each township are 36 sections, each one mile square. Each section contains approximately 640 acres. The sections are numbered from 1 to 36 in the following order.

35	36	31	32	33	34	35	36	31	32
2	1	6	5	4	3	2	1	6	5
11	12	7	8	9	10	11	12	7	8
14	13	18	17	16	15	14	13	18	17
23	24	19	20	21	22	23	24	19	20
26	25	30	29	28	27	26	25	30	29
35	36	31	32	33	34	35	36	31	32
2	1	6	5	4	3	2	1	6	5

Figure A.2 I-D-F example site location for 2-year 10-minute precipitation

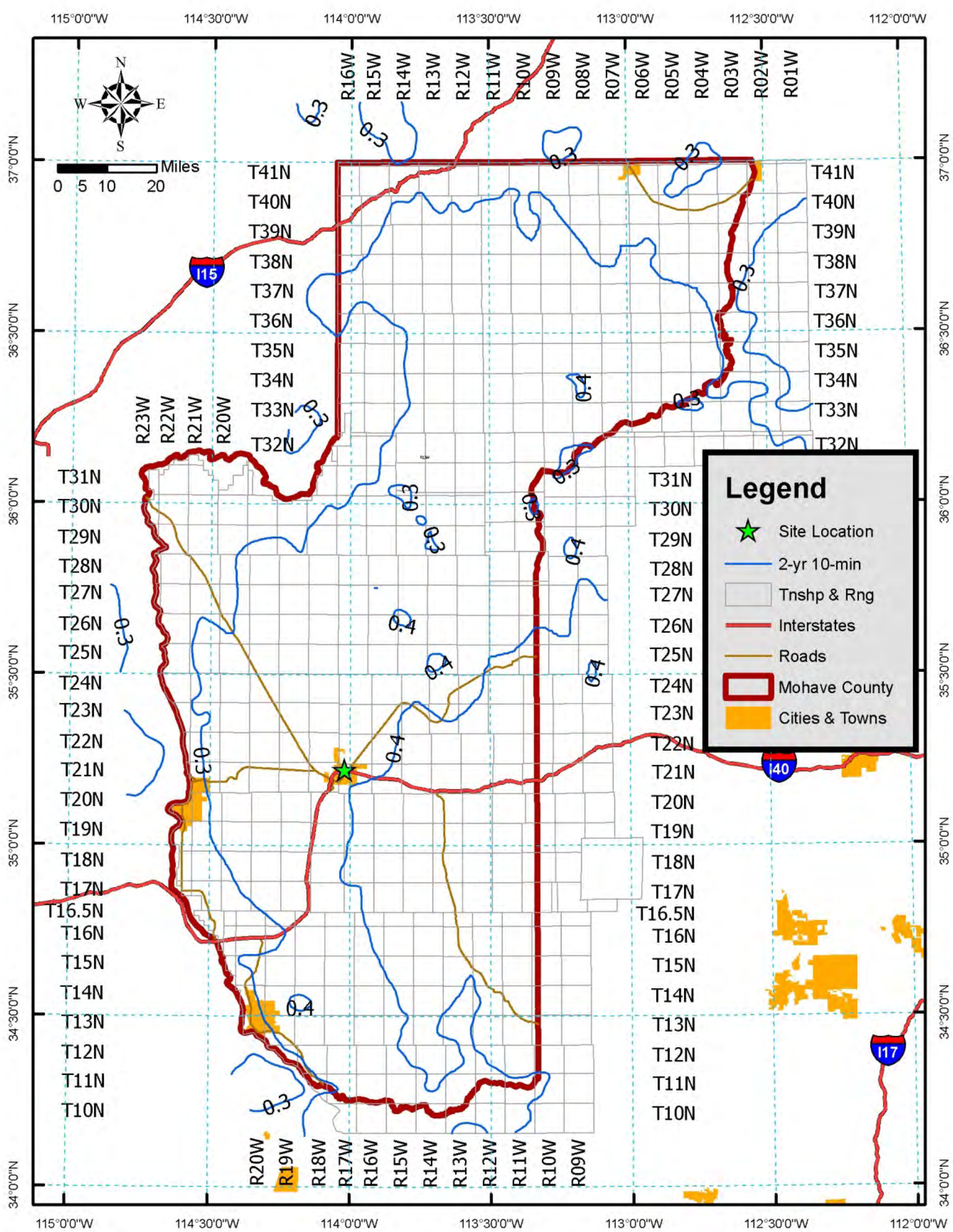


Table A.1 Rainfall Depth-Duration-Frequency for Kingman, AZ (manual)

(estimated using Figure B.1 through Figure B.60)

Duration	Rainfall Depth, in inches					
	Storm Frequency, in years					
	2	5	10	25	50	100
5-min	0.23	0.37	0.44	0.56	0.60	0.69
10-min	0.39	0.56	0.66	0.79	0.90	1.05
15-min	0.48	0.68	0.80	0.99	1.18	1.29
30-min	0.64	0.90	1.09	1.38	1.58	1.70
1-hour	0.79	1.10	1.37	1.68	1.96	2.18
2-hour	0.88	1.26	1.50	1.90	2.20	2.49
3-hour	0.95	1.29	1.59	2.00	2.41	2.80
6-hour	1.09	1.49	1.86	2.36	2.76	3.30
12-hour	1.29	1.77	2.17	2.76	3.10	3.50
24-hour	1.58	2.17	2.75	3.40	3.90	4.40

The next step is to use the point precipitation data from Table A.1 to compute the rainfall intensity for each storm duration and frequency combination. This is done as follows:

$$I_{F,D} = \frac{P_{F,D}}{D} \qquad \text{A.1}$$

where:

$I_{F,D}$ = rainfall intensity in inches per hour for frequency F and duration D.
$P_{F,D}$ = point precipitation in inches for frequency F and duration D.
D = storm duration D in hours.

Applying Equation A.1 for the 5-minute 2-year storm:

$$I_{2-\text{yr},5-\text{min}} = \frac{0.23}{\frac{5}{60}}$$

= 2.76 inches/hour.

Insert the computed value in Table A.2 in the 2-year 5-minute cell. Apply Equation A.1 to all values from Table A.1 and place the results in Table A.2.

Table A.2 Rainfall Intensity-Duration-Frequency for Kingman, AZ (manual)

(computed using the data in Table A.1)

Duration	Rainfall Intensity, in inches/hour					
	Storm Frequency, in years					
	2	5	10	25	50	100
5-min	2.76	4.44	5.28	6.72	7.20	8.28
10-min	2.34	3.36	3.96	4.74	5.40	6.30
15-min	1.92	2.72	3.20	3.96	4.72	5.16
30-min	1.28	1.80	2.18	2.76	3.16	3.40
1-hour	0.79	1.10	1.37	1.68	1.96	2.18
2-hour	0.44	0.63	0.75	0.95	1.10	1.25
3-hour	0.32	0.43	0.53	0.67	0.80	0.93
6-hour	0.18	0.25	0.31	0.39	0.46	0.55
12-hour	0.11	0.15	0.18	0.23	0.26	0.29
24-hour	0.07	0.09	0.11	0.14	0.16	0.18

A.1.1.2 Example using the DDMSW Manual Method

NOTE: *To apply this method, the Mohave County-specific version of the DDMSW computer program must be installed on your computer as well as Adobe Acrobat Reader. Both are free programs. DSMSW can be downloaded from the Mohave County web site at* DDMSW Download *and Adobe Acrobat Reader can be downloaded at* http://www.adobe.com.

Solution: The NOAA Atlas 14-point precipitation data is supplied by NOAA in a GIS grid format with a cell size of about 2,500 feet square. This method is applied by determining the average point precipitation value of the cell or cells that cover the subject watershed. In DDMSW, the user selects the cell or cells that cover the project site. DDMSW then “looks up” the point precipitation values for each storm frequency and duration for each cell or cells specified and compute an average value for every storm frequency-duration combination. To select the project cells, the general project site location is identified by the user from an index map contained within DDMSW in Adobe PDF format. The index map is on page 1 of the PDF (100 pages). The user locates the map covering the project watershed (Figure A.3) and then moves to the page where the more detailed map is located (Figure A.4).

Figure A.3 DDMSW NOAA Atlas 14 index map

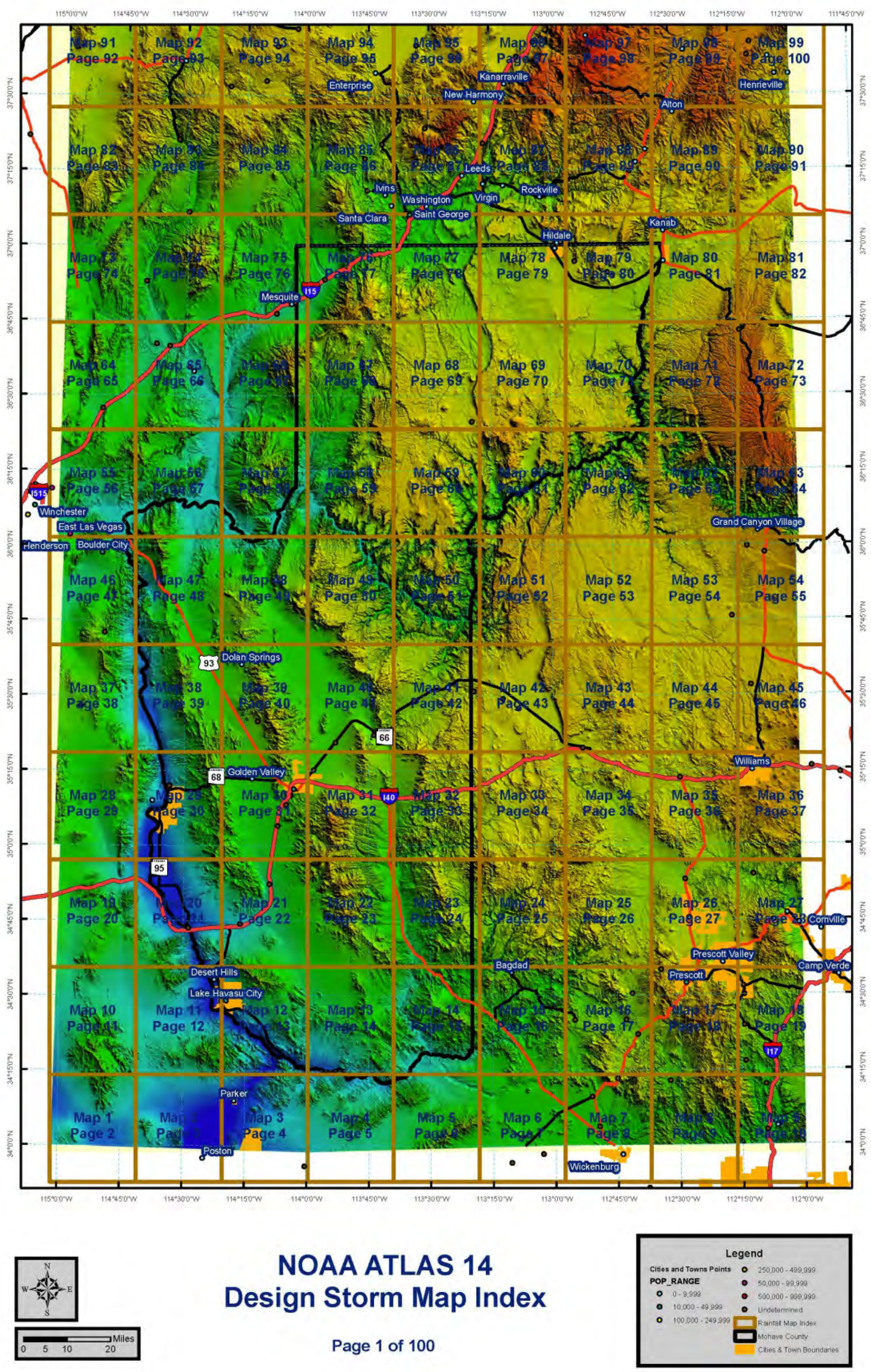
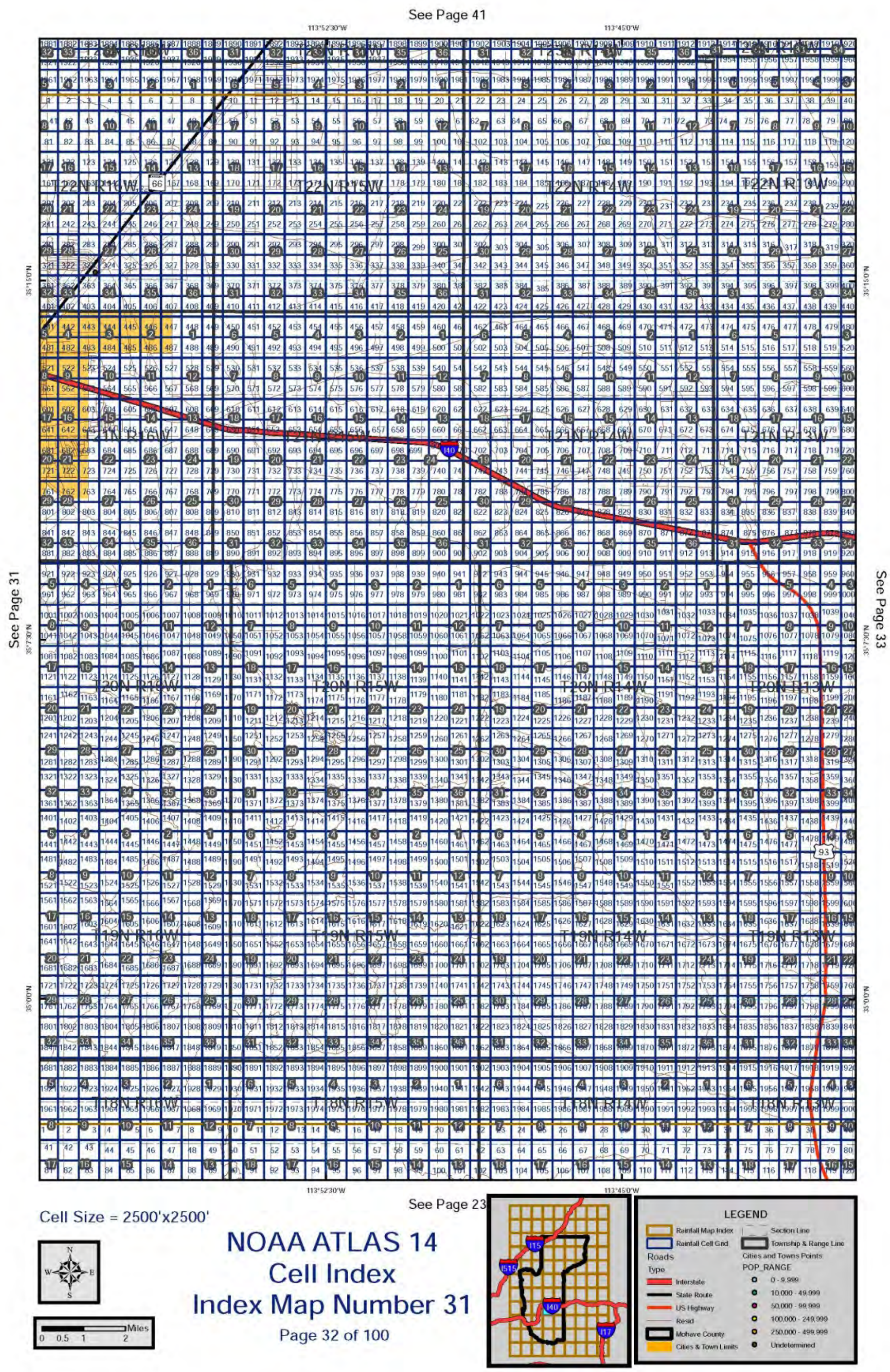


Figure A.4 DDMSW NOAA Atlas 14 detailed location map



Using Figure A.3, it can be seen that the project site, in T21N, R16W, is located on Map 31 (page 32). Moving to Map 31, as shown on Figure A.4, the Sections 8 and 9 must be located. The sections are labeled in white with a brown background. The NOAA Atlas 14 cells are labeled blue. Grid cells 521, 522, 561 and 562 approximate the location of the watershed in the west half of Section 9 and overlapping into Section 8.

In DDMSW, establish a new project then perform the following steps:

1. Open menu item *Hydrology|Rainfall*.
2. Set the *Data Source* to Manual.
3. Click on the *Maps* button to load the PDF of the NOAA Atlas 14 Index Maps.
4. Locate the project site on the overview index page and see that detailed Map Number 31 is needed.
5. Move to PDF page 32 to find Map Number 31.
6. Verify that Map Number 31 depicts Township 21N, Range 16W. Estimate the location of Section 9 on the map and write down the numbers of the grid cells covering the project watershed (521, 522, 562 and 562).
7. Close the PDF file and return to DDMSW.
8. Use the *Multiple Map Selection Menu*. The table on the left side of the window with the headings *Map*, *From*, and *To*, should be empty.
9. Click on *Add*.
10. Click on the *Magnifying Glass* icon to the right of *Map Index* and select Map 31.
11. Enter 521 in the *From* field and 522 in the *To* field. Click Save.
12. Click on *Add*.
13. Enter 561 in the *From* field and 562 in the *To* field. Click Save.
14. Click on *Update*. The *Average Rainfall Data for Project* table should be updated and match the values listed in Table A.3.

Table A.3 Rainfall Depth-Duration-Frequency for Kingman, AZ (DDMSW mm)

(estimated using the DDMSW Manual Method)

Duration	Rainfall Depth, in inches					
	Storm Frequency, in years					
	2	5	10	25	50	100
5-min	0.254	0.357	0.429	0.526	0.597	0.671
10-min	0.387	0.543	0.653	0.801	0.907	1.022
15-min	0.480	0.673	0.810	0.992	1.127	1.267
30-min	0.646	0.907	1.091	1.336	1.518	1.706
1-hour	0.800	1.122	1.350	1.654	1.878	2.111
2-hour	0.874	1.234	1.512	1.891	2.203	2.529
3-hour	0.936	1.302	1.599	2.021	2.375	2.757
6-hour	1.101	1.509	1.833	2.302	2.686	3.107
12-hour	1.284	1.754	2.134	2.653	3.076	3.531
24-hour	1.597	2.189	2.650	3.299	3.819	4.368

A.1.1.3 Example using the DDMSW GIS Method

Solution: Create an ESRI shape file containing a polygon of the total study watershed area. The fields required for the various ESRI shape files used within DDMSW are listed in Table A.4. Note that the rainfall shape file for the overall watershed boundary polygon only requires one field, the Major Basin ID. For this example, a polygon of the Kingman corporate boundary is used to obtain an average D-D-F for the entire city (Figure A.5). DDMSW overlays the polygon on the NOAA Atlas 14 rain cell grid, which is a GIS version of the grids shown in the PDF file used for the DDMSW manual method (see Figure A.4). The grid cells that touch and are contained within the polygon are selected and an average point precipitation depth computed for each frequency-duration combination. To implement the GIS approach using DDMSW, the following steps should be followed. For this example, the results are shown in Table A.5.

1. Open menu item *Hydrology|Rainfall*.
2. Set the *Data Source* to GIS.
3. Click on the *Select a* file button and point DDMSW to the desired polygon of the entire watershed under consideration.
4. Click on *Update*.

Table A.4 DDMSW required fields for GIS shape files

Map	Field Name	Type and Length	Description
Rainfall	BASINID	Character 2	Major Basin ID
Sub Basin	AREAID	Character 6	Unique ID
	BASINID	Character 2	Major Basin ID
	AREASF	Numeric 12.0	Area in square feet
Land Use	LUCODE	Character 15	Land use code
Soils	SOIL_LID	Numeric 15.0	Soils code
L_{ca}	AREAID	Character 6	Unique ID (same as sub basin)
	BASINID	Character 2	Major Basin ID
	LENGTH	Numeric 12.0	Length in feet
	USGE	Numeric 9.2	Upstream ground elevation
	DSGE	Numeric 9.2	Downstream ground elevation
T_c	AREAID	Character 6	Unique ID (same as sub basin)
	BASINID	Character 2	Major Basin ID
	LENGTH	Numeric 12.0	Length in feet
	USGE	Numeric 9.2	Upstream ground elevation
	DSGE	Numeric 9.2	Downstream ground elevation

Figure A.5 DDMSW NOAA Atlas 14 Kingman-area polygon

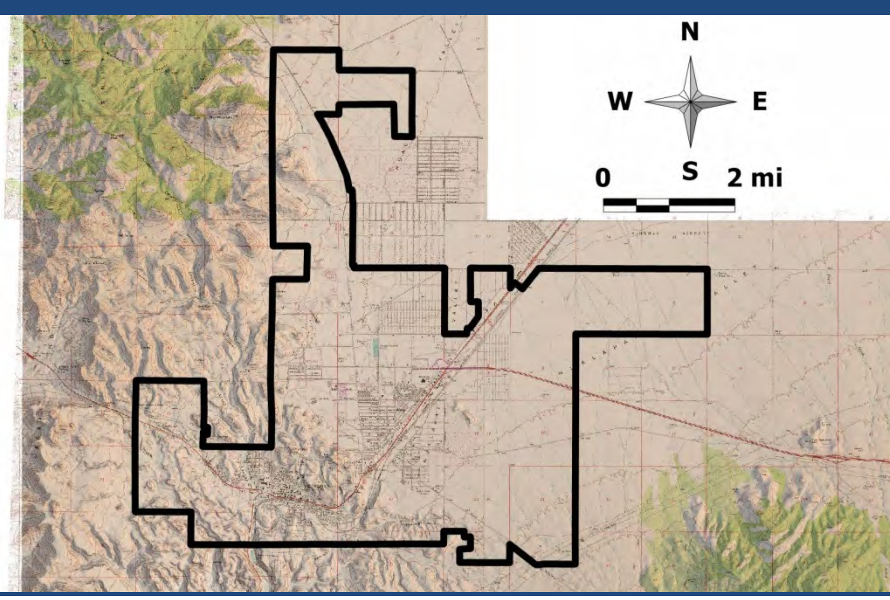


Table A.5 Rainfall Depth-Duration-Frequency for Kingman, AZ (DDMSW GIS)

(estimated using the DDMSW GIS Method)

Duration	Rainfall Depth, in inches Storm Frequency, in years					
	2	5	10	25	50	100
5-min	0.252	0.354	0.427	0.526	0.599	0.676
10-min	0.383	0.539	0.651	0.800	0.912	1.029
15-min	0.475	0.669	0.807	0.992	1.131	1.276
30-min	0.640	0.901	1.087	1.336	1.523	1.719
1-hour	0.792	1.115	1.345	1.654	1.886	2.127
2-hour	0.870	1.230	1.509	1.894	2.211	2.545
3-hour	0.932	1.300	1.598	2.022	2.379	2.766
6-hour	1.097	1.506	1.832	2.304	2.691	3.114
12-hour	1.280	1.752	2.133	2.656	3.086	3.540
24-hour	1.580	2.168	2.625	3.272	3.789	4.340

An important consideration when applying the DDMSW GIS method is to be sure the following projection and coordinate system is used when preparing all shape files for use with the Mohave County-specific version of DDMSW:

State Plane Coordinate System, NAD 83, Arizona West, International feet.

The Mohave County DDMSW NOAA Atlas 14 GIS rainfall data is in the above projection. To obtain meaningful results, all shape files must be in the Mohave County standard projection and coordinate system.

An ESRI ArcView license is NOT required to apply the DDMSW GIS method. Shape files can, of course, be created using ArcView (ESRI). Other options include Global Mapper (Global Mapper) AutoCAD Civil 3D and Bentley Map , Map Info (MapInfo Pro), and Manifold Project (MANIFOLD).

A.1.1.4 Comparison of Methods

The first comparison is between the Manual Method and the DDMSW Manual Method. Closely examine the results in Table A.1 and Table A.3. The differences in point precipitation vary from hundredths of an inch to as much as 0.19 inches for the 100-year 6-hour storm. The differences are minimal and will not have a significant effect on hydrologic modeling results for small watersheds based on either method when applying the Rational Method.

The second comparison is between the DDMSW Manual Method and the DDMSW GIS method. Keep in mind that the DDMSW Manual Method example is for a site-specific location within Kingman in Section 9, T21N, R16W. The DDMSW GIS Method example is for the City of Kingman corporate area. Closely examine the results displayed in Table A.3 and Table A.5. The differences are minor, with variances measured in hundredths of an inch. This means that the NOAA Atlas 14-point precipitation data only has slight variations for all considered durations and frequencies across the entire Kingman metropolitan area. The data in Table A.5 can be used with confidence for rainfall-runoff modeling for watersheds within the Kingman corporate boundary.

A.1.2 RAINFALL DATA FOR USE WITH THE UNIT HYDROGRAPH METHOD

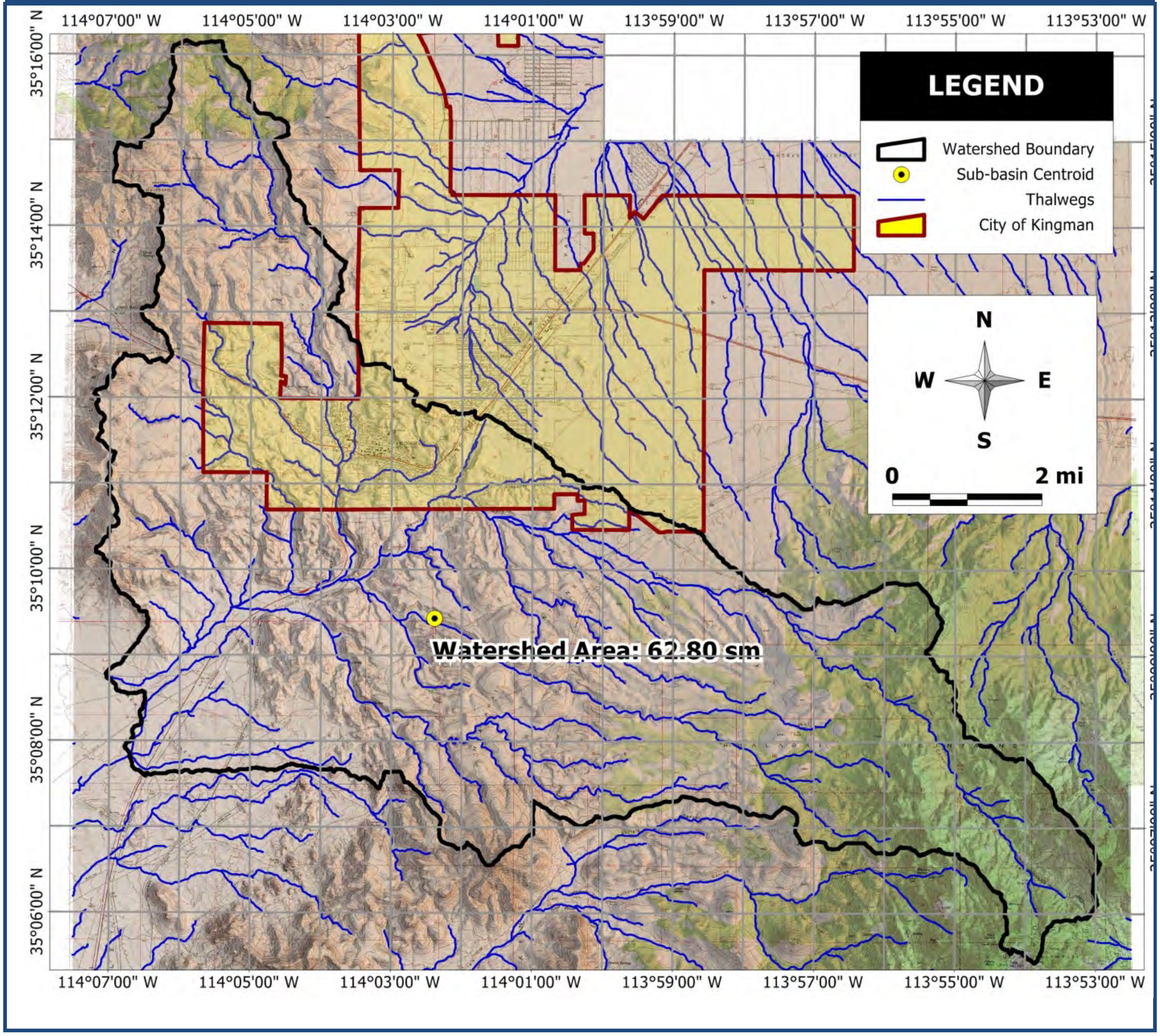
The data necessary for use with the unit hydrograph method is as follows:

1. The following point precipitation values for the storm to be modeled (ie. 100-yr, 10-yr, etc.). Items g and h are only necessary for storms longer than 6-hours.
   a. 5-min, b. 15- min, c. 1-hr, d. 2- hr, e. 3- hr, f. 6- hr, g. 12- hr, h. 24- hr.

The depth area curve for the storm to be modeled.

Problem: Point precipitation data are needed for a HEC-1 model of a large watershed partially within, and south of, Kingman, AZ. The site is located as shown on Figure A.6. Prepare the HEC-1 precipitation records for a 100-year 24-hour storm.

Figure A.6 Unit Hydrograph Method watershed limits map



A.1.2.2 Example Using the Manual Method

Solution: Prepare a watershed location map as shown on Figure A.6. Next, assemble copies of Figure B.51, Figure B.53, and Figure B.55 through Figure B.60. There is a significant elevation difference from the top to the bottom of the watershed; 8,054 to 2,814. Therefore, orographic effects could significantly affect precipitation. Due to the scale and lack of resolution of the isopluvial maps, it is not reasonable to attempt to determine multiple precipitation values for representative portions of the watershed. Therefore, accounting for orographic effects is not a viable option for this watershed when using this method. The centroid of the overall watershed is used to estimate the average point precipitation values. The same basic procedure applied in Appendix A.1.1.1 should be followed here. However, instead of using the Section, Township, and Range information, the world coordinates for the watershed centroid will be used to location the position on the NOAA Atlas 14 isopluvial maps from Appendix B. The coordinates of the watershed centroid are: 35°09'26" North by -114°02'23" West.

A world coordinate graticule grid (latitude and longitude) with a 30-second resolution is shown on each isopluvial figure. Using this information, the point precipitation values were interpolated from Figure B.51, Figure B.53, and Figure B.55 through Figure B.60 and are shown in Table A.6.

Table A.6 Unit Hydrograph Method point precipitation estimate (manual)

ID	5-min	15-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Watershed	0.70	1.31	2.20	2.65	2.83	3.40	3.70	4.50

Depth-area reduction factors for the 100-year 24-hour storm are determined using the data in Table 7.3. The results are shown in Table A.7.

Table A.7 Unit Hydrograph Method depth-area reduction (manual)

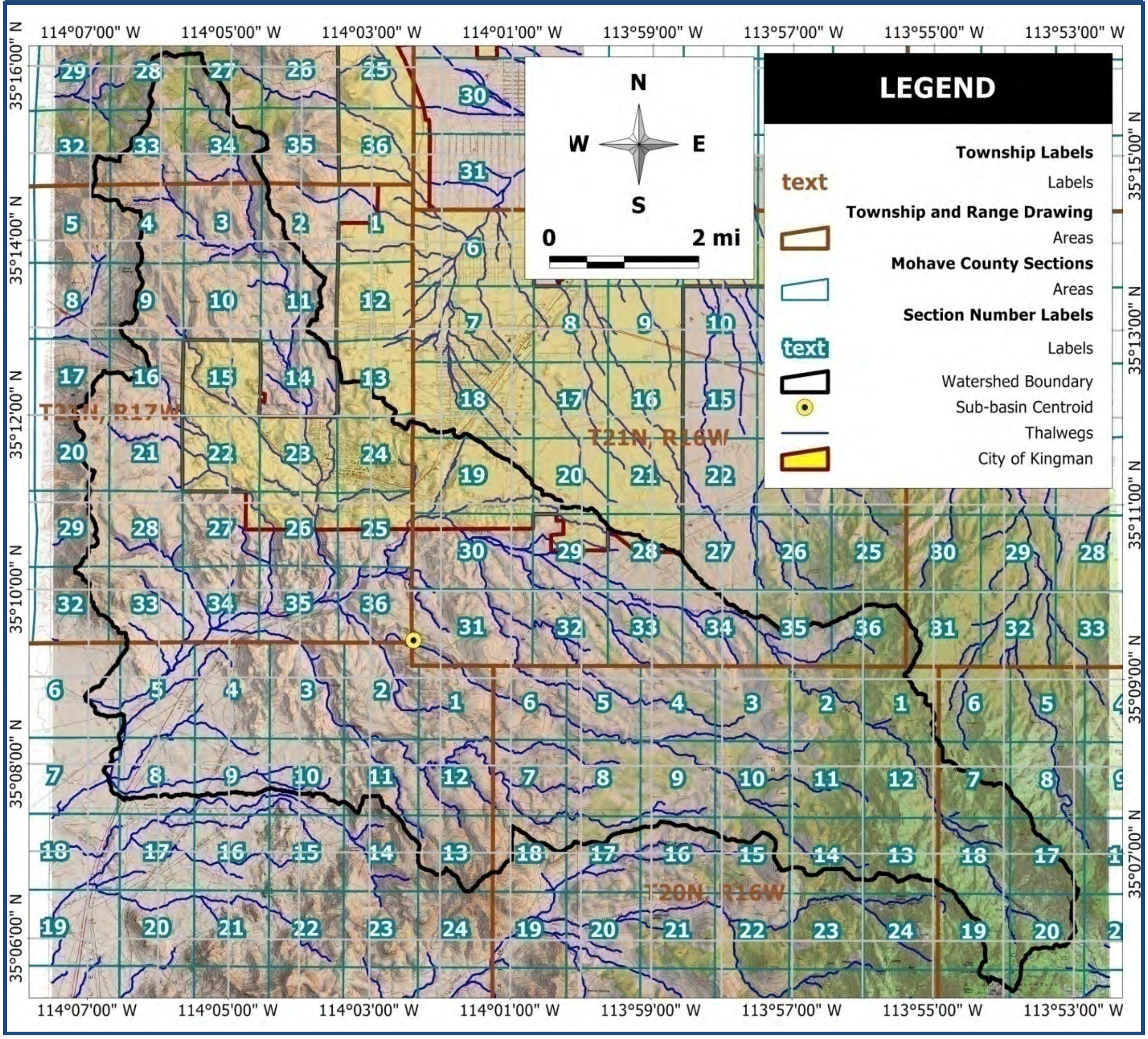
Watershed Area	Depth-Area Factor	Areally Reduced Precipitation
0	1.000	4.50
10	0.950	4.28
20	0.919	4.14
30	0.900	4.05
40	0.887	3.99
50	0.877	3.95
60	0.870	3.92
70	0.863	3.88

A.1.2.3 Example using the DDMSW Manual Method

NOTE: *To apply this method, the Mohave County-specific version of the DDMSW computer program must be installed on your computer as well as Adobe Acrobat Reader. Both are free programs. DSMSW can be downloaded from the Mohave County web site at* DDMSW Download *and Adobe Acrobat Reader can be downloaded at* http://www.adobe.com.

Solution: Follow the same approach as outlined in Appendix A.1.1.2. The Section, Township and Range lines are shown on Figure A.7. Use this information with the PDF map file in DDMSW to locate the project cells. Inspection of the DDMSW PDF Index Map shows that the subject watershed lies on Maps 30 and 31 as shown on Figure A.8. Inspection of these four maps with the section, township and range data yields the following cell numbers listed by Map Number and shown graphically on Figure A.9 and Figure A.10:

Figure A.7 Unit Hydrograph Method watershed limits map



Map 30: 269-270, 308-311, 348-352, 387-392, 427-432, 468-473, 508-513, 548-553, 588-594, 626-635, 666-678, 707-719, 747-760, 787-800, 826-840, 867-880, 907-920, 947-960, 987-1000, 1027-1040, 1067-1080, 1115-1120, and 1156-1158.

Map 31: 721, 761-763, 801-804, 841-849, 881-889, 921-930, 961-970, 1001-1012, 1041-1052, 1081-1093, 1125-1134, 1170-1174, 1211-1214, and 1251-1252.

In DDMSW, establish a new project then perform the following steps:

1. Open menu item *Hydrology|Rainfall*.
2. Set the *Data Source* to Manual.
3. Click on the *Maps* button to load the PDF of the NOAA Atlas 14 Index Maps.
4. Locate the project site on the overview index page and see that detailed Map Numbers 30 and 31 are needed.
5. Examine PDF pages 31 and 32 to find Map Numbers 30 and 31, respectively. Determine the cell numbers listed above for each map.
6. Close the PDF file and return to DDMSW.
7. Use the *Multiple Map Selection Menu*. The table on the left side of the wind with the headings *Map*, *From*, and *To*, should be empty.
8. Click on *Add*.
9. Click on the *Magnifying Glass* icon to the right of *Map Index* and select Map 30.
10. Enter 269 in the *From* field and 270 in the *To* field. Click Save.
11. Click on *Add*.
12. Enter 308 in the *From* field and 311 in the *To* field. Click Save.
13. Repeat Steps 11 and 12 for the remaining cells on Map 30.
14. Follow Steps 8 through 13 for cells on Map 31.
15. Click on *Update*. The *Average Rainfall Data for Project* table should be updated and match the values listed in Table A.8.

Figure A.8 DDMSW NOAA Atlas 14 Index Map

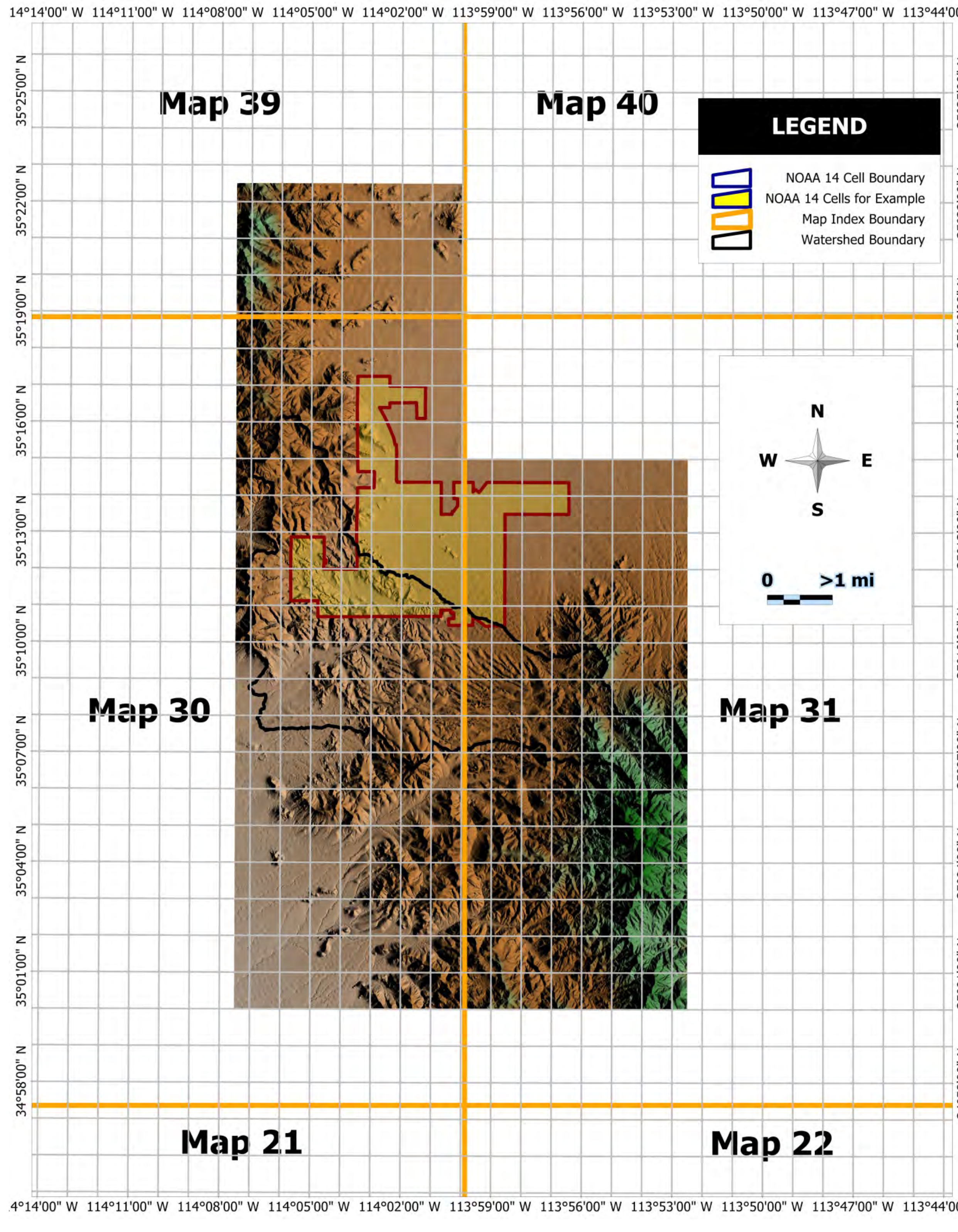


Figure A.9 DDMSW NOAA Atlas 14 Map 30

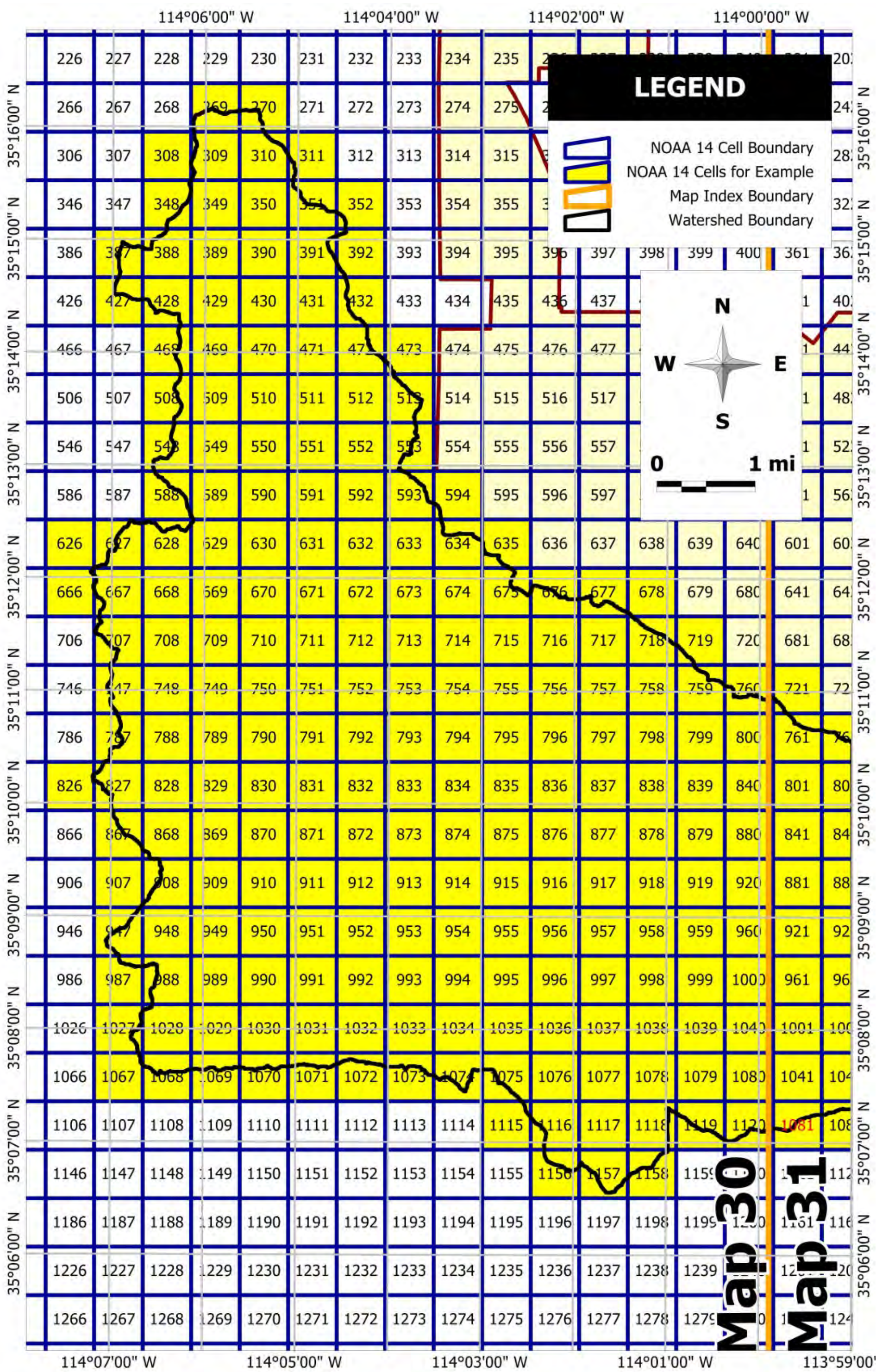


Figure A.10 DDMSW NOAA Atlas 14 Map 31

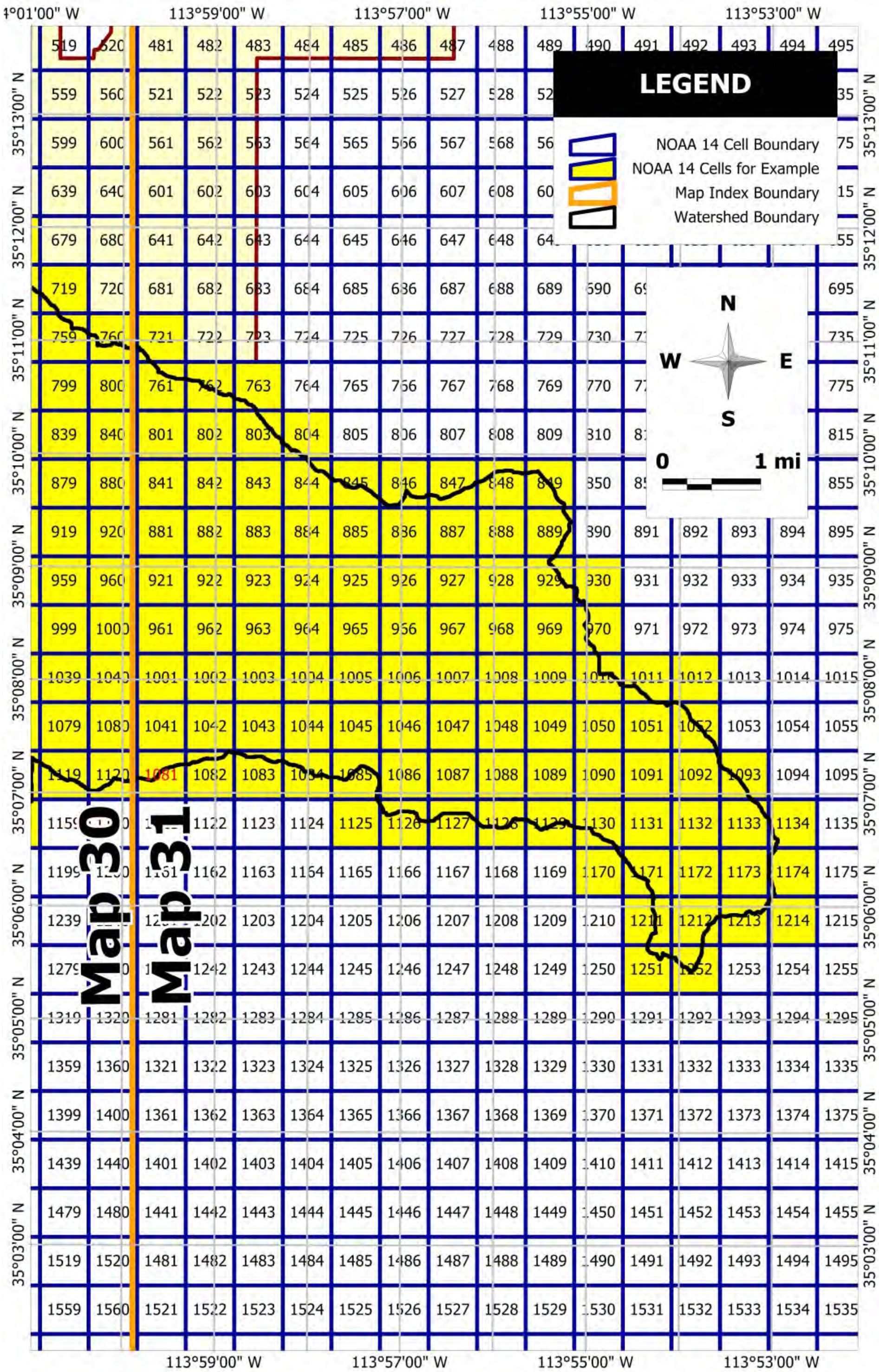


Table A.8 Rainfall D-D-F for Unit Hydrograph Example (DDMSW mm)

(estimated using the DDMSW Manual Method)

Duration	Rainfall Depth, in inches					
	Storm Frequency, in years					
	2	5	10	25	50	100
5-min	0.257	0.363	0.439	0.543	0.622	0.705
10-min	0.391	0.552	0.669	0.826	0.946	1.073
15-min	0.485	0.685	0.829	1.025	1.174	1.331
30-min	0.653	0.922	1.117	1.380	1.581	1.792
1-hour	0.808	1.142	1.382	1.708	1.957	2.218
2-hour	0.894	1.267	1.558	1.963	2.299	2.656
3-hour	0.958	1.338	1.648	2.091	2.464	2.872
6-hour	1.128	1.549	1.888	2.378	2.781	3.222
12-hour	1.320	1.808	2.202	2.746	3.191	3.667
24-hour	1.615	2.219	2.690	3.359	3.894	4.464

The data in Table A.8 can then be used to prepare the needed input data for the HEC-1 PH and JD records as shown in Table A.9 and Table A.10.

Table A.9 Unit Hydrograph Method point precipitation estimate(DDMSW mm)

(results using the DDMSW Manual Method)

ID	5-min	15-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Watershed	0.705	1.331	2.218	2.656	2.872	3.222	3.667	4.464

Depth-area reduction factors for the 100-year 24-hour storm are determined using the data in Table 7.3. The results are shown in Table A.10.

Table A.10 Unit Hydrograph Method depth-area reduction (DDMSW manual)		
Watershed Area	**Depth-Area Factor**	**Areally Reduced Precipitation**
0	1.000	4.464
10	0.950	4.241
20	0.919	4.102
30	0.900	4.018
40	0.887	3.960
50	0.877	3.915
60	0.870	3.884
70	0.863	3.852

A.1.2.4 Example using the DDMSW GIS Method

Solution: Create an ESRI shape file containing a polygon of the total study watershed area. The fields required for the various ESRI shape files used within DDMSW are listed in Table A.4. Note that the rainfall shape file for the overall watershed boundary polygon only requires one field, the Major Basin ID. For this example, a polygon of the entire watershed is used to obtain a watershed-specific D-D-F for the study area (Figure A.6). DDMSW overlays the polygon on the NOAA Atlas 14 rain cell grid, which is a GIS version of the grids shown in the PDF file used for the DDMSW manual method (see Figure A.8 through Figure A.10). The grid cells that touch and are contained within the polygon are selected and an average point precipitation depth computed for each frequency-duration combination. To implement the GIS approach using DDMSW, the following steps should be followed. For this example, the results are shown in Table A.11.

1. Open menu item *Hydrology|Rainfall*.
2. Set the *Data Source* to GIS.
3. Click on the *Select* button and point DDMSW to the desired polygon of the entire watershed under consideration.

Click on *Update*.

Be sure to verify that the correct projection and coordinate system is assigned to the GIS shape file used for the watershed limits, as described in Appendix A.1.1.3.

Table A.11 Rainfall D-D-F for unit hydrograph example (DDMSW GIS)

(estimated using the DDMSW GIS Method)

Duration	Rainfall Depth, in inches					
	Storm Frequency, in years					
	2	5	10	25	50	100
5-min	0.257	0.363	0.439	0.543	0.622	0.705
10-min	0.391	0.552	0.669	0.826	0.946	1.073
15-min	0.485	0.685	0.829	1.025	1.174	1.331
30-min	0.653	0.922	1.117	1.380	1.581	1.792
1-hour	0.808	1.142	1.382	1.708	1.957	2.218
2-hour	0.894	1.267	1.558	1.963	2.299	2.656
3-hour	0.958	1.338	1.648	2.091	2.464	2.872
6-hour	1.128	1.549	1.888	2.378	2.781	3.222
12-hour	1.320	1.808	2.202	2.746	3.191	3.667
24-hour	1.615	2.219	2.690	3.359	3.894	4.464

The data in Table A.11 can then be used to prepare the needed input data for the HEC-1 PH and JD records as shown in Table A.12 and Table A.13.

Table A.12 Unit Hydrograph Method point precipitation estimate(DDMSW GIS)

(results using the DDMSW GIS Method)

ID	5-min	15-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Watershed	0.705	1.331	2.218	2.656	2.872	3.222	3.667	4.464

Depth-area reduction factors for the 100-year 24-hour storm are determined using the data in Table 7.3. The results are shown in Table A.13.

Table A.13 Unit Hydrograph Method depth-area reduction (DDMSW GIS)

Watershed Area	Depth-Area Factor	Areally Reduced Precipitation
0	1.000	4.464
10	0.950	4.241
20	0.919	4.102
30	0.900	4.018
40	0.887	3.960
50	0.877	3.915
60	0.870	3.884
70	0.863	3.852

A.1.2.5 Comparison of Methods

The results from the three methods for use with the HEC-1 PH and JD records are compared in Table A.14.

Table A.14 Unit Hydrograph Method point precipitation estimate(DDMSW GIS)

(results using the DDMSW GIS Method)

Method	5-min	15-min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
Manual	0.70	1.31	2.20	2.65	2.83	3.40	3.70	4.50
DDMSW Manual	0.705	1.331	2.218	2.656	2.872	3.222	3.667	4.464
DDMSW GIS	0.705	1.331	2.218	2.656	2.872	3.222	3.667	4.464

The most accurate results are expected from the DDMSW GIS Method, so the other two methods are compared with it. Note that the Manual Method has the highest error, especially for the 100-year 24-hour point precipitation. The DDMSW Manual Method and the DDMSW GIS Method are identical. The Manual Method is most acceptable for small watersheds where the difference in point precipitation values are small across the watershed. The DDMSW methods should be used for larger watersheds.

Page Intentionally Left Blank

A.2 RATIONAL METHOD EXAMPLE

A.2.1 PROBLEM STATEMENT

A 212.3 acre mixed-use residential and commercial development is planned in Kingman, AZ for the tract of land shown on Figure A.11. One of the watersheds (71.38 acres) that is contained entirely within the site has been delineated into three (3) sub-basins using available topographic mapping and the proposed street drainage patterns. A storm drain is to be constructed to convey runoff from the residential areas through the commercial tract.

Determine the 10-year, post-development peak discharge at concentration points CP 1 (storm drain inlet) and CP 2 (storm drain outlet). Use both the combined watershed and triangular hydrograph method approaches as defined in Section 7.3.3.2. Compare the results.

A.2.2 GIVEN PARAMETERS

Rainfall depth-duration-frequency statistics were prepared as described in Appendix A.1 and the results listed in Table A.15 and Table A.16.

Time of concentration and land use area data are listed in Table A.17.

The resistance coefficient for all three sub-basins is 0.025 per Table 7.4.

The maximum permissible velocity in the storm drain is 6 fps, and the storm drain length is 918 feet, as shown on Figure A.11.

The land use zoning classifications proposed are:

R-1, 2 acre minimum = LDR Land Use Code
R-1, 0.5 acre minimum = LDR Land Use Code
R-MH, 7,000 sf lots = MDR Land Use Code
C-1, Neighborhood Commercial = C1 Land Use Code

Table A.15 Rainfall Depth-Duration-Frequency for Kingman, AZ (DDMSW GIS)

(estimated using the DDMSW GIS Method)

Duration	Rainfall Depth, in inches					
	Storm Frequency, in years					
	2	5	10	25	50	100
5-min	0.252	0.354	0.427	0.526	0.599	0.676
10-min	0.383	0.539	0.651	0.800	0.912	1.029
15-min	0.475	0.669	0.807	0.992	1.131	1.276
30-min	0.640	0.901	1.087	1.336	1.523	1.719
1-hour	0.792	1.115	1.345	1.654	1.886	2.127
2-hour	0.870	1.230	1.509	1.894	2.211	2.545
3-hour	0.932	1.300	1.598	2.022	2.379	2.766
6-hour	1.097	1.506	1.832	2.304	2.691	3.114
12-hour	1.280	1.752	2.133	2.656	3.086	3.540
24-hour	1.580	2.168	2.625	3.272	3.789	4.340

Table A.16 Rainfall Intensity-Duration-Frequency for Kingman, AZ (DDMSW GIS)

(computed using the data in Table A.15)

Duration	Rainfall Intensity, in inches/hour					
	Storm Frequency, in years					
	2	5	10	25	50	100
5-min	3.024	4.248	5.124	6.312	7.188	8.112
10-min	2.298	3.234	3.906	4.800	5.472	6.174
15-min	1.900	2.676	3.228	3.968	4.524	5.104
30-min	1.280	1.802	2.174	2.672	3.046	3.438
1-hour	0.792	1.115	1.345	1.654	1.886	2.127
2-hour	0.435	0.615	0.755	0.947	1.106	1.273
3-hour	0.311	0.433	0.533	0.674	0.793	0.922
6-hour	0.183	0.251	0.305	0.384	0.449	0.519
12-hour	0.107	0.146	0.178	0.221	0.257	0.295
24-hour	0.066	0.090	0.109	0.136	0.158	0.181

Figure A.11 Rational Method watershed and land use map

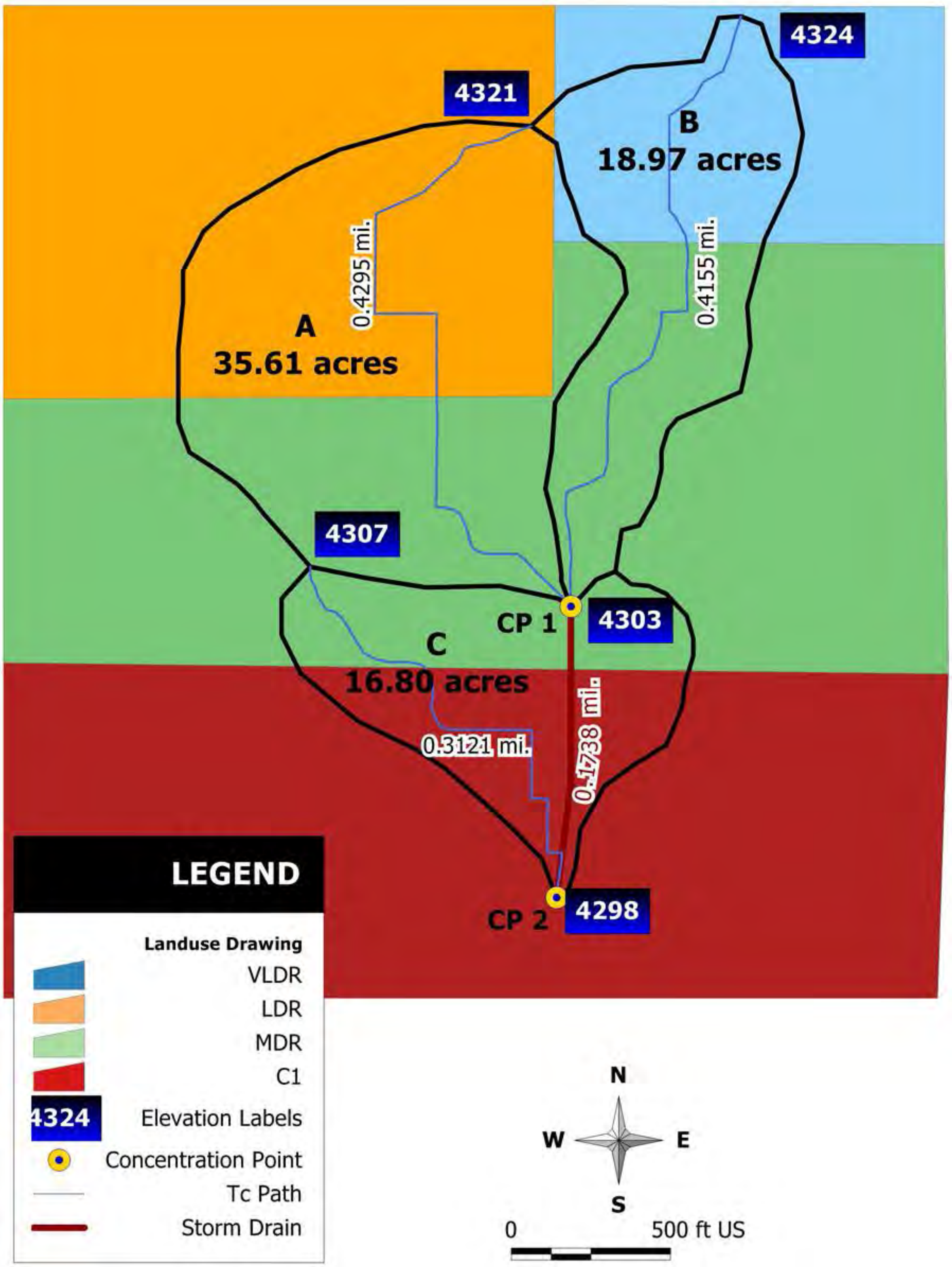


Table A.17 T_c and land use data

Sub-basin ID	T_c Computation Data			Land Use Area, acres				Total Drainage Area, acres
	Length, miles	Slope, ft./mi.	K_b	VLDR (114)	LDR (140)	MDR (160)	C1 (220)	
A	0.4295	41.9	0.025	0.36	20.25	15.00	0.00	35.61
B	0.4155	50.5	0.025	9.44	0.11	9.42	0.00	18.97
C	0.3121	28.8	0.025	0.00	0.00	7.61	9.19	16.80
			TOTALS:	**9.80**	**20.36**	**32.03**	**9.19**	**71.38**

A.2.3 SOLUTION USING MANUAL METHODS

1. Area: The areas for each sub-basin, and each land use within each sub-basin, were determined using available topographic mapping and are provided in Table A.17.

C: The C values for each land use were selected from Table 7.19 and are shown in Table A.18.

Table A.18 Rational Method example, land use C coefficients

DDMSW ID	Zoning Classification	Hydrologic Classification	Land Use Code	C	K_b
114	R-1, 2 acre	Very Low Density Residential	VLDR	0.42	0.04
140	R-1, 0.5 acre	Low Density Residential	LDR	0.48	0.04
160	R-MH, 7,000 sf	Medium Density Residential	MDR	0.60	0.025
220	C-1, Neighborhood Commercial	Commercial	C1	0.83	0.025

Compute the arithmetically area-weighted C value for sub-basins A, B, and C; A+B; and A+B+C, using the areas from Table A.17 and the C values from Table A.18:

NOTE: Composite C values are normally rounded to the nearest hundredth.

Sub-basin A:

$$C_w = \frac{(0.42)(0.36)+(0.48)(20.25)+(0.60)(15.00)}{35.61} = 0.53$$

Sub-basin B:

$$C_w = \frac{(0.42)(9.44)+(0.48)(0.11)+(0.60)(9.42)}{18.97} = 0.51$$

Sub-basin C:

$$C_w = \frac{(0.60)(7.61)+(0.83)(9.19)}{16.80} = 0.73$$

Sub-basins A + B:

$$C_w = \frac{(0.53)(35.61)+(0.51)(18.97)}{54.58} = 0.52$$

Sub-basins A + B + C:

$$C_w = \frac{(0.53)(35.61)+(0.51)(18.97)+(0.73)(16.80)}{71.38} = 0.57$$

The computed runoff coefficients (C) are:

Sub-basin A: 0.53

Sub-basin B: 0.51

Sub-basin C: 0.73

Sub-basin A + B: 0.52

Sub-basin A + B + C: 0.57

T_c Parameters:

L: The T_c flow paths were defined on the topographic mapping and measured. The lengths are tabulated in Table A.17.

S: The T_c paths were inspected and found to have a reasonably constant slope. The slopes were calculated in feet/mile using the lengths and elevations shown on Figure A.11 and tabulated in Table A.17.

K_b: Compute the arithmetically area-weighted K_b value for sub-basins A, B, and C; A+B; and A+B+C, using the areas from Table A.17 and the K_b values from Table A.18:

Sub-basin A:

$$K_{b_w} = \frac{(0.04)(0.36)+(0.04)(20.25)+(0..025)(15.00)}{35.61} = 0.034$$

Sub-basin B:

$$K_{b_w} = \frac{(0.04)(9.44)+(0.04)(0.11)+(0..025)(9.42)}{18.97} = 0.033$$

Sub-basin C:

$$K_{b_w} = 0.025$$

Sub-basins A + B:

$$K_{b_w} = \frac{(0.034)(35.61)+(0.033)(18.97)}{54.58} = 0.034$$

Sub-basins A + B + C:

$$K_{b_w} = \frac{(0.034)(35.76)+(0033)(18.97)+(0.025)(16.80)}{71.38} = 0.032$$

NOTE: K_b estimates are normally rounded to the nearest hundredth.

The computed K_b estimates are:

Sub-basin A: 0.03

Sub-basin B: 0.03

Sub-basin C: 0.03

Sub-basin A + B: 0.03

Sub-basin A + B + C: 0.03

Compile the rainfall data (already complete, see Table A.15 and Table A.16).

T_c: Compute T_c for sub-basins A, B, C, A + B, and A + B + C:

Sub-basin A:

$$T_c = 11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}$$

$$T_c = 11.4(0.4295)^{0.5}(0.03)^{0.52}(41.9)^{-0.31}i^{-0.38}$$

$$T_c = 0.379i^{-0.38}$$

Estimate an initial T_c. Assume 5 fps velocity.

T_c = L/V = 2,268/5*60 = 8 min

From Table A.16:

$$i = \left((8-5)/(10-5)\right) * (3.91-5.14) + 5.14 = 4.4\ inches/hour$$

NOTE: Estimates of *i* are normally rounded to the nearest tenth of an inch per hour.

$$T_c = 0.379(4.4)^{-0.38} = 0.216\ hours = 13.0\ minutes$$

Recompute i for T_c = 13.0 minutes

$$i = \left((13.0-10)/(15-10)\right) * (3.23-3.91) + 3.91 = 3.5\ inches/hour$$

$$T_c = 0.379(3.5)^{-0.38} = 0.235\ hours = 14.1\ minutes$$

Recompute i for T_c = 14.1 minutes

$$i = \left((14.1-10)/(15-10)\right) * (3.23-3.91) + 3.91 = 3.4\ inches/hour$$

$$T_c = 0.379(3.4)^{-0.38} = 0.238\ hours = 14.3\ minutes$$

Difference is less than 2%. Use T_c = 14 min, i = 3.4 inches/hour

Sub-basin B:

$$T_c = 11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}$$

$$T_c = 11.4(0.4155)^{0.5}(0.03)^{0.52}(50.5)^{-0.31}i^{-0.38}$$

$$T_c = 0.352i^{-0.38}$$

Estimate an initial T_c. Assume 4 fps velocity.

T_c = L/V = 2193/4*60 = 9 min

From Table A.16:

$$i = \left((9-5)/(10-5)\right) * (3.91-5.14) + 5.14 = 4.2\ inches/hour$$

$$T_c = 0.352(4.2)^{-0.38} = 0.204\ hours = 12.2\ minutes$$

Recompute i for T_c = 12.2 minutes

$$i = \left((12.2-10)/(15-10)\right) * (3.23-3.91) + 3.91 = 3.6\ inches/hour$$

$$T_c = 0.352(3.6)^{-0.38} = 0.216\ hours = 13.0\ minutes$$

Recompute i for T_c = 13.0 minutes

$$i = \left((13.0-10)/(15-10)\right) * (3.23-3.91) + 3.91 = 3.5\ inches/hour$$

$$T_c = 0.352(3.5)^{-0.38} = 0.219\ hours = 13.1\ minutes$$

Difference is less than 2%. Use T_c = 13 min, i = 3.5 inches/hour

Sub-basin C:

$$T_c = 11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}$$

$$T_c = 11.4(0.3121)^{0.5}(0.03)^{0.52}(28.8)^{-0.31}i^{-0.38}$$

$$T_c = 0.363i^{-0.38}$$

Estimate an initial T_c. Assume 4 fps velocity.

T_c = L/V = 1648/4*60 = 6.9 min

From Table A.16:

$$i = \left((6.9 - 5)/(10 - 5)\right) * (3.91 - 5.14) + 5.14 = 4.7\ inches/hour$$

$$T_c = 0.363(4.7)^{-0.38} = 0.202\ hours = 12.1\ minutes$$

Recompute i for T_c = 12.1 minutes

$$i = \left((12.1 - 10)/(15 - 10)\right) * (3.23 - 3.91) + 3.91 = 3.6\ inches/hour$$

$$T_c = 0.363(3.6)^{-0.38} = 0.223\ hours = 13.4\ minutes$$

Recompute i for T_c = 13.4 minutes

$$i = \left((13.4 - 10)/(15 - 10)\right) * (3.23 - 3.91) + 3.91 = 3.4\ inches/hour$$

$$T_c = 0.363(3.4)^{-0.38} = 0.228\ hours = 13.7\ minutes$$

Recompute i for T_c = 13.7 minutes

$$i = \left((13.7 - 10)/(15 - 10)\right) * (3.23 - 3.91) + 3.91 = 3.4\ inches/hour$$

$$T_c = 0.363(3.4)^{-0.38} = 0.228\ hours = 13.7\ minutes$$

Difference is less than 2%. Use T_c = 14 min, i = 3.4 inches/hour

Sub-basin A + B:

$$T_c = 11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}$$

Use the longest L, which is sub-basin A, and the T_c from sub-basin A, assuming that a K_b of 0.034 will have negligible effect on T_c.

Use T_c = 14 min, i = 3.4 inches/hour

Sub-basin A + B + C:

$T_c = 11.4L^{0.5}K_b^{0.52}S^{-0.31}i^{-0.38}$

L = 2268 + 918 = 3186 ft

S = (4321-4298)/3186/5280 = 38.1 feet/mile

$T_c = 11.4(0.6034)^{0.5}(0.03)^{0.52}(38.1)^{-0.31}i^{-0.38}$

$T_c = 0.462i^{-0.38}$

Estimate an initial T_c. Assume 4 fps velocity.

T_c = L/V = 3186/4*60 = 13.3 min

From Table A.16:

$i = \big((13.3 - 10)/(15 - 10)\big) * (3.23 - 3.91) + 3.91 = 3.5\ inches/hour$

$T_c = 0.462(3.5)^{-0.38} = 0.287\ hours = 17.2\ minutes$

Recompute i for T_c = 17.2 minutes

$i = \big((17.2 - 15)/(30 - 15)\big) * (2.18 - 3.23) + 3.23 = 3.1\ inches/hour$

$T_c = 0.462(3.1)^{-0.38} = 0.301\ hours = 18.1\ minutes$

Recompute i for T_c = 18.1 minutes

$i = \big((18.1 - 15)/(30 - 15)\big) * (2.18 - 3.23) + 3.23 = 3.0\ inches/hour$

$T_c = 0.462(3.0)^{-0.38} = 0.304\ hours = 18.3\ minutes$

Difference is less than 2%. Use T_c = 18.0 min, i = 3.0 inches/hour

To summarize:

Sub-basin A: T_c = 14 min, i = 3.4 inches/hour

Sub-basin B: Use T_c = 13 min, i = 3.5 inches/hour

Sub-basin C: Use T_c = 14 min, i = 3.4 inches/hour

Sub-basin A + B: Use T_c = 14 min, i = 3.4 inches/hour

Sub-basin A + B + C: Use T_c = 18.0 min, i = 3.0 inches/hour

Compute Q for each Sub-basin using the Combined Watershed Approach:

Sub-basin A: $Q_{10} = CiA = (0.53)(3.4)(35.61) = 64\ cfs$

Sub-basin B: $Q_{10} = CiA = (0.51)(3.5)(18.97) = 34\ cfs$

Sub-basin C: $Q_{10} = CiA = (0.73)(3.4)(16.80) = 42\ cfs$

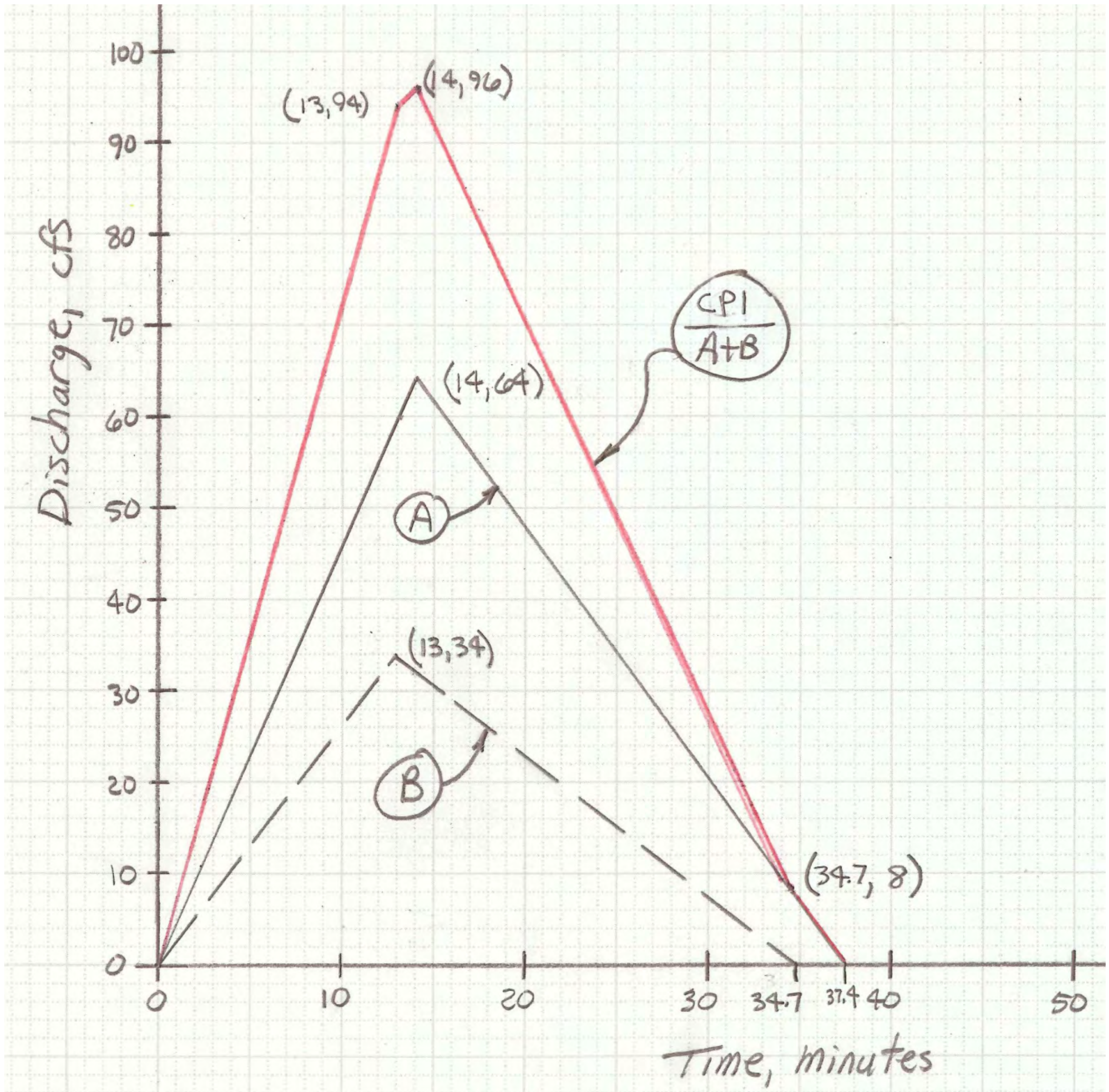
Sub-basin A + B: $Q_{10} = CiA = (0.52)(3.4)(54.58) = 97\ cfs$

Sub-basin A + B + C: $Q_{10} = CiA = (0.57)(3.0)(71.38) = 122\ cfs$

Compute Q for each sub-basin using the manual Triangular Hydrograph Approach:

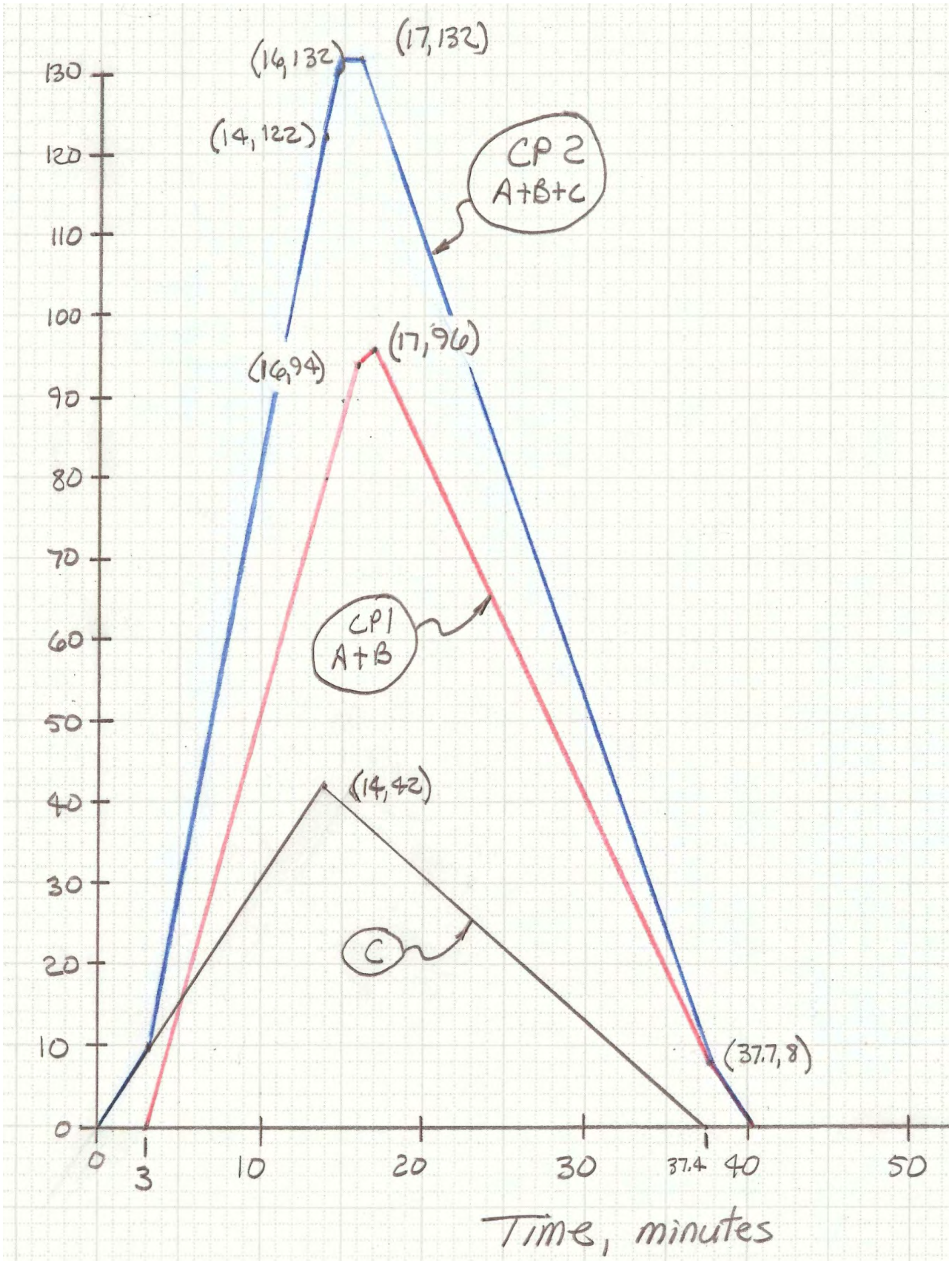
Use Figure 7.9 to construct a triangular hydrograph for both sub-basin A and sub-basin B. Then add the ordinates of the two hydrographs to estimate the total flow at CP 1 as shown on Figure A.12.

Figure A.12 10-year Rational Method hydrographs at CP 1



Lag the hydrograph for CP 1 in relation to the hydrograph for sub-basin C and plot as shown on Figure A.13. Assume that the travel time for flow from CP 1 to CP 2 is the length of the storm drain divided by 6 fps. The length of the storm drain is 918 ft. At 6 fps, the estimated travel time is about 3 minutes. Therefore, lag the hydrograph from CP 1 (sub-basin A + sub-basin B) by 3 minutes in relation to the hydrograph from sub-basin C. Then add the ordinates of the two hydrographs to estimate the total flow at CP 2.

Figure A.13 10-year Rational Method hydrographs at CP 2



The total peak discharge at the two concentration points is estimated to be:

CP 1: Q_{10} = 96 cfs at 14 minutes.

CP 2: Q_{10} = 132 cfs at 17 minutes.

The results of the two multiple basin approaches are summarized in Table A.19. Note that the results compare favorably with the exception of the peak discharge at CP 2. There is a 1-minute difference in time-to-peak between the two methods, contributing to the difference in peak discharge of 10 cfs.

The Triangular Hydrograph results should be revised using the actual velocity in the storm drain for a peak discharge of 96 cfs. Assuming a 54-inch diameter CMP storm drain, it is determined that the full flow capacity is only about 79 cfs. Therefore, the design is revised to use two 54-inch CMP's with a full flow capacity of about 157 cfs and a velocity of about 4.9 fps, which provides factor of safety. The design could be refined to use smaller pipes, and of course other physical constraints may affect the final pipe size selection. For a storm drain length of 918 feet, the travel time is approximately 3.1 minutes. The lag of 3 minutes is still a valid assumption.

In general, the accepted approach is to use the Triangular Hydrograph Method when applying the Rational Method in Mohave County; however, the Combined Watershed Method may be used when performing the hydrology computations manually.

A.2.4 SOLUTION USING DDMSW

The DDMSW computer program applies only the Triangular Hydrograph Method. The general steps for using the Rational Method under DDMSW are as follows:

1. *File|Select Project*. Create a new project and set the model project default to Rational.
2. *Hydrology|Rainfall*. Establish the rainfall criteria as described in Appendix A.1.1.
3. Sub-Basin and Land Use Data, GIS Method:
    a. Create shape files for the sub-basins, land use and Tc paths, making sure the required fields exist and are populated. Make sure the projection and coordinate system are the Mohave County standard.
    b. *Maps|Update Hydrology*. Set the pointers to the path and file name for the sub-basins, land use and T_c GIS shape files. Click *Save*, then click *Update*.
    c. *Hydrology|Sub Basins*. Check data to be sure it was imported properly. Click *Update*.
    d. *Hydrology|Land Use*. Check data to be sure it was imported properly. Click *Update*.

Sub-Basin and Land Use Data, Manual Method.

a. *Hydrology|Sub Basins*. Enter the sub-basin data manually and click *Update*.

b. *Hydrology|Land Use*. Enter land use data manually and click *Update*.

Hydrology|Rational Method|Network. Click Add and select *Type* sub-basin. Select the *ID* for the first sub-basin. Click Save. Repeat for all sub-basins.

Hydrology|Rational Method|Model. Select desired return periods and click *Run Model*. Click *Results,* then click *View* and select the return period you want to review first. Check for reasonableness. Click *Graph* and review hydrographs for reasonableness. Click *View* and select another return period (assuming you ran the model with multiple return periods selected). Repeat for all storm return periods modeled.

Hydraulics|Conveyance Facilities. If conveyance facilities such as storm drains are to be modeled, add them in.

Hydrology|Rational Method|Network. Add in the Conveyance Facilities defined and add in any hydrograph combines. Place in the proper order to simulate the flow progression.

Repeat Step 6.

The DDMSW 10-year results for the example problem are shown on Figure A.14, Figure A.15, and Figure A.16. One of the many advantages of using DDMSW is that the results can easily be obtained for multiple return periods (not shown for this example).

Figure A.14 DDMSW 10-year Rational Method results

			County of Mohave									
			Drainage Design Management System									
			RATIONAL METHOD FLOW SUMMARY									
			Project Reference: MOHAVE EXAMPLE2									
Page	1		Return Period: 10 Years									8/21/2012
Type	Model ID		Size	Area (acres)	CA (acres)	I (in/hr)	Q (cfs)	elocity (ft/sec)	Length (feet)	Tp (min)	Tc (min)	
Major Basin: 01												
Sub Basin	A			35.6	18.87	3.30	62.3				14	
Sub Basin	B			19.0	9.67	3.50	33.8				13	
Combine	C1			54.6	28.54		94.5					
Convey	P1	*	2-54" Dia Pipe	54.6	28.54		94.5	4.9	918	3.1		
Sub Basin	C			16.8	12.26	3.40	41.7				14	
Combine	C2			71.4	40.80		130.8					

A.2.5 COMPARISON OF RESULTS

The results prepared using DDMSW are compared with the Manual Method results in Table A.19. Rainfall is for the City of Kingman corporate area. Note that the DDMSW method produces more accurate computations, but when rounded are nearly identical to the Manual Method results.

Figure A.15 DDMSW 10-year Rational Method hydrographs at CP 1

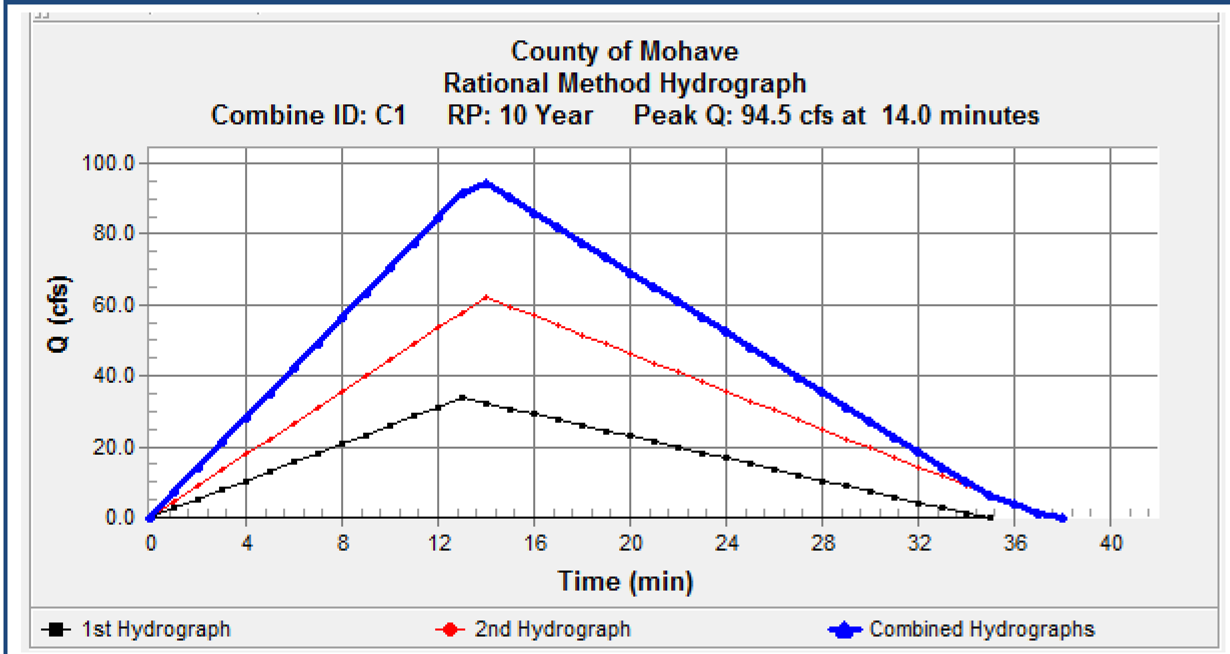


Figure A.16 DDMSW 10-year Rational Method hydrographs at CP 2

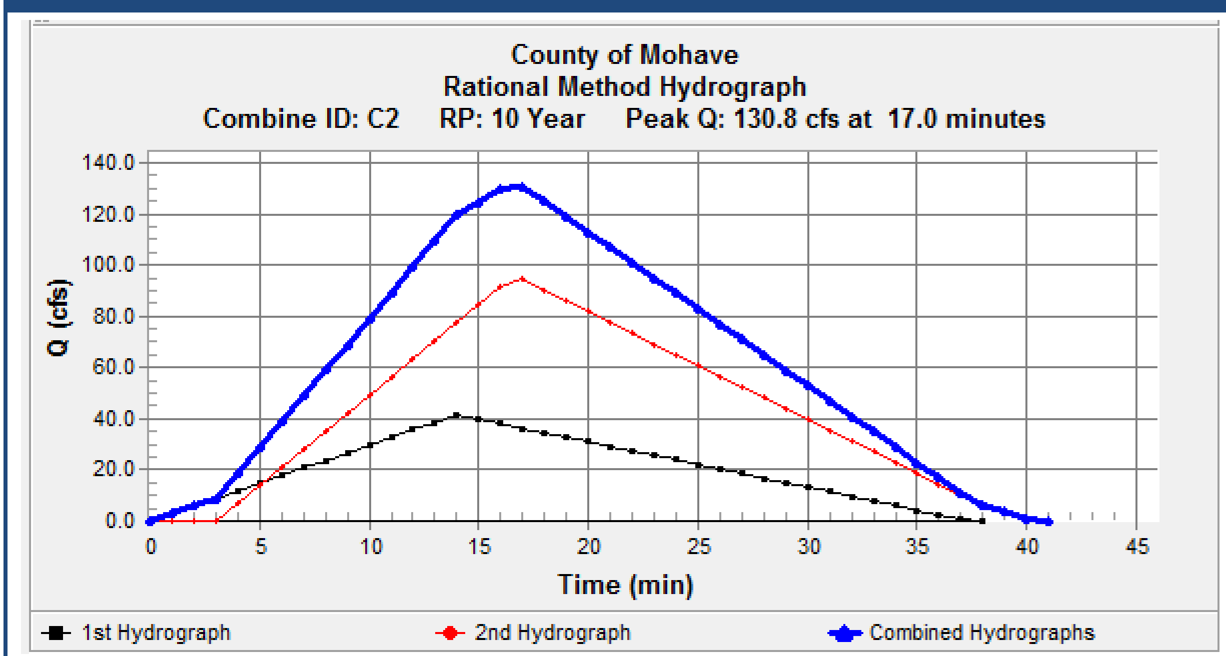


Table A.19 Summary of results for the various methods

Location	Manual Method		Triangular Hydrograph Method			
			Manual Method		DDMSW	
	Q_{10}, cfs	T_p, min.	T_p, min.	Q_{10}, cfs	T_p, min	Q_{10}, cfs
Sub-basin A	64	14	14	64	14.4	62.3
Sub-basin B	34	13	13	34	13.1	33.8
CP 1	97	14	14	96	14.0	94.5
Sub-basin C	42	14	14	42	13.6	41.7
CP 2	122	18	17	132	17.0	130.8

A.3 RAINFALL LOSSES EXAMPLE

This section pertains to estimating rainfall loss parameters for use with the unit hydrograph method. Refer to Section 7.4 for a description of the methodology used. Refer to Appendix D for a complete description of the Green and Ampt parameters used in Mohave County and derived from NCRS databases and GIS coverages.

A.3.1 EXAMPLE FOR GREEN AND AMPT METHOD

A.3.1.1 Problem Statement

Rainfall loss parameters for use with the Green and Ampt method are needed for a HEC-1 model of a large watershed within, and south of, Kingman, AZ. The site is located as shown on Figure A.6. Derive the parameters and prepare the HEC-1 rainfall loss records for the model using the instructions set forth in Section 7.4.4. There are three methods that can be used:

1. Manual Computations. Computations are performed by hand or with a calculator.
2. DDMSW Manual Input. Areas and other parameters are determined by the most expedient means available and then manually input to DDMSW. DDMSW then computes rainfall loss parameters for each sub-basin.
3. DDMSW GIS Method. Sub-basin boundaries, soil map unit boundaries and land use boundaries are created in ERSI GIS shape file format external to DDMSW, read into DDMSW, and then DDMSW performs the rainfall loss parameter computations for each sub-basin using the GIS information.

A.3.1.2 Problem Solution

The solution consists of several steps, which are common to all methods.

1. Watershed delineation.
2. Watershed slope evaluation.
3. Land use definition.
4. Soil Map Unit definition.
5. Concentration point definition and Sub-basin delineation.
6. Computation of sub-basin composite initial abstraction.
7. Computation of sub-basin composite bare ground XKSAT.
8. Assignment of PSIF and DTHETA.
9. Computation of sub-basin composite vegetation cover density (VCD).
10. Computation of XKSAT adjusted for vegetation canopy cover.

11. Estimation of sub-basin composite RTIMP.
12. Preparation of the HEC-1 rainfall loss input records.

Step 1. Watershed Delineation.

The bottom end of the study watershed is normally a known point that is the focus of the study. The upstream watershed should first be delineated using the best available topographic information. USGS quadrangle maps covering the watershed, in combination with the 10-meter resolution USGS digital elevation maps (DEM), were used for delineation of the watershed boundaries shown on Figure A.6.

Step 2. Watershed Slope Evaluation.

It is very helpful to assess the range of slopes present on the watershed. This information is useful when deciding how the watershed should be delineated into sub-basins, and for the assignment natural land use classifications (undeveloped desert, hillslopes, or mountain terrain), which are slope dependant. The USGS DEM's of the watershed were used to prepare Figure A.17. Slope ranges defined were less than 5%, greater than 5%, and greater than 20%. This information was used to define simplified natural terrain polygons for the three classifications, as shown on Figure A.18, which is the natural land use map. The land use codes (LUCODE) shown on Figure A.18 are related to terrain classification in Table A.20.

Table A.20 Natural land use codes

LUCODE	Description
500	Undeveloped Desert Rangeland. Little topographic relief, slopes <5%.
510	Hillslopes, Sonoran Desert. Moderate topographic relief, slopes >5%.
520	Mountain Terrain. High topographic relief, slopes >20%.

Step 3. Land Use Definition.

Definition of land use spatial limits is necessary to estimate the impervious area (RTIMP), developed vegetation canopy cover (VCD), Initial Abstraction (IA), and the areas where the soil moisture deficit at start of rainfall (DTHETA) are assumed to be have a normal value. The standard Mohave County land use/zoning map in GIS shape file format was used to define the land uses for the areas in the unincorporated County. Land use polygons for the area within Kingman were drawn in GIS using the USGS quadrangle maps and knowledge of the area. These land use types and limits are for the purposes of this example only and are not an accurate representation of actual land uses in the area. The urban land use map was combined with the natural land use map to produce a comprehensive land use GIS shape file coverage of the entire watershed. Refer to Figure A.19.

Figure A.17 Unit Hydrograph Method watershed slope variation map

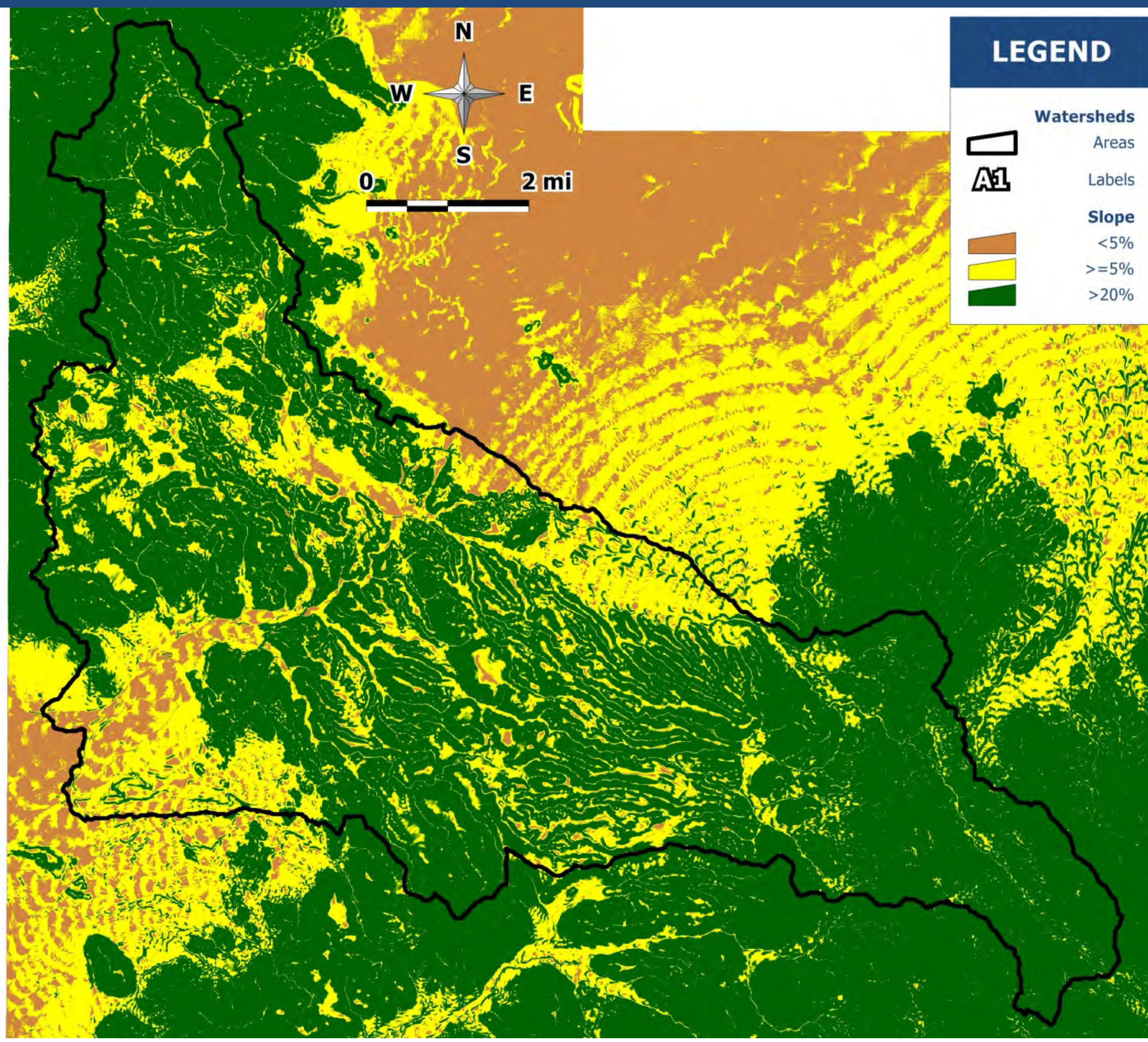


Figure A.18 Unit Hydrograph Method natural terrain classification map

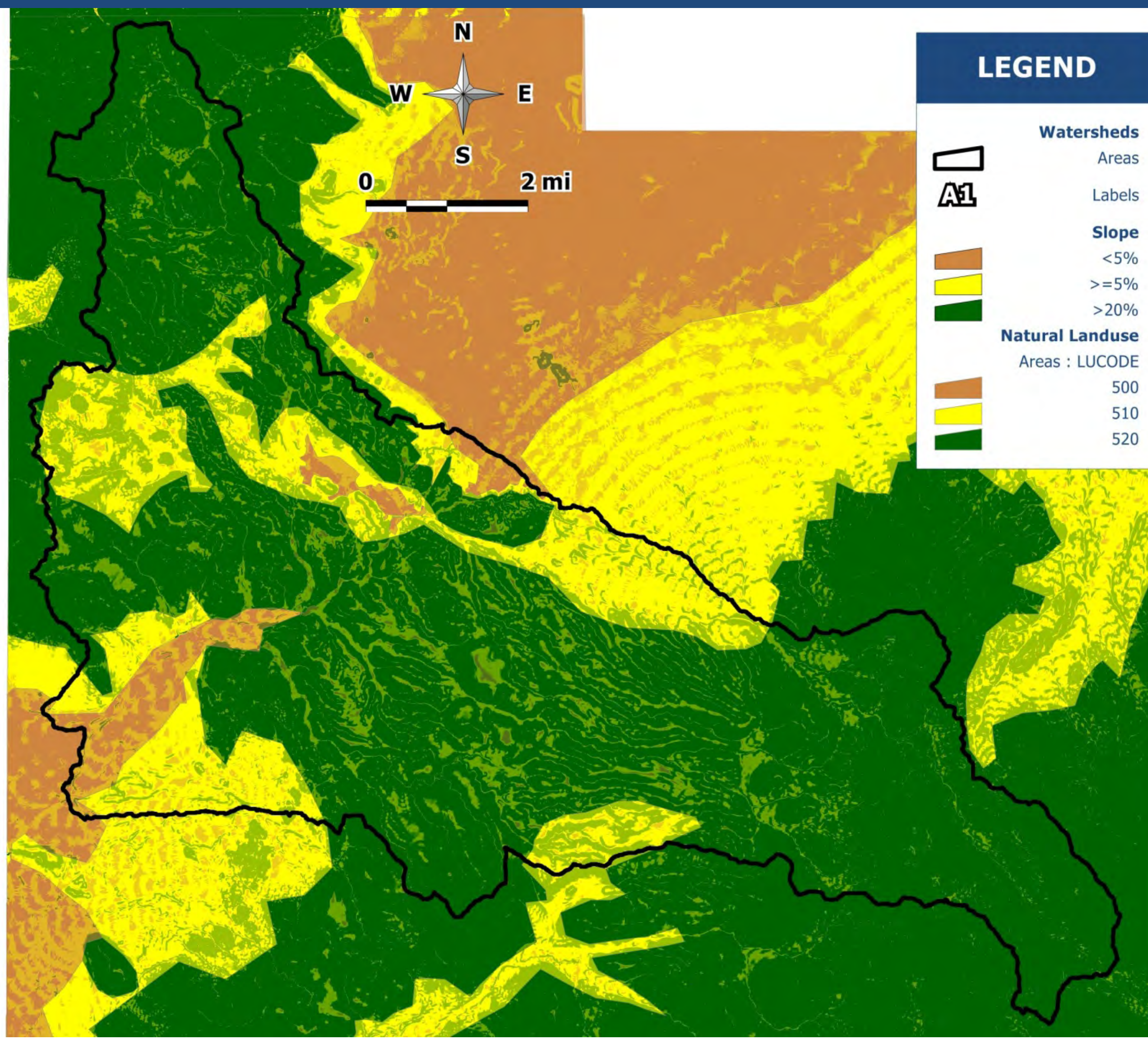
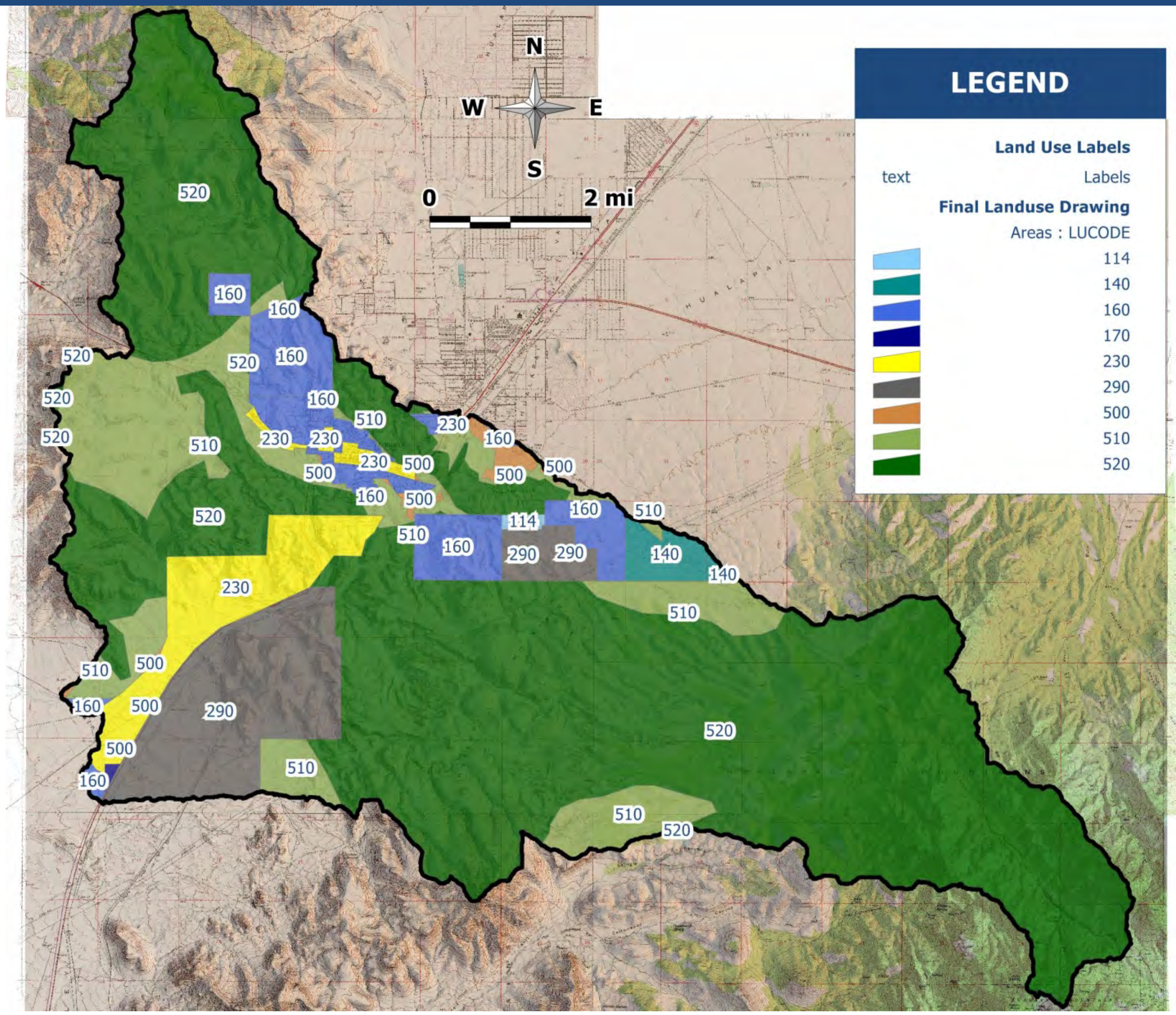


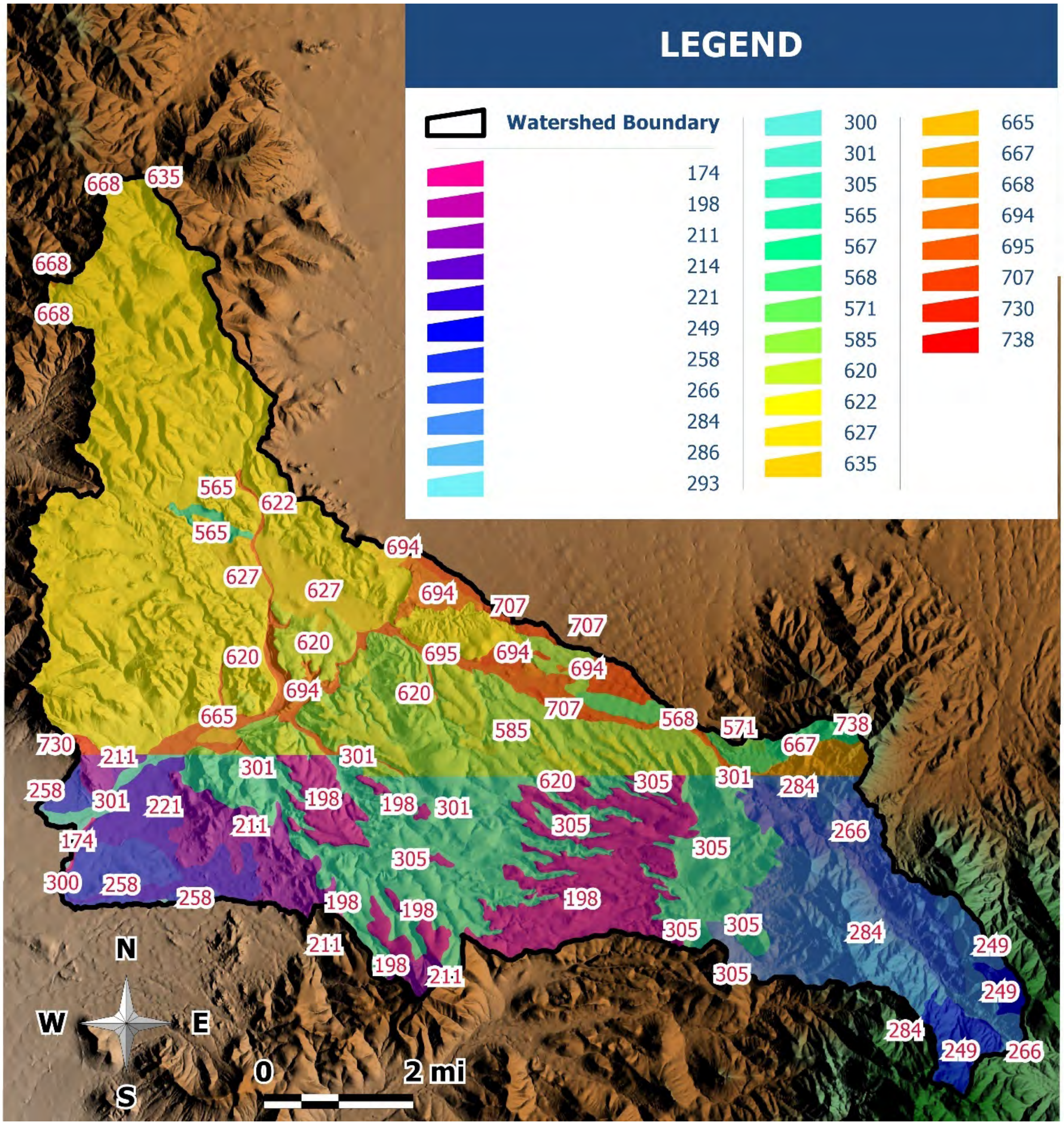
Figure A.19 Unit Hydrograph Method combined land use map



Step 4. Soil Map Unit Definition.

The NRCS soil map units (SMU) present in each sub-basin are needed for estimation of saturated hydraulic conductivity (XKSAT), the wetting front capillary suction (PSIF), and DTHETA. The NRCS soil map units for all Mohave County watersheds are available in GIS shape file format. The soil map unit boundaries for the watershed are shown on Figure A.20. The NRCS soils data for the watershed were used to define sub-areas for this example. Each sub-area polygon defines the limits of an NRCS soil map unit (SMU). These sub-area polygons are used to define natural impervious area and to estimate the Green and Ampt rainfall loss parameters.

Figure A.20 Unit Hydrograph Method soil map units map



Step 5. Concentration Point Definition and Sub-Basin Delineation.

The watershed should be broken into sub-basins if hydrologic parameters such as topography, land use, soil characteristics, vegetation, or percent impervious area vary significantly. The sub-basins should be as homogeneous as possible in terms of those parameters. For this example, significant changes in slope and differences in land ownership occur between the upper and lower watersheds; therefore, the watershed is divided into nine (9) sub-basins as shown on Figure A.21 and Figure A.22. The land use types with the delineated sub-basins superimposed are shown on Figure A.23. The soil map units with the delineated sub-basins superimposed are shown on Figure A.24. Method 2006 natural XKSAT values are shown on Figure A.25. Further delineation of sub-basins A2 and A3 would be warranted for an actual study because of the change in land use from natural to urban and the need for concentration points where off-site watersheds impact the developed area. Sub-basin A5 could also be split again because of slope change. Further sub-basin delineation would make this example more complex and harder to follow and therefore was not done.

Computation of the rainfall loss parameters using manual methods will be done for sub-basin A3. Computation of the rainfall loss parameters for the other sub-basins will be done using DDMSW.

Figure A.21 Unit Hydrograph Method sub-basin delineation map (quads)

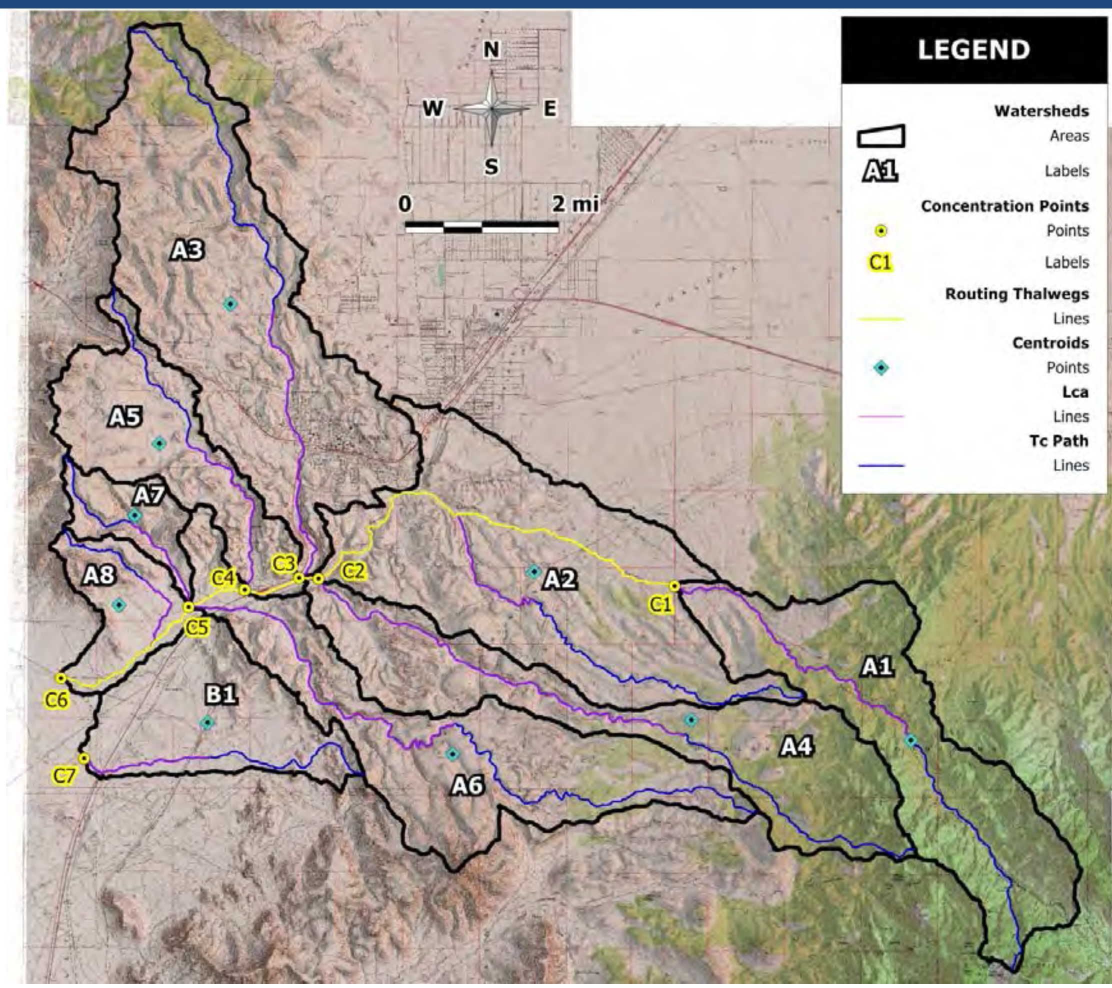


Figure A.22 Unit Hydrograph Method sub-basin delineation map (photo)

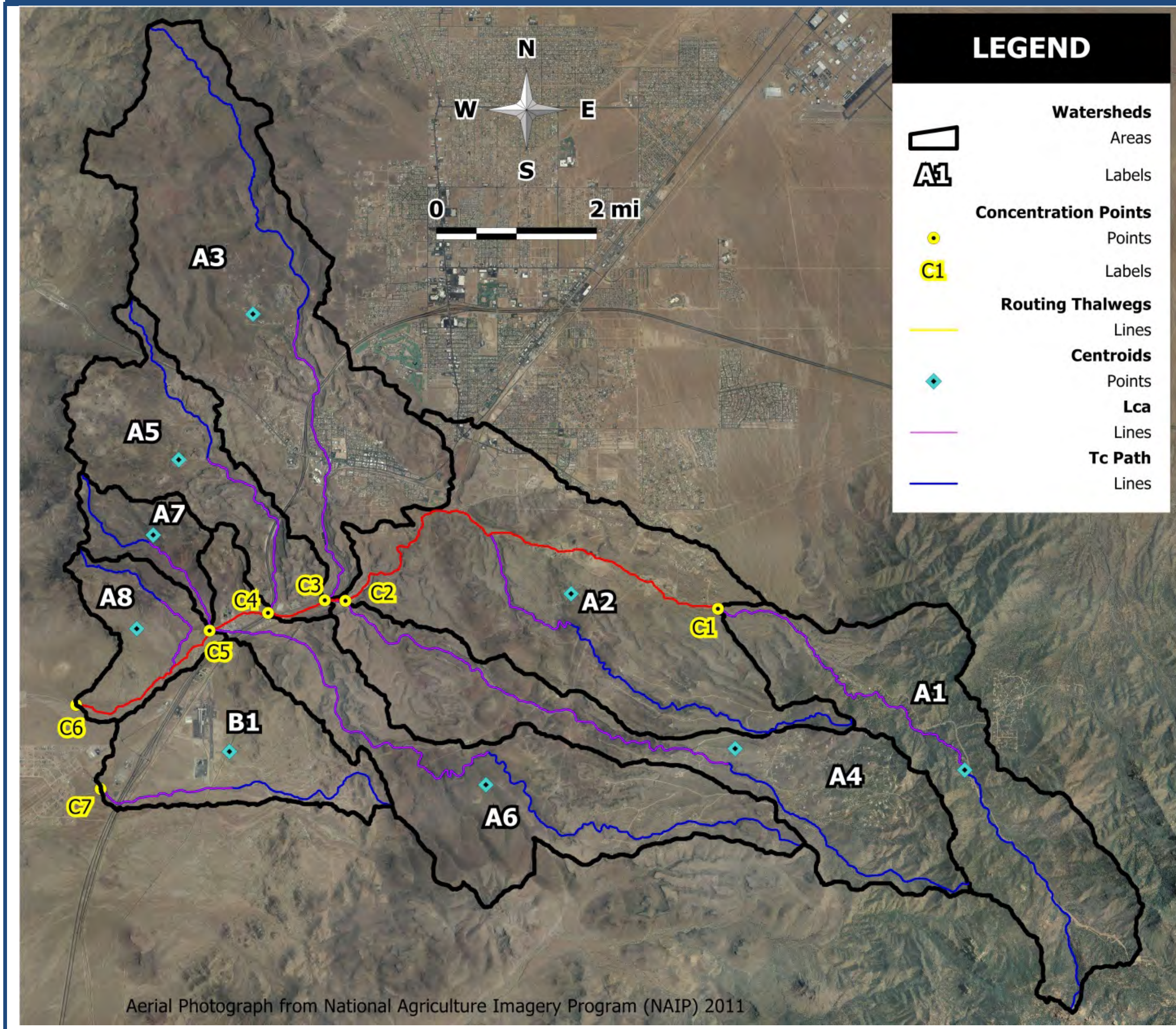
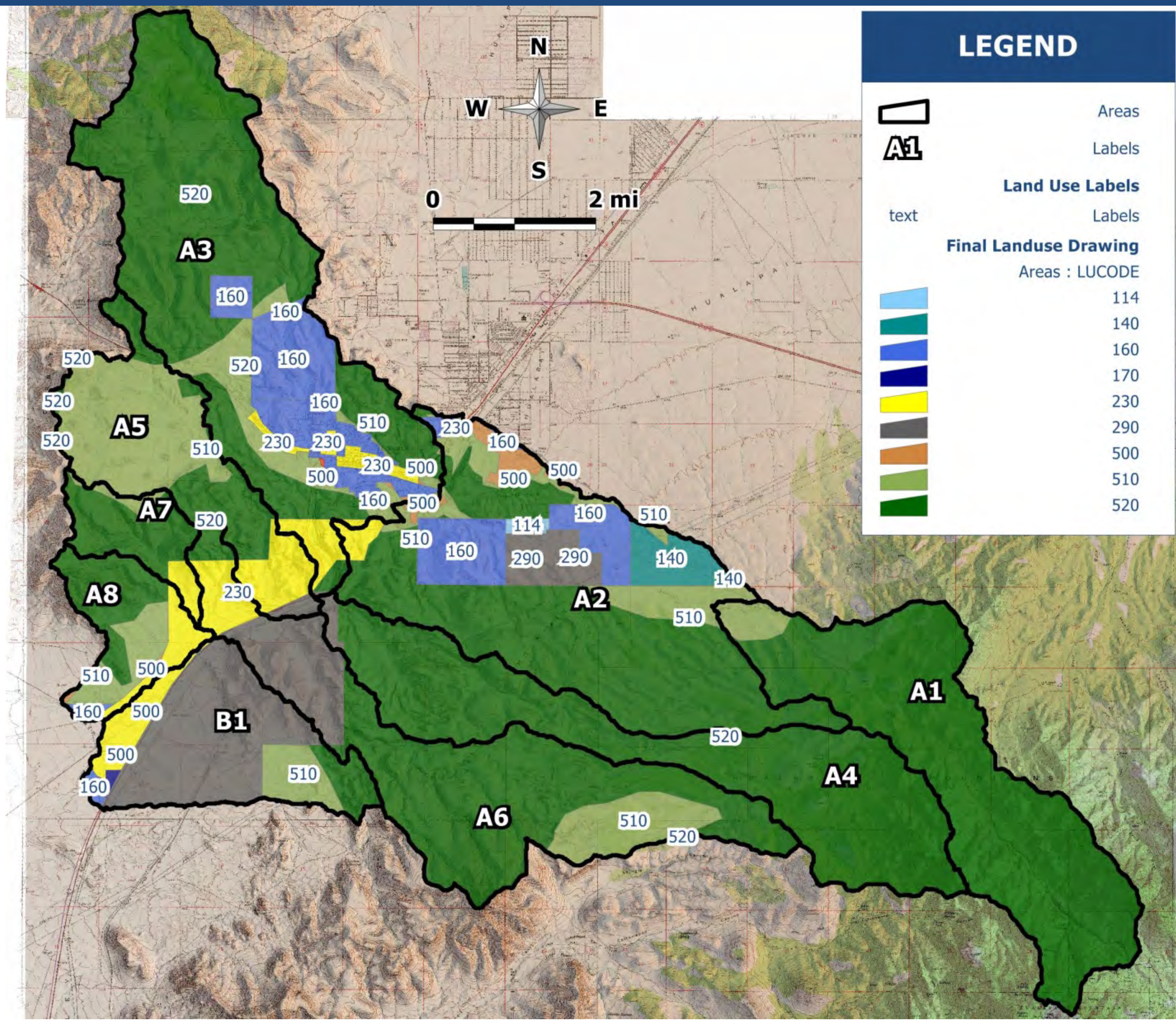


Figure A.23 Unit Hydrograph Method land use map



Step 6. Computation of sub-basin composite initial abstraction.

IA is estimated by calculating an area-weighted value for each sub-basin using standard values assigned for the land use sub-areas. The areas of the land use sub-areas can be determined by hand using a hard copy of the watershed land use map or digitally using CADD or GIS software. For this example, the areas were calculated using GIS. The sub-basin and land use sub-areas are summarized in Table A.22.

Figure A.24 Unit Hydrograph Method soils ID map

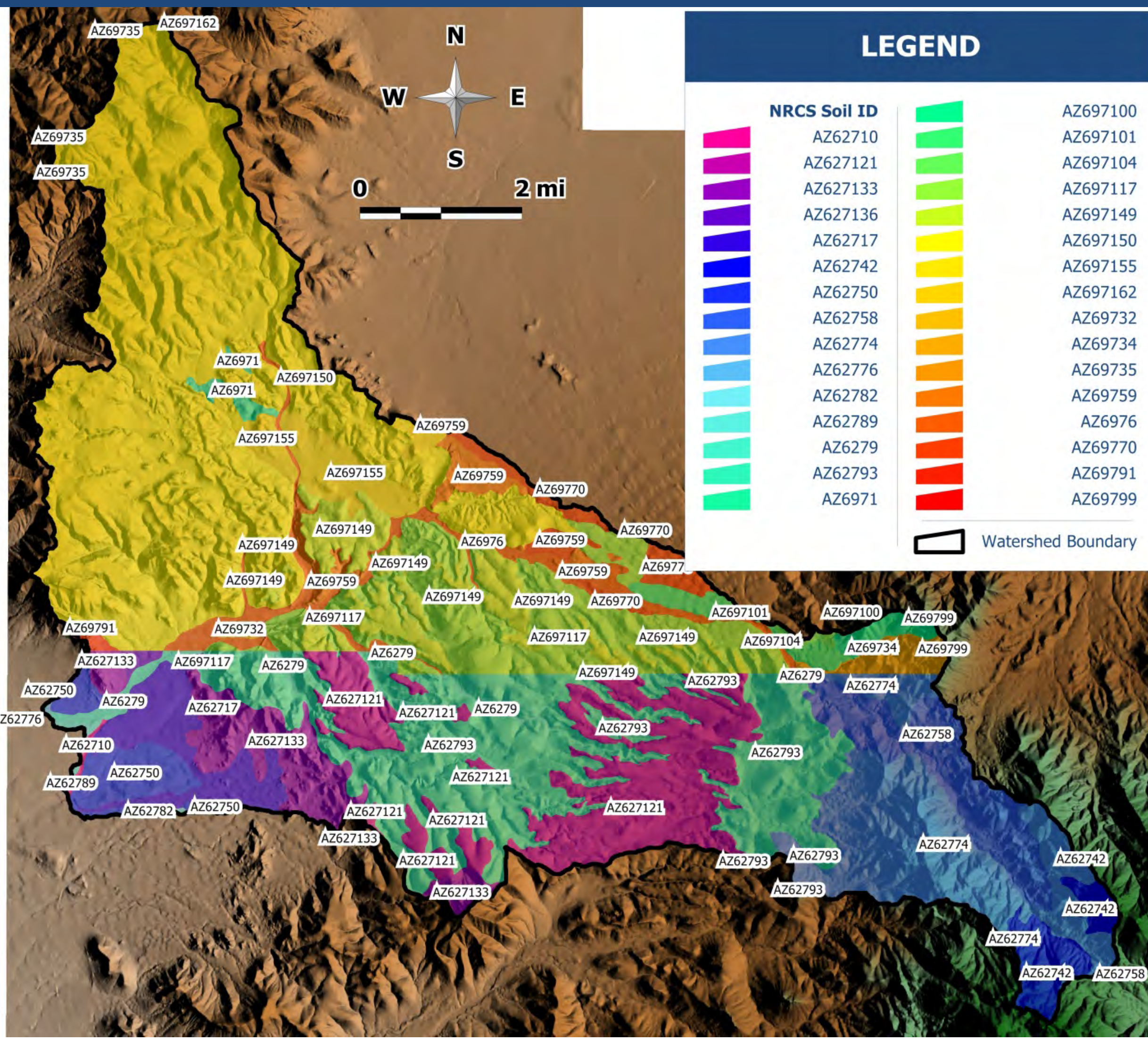


Figure A.25 Unit Hydrograph Method soils XKSAT map

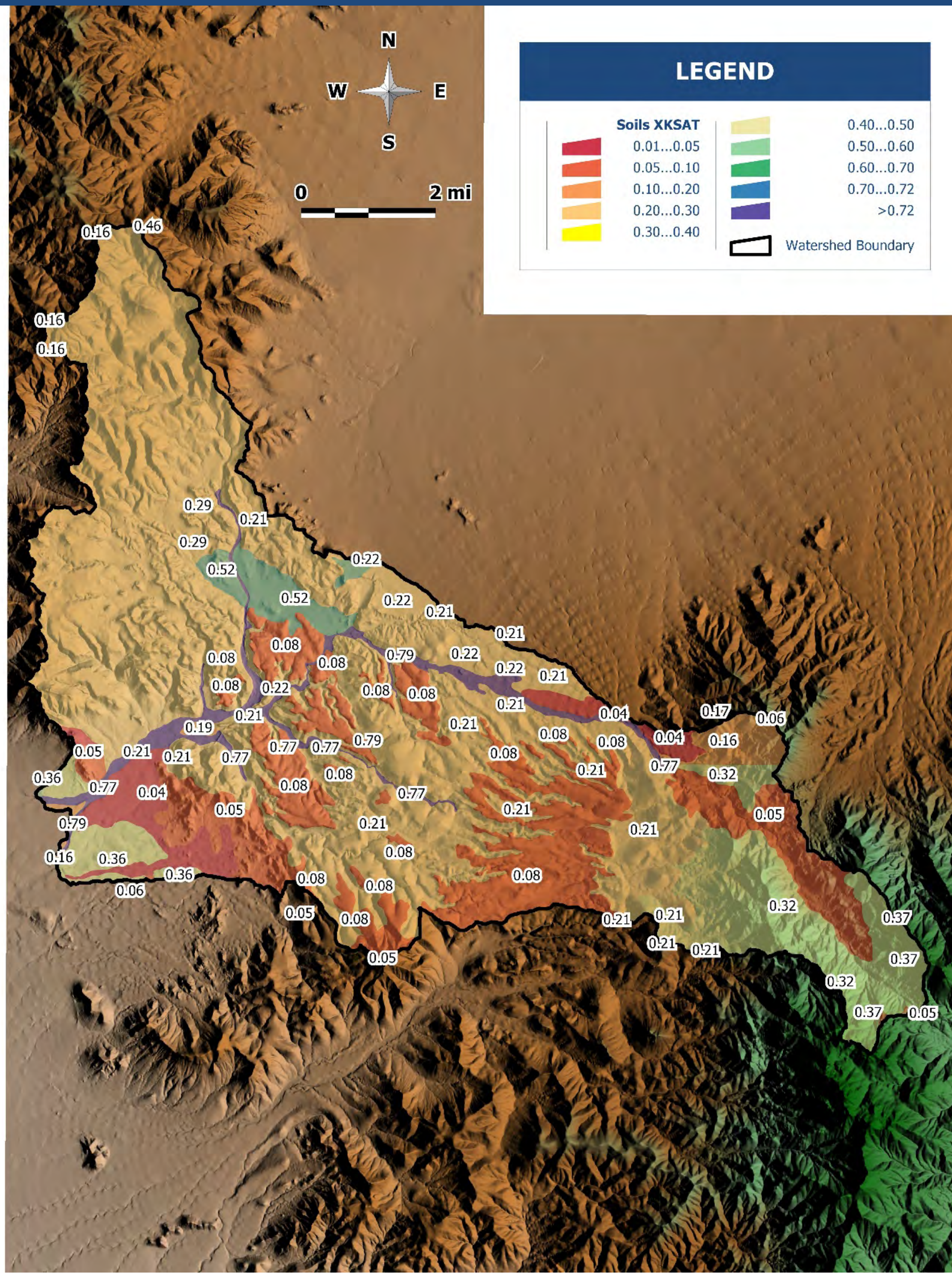


Table A.21 Unit hydrograph example soils and land use parameters

ID	Soil ID	Land Use CODE	Land Use Cond.	XKSAT, in/hr Nat	XKSAT, in/hr Dev	XKSAT, in/hr Assign	XKSAT, in/hr Log10	Area (A) sm	Area (A) %	[8]*[10]	VCD	VCD * A [12]*[10]	IA	IA * A [14]*[10]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A1	AZ697101	510	N	0.04	0.01	0.04	-1.40	0.050	0.6	-0.840	10	6.0	0.15	0.09
A1	AZ697117	510	N	0.21	0.10	0.21	-0.68	0.228	2.7	-1.836	10	27.0	0.15	0.41
A1	AZ697149	510	N	0.08	0.03	0.08	-1.10	0.002	0.0	0.000	10	0.0	0.15	0.00
A1	AZ6976	510	N	0.79	0.46	0.79	-0.10	0.072	0.9	-0.090	10	9.0	0.15	0.14
A1	AZ627121	520	N	0.08	0.03	0.08	-1.10	0.040	0.5	-0.550	20	10.0	0.25	0.13
A1	AZ62742	520	N	0.37	0.20	0.37	-0.43	1.074	12.8	-5.504	20	256.0	0.25	3.20
A1	AZ62758	520	N	0.05	0.02	0.05	-1.30	2.376	28.4	-36.920	20	568.0	0.25	7.10
A1	AZ62774	520	N	0.32	0.16	0.32	-0.49	2.635	31.5	-15.435	20	630.0	0.25	7.88
A1	AZ6279	520	N	0.77	0.45	0.77	-0.11	0.008	0.1	-0.011	20	2.0	0.25	0.03
A1	AZ62793	520	N	0.21	0.10	0.21	-0.68	0.356	4.3	-2.924	20	86.0	0.25	1.08
A1	AZ697100	520	N	0.17	0.07	0.17	-0.77	0.359	4.3	-3.311	20	86.0	0.25	1.08
A1	AZ697101	520	N	0.04	0.01	0.04	-1.40	0.195	2.3	-3.220	20	46.0	0.25	0.58
A1	AZ697104	520	N	0.04	0.01	0.04	-1.40	0.102	1.2	-1.680	20	24.0	0.25	0.30
A1	AZ697117	520	N	0.21	0.10	0.21	-0.68	0.234	2.8	-1.904	20	56.0	0.25	0.70
A1	AZ697149	520	N	0.08	0.03	0.08	-1.10	0.037	0.4	-0.440	20	8.0	0.25	0.10
A1	AZ69734	520	N	0.16	0.07	0.16	-0.80	0.544	6.5	-5.200	20	130.0	0.25	1.63
A1	AZ6976	520	N	0.79	0.46	0.79	-0.10	0.048	0.6	-0.060	20	12.0	0.25	0.15
A1	AZ69799	520	N	0.06	0.02	0.06	-1.22	0.003	0.0	0.000	20	0.0	0.25	0.00
			Area				**Totals:**	**8.363**	**99.9**	**-79.930**		**1956.0**		**24.56**
		Natural Area:	**99.9**	**%**				**Bare Ground XKSAT$_{Comp}$:**	**0.158**		**VC$_{Avg}$:**	**19.6**		**A1**
		Developed Area:	**0.0**	**%**				**PSIF:**	**8.68**		**DTHETA$_{Avg}$:**	**0.29**		
		Total:	**99.9**	**%**				**DTHETA$_{Dry}$:**	**0.29**		**XKSAT$_{Adj}$:**	**0.18**		
								DTHETA$_{Normal}$:	**0.18**		**IA$_{Avg}$:**	**0.25**		
A2	AZ697150	114	N	0.21	0.09	0.21	-0.68	0.091	0.8	-0.544	50	40.0	0.30	0.24
A2	AZ6976	114	N	0.79	0.46	0.79	-0.10	0.005	0.0	0.000	50	0.0	0.30	0.00
A2	AZ697101	140	D	0.04	0.01	0.01	-2.00	0.092	0.8	-1.600	50	40.0	0.25	0.20
A2	AZ697117	140	D	0.21	0.10	0.10	-1.00	0.182	1.6	-1.600	50	80.0	0.25	0.40
A2	AZ69759	140	D	0.22	0.09	0.09	-1.05	0.010	0.1	-0.105	50	5.0	0.25	0.03
A2	AZ6976	140	D	0.79	0.46	0.46	-0.34	0.067	0.6	-0.204	50	30.0	0.25	0.15
A2	AZ69770	140	D	0.21	0.08	0.08	-1.10	0.335	2.9	-3.190	50	145.0	0.25	0.73
A2	AZ697117	160	D	0.21	0.10	0.10	-1.00	0.744	6.4	-6.400	50	320.0	0.25	1.60
A2	AZ697149	160	D	0.08	0.03	0.03	-1.52	0.196	1.7	-2.584	50	85.0	0.25	0.43
A2	AZ697150	160	D	0.21	0.09	0.09	-1.05	0.164	1.4	-1.470	50	70.0	0.25	0.35
A2	AZ697155	160	D	0.52	0.28	0.28	-0.55	0.068	0.6	-0.330	50	30.0	0.25	0.15
A2	AZ69759	160	D	0.22	0.09	0.09	-1.05	0.054	0.5	-0.525	50	25.0	0.25	0.13
A2	AZ6976	160	D	0.79	0.46	0.46	-0.34	0.163	1.4	-0.476	50	70.0	0.25	0.35
A2	AZ69770	160	D	0.21	0.08	0.08	-1.10	0.237	2.0	-2.200	50	100.0	0.25	0.50
A2	AZ697149	230	D	0.08	0.03	0.03	-1.52	0.148	1.3	-1.976	75	97.5	0.10	0.13
A2	AZ697155	230	D	0.52	0.28	0.28	-0.55	0.033	0.3	-0.165	75	22.5	0.10	0.03
A2	AZ69759	230	D	0.22	0.09	0.09	-1.05	0.032	0.3	-0.315	75	22.5	0.10	0.03
A2	AZ69770	230	D	0.21	0.08	0.08	-1.10	0.000	0.0	0.000	75	0.0	0.10	0.00
A2	AZ697117	290	D	0.21	0.10	0.10	-1.00	0.218	1.9	-1.900	60	114.0	0.15	0.29
A2	AZ697149	290	D	0.08	0.03	0.03	-1.52	0.206	1.8	-2.736	60	108.0	0.15	0.27
A2	AZ697150	290	D	0.21	0.09	0.09	-1.05	0.017	0.1	-0.105	60	6.0	0.15	0.02

Table A.21 Unit hydrograph example soils and land use parameters

ID	Soil ID	Land Use		XKSAT, in/hr				Area (A)		[8]*[10]	VCD	VCD * A	IA	IA * A
		CODE	Cond.	Nat	Dev	Assign	Log10	sm	%			[12]*[10]		[14]*[10]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A2	AZ69759	290	D	0.22	0.09	0.09	-1.05	0.022	0.2	-0.210	60	12.0	0.15	0.03
A2	AZ6976	290	D	0.79	0.46	0.46	-0.34	0.178	1.5	-0.510	60	90.0	0.15	0.23
A2	AZ69770	290	D	0.21	0.08	0.08	-1.10	0.071	0.6	-0.660	60	36.0	0.15	0.09
A2	AZ697149	500	N	0.08	0.03	0.08	-1.10	0.003	0.0	0.000	10	0.0	0.35	0.00
A2	AZ697150	500	N	0.21	0.09	0.21	-0.68	0.000	0.0	0.000	10	0.0	0.35	0.00
A2	AZ697155	500	N	0.52	0.28	0.52	-0.28	0.007	0.1	-0.028	10	1.0	0.35	0.04
A2	AZ69759	500	N	0.22	0.09	0.22	-0.66	0.166	1.4	-0.924	10	14.0	0.35	0.49
A2	AZ6976	500	N	0.79	0.46	0.79	-0.10	0.025	0.2	-0.020	10	2.0	0.35	0.07
A2	AZ69770	500	N	0.21	0.08	0.21	-0.68	0.117	1.0	-0.680	10	10.0	0.35	0.35
A2	AZ697101	510	N	0.04	0.01	0.04	-1.40	0.188	1.6	-2.240	10	16.0	0.15	0.24
A2	AZ697117	510	N	0.21	0.10	0.21	-0.68	0.359	3.1	-2.108	10	31.0	0.15	0.47
A2	AZ697149	510	N	0.08	0.03	0.08	-1.10	0.069	0.6	-0.660	10	6.0	0.15	0.09
A2	AZ697150	510	N	0.21	0.09	0.21	-0.68	0.123	1.1	-0.748	10	11.0	0.15	0.17
A2	AZ697155	510	N	0.52	0.28	0.52	-0.28	0.024	0.2	-0.056	10	2.0	0.15	0.03
A2	AZ69759	510	N	0.22	0.09	0.22	-0.66	0.182	1.6	-1.056	10	16.0	0.15	0.24
A2	AZ6976	510	N	0.79	0.46	0.79	-0.10	0.131	1.1	-0.110	10	11.0	0.15	0.17
A2	AZ69770	510	N	0.21	0.08	0.21	-0.68	0.176	1.5	-1.020	10	15.0	0.15	0.23
A2	AZ627121	520	N	0.08	0.03	0.08	-1.10	1.184	10.2	-11.220	20	204.0	0.25	2.55
A2	AZ62758	520	N	0.05	0.02	0.05	-1.30	0.000	0.0	0.000	20	0.0	0.25	0.00
A2	AZ62793	520	N	0.21	0.10	0.21	-0.68	1.078	9.3	-6.324	20	186.0	0.25	2.33
A2	AZ697117	520	N	0.21	0.10	0.21	-0.68	2.397	20.7	-14.076	20	414.0	0.25	5.18
A2	AZ697149	520	N	0.08	0.03	0.08	-1.10	1.165	10.0	-11.000	20	200.0	0.25	2.50
A2	AZ697150	520	N	0.21	0.09	0.21	-0.68	0.608	5.2	-3.536	20	104.0	0.25	1.30
A2	AZ697155	520	N	0.52	0.28	0.52	-0.28	0.013	0.1	-0.028	20	2.0	0.25	0.03
A2	AZ69759	520	N	0.22	0.09	0.22	-0.66	0.150	1.3	-0.858	20	26.0	0.25	0.33
A2	AZ6976	520	N	0.79	0.46	0.79	-0.10	0.088	0.8	-0.080	20	16.0	0.25	0.20
A2	AZ69770	520	N	0.21	0.08	0.21	-0.68	0.013	0.1	-0.068	20	2.0	0.25	0.03
			Area				**Totals:**	**11.599**	**100.0**	**-86.645**		**2837.5**		**23.34**
		Natural Area:	**72.0**	**%**				**Bare Ground XKSAT$_{Comp}$:**	**0.136**		**VC$_{Avg}$:**	**28.4**	**A2**	
		Developed Area:	**28.0**	**%**				**PSIF:**	**9.05**		**DTHETA$_{Avg}$:**	**0.25**		
		Total:	**100.0**	**%**				**DTHETA$_{Dry}$:**	**0.28**		**XKSAT$_{Adj}$:**	**0.17**		
								DTHETA$_{Normal}$:	**0.17**		**IA$_{Avg}$:**	**0.23**		
A3	AZ6971	160	D	0.29	0.13	0.13	-0.89	0.137	1.0	-0.890	50	50.0	0.25	0.25
A3	AZ697149	160	D	0.08	0.03	0.03	-1.52	0.020	0.2	-0.304	50	10.0	0.25	0.05
A3	AZ697150	160	D	0.21	0.09	0.09	-1.05	1.309	9.9	-10.395	50	495.0	0.25	2.48
A3	AZ697155	160	D	0.52	0.28	0.28	-0.55	0.818	6.2	-3.410	50	310.0	0.25	1.55
A3	AZ6976	160	D	0.79	0.46	0.46	-0.34	0.081	0.6	-0.204	50	30.0	0.25	0.15
A3	AZ697149	230	D	0.08	0.03	0.03	-1.52	0.113	0.9	-1.368	75	67.5	0.10	0.09
A3	AZ697150	230	D	0.21	0.09	0.09	-1.05	0.163	1.2	-1.260	75	90.0	0.10	0.12
A3	AZ697155	230	D	0.52	0.28	0.28	-0.55	0.289	2.2	-1.210	75	165.0	0.10	0.22
A3	AZ69759	230	D	0.22	0.09	0.09	-1.05	0.053	0.4	-0.420	75	30.0	0.10	0.04
A3	AZ6976	230	D	0.79	0.46	0.46	-0.34	0.058	0.4	-0.136	75	30.0	0.10	0.04
A3	AZ697150	290	D	0.21	0.09	0.09	-1.05	0.000	0.0	0.000	60	0.0	0.15	0.00
A3	AZ69759	290	D	0.22	0.09	0.09	-1.05	0.003	0.0	0.000	60	0.0	0.15	0.00

Table A.21 Unit hydrograph example soils and land use parameters

ID	Soil ID	Land Use		XKSAT, in/hr				Area (A)		[8]*[10]	VCD	VCD * A [12]*[10]	IA	IA * A [14]*[10]
		CODE	Cond.	Nat	Dev	Assign	Log10	sm	%					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A3	AZ6976	290	D	0.79	0.46	0.46	-0.34	0.008	0.1	-0.034	60	6.0	0.15	0.02
A3	AZ697149	500	N	0.08	0.03	0.08	-1.10	0.000	0.0	0.000	10	0.0	0.35	0.00
A3	AZ697155	500	N	0.52	0.28	0.52	-0.28	0.041	0.3	-0.084	10	3.0	0.35	0.11
A3	AZ6971	510	N	0.29	0.13	0.29	-0.54	0.087	0.7	-0.378	10	7.0	0.15	0.11
A3	AZ697149	510	N	0.08	0.03	0.08	-1.10	0.150	1.1	-1.210	10	11.0	0.15	0.17
A3	AZ697150	510	N	0.21	0.09	0.21	-0.68	0.813	6.2	-4.216	10	62.0	0.15	0.93
A3	AZ697155	510	N	0.52	0.28	0.52	-0.28	0.119	0.9	-0.252	10	9.0	0.15	0.14
A3	AZ69759	510	N	0.22	0.09	0.22	-0.66	0.002	0.0	0.000	10	0.0	0.15	0.00
A3	AZ6976	510	N	0.79	0.46	0.79	-0.10	0.014	0.1	-0.010	10	1.0	0.15	0.02
A3	AZ6971	520	N	0.29	0.13	0.29	-0.54	0.005	0.0	0.000	20	0.0	0.25	0.00
A3	AZ697149	520	N	0.08	0.03	0.08	-1.10	0.166	1.3	-1.430	20	26.0	0.25	0.33
A3	AZ697150	520	N	0.21	0.09	0.21	-0.68	8.510	64.6	-43.928	20	1292.0	0.25	16.15
A3	AZ697155	520	N	0.52	0.28	0.52	-0.28	0.022	0.2	-0.056	20	4.0	0.25	0.05
A3	AZ697162	520	N	0.46	0.24	0.46	-0.34	0.007	0.1	-0.034	20	2.0	0.25	0.03
A3	AZ69735	520	N	0.16	0.07	0.16	-0.80	0.040	0.3	-0.240	20	6.0	0.25	0.08
A3	AZ69759	520	N	0.22	0.09	0.22	-0.66	0.064	0.5	-0.330	20	10.0	0.25	0.13
A3	AZ6976	520	N	0.79	0.46	0.79	-0.10	0.075	0.6	-0.060	20	12.0	0.25	0.15
			Area				**Totals:**	**13.167**	**100.0**	**-71.859**		**2728.5**		**23.36**
		Natural Area:	**76.9**	**%**			**Bare Ground $XKSAT_{Comp}$:**		**0.191**		**VC_{Avg}:**	**27.3**	**A3**	
		Developed Area:	**23.1**	**%**			**PSIF:**		**8.18**		**$DTHETA_{Avg}$:**	**0.28**		
		Total:	**100.0**	**%**			**$DTHETA_{Dry}$:**		**0.30**		**$XKSAT_{Adj}$:**	**0.23**		
							$DTHETA_{Normal}$:		**0.19**		**IA_{Avg}:**	**0.23**		
A4	AZ627121	290	D	0.08	0.03	0.03	-1.52	0.017	0.2	-0.30	60	12.0	0.15	0.03
A4	AZ697117	290	D	0.21	0.10	0.10	-1.00	0.021	0.3	-0.30	60	18.0	0.15	0.05
A4	AZ697149	290	D	0.08	0.03	0.03	-1.52	0.057	0.7	-1.06	60	42.0	0.15	0.11
A4	AZ69759	290	D	0.22	0.09	0.09	-1.05	0.004	0.1	-0.11	60	6.0	0.15	0.02
A4	AZ6976	290	D	0.79	0.46	0.46	-0.34	0.023	0.3	-0.10	60	18.0	0.15	0.05
A4	AZ627121	520	N	0.08	0.03	0.08	-1.10	1.372	17.2	-18.92	20	344.0	0.25	4.30
A4	AZ62758	520	N	0.05	0.02	0.05	-1.30	0.013	0.2	-0.26	20	4.0	0.25	0.05
A4	AZ62774	520	N	0.32	0.16	0.32	-0.49	2.189	27.5	-13.48	20	550.0	0.25	6.88
A4	AZ6279	520	N	0.77	0.45	0.77	-0.11	0.082	1.0	-0.11	20	20.0	0.25	0.25
A4	AZ62793	520	N	0.21	0.10	0.21	-0.68	3.559	44.7	-30.40	20	894.0	0.25	11.18
A4	AZ697117	520	N	0.21	0.10	0.21	-0.68	0.338	4.2	-2.86	20	84.0	0.25	1.05
A4	AZ697149	520	N	0.08	0.03	0.08	-1.10	0.186	2.3	-2.53	20	46.0	0.25	0.58
A4	AZ6976	520	N	0.79	0.46	0.79	-0.10	0.096	1.2	-0.12	20	24.0	0.25	0.30
			Area				**Totals:**	**7.957**	**99.9**	**-70.54**		**2062.0**		**24.82**
		Natural Area:	**98.3**	**%**			**Bare Ground $XKSAT_{Comp}$:**		**0.197**		**VC_{Avg}:**	**20.6**	**A4**	
		Developed Area:	**1.6**	**%**			**PSIF:**		**8.09**		**$DTHETA_{Avg}$:**	**0.30**		
		Total:	**99.9**	**%**			**$DTHETA_{Dry}$:**		**0.30**		**$XKSAT_{Adj}$:**	**0.22**		
							$DTHETA_{Normal}$:		**0.19**		**IA_{Avg}:**	**0.25**		
A5	AZ697149	230	D	0.08	0.03	0.03	-1.52	0.087	1.9	-2.89	75	142.5	0.10	0.19
A5	AZ697150	230	D	0.21	0.09	0.09	-1.05	0.486	10.4	-10.92	75	780.0	0.10	1.04
A5	AZ69732	230	D	0.19	0.07	0.07	-1.15	0.001	0.0	0.00	75	0.0	0.10	0.00

Table A.21 Unit hydrograph example soils and land use parameters

	Soil	Land Use		XKSAT, in/hr				Area (A)				VCD * A		IA * A
ID	ID	CODE	Cond.	Nat	Dev	Assign	Log10	sm	%	[8]*[10]	VCD	[12]*[10]	IA	[14]*[10]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A5	AZ6976	230	D	0.79	0.46	0.46	-0.34	0.069	1.5	-0.51	75	112.5	0.10	0.15
A5	AZ697117	290	D	0.21	0.10	0.10	-1.00	0.064	1.4	-1.40	60	84.0	0.15	0.21
A5	AZ697150	290	D	0.21	0.09	0.09	-1.05	0.004	0.1	-0.11	60	6.0	0.15	0.02
A5	AZ69732	290	D	0.19	0.07	0.07	-1.15	0.007	0.1	-0.12	60	6.0	0.15	0.02
A5	AZ6976	290	D	0.79	0.46	0.46	-0.34	0.048	1.0	-0.34	60	60.0	0.15	0.15
A5	AZ697150	510	N	0.21	0.09	0.21	-0.68	2.607	55.8	-37.94	10	558.0	0.15	8.37
A5	AZ697150	520	N	0.21	0.09	0.21	-0.68	1.289	27.6	-18.77	20	552.0	0.25	6.90
A5	AZ6976	520	N	0.79	0.46	0.79	-0.10	0.007	0.1	-0.01	20	2.0	0.25	0.03
			Area				**Totals:**	**4.669**	**99.9**	**-73.00**		**2303.0**		**17.07**
		Natural Area:	**83.5**	**%**				**Bare Ground $XKSAT_{Comp}$:**	**0.186**		**VC_{Avg}:**	**23.1**	**A5**	
		Developed Area:	**16.4**	**%**				**PSIF:**	**8.25**		**$DTHETA_{Avg}$:**	**0.28**		
		Total:	**99.9**	**%**				**$DTHETA_{Dry}$:**	**0.30**		**$XKSAT_{Adj}$:**	**0.22**		
								$DTHETA_{Normal}$:	**0.18**		**IA_{Avg}:**	**0.17**		
A6	AZ697150	230	D	0.21	0.09	0.09	-1.05	0.363	4.2	-4.41	75	315.0	0.10	0.42
A6	AZ69732	230	D	0.19	0.07	0.07	-1.15	0.018	0.2	-0.23	75	15.0	0.10	0.02
A6	AZ6976	230	D	0.79	0.46	0.46	-0.34	0.114	1.3	-0.44	75	97.5	0.10	0.13
A6	AZ627121	290	D	0.08	0.03	0.03	-1.52	0.055	0.6	-0.91	60	36.0	0.15	0.09
A6	AZ627133	290	D	0.05	0.03	0.03	-1.52	0.129	1.5	-2.28	60	90.0	0.15	0.23
A6	AZ6279	290	D	0.77	0.45	0.45	-0.35	0.033	0.4	-0.14	60	24.0	0.15	0.06
A6	AZ62793	290	D	0.21	0.10	0.10	-1.00	0.775	8.9	-8.90	60	534.0	0.15	1.34
A6	AZ697117	290	D	0.21	0.10	0.10	-1.00	0.178	2.0	-2.00	60	120.0	0.15	0.30
A6	AZ697149	290	D	0.08	0.03	0.03	-1.52	0.011	0.1	-0.15	60	6.0	0.15	0.02
A6	AZ69732	290	D	0.19	0.07	0.07	-1.15	0.061	0.7	-0.81	60	42.0	0.15	0.11
A6	AZ6976	290	D	0.79	0.46	0.46	-0.34	0.100	1.2	-0.41	60	72.0	0.15	0.18
A6	AZ627121	510	N	0.08	0.03	0.08	-1.10	1.113	12.8	-14.08	10	128.0	0.15	1.92
A6	AZ62793	510	N	0.21	0.10	0.21	-0.68	0.023	0.3	-0.20	10	3.0	0.15	0.05
A6	AZ627121	520	N	0.08	0.03	0.08	-1.10	1.717	19.8	-21.78	20	396.0	0.25	4.95
A6	AZ627133	520	N	0.05	0.03	0.05	-1.30	0.362	4.2	-5.46	20	84.0	0.25	1.05
A6	AZ62774	520	N	0.32	0.16	0.32	-0.49	0.000	0.0	0.00	20	0.0	0.25	0.00
A6	AZ62793	520	N	0.21	0.10	0.21	-0.68	3.441	39.6	-26.93	20	792.0	0.25	9.90
A6	AZ697150	520	N	0.21	0.09	0.21	-0.68	0.197	2.3	-1.56	20	46.0	0.25	0.58
			Area				**Totals:**	**8.690**	**100.1**	**-90.70**		**2800.5**		**21.32**
		Natural Area:	**79.0**	**%**				**Bare Ground $XKSAT_{Comp}$:**	**0.124**		**VC_{Avg}:**	**28.0**	**A6**	
		Developed Area:	**21.1**	**%**				**PSIF:**	**9.25**		**$DTHETA_{Avg}$:**	**0.25**		
		Total:	**100.1**	**%**				**$DTHETA_{Dry}$:**	**0.28**		**$XKSAT_{Adj}$:**	**0.15**		
								$DTHETA_{Normal}$:	**0.16**		**IA_{Avg}:**	**0.21**		
A7	AZ697150	230	D	0.21	0.09	0.09	-1.05	0.195	13.3	-13.97	75	997.5	0.10	1.33
A7	AZ6976	230	D	0.79	0.46	0.46	-0.34	0.000	0.0	0.00	75	0.0	0.10	0.00
A7	AZ697150	510	N	0.21	0.09	0.21	-0.68	0.158	10.8	-7.34	10	108.0	0.15	1.62
A7	AZ697150	520	N	0.21	0.09	0.21	-0.68	1.111	75.9	-51.61	20	1518.0	0.25	18.98
			Area				**Totals:**	**1.464**	**100.0**	**-72.92**		**2623.5**		**21.93**

Table A.21 Unit hydrograph example soils and land use parameters

ID	Soil ID	Land Use		XKSAT, in/hr				Area (A)		[8]*[10]	VCD	VCD * A	IA	IA * A
		CODE	Cond.	Nat	Dev	Assign	Log10	sm	%			[12]*[10]		[14]*[10]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Natural Area:	**86.7**	**%**			**Bare Ground $XKSAT_{Comp}$:**		**0.187**		**VC_{Avg}:**	**26.2**	**A7**	
		Developed Area:	**13.3**	**%**			**PSIF:**		**8.24**		**$DTHETA_{Avg}$:**	**0.29**		
		Total:	**100.0**	**%**			**$DTHETA_{Dry}$:**		**0.30**		**$XKSAT_{Adj}$:**	**0.22**		
							$DTHETA_{Normal}$:		**0.18**		**IA_{Avg}:**	**0.22**		
A8	AZ62750	160	D	0.36	0.16	0.16	-0.80	0.003	0.1	-0.08	50	5.0	0.25	0.03
A8	AZ62789	160	D	0.16	0.06	0.06	-1.22	0.024	1.1	-1.34	50	55.0	0.25	0.28
A8	AZ6279	160	D	0.77	0.45	0.45	-0.35	0.049	2.2	-0.77	50	110.0	0.25	0.55
A8	AZ627133	230	D	0.05	0.03	0.03	-1.52	0.001	0.0	0.00	75	0.0	0.10	0.00
A8	AZ627136	230	D	0.21	0.09	0.09	-1.05	0.024	1.1	-1.16	75	82.5	0.10	0.11
A8	AZ62717	230	D	0.04	0.01	0.01	-2.00	0.040	1.8	-3.60	75	135.0	0.10	0.18
A8	AZ62750	230	D	0.36	0.16	0.16	-0.80	0.001	0.0	0.00	75	0.0	0.10	0.00
A8	AZ62789	230	D	0.16	0.06	0.06	-1.22	0.014	0.6	-0.73	75	45.0	0.10	0.06
A8	AZ6279	230	D	0.77	0.45	0.45	-0.35	0.138	6.2	-2.17	75	465.0	0.10	0.62
A8	AZ697150	230	D	0.21	0.09	0.09	-1.05	0.155	7.0	-7.35	75	525.0	0.10	0.70
A8	AZ6976	230	D	0.79	0.46	0.46	-0.34	0.045	2.0	-0.68	75	150.0	0.10	0.20
A8	AZ627133	500	N	0.05	0.03	0.05	-1.30	0.002	0.1	-0.13	10	1.0	0.35	0.04
A8	AZ627136	500	N	0.21	0.09	0.21	-0.68	0.002	0.1	-0.07	10	1.0	0.35	0.04
A8	AZ62750	500	N	0.36	0.16	0.36	-0.44	0.003	0.1	-0.04	10	1.0	0.35	0.04
A8	AZ62776	500	N	0.45	0.23	0.45	-0.35	0.011	0.5	-0.18	10	5.0	0.35	0.18
A8	AZ6279	500	N	0.77	0.45	0.77	-0.11	0.013	0.6	-0.07	10	6.0	0.35	0.21
A8	AZ627133	510	N	0.05	0.03	0.05	-1.30	0.108	4.9	-6.37	10	49.0	0.15	0.74
A8	AZ627136	510	N	0.21	0.09	0.21	-0.68	0.068	3.1	-2.11	10	31.0	0.15	0.47
A8	AZ62750	510	N	0.36	0.16	0.36	-0.44	0.220	9.9	-4.36	10	99.0	0.15	1.49
A8	AZ62776	510	N	0.45	0.23	0.45	-0.35	0.001	0.0	0.00	10	0.0	0.15	0.00
A8	AZ6279	510	N	0.77	0.45	0.77	-0.11	0.009	0.4	-0.04	10	4.0	0.15	0.06
A8	AZ697150	510	N	0.21	0.09	0.21	-0.68	0.205	9.2	-6.26	10	92.0	0.15	1.38
A8	AZ69791	510	N	0.04	0.02	0.04	-1.40	0.027	1.2	-1.68	10	12.0	0.15	0.18
A8	AZ627133	520	N	0.05	0.03	0.05	-1.30	0.117	5.3	-6.89	20	106.0	0.25	1.33
A8	AZ62750	520	N	0.36	0.16	0.36	-0.44	0.017	0.8	-0.35	20	16.0	0.25	0.20
A8	AZ697150	520	N	0.21	0.09	0.21	-0.68	0.860	38.8	-26.38	20	776.0	0.25	9.70
A8	AZ69791	520	N	0.04	0.02	0.04	-1.40	0.061	2.8	-3.92	20	56.0	0.25	0.70
			Area				**Totals:**	**2.218**	**99.9**	**-76.72**		**2827.5**		**19.44**
		Natural Area:	**77.8**	**%**	28.3				**0.171**		**VC_{Avg}:**	**28.3**	**A8**	
		Developed Area:	**22.1**	**%**	0.27				**8.49**		**$DTHETA_{Avg}$:**	**0.27**		
		Total:	**99.9**	**%**	0.21				**0.29**		**$XKSAT_{Adj}$:**	**0.21**		
							$DTHETA_{Normal}$:		**0.18**		**IA_{Avg}:**	**0.19**		
B1	AZ62710	160	D	0.79	0.46	0.46	-0.34	0.010	0.2	-0.07	50	10.0	0.25	0.05
B1	AZ62717	160	D	0.04	0.01	0.01	-2.00	0.004	0.1	-0.20	50	5.0	0.25	0.03
B1	AZ62750	160	D	0.36	0.16	0.16	-0.80	0.060	1.3	-1.04	50	65.0	0.25	0.33
B1	AZ62789	160	D	0.16	0.06	0.06	-1.22	0.010	0.2	-0.24	50	10.0	0.25	0.05
B1	AZ62750	170	D	0.36	0.16	0.16	-0.80	0.034	0.7	-0.56	50	35.0	0.25	0.18
B1	AZ62710	230	D	0.79	0.46	0.46	-0.34	0.041	0.9	-0.31	75	67.5	0.10	0.09
B1	AZ62717	230	D	0.04	0.01	0.01	-2.00	0.287	6.1	-12.20	75	457.5	0.10	0.61

Table A.21 Unit hydrograph example soils and land use parameters

ID	Soil ID	Land Use CODE	Land Use Cond.	XKSAT, in/hr Nat	XKSAT, in/hr Dev	XKSAT, in/hr Assign	XKSAT, in/hr Log10	Area (A) sm	Area (A) %	[8]*[10]	VCD	VCD * A [12]*[10]	IA	IA * A [14]*[10]
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B1	AZ62750	230	D	0.36	0.16	0.16	-0.80	0.129	2.8	-2.24	75	210.0	0.10	0.28
B1	AZ62789	230	D	0.16	0.06	0.06	-1.22	0.040	0.9	-1.10	75	67.5	0.10	0.09
B1	AZ6279	230	D	0.77	0.45	0.45	-0.35	0.041	0.9	-0.32	75	67.5	0.10	0.09
B1	AZ6976	230	D	0.79	0.46	0.46	-0.34	0.002	0.0	0.00	75	0.0	0.10	0.00
B1	AZ627133	290	D	0.05	0.03	0.03	-1.52	0.900	19.3	-29.34	60	1158.0	0.15	2.90
B1	AZ62717	290	D	0.04	0.01	0.01	-2.00	1.081	23.1	-46.20	60	1386.0	0.15	3.47
B1	AZ62750	290	D	0.36	0.16	0.16	-0.80	0.840	18.0	-14.40	60	1080.0	0.15	2.70
B1	AZ62782	290	D	0.06	0.03	0.03	-1.52	0.008	0.2	-0.30	60	12.0	0.15	0.03
B1	AZ6279	290	D	0.77	0.45	0.45	-0.35	0.006	0.1	-0.04	60	6.0	0.15	0.02
B1	AZ62793	290	D	0.21	0.10	0.10	-1.00	0.188	4.0	-4.00	60	240.0	0.15	0.60
B1	AZ697117	290	D	0.21	0.10	0.10	-1.00	0.001	0.0	0.00	60	0.0	0.15	0.00
B1	AZ6976	290	D	0.79	0.46	0.46	-0.34	0.007	0.1	-0.03	60	6.0	0.15	0.02
B1	AZ62717	500	N	0.04	0.01	0.04	-1.40	0.000	0.0	0.00	10	0.0	0.35	0.00
B1	AZ62750	500	N	0.36	0.16	0.36	-0.44	0.000	0.0	0.00	10	0.0	0.35	0.00
B1	AZ627133	510	N	0.05	0.03	0.05	-1.30	0.283	6.1	-7.93	10	61.0	0.15	0.92
B1	AZ62717	510	N	0.04	0.01	0.04	-1.40	0.289	6.2	-8.68	10	62.0	0.15	0.93
B1	AZ62750	510	N	0.36	0.16	0.36	-0.44	0.001	0.0	0.00	10	0.0	0.15	0.00
B1	AZ627133	520	N	0.05	0.03	0.05	-1.30	0.381	8.2	-10.66	20	164.0	0.25	2.05
B1	AZ62793	520	N	0.21	0.10	0.21	-0.68	0.028	0.6	-0.41	20	12.0	0.25	0.15
			Area				**Totals:**	**4.671**	**100.0**	**-140.26**		**5182.0**		**15.55**
		Natural Area:	**21.1**	**%**			**Bare Ground XKSAT$_{Comp}$:**		**0.040**		**VC$_{Avg}$:**	**51.8**	**B1**	
		Developed Area:	**78.9**	**%**			**PSIF:**		**10.81**		**DTHETA$_{Avg}$:**	**0.13**		
		Total:	**100.0**	**%**			**DTHETA$_{Dry}$:**		**0.23**		**XKSAT$_{Adj}$:**	**0.06**		
					DTHETA$_{Normal}$:				**0.10**	**IA$_{Avg}$:**		**0.16**		

Table A.22 Sub-basin and land use areas

Sub-basin ID	Land Use Area, in sq. mi. 114	140	160	170	230	290	500	510	520	Totals
A1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.352	8.012	8.363
A2	0.096	0.686	1.625	0.000	0.214	0.712	0.318	1.252	6.696	11.599
A3	0.000	0.000	2.365	0.000	0.676	0.012	0.042	1.184	8.888	13.167
A4	0.000	0.000	0.000	0.000	0.000	0.122	0.000	0.000	7.834	7.957
A5	0.000	0.000	0.000	0.000	0.643	0.123	0.000	2.607	1.296	4.669
A6	0.000	0.000	0.000	0.000	0.495	1.341	0.000	1.136	5.717	8.689
A7	0.000	0.000	0.000	0.000	0.196	0.000	0.000	0.158	1.111	1.464
A8	0.000	0.000	0.076	0.000	0.417	0.000	0.030	0.638	1.055	2.215
B1	0.000	0.000	0.084	0.034	0.539	3.033	0.001	0.573	0.409	4.672
Totals	0.096	0.686	4.150	0.034	3.179	5.347	0.391	7.901	41.017	62.800

Per Table 7.20, the unit hydrograph land use parameters are listed in Table A.23 for each land use type present in the watershed:

Table A.23 Unit hydrograph land use parameters

DDMS ID	Mohave County Zoning Classification	Vegetation Cover Density	RTIMP	IA	DTHETA Condition
Commercial					
230	C-2: General Commercial (6,000 sf minimum, C2)	75	80	0.10	NORMAL
290	M-X: Heavy Manufacturing (1 acre minimum, I2)	60	60	0.15	NORMAL
Natural					
500	Undeveloped Desert Rangeland. Little topographic relief, slopes <5%	10 (varies)	varies	0.35	DRY
510	Hillslopes, Sonoran Desert. Moderate topographic relief, slopes >5%	10 (varies)	varies	0.15	DRY
520	Mountain Terrain. High topographic relief, slopes >20%	20 (varies)	varies	0.25	DRY
Residential					
114	A-R, R-E, R-1, R-MH, R-TT, R-M, R-O, R-O/A (2-5 acre minimum, VLDR)	50	15	0.30	NORMAL
140	R-E, R-1, R-MH, R-TT, R-M, R-O (20,000 sf – 1 acre minimum, LDR)	50	25	0.25	NORMAL
160	R-1, R-MH, R-TT, R-M, R-O (7,000-10,000 sf minimum, MDR)	50	50	0.25	NORMAL
170	R-1, R-MH, R-TT, R-M, R-O (6,000-7,000 sf minimum, MDR)	50	60	0.25	NORMAL

Using sub-basin A7 as an example and the data in Table A.21, the area-weighted, or composite, value of IA is computed as follows, using Equation 7.12 in Section 7.4.4.3:

$$\overline{IA} = \left(\frac{\sum A_i IA_i}{A_T} \right)$$

where:

$\overline{IA}$ = composite value of IA, inches

IA_i = IA of each sub-area, inches

A_i = size of IA sub-area

A_T = size of the watershed or sub-basin

$$\overline{IA} = \left(\frac{0.000*0.10 + 0.195*0.10 + 0.158*0.15 + 1.111*0.25}{1.464} \right) = 0.22\,inches$$

Using the same procedure, IA for the other sub-basins was computed. Refer to Table A.21. The results are summarized as follows:

	A1	A2	A3	A4	A5	A6	A7	A8	B1
IA	0.25	0.23	0.23	0.25	0.17	0.21	0.22	0.19	0.16

Step 7. Computation of sub-basin composite bare ground XKSAT.

The first step is to obtain the needed soil properties data. The most difficult part has already been completed on a countywide basis for Mohave County. This is the estimate for an average value of bare ground XKSAT for natural and developed conditions each NRCS soil map unit (SMU). The procedures used to accomplish this are described in Appendix D. The values of XKSAT for each SMU in each NRCS Soil Survey are tabulated in Appendix D.3.

To estimate an average value of bare ground XKSAT for each sub-basin, the area of each SMU within the sub-basin is needed. These areas can be measured by hand using a scaled map of the watershed overlaid on the NRCS soil map, in CAD software by importing the available GIS databases, using GIS software, or using the GIS Method within the DDMSW computer program. For this example, the GIS Method within DDMSW was used. The computed soils sub-areas for sub-basin A7 are listed in Table A.21. The value of XKSAT used in the computation of sub-basin average XKSAT is dependant on the land use condition. Therefore, the land use polygons must be overlaid on the soil map unit polygons to define the land use condition overlaying each soil map unit individual area. The values in Table A.21 reflect this double "cookie-cutter" approach for each sub-basin. For example, in Sub-basin A7, the 1st polygon listed in Table A.21 is for Soil_ID AZ697150 (NRCS Soil Survey AZ697, SMU 150) and Land Use Code 230. Since the land use condition is developed, the developed condition XKSAT (0.09 in/hr) is used in the computation. For the 3rd polygon, Soil_ID AZ697150 and Land Use Code 510, the natural condition XKSAT value (0.21 in/hr) is used.

The sub-basin log-area-averaged value of bare ground XKSAT for sub-basin A7 is computed using Equation 7.13 in Section 7.4.4.4 and data from Table A.21 as follows:

$$\overline{XKSAT} = anti\log\left(\frac{\sum A_i \log_{10} XKSAT_i}{A_T}\right)$$

where:

$\overline{XKSAT}$ = composite bare ground hydraulic conductivity for the watershed sub-basin, inches/hour

$XKSAT_i$ = bare ground hydraulic conductivity of the soil map unit within a sub-basin, inches/hour

A_i = area of soil map unit subarea within a sub-basin

A_T = total area of the watershed or sub-basin

$$\overline{XKSAT} = a\log\left[\frac{0.195\log_{10}(0.09) + 0.000\log_{10}(0.46) + 0.158\log_{10}(0.21) + 1.111\log_{10}(0.21)}{1.464}\right]$$

$$\overline{XKSAT} = 0.19\ inches/hour$$

Using the same procedure, composite bare ground XKSAT for the other sub-basins was computed. The results are summarized as follows:

Bare Ground	**A1**	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**B1**
XKSAT	0.16	0.14	0.19	0.20	0.19	0.12	0.19	0.17	0.04

Step 8. Assignment of PSIF and DTHETA.

The values of PSIF and DTHETA for each sub-basin are estimated using the bare ground XKSAT computed in Step 7. Refer to Figure 7.14 and Figure 7.15, and Equation 7.9, Equation 7.10, and Equation 7.11 in Section 7.4.2.3. The bare ground XKSAT for sub-basin A7 is 0.19 in/hr. From Figure 7.14, the PSIF value corresponding to an XKSAT of 0.19 is approximately 8 in. Applying Equation 7.9, PSIF is:

$$PSIF = 11.63103 * 0.15801^{0.19}$$

$PSIF = 8.19\ inches$ (Note:Table A.21 shows a value of 8.24, based on XKSAT carried to 3 decimal place accuracy)

From Figure 7.15, $DTHETA_{dry}$ and $DTHETA_{normal}$ are about 0.30 and 0.19, respectively. Applying Equation 7.10 and Equation 7.11, $DTHETA_{dry}$ and $DTHETA_{normal}$ are:

$$DTHETA_{dry} = 0.36180 + 0.03953 * \log_e 0.19$$

$$DTHETA_{dry} = 0.30$$

$$DTHETA_{norm} = 0.28536 + 0.060058 * LOG_e(0.19) - 0.001009 * LOG_e(0.19)^2 - 0.000615 * LOG_e(0.19)^3$$

$DTHETA_{norm} = 0.19$ (Note: Table A.21 shows a value of 0.18, based on XKSAT carried to 3 decimal place accuracy)

When a sub-basin contains a mix of natural and urban land uses, an area-weighted value of DTHETA should be computed. The total area of natural land use from Table A.22 (Types 510 and 520) for sub-basin A7 is 1.268 square miles, or 86.7%. The total area of developed land use from Table A.22 (Type 230) for sub-basin A7 is 0.196 square miles, or 13.3%. The area-weighted, or composite, value of DTHETA is computed as follows, using Equation 7.14 in Section 7.4.4.5:

$$\overline{DTHETA} = \left(\frac{\sum A_i DTHETA_i}{A_T} \right)$$

where:

$\overline{DTHETA}$	=	composite value of DTHETA
$DTHETA_i$	=	DTHETA of each subarea
A_i	=	size of DTHETA subarea
A_T	=	size of the watershed or sub-basin

$$\overline{DTHETA} = \left(\frac{86.7 * 0.30 + 13.3 * 0.19}{100.0} \right) = 0.29$$

The percent of natural and developed area, rather than the area in square miles or acres, is used for this example because that is how DDMSW does its calculations. Using the same procedure, area-weighted DTHETA for the other sub-basins was computed. The results, taken from Table A.21, are summarized as follows:

	A1	A2	A3	A4	A5	A6	A7	A8	B1
PSIF	8.68	9.05	8.18	8.09	8.25	9.25	8.24	8.49	10.81
PSIF DDMSW Ex 1	8.67	9.03	8.15	8.07	8.22	9.24	8.22	8.47	10.80
DTHETA	0.29	0.25	0.28	0.30	0.28	0.25	0.29	0.27	0.13

The values of PSIF computed by DDMSW are included above to show there are slight differences between DDMSW and the hand calculations shown herein. These slight differences are due to roundoff within DDMSW.

Step 9. Computation of sub-basin composite vegetation cover density (VCD).

VCD is estimated by calculating an area-weighted value for each sub-basin using standard values assigned for the land use sub-areas. The areas of the land use sub-areas can be determined by hand using a hard copy of the watershed land use map or digitally using CADD or GIS software. For this example, the areas were calculated using GIS. The sub-basin and land use sub-areas are summarized in Table A.22, the default values of VCD for each land use are listed in Table A.23.

Using sub-basin A7 as an example, the area-weighted, or composite, value of VCD is computed as follows, using Equation 7.15 in Section 7.4.4.6:

$$\overline{VCD} = \left(\frac{\sum A_i VCD_i}{A_T} \right)$$

where:

$\overline{VCD}$ = composite value of VCD, inches

VCD_i = VCD of each subarea, inches

A_i = size of VCD subarea

A_T = size of the watershed or sub-basin

$$\overline{VCD} = \left(\frac{0.196*75 + 0.000*75 + 0.158*10 + 1.111*20}{1.464} \right) = 26\%$$

Using the same procedure, VCD for the other sub-basins was computed. The results are summarized as follows, rounded to the nearest percent:

	A1	A2	A3	A4	A5	A6	A7	A8	B1
VCD	20	28	27	21	23	28	26	28	52

Note that the sub-basin VCD values are affected by having a significant percentage of both developed and undeveloped land uses within most of the sub-basins. The sub-basin VCD is significantly higher than the estimates for the undeveloped areas and significantly lower than the estimates for the developed areas. This is an example of why it is a preferred approach to breakout developed and undeveloped areas into separate sub-basins. The same effect can be seen in IA, DTHETA and RTIMP.

Step 10. Computation of XKSAT adjusted for vegetation canopy cover.

The sub-basin composite bare ground XKSAT values from Step 7 area adjusted for the effects of vegetation canopy cover using Figure 7.16 or Equation 7.16 in Section 7.4.4.6. The adjusted XKSAT for sub-basin A7 is computed using Equation 7.16 as follows:

$$XKSAT_{adj} = \overline{XKSAT}_{BG}\left(\frac{\overline{VCD} - 10}{90} + 1\right)$$

where:

$XKSAT_{adj}$ = $\overline{XKSAT}_{BG}$ adjusted for the effects of vegetation canopy cover, inches/hour

$\overline{XKSAT}_{BG}$ = sub-basin composite bare ground XKSAT, inches/hour

$\overline{VCD}$ = sub-basin composite value of vegetation canopy cover, percent

$$XKSAT_{adj} = 0.187\left(\frac{26 - 10}{90} + 1\right) = 0.22\ inches/hour$$

Using the same procedure, $XKSAT_{adj}$ for the other sub-basins was computed. The results are summarized as follows:

	A1	A2	A3	A4	A5	A6	A7	A8	B1
$XKSAT_{adj}$	0.18	0.17	0.23	0.22	0.22	0.15	0.22	0.21	0.06

Step 11. Estimation of sub-basin composite RTIMP.

RTIMP is estimated by calculating an area-weighted value for each sub-basin for the natural areas and the developed areas separately, and then area weighting the natural and developed average values. The RTIMP computations for each sub-basin are listed in Table A.24.

Table A.24 Unit hydrograph example RTIMP calculations

Basin ID	Soil LID	Land Use CODE	Land Use Cond.	RTIMP Nat % Eff	RTIMP, % Nat.	RTIMP, % Adj	RTIMP, % Dev.	Area sm	Area x $RTIMP_N$	Area x $RTIMP_D$
1	2	3	4	5	6	7	8	9	10	11
A1	AZ697101	510	N	100	0	0	0	0.050	0.000	0.000
A1	AZ697117	510	N	100	20	20	0	0.228	4.560	0.000
A1	AZ697149	510	N	100	0	0	0	0.002	0.000	0.000
A1	AZ6976	510	N	100	0	0	0	0.072	0.000	0.000
A1	AZ627121	520	N	100	0	0	0	0.040	0.000	0.000
A1	AZ62742	520	N	100	20	20	0	1.074	21.480	0.000
A1	AZ62758	520	N	100	20	20	0	2.376	47.520	0.000
A1	AZ62774	520	N	100	20	20	0	2.635	52.700	0.000
A1	AZ6279	520	N	100	0	0	0	0.008	0.000	0.000
A1	AZ62793	520	N	100	20	20	0	0.356	7.120	0.000
A1	AZ697100	520	N	100	0	0	0	0.359	0.000	0.000
A1	AZ697101	520	N	100	0	0	0	0.195	0.000	0.000
A1	AZ697104	520	N	100	0	0	0	0.102	0.000	0.000
A1	AZ697117	520	N	100	20	20	0	0.234	4.680	0.000
A1	AZ697149	520	N	100	0	0	0	0.037	0.000	0.000
A1	AZ69734	520	N	100	20	20	0	0.544	10.880	0.000
A1	AZ6976	520	N	100	0	0	0	0.048	0.000	0.000
A1	AZ69799	520	N	100	20	20	0	0.003	0.060	0.000
							Totals:	**8.363**	**149.000**	**0.000**
								$RTIMP_{Avg}$:	**17.82**	**0.00**
								Total RTIMP:	**18**	**A1**
A2	AZ697150	114	N	100	0	0	15	0.091	0.000	1.365
A2	AZ6976	114	N	100	0	0	15	0.005	0.000	0.075
A2	AZ697101	140	D	100	0	0	25	0.092	0.000	2.300
A2	AZ697117	140	D	100	20	20	25	0.182	3.640	4.550
A2	AZ69759	140	D	100	20	20	25	0.010	0.200	0.250
A2	AZ6976	140	D	100	0	0	25	0.067	0.000	1.675
A2	AZ69770	140	D	100	0	0	25	0.335	0.000	8.375
A2	AZ697117	160	D	100	20	20	50	0.744	14.880	37.200
A2	AZ697149	160	D	100	0	0	50	0.196	0.000	9.800
A2	AZ697150	160	D	100	0	0	50	0.164	0.000	8.200
A2	AZ697155	160	D	100	0	0	50	0.068	0.000	3.400
A2	AZ69759	160	D	100	20	20	50	0.054	1.080	2.700
A2	AZ6976	160	D	100	0	0	50	0.163	0.000	8.150
A2	AZ69770	160	D	100	0	0	50	0.237	0.000	11.850
A2	AZ697149	230	D	100	0	0	80	0.148	0.000	11.840
A2	AZ697155	230	D	100	0	0	80	0.033	0.000	2.640

Table A.24 Unit hydrograph example RTIMP calculations

Basin ID	Soil LID	Land Use		RTIMP	RTIMP, %			Area sm	Area x $RTIMP_N$	Area x $RTIMP_D$
		CODE	Cond.	Nat % Eff	Nat.	Adj	Dev.			
1	2	3	4	5	6	7	8	9	10	11
A2	AZ69759	230	D	100	20	20	80	0.032	0.640	2.560
A2	AZ69770	230	D	100	0	0	80	0.000	0.000	0.000
A2	AZ697117	290	D	100	20	20	60	0.218	4.360	13.080
A2	AZ697149	290	D	100	0	0	60	0.206	0.000	12.360
A2	AZ697150	290	D	100	0	0	60	0.017	0.000	1.020
A2	AZ69759	290	D	100	20	20	60	0.022	0.440	1.320
A2	AZ6976	290	D	100	0	0	60	0.178	0.000	10.680
A2	AZ69770	290	D	100	0	0	60	0.071	0.000	4.260
A2	AZ697149	500	N	100	0	0	0	0.003	0.000	0.000
A2	AZ697150	500	N	100	0	0	0	0.000	0.000	0.000
A2	AZ697155	500	N	100	0	0	0	0.007	0.000	0.000
A2	AZ69759	500	N	50	20	10	0	0.166	1.660	0.000
A2	AZ6976	500	N	100	0	0	0	0.025	0.000	0.000
A2	AZ69770	500	N	100	0	0	0	0.117	0.000	0.000
A2	AZ697101	510	N	100	0	0	0	0.188	0.000	0.000
A2	AZ697117	510	N	50	20	10	0	0.359	3.590	0.000
A2	AZ697149	510	N	100	0	0	0	0.069	0.000	0.000
A2	AZ697150	510	N	100	0	0	0	0.123	0.000	0.000
A2	AZ697155	510	N	100	0	0	0	0.024	0.000	0.000
A2	AZ69759	510	N	50	20	10	0	0.182	1.820	0.000
A2	AZ6976	510	N	100	0	0	0	0.131	0.000	0.000
A2	AZ69770	510	N	100	0	0	0	0.176	0.000	0.000
A2	AZ627121	520	N	100	0	0	0	1.184	0.000	0.000
A2	AZ62758	520	N	50	20	10	0	0.000	0.000	0.000
A2	AZ62793	520	N	50	20	10	0	1.078	10.780	0.000
A2	AZ697117	520	N	50	20	10	0	2.397	23.970	0.000
A2	AZ697149	520	N	100	0	0	0	1.165	0.000	0.000
A2	AZ697150	520	N	100	0	0	0	0.608	0.000	0.000
A2	AZ697155	520	N	100	0	0	0	0.013	0.000	0.000
A2	AZ69759	520	N	50	20	10	0	0.150	1.500	0.000
A2	AZ6976	520	N	100	0	0	0	0.088	0.000	0.000
A2	AZ69770	520	N	100	0	0	0	0.013	0.000	0.000
							Totals:	**11.599**	**68.560**	**159.650**
								$RTIMP_{Avg}$:	**5.91**	**13.76**
								Total RTIMP:	**20**	**A2**
A3	AZ6971	160	D	100	0	0	50	0.137	0.000	6.850
A3	AZ697149	160	D	100	0	0	50	0.020	0.000	1.000
A3	AZ697150	160	D	100	0	0	50	1.309	0.000	65.450
A3	AZ697155	160	D	100	0	0	50	0.818	0.000	40.900
A3	AZ6976	160	D	100	0	0	50	0.081	0.000	4.050
A3	AZ697149	230	D	100	0	0	80	0.113	0.000	9.040
A3	AZ697150	230	D	100	0	0	80	0.163	0.000	13.040
A3	AZ697155	230	D	100	0	0	80	0.289	0.000	23.120
A3	AZ69759	230	D	100	20	20	80	0.053	1.060	4.240

Table A.24 Unit hydrograph example RTIMP calculations

Basin ID	Soil LID	Land Use CODE	Land Use Cond.	RTIMP Nat % Eff	RTIMP, % Nat.	RTIMP, % Adj	RTIMP, % Dev.	Area sm	Area x $RTIMP_N$	Area x $RTIMP_D$
1	2	3	4	5	6	7	8	9	10	11
A3	AZ6976	230	D	100	0	0	80	0.058	0.000	4.640
A3	AZ697150	290	D	100	0	0	60	0.000	0.000	0.000
A3	AZ69759	290	D	100	20	20	60	0.003	0.060	0.180
A3	AZ6976	290	D	100	0	0	60	0.008	0.000	0.480
A3	AZ697149	500	N	100	0	0	0	0.000	0.000	0.000
A3	AZ697155	500	N	100	0	0	0	0.041	0.000	0.000
A3	AZ6971	510	N	100	0	0	0	0.087	0.000	0.000
A3	AZ697149	510	N	100	0	0	0	0.150	0.000	0.000
A3	AZ697150	510	N	100	0	0	0	0.813	0.000	0.000
A3	AZ697155	510	N	100	0	0	0	0.119	0.000	0.000
A3	AZ69759	510	N	100	20	20	0	0.002	0.040	0.000
A3	AZ6976	510	N	100	0	0	0	0.014	0.000	0.000
A3	AZ6971	520	N	100	0	0	0	0.005	0.000	0.000
A3	AZ697149	520	N	100	0	0	0	0.166	0.000	0.000
A3	AZ697150	520	N	100	0	0	0	8.510	0.000	0.000
A3	AZ697155	520	N	100	0	0	0	0.022	0.000	0.000
A3	AZ697162	520	N	100	10	10	0	0.007	0.070	0.000
A3	AZ69735	520	N	100	0	0	0	0.040	0.000	0.000
A3	AZ69759	520	N	100	20	20	0	0.064	1.280	0.000
A3	AZ6976	520	N	100	0	0	0	0.075	0.000	0.000
							Totals:	**13.167**	**2.510**	**172.990**
								$RTIMP_{Avg}$:	**0.19**	**13.14**
								Total RTIMP:	**13**	**A3**
A4	AZ627121	290	D	100	0	0	60	0.017	0.000	1.020
A4	AZ697117	290	D	100	20	20	60	0.021	0.420	1.260
A4	AZ697149	290	D	100	0	0	60	0.057	0.000	3.420
A4	AZ69759	290	D	100	20	20	60	0.004	0.080	0.240
A4	AZ6976	290	D	100	0	0	60	0.023	0.000	1.380
A4	AZ627121	520	N	100	0	0	0	1.372	0.000	0.000
A4	AZ62758	520	N	100	20	20	0	0.013	0.260	0.000
A4	AZ62774	520	N	100	20	20	0	2.189	43.780	0.000
A4	AZ6279	520	N	100	0	0	0	0.082	0.000	0.000
A4	AZ62793	520	N	100	20	20	0	3.559	71.180	0.000
A4	AZ697117	520	N	100	20	20	0	0.338	6.760	0.000
A4	AZ697149	520	N	100	0	0	0	0.186	0.000	0.000
A4	AZ6976	520	N	100	0	0	0	0.096	0.000	0.000
							Totals:	**7.957**	**122.480**	**7.320**
								$RTIMP_{Avg}$:	**15.39**	**0.92**
								Total RTIMP:	**16**	**A4**
A5	AZ697149	230	D	100	0	0	80	0.087	0.000	6.960
A5	AZ697150	230	D	100	0	0	80	0.486	0.000	38.880
A5	AZ69732	230	D	100	0	0	80	0.001	0.000	0.080
A5	AZ6976	230	D	100	0	0	80	0.069	0.000	5.520

Table A.24 Unit hydrograph example RTIMP calculations

Basin ID	Soil LID	Land Use CODE	Land Use Cond.	RTIMP Nat % Eff	RTIMP, % Nat.	RTIMP, % Adj	RTIMP, % Dev.	Area sm	Area x $RTIMP_N$	Area x $RTIMP_D$
1	2	3	4	5	6	7	8	9	10	11
A5	AZ697117	290	D	100	20	20	60	0.064	1.280	3.840
A5	AZ697150	290	D	100	0	0	60	0.004	0.000	0.240
A5	AZ69732	290	D	100	0	0	60	0.007	0.000	0.420
A5	AZ6976	290	D	100	0	0	60	0.048	0.000	2.880
A5	AZ697150	510	N	100	0	0	0	2.607	0.000	0.000
A5	AZ697150	520	N	100	0	0	0	1.289	0.000	0.000
A5	AZ6976	520	N	100	0	0	0	0.007	0.000	0.000
							Totals:	**4.669**	**1.280**	**58.820**
								$RTIMP_{Avg}$:	**0.27**	**12.60**
								Total RTIMP:	**13**	**A5**
A6	AZ697150	230	D	100	0	0	80	0.363	0.000	29.040
A6	AZ69732	230	D	100	0	0	80	0.018	0.000	1.440
A6	AZ6976	230	D	100	0	0	80	0.114	0.000	9.120
A6	AZ627121	290	D	100	0	0	60	0.055	0.000	3.300
A6	AZ627133	290	D	100	15	15	60	0.129	1.935	7.740
A6	AZ6279	290	D	100	0	0	60	0.033	0.000	1.980
A6	AZ62793	290	D	100	20	20	60	0.775	15.500	46.500
A6	AZ697117	290	D	100	20	20	60	0.178	3.560	10.680
A6	AZ697149	290	D	100	0	0	60	0.011	0.000	0.660
A6	AZ69732	290	D	100	0	0	60	0.061	0.000	3.660
A6	AZ6976	290	D	100	0	0	60	0.100	0.000	6.000
A6	AZ627121	510	N	100	0	0	0	1.113	0.000	0.000
A6	AZ62793	510	N	100	20	20	0	0.023	0.460	0.000
A6	AZ627121	520	N	100	0	0	0	1.717	0.000	0.000
A6	AZ627133	520	N	100	15	15	0	0.362	5.430	0.000
A6	AZ62774	520	N	100	20	20	0	0.000	0.000	0.000
A6	AZ62793	520	N	100	20	20	0	3.441	68.820	0.000
A6	AZ697150	520	N	100	0	0	0	0.197	0.000	0.000
							Totals:	**8.690**	**95.705**	**120.120**
								$RTIMP_{Avg}$:	**11.01**	**13.82**
								Total RTIMP:	**25**	**A6**
A7	AZ697150	230	D	100	0	0	80	0.195	0.000	15.600
A7	AZ6976	230	D	100	0	0	80	0.000	0.000	0.000
A7	AZ697150	510	N	100	0	0	0	0.158	0.000	0.000
A7	AZ697150	520	N	100	0	0	0	1.111	0.000	0.000
							Totals:	**1.464**	**0.000**	**15.600**
								$RTIMP_{Avg}$:	**0.00**	**10.66**
								Total RTIMP:	**11**	**A7**
A8	AZ62750	160	D	100	0	0	50	0.003	0.000	0.150
A8	AZ62789	160	D	100	0	0	50	0.024	0.000	1.200
A8	AZ6279	160	D	100	0	0	50	0.049	0.000	2.450
A8	AZ627133	230	D	100	15	15	80	0.001	0.015	0.080
A8	AZ627136	230	D	100	0	0	80	0.024	0.000	1.920

Table A.24 Unit hydrograph example RTIMP calculations

Basin ID	Soil LID	Land Use		RTIMP	RTIMP, %			Area sm	Area x $RTIMP_N$	Area x $RTIMP_D$
		CODE	Cond.	Nat % Eff	Nat.	Adj	Dev.			
1	2	3	4	5	6	7	8	9	10	11
A8	AZ62717	230	D	100	0	0	80	0.040	0.000	3.200
A8	AZ62750	230	D	100	0	0	80	0.001	0.000	0.080
A8	AZ62789	230	D	100	0	0	80	0.014	0.000	1.120
A8	AZ6279	230	D	100	0	0	80	0.138	0.000	11.040
A8	AZ697150	230	D	100	0	0	80	0.155	0.000	12.400
A8	AZ6976	230	D	100	0	0	80	0.045	0.000	3.600
A8	AZ627133	500	N	100	15	15	0	0.002	0.030	0.000
A8	AZ627136	500	N	100	0	0	0	0.002	0.000	0.000
A8	AZ62750	500	N	100	0	0	0	0.003	0.000	0.000
A8	AZ62776	500	N	100	0	0	0	0.011	0.000	0.000
A8	AZ6279	500	N	100	0	0	0	0.013	0.000	0.000
A8	AZ627133	510	N	100	15	15	0	0.108	1.620	0.000
A8	AZ627136	510	N	100	0	0	0	0.068	0.000	0.000
A8	AZ62750	510	N	100	0	0	0	0.220	0.000	0.000
A8	AZ62776	510	N	100	0	0	0	0.001	0.000	0.000
A8	AZ6279	510	N	100	0	0	0	0.009	0.000	0.000
A8	AZ697150	510	N	100	0	0	0	0.205	0.000	0.000
A8	AZ69791	510	N	100	15	15	0	0.027	0.405	0.000
A8	AZ627133	520	N	100	15	15	0	0.117	1.755	0.000
A8	AZ62750	520	N	100	0	0	0	0.017	0.000	0.000
A8	AZ697150	520	N	100	0	0	0	0.860	0.000	0.000
A8	AZ69791	520	N	100	15	15	0	0.061	0.915	0.000
							Totals:	**2.218**	**4.740**	**37.240**
								$RTIMP_{Avg}$:	**2.14**	**16.79**
								Total RTIMP:	**19**	**A8**
B1	AZ62710	160	D	100	0	0	50	0.010	0.000	0.500
B1	AZ62717	160	D	100	0	0	50	0.004	0.000	0.200
B1	AZ62750	160	D	100	0	0	50	0.060	0.000	3.000
B1	AZ62789	160	D	100	0	0	50	0.010	0.000	0.500
B1	AZ62750	170	D	100	0	0	60	0.034	0.000	2.040
B1	AZ62710	230	D	100	0	0	80	0.041	0.000	3.280
B1	AZ62717	230	D	100	0	0	80	0.287	0.000	22.960
B1	AZ62750	230	D	100	0	0	80	0.129	0.000	10.320
B1	AZ62789	230	D	100	0	0	80	0.040	0.000	3.200
B1	AZ6279	230	D	100	0	0	80	0.041	0.000	3.280
B1	AZ6976	230	D	100	0	0	80	0.002	0.000	0.160
B1	AZ627133	290	D	100	15	15	60	0.900	13.500	54.000
B1	AZ62717	290	D	100	0	0	60	1.081	0.000	64.860
B1	AZ62750	290	D	100	0	0	60	0.840	0.000	50.400
B1	AZ62782	290	D	100	0	0	60	0.008	0.000	0.480
B1	AZ6279	290	D	100	0	0	60	0.006	0.000	0.360
B1	AZ62793	290	D	100	20	20	60	0.188	3.760	11.280
B1	AZ697117	290	D	100	20	20	60	0.001	0.020	0.060
B1	AZ6976	290	D	100	0	0	60	0.007	0.000	0.420

Table A.24 Unit hydrograph example RTIMP calculations

Basin ID	Soil LID	Land Use		RTIMP	RTIMP, %			Area sm	Area x $RTIMP_N$	Area x $RTIMP_D$
		CODE	Cond.	Nat % Eff	Nat.	Adj	Dev.			
1	2	3	4	5	6	7	8	9	10	11
B1	AZ62717	500	N	100	0	0	0	0.000	0.000	0.000
B1	AZ62750	500	N	100	0	0	0	0.000	0.000	0.000
B1	AZ627133	510	N	100	15	15	0	0.283	4.245	0.000
B1	AZ62717	510	N	100	0	0	0	0.289	0.000	0.000
B1	AZ62750	510	N	100	0	0	0	0.001	0.000	0.000
B1	AZ627133	520	N	100	15	15	0	0.381	5.715	0.000
B1	AZ62793	520	N	100	20	20	0	0.028	0.560	0.000
							Totals:	4.671	27.800	231.300
								$RTIMP_{Avg}$:	5.95	49.52
								Total RTIMP:	55	B1

Using Equation 7.17 in Section 7.4.4.7, the developed RTIMP for sub-basin A5 is computed as follows:

$$\overline{RTIMP}_{N,D} = \left(\frac{\sum A_i RTIMP_i}{A_T} \right)$$

where:

$\overline{RTIMP}_{N,D}$ = natural or developed condition composite value of RTIMP, inches

$RTIMP_i$ = RTIMP of each subarea, inches

A_i = area of RTIMP subarea

A_T = area of the watershed or sub-basin

$$\overline{RTIMP}_N = \left(\frac{0.064 * 20}{4.669} \right)$$

$$\overline{RTIMP}_N = 0.27\%$$

$$\overline{RTIMP}_D = \left(\frac{(0.087 + 0.486 + 0.001 + 0.069) * 80 + (0.064 + 0.004 + 0.007 + 0.048) * 60 + (2.607 + 1.289 + 0.007) * 0}{4.669} \right)$$

$$\overline{RTIMP}_D = 12.59\%$$

$$\overline{RTIMP} = \overline{RTIMP}_N + \overline{RTIMP}_D$$

$$\overline{RTIMP} = 0.27 + 12.59 = 13\%$$

The impervious areas for Sub-basin A-5 are assumed to be hydraulically connected and 100% effective for the purposes of this example. Refer to Table A.24, column 5. If the impervious area cannot be assumed hydraulically connected, as with some sub-areas within sub-basin A-2, then the impervious area is reduced based on engineering judgment, in this case using a 50%

reduction. Using the same procedure, composite RTIMP for the other sub-basins was computed. The results, rounded to the nearest percent, are summarized as follows:

	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**B1**
RTIMP	18	20	13	16	13	25	11	19	55

Note that the DDMSW Example 1 uses an RTIMP of 23% for sub-basin A-2. This is because that example does not apply the 50% effective factor done for illustrative purposes here.

Step 12. Preparation of the HEC-1 rainfall loss input records.

Code the HEC-1 LG record for sub-basin A3 as follows:

```
_______1_______2_______3_______4_______5_______6_______7_______8_______9______10
LG  0.23    0.28    7.94    0.25    13.0
```

Where Field 1 is IA, Field 2 is DTHETA, Field 3 is PSIF, Field 4 is adjusted XKSAT and Field 5 is RTIMP.

The other sub-basin LG records are coded similarly.

A.3.2 EXAMPLE FOR INITIAL LOSS AND UNIFORM LOSS RATE METHOD

The Initial Loss and Uniform Loss Rate Method is not normally applied in Mohave County. This method may be applicable when the soils for a watershed are predominately sands with a bare ground XKSAT greater than 2 inches hour. Sub-basin A3 from Appendix A.3.1 is used to illustrate application of this method. Refer to Section 7.4.5 for the procedures for the Initial Loss and Uniform Loss Rate Method.

Steps 1 through 7, 9, 10 and 11 from Appendix A.3.1 should be followed to obtain sub-basin composite values of IA, adjusted bare ground XKSAT, and RTIMP. The adjusted bare ground XKSAT is assigned as CNSTL. For sub-basin A3, this is 0.19 inches/hour.

Estimate STRTL. STRTL is the sum of IA and the initial infiltration, II. IA for sub-basin A3 is computed to be 0.23 inches. Using Table 7.10, and a CNSTL of 0.19 inches/hour, II_{dry} is 0.5 inches and II_{normal} is 0.3 inches. II_{dry} is applicable for the natural portion of sub-basin A3, and II_{normal} is applicable to the developed areas. An area-weighted value of II is computed as follows, using a similar method to that applied in Green and Ampt Step 8 above for computing composite DTHETA:

$$\overline{II} = \left(\frac{\sum A_i II_i}{A_T} \right)$$

where:

$\overline{II}$ = composite value of II, inches

II_i = II of each subarea, inches

A_i = size of II subarea

A_T = size of the watershed or sub-basin

$$\overline{II} = \left(\frac{10.114 * 0.5 + 3.053 * 0.3}{13.167} \right) = 0.45 inches$$

$$STRL = \overline{IA} + \overline{II}$$

$$STRTL = 0.23 + 0.45 = \ 0.68\ inches$$

Preparation of the HEC-1 rainfall loss input records.

Code the HEC-1 LU record for sub-basin A3 as follows:

```
_______1_______2_______3_______4_______5_______6_______7_______8_______9______10
LU  0.68    0.25    13.0
```

where: Field 1 is STRTL, Field 2 is CNSTL, and Field 3 is RTIMP.

Page Intentionally Left Blank

A.4 UNIT HYDROGRAPH EXAMPLE

A.4.1 PROBLEM STATEMENT

Clark unit hydrograph parameters are needed for a HEC-1 model of a large watershed within, and south of, Kingman, AZ. The site is located as shown on Figure A.6, and is the same watershed used for the Appendix A.3 example. Derive the parameters and prepare the HEC-1 unit hydrograph records for the model using the instructions set forth in Section 7.5.3. There are two methods that can be used:

1. Manual Computations. Computations are performed by hand or with a calculator.
2. DDMSW Manual Input. Lengths and other parameters are determined by the most expedient means available and then manually input to DDMSW. DDMSW then computes the Clark unit hydrograph parameters for each sub-basin.
3. DDMSW GIS Method. Sub-basin boundaries, land use boundaries, Tc paths, and Lca paths are created in ERSI GIS shape file format external to DDMSW, read into DDMSW, and then DDMSW computes Clark unit hydrograph parameters for each sub-basin using the GIS information.

A.4.2 PROBLEM SOLUTION

The manual solution consists of the following steps.

1. Watershed delineation.
2. Definition of the T_c and L_{ca} paths for each sub-basin.
3. Definition of the L_{ca} path for each sub-basin.
4. Calculation of T_c.
5. Calculation of R.
6. Determination of the time-area relationship for each sub-basin.
7. Preparation of the HEC-1 UC record for each sub-basin.\

Determine the NMIN and NQ Parameters for the HEC-1 Model.

Step 1. Watershed Delineation.

Refer to Appendix A.3.1.2, Step 1.

Step 2. Definition of the T_c and L_{ca} paths for each sub-basin.

The T_c and L_{ca} paths were delineated using the USGS 7.5-minute Quadrangle Maps and 10-meter Digital Elevation Maps (DEM) of the area. The results are shown on Figure A.21. The parameters derived from the USGS Quadrangle Maps and DEMs are listed in Table A.25.

Table A.25 Unit hydrograph T_c and L_{ca} parameters

Sub-basin ID	Area, sm	T_c Path				L_{ca}
		Length, mi	Top Elevation	Bottom Elevation	Slope, ft/mi	Length, mi
A1	8.363	8.66	8054.4	4068.0	460.4	4.77
A2	11.599	9.98	5009.5	3162.2	185.1	5.06
A3	13.167	9.29	5161.0	3131.1	218.4	4.19
A4	7.957	10.60	6274.5	3131.1	296.4	6.54
A5	4.669	5.35	4311.9	3055.8	235.0	2.70
A6	8.690	11.03	4896.3	3001.6	171.8	5.44
A7	1.464	3.12	4110.7	3001.6	355.5	1.54
A8	2.215	4.25	3925.8	2840.1	255.7	2.78
B1	4.672	4.58	3827.5	2813.6	221.3	1.92

Step 3. Determination of sub-basin land uses.

The land uses present on the watershed are shown on Figure A.23. Based on an evaluation of the land uses for each sub-basin, the Tc equation appropriate to the dominate land use in each sub-basin was assigned as listed in Table A.26. Refer to Section 7.5.2.1.

Table A.26 Unit hydrograph T_c equation type assignment

Sub-basin ID	T_c Equation Type
A1	Desert/Mountain
A2	Desert/Mountain
A3	Desert/Mountain
A4	Desert/Mountain
A5	Desert/Mountain
A6	Desert/Mountain
A7	Desert/Mountain
A8	Desert/Mountain
B1	Urban

Step 4. Calculation of T_c.

The time of concentration, T_c, for sub-basins A3 and B1 are computed using the appropriate T_c equation (Equation 7.17 or 7.19) and data from Appendix A.3.1.2 and Table A.25 as follows:

desert/mountain:

$$T_c = 2.4A^{0.1}L^{0.25}{L_{ca}}^{0.25}S^{-0.2}$$

urban

$$T_c = 3.2A^{0.1}L^{0.25}{L_{ca}}^{0.25}S^{-0.14}RTIMP^{-0.36} \quad \text{A.1}$$

where:

T_c	=	time of concentration, in hours,
A	=	area, in square miles,
S	=	watercourse slope, in feet/mile,
L	=	length of watercourse to the hydraulically most distant point, in miles,
L_{ca}	=	length measured from the concentration point along L to a point on L that is perpendicular to the watershed centroid, in miles, and
RTIMP	=	effective impervious area, in percent.

Sub-basin A3:

$$T_c = 2.4(13.167)^{0.1}(9.29)^{0.25}(4.19)^{0.25}(218.4)^{-0.2}$$

$$T_c = 2.64\ hours$$

Sub-basin B1:

$$T_c = 3.2(4.672)^{0.1}(4.58)^{0.25}(1.92)^{0.25}(221.3)^{-0.14}(55)^{-0.36}$$

$$T_c = 0.71\ hours$$

Step 5. Calculation of R.

The storage coefficient, R, for sub-basins A3 and B1 are computed using Equation 7.20 and data from Appendix A.3.1.2 and Table A.25 as follows:

$$R = 0.37{T_c}^{1.11}L^{0.80}A^{-0.57}$$

where: R is in hours and the variables are as defined for the T_c equations.

Sub-basin A3:

$$R = 0.37(2.64)^{1.11}(9.29)^{0.80}(13.167)^{-0.57}$$

$$R = 1.49\ hours$$

Sub-basin B1:

$$R = 0.37(0.71)^{1.11}(4.58)^{0.80}(4.672)^{-0.57}$$

$$R = 0.36\ hours$$

Using the same procedures, T_c and R for the other sub-basins were computed. The results are summarized as follows:

	A1	A2	A3	A4	A5	A6	A7	A8	B1
T_c	2.21	2.88	2.64	2.73	1.83	2.96	1.14	1.59	0.71
R	1.49	1.86	1.49	2.29	1.15	2.46	0.86	1.25	0.36

Step 6. Determination of the time-area relationship for each sub-basin.

A time-area relationship must be either computed or assigned using one of the three synthetic relationships defined in Section 7.5.2.3. For the majority of cases in Mohave County, use of the synthetic relationships is appropriate. In general, the land use codes assigned in Appendix A.3.1.2 can be used as guidance for assigning the synthetic time-area relationship. The dominate land use and the assigned time-area relationship for each sub-basin are listed in Table A.27.

Table A.27 Assignment of the time-area relationship to each sub-basin

Sub-basin ID	Dominate Land Use	Assigned Time-Area Relationship
A1	520	Mountain, HEC-1 Default Curve B
A2	520	Mountain, HEC-1 Default Curve B
A3	520	Mountain, HEC-1 Default Curve B
A4	520	Mountain, HEC-1 Default Curve B
A5	510	Desert Rangeland, Curve C
A6	520	Mountain, HEC-1 Default Curve B
A7	520	Mountain, HEC-1 Default Curve B
A8	520	Mountain, HEC-1 Default Curve B
B1	290	Urban, Curve A

Land use codes 500 and 510, undeveloped desert rangeland and hillslope areas, are assigned curve C. Land use code 520, Mountain, areas are assigned curve B. Predominately urban areas are assigned curve A. Note that this is another instance where proper sub-basin delineation based on land use is very important. For instance, sub-basins A2 and A3 have a significant percentage of urban area. The urban areas should be delineated into separate sub-basins whenever possible so that an appropriate time-area relationship can be assigned.

Step 7. Preparation of the HEC-1 UC record for each sub-basin.

Code the HEC-1 UC record for the Clark unit hydrograph parameters for sub-basin A3 as follows:

```
_______1_______2_______3_______4_______5_______6_______7_______8_______9______10
UC  2.64    1.49
```

Where Field 1 is T_c, and Field 2 is R.

Code the HEC-1 UA record for the time-area relationship for sub-basin A3 as follows. The UA records follow the UC record in the HEC-1 input file.

```
_______1_______2_______3_______4_______5_______6_______7_______8_______9______10

UA     0     4.5    12.6    23.2    35.8    50.0    64.2    76.8    87.4    95.5
UA   100
```

Where Field 1 is percent of watershed area at time interval 0, Field 2 is percent of watershed area at time interval 2, etc. UC and UA records for the other sub-basins should be coded in a similar manner.

Step 8. Determine the NMIN and NQ Parameters for the HEC-1 Model.

As described in Section 7.9.2.4, NMIN is the integer number of minutes for the computation interval, which will usually be either 2 minutes or 5 minutes. To determine NMIN, estimate the time of concentration (T_c) for the smallest sub-basin. Using this value, estimate the number of hydrograph ordinates (NQ) required to provide an adequate time base for the HEC-1 model.

Per Step 6 above, the shortest T_c is 0.71 hours for sub-basin B1. NMIN should be between $0.1T_c$ and $0.25T_c$, or between 4 and 11 minutes. Select a T_c of 5-minutes.

The total length of channel reach routes for the model is 56,701 feet (refer to Appendix A.5). Assuming an average velocity of 5 fps, the total reach travel time is 3.15 hours. The storm duration for this example is 24-hours. Use a model duration of 24+4 hours = 28 hours. NQ is therefore 28*60/NMIN or 336. Use NQ = 400. NQ should be checked after the HEC-1 model is completed.

A.4.3 UNIT HYDROGRAPH METHOD HEC-1 MODEL RESULTS

DDMSW was used to model the unit hydrograph method example discussed in Appendixs A.3, A.4, A.5, and A.6. The resultant HEC-1 input file is listed in Figure A.26.

Figure A.26 Unit Hydrograph Method example HEC-1 input file

```
ID      County of Mohave
ID      MOHAVE EXAMPLE1 - Mohave County Unit Hydrograph Method Example
ID      100 YEAR
ID      24 Hour Storm
ID      Unit Hydrograph: Clark
ID      09/11/2017
IT     5       0       0     400
IN    15
IO     3
*DIAGRAM
*
JD 4.464    0.01
PH                0.705   1.331   2.218   2.656   2.872   3.222   3.667   4.464
JD 4.241      10
JD 4.098      20
JD 4.018      30
JD 3.915      50
JD 3.785     100
JD 3.714     150
JD 3.598     300
JD 3.495     500
KK     A1   BASIN
BA 8.363
LG  0.25     0.29     8.67     0.18      18
UC 2.207    1.493
UA      0     4.5     12.6     23.2     35.8     50.0     64.2     76.8     87.4     95.5
UA   100
*
KK001002   ROUTE
RS      8    FLOW
RC 0.055    0.045    0.055    33573  0.0270 3575.00
RX  0.00  100.00  614.00  629.00  739.00  748.60  765.80  950.40
RY3624.2 3570.00 3569.00 3566.00 3566.00 3570.90 3573.10 3618.00
*
KK     A2   BASIN
BA11.599
```

Figure A.26 Unit Hydrograph Method example HEC-1 input file

```
LG  0.23    0.25    9.03    0.16      23
UC 2.877   1.863
UA     0     4.5    12.6    23.2    35.8    50.0    64.2    76.8    87.4    95.5
UA   100
*
KK    C2 COMBINE
KO     1
HC     2
*
KK002003   ROUTE
RS     1    FLOW
RC 0.055   0.045   0.055    1586  0.0196 3170.00
RX  0.00    0.10  253.00  274.00  336.20  359.40  380.70  394.80
RY3173.5 3166.40 3164.50 3162.20 3162.40 3164.90 3164.90 3173.50
*
KK    A3   BASIN
BA13.167
LG  0.23    0.27    8.15    0.23      13
UC 2.642   1.489
UA     0     4.5    12.6    23.2    35.8    50.0    64.2    76.8    87.4    95.5
UA   100
*
KK    A4   BASIN
BA 7.957
LG  0.25    0.30    8.07    0.22      16
UC 2.730   2.287
UA     0     4.5    12.6    23.2    35.8    50.0    64.2    76.8    87.4    95.5
UA   100
*
KK    C3 COMBINE
KO     1
HC     3
*
KK003004   ROUTE
RS     1    FLOW
RC 0.055   0.045   0.055    4417  0.0170 3123.00
RX  0.00   31.20   77.70  124.50  164.60  231.90  316.30  363.50
RY3123.3 3122.90 3116.10 3112.80 3114.20 3118.40 3121.00 3123.30
*
KK    A5   BASIN
BA 4.669
LG  0.17    0.28    8.22    0.22      13
UC 1.831   1.150
UA     0     3.0     5.0     8.0    12.0    20.0    43.0    75.0    90.0    96.0
UA   100
```

Figure A.26 Unit Hydrograph Method example HEC-1 input file

```
*
KK    C4 COMBINE
KO     1
HC     2
*
KK004005   ROUTE
RS     1    FLOW
RC 0.055   0.045   0.055    4644  0.0117 3039.00
RX  0.00  256.30  462.90  620.20  673.90  826.70  936.90 1045.80
RY3044.2 3042.70 3035.70 3030.80 3030.40 3035.60 3041.50 3049.90
*
KK    A6   BASIN
BA 8.690
LG  0.21    0.26    9.24    0.15      25
UC 2.962   2.457
UA     0     4.5    12.6    23.2    35.8    50.0    64.2    76.8    87.4    95.5
UA   100
*
KK   C5L COMBINE
KO     1
HC     2
*
KK    A7   BASIN
BA 1.464
LG  0.22    0.28    8.22    0.22      11
UC 1.140   0.856
UA     0     4.5    12.6    23.2    35.8    50.0    64.2    76.8    87.4    95.5
UA   100
*
KK    C5 COMBINE
KO     1
HC     2
*
KK005006   ROUTE
RS     4    FLOW
RC 0.055   0.045   0.055   12481  0.0129 2925.00
RX  0.00  102.40  200.20  285.30  391.40  478.90  530.80  619.50
RY2928.0 2922.70 2916.90 2918.30 2918.10 2916.00 2917.60 2928.00
*
KK    A8   BASIN
BA 2.215
LG  0.19    0.27    8.47    0.21      19
UC 1.589   1.250
UA     0     4.5    12.6    23.2    35.8    50.0    64.2    76.8    87.4    95.5
UA   100
```

Figure A.26 Unit Hydrograph Method example HEC-1 input file

```
*
KK    C6 COMBINE
KO     1
HC     2
*
KK    B1   BASIN
KO     1
BA 4.672
LG  0.16    0.13   10.80    0.06      55
UC 0.713   0.357
UA     0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA   100
*
KK  B1DS  DIVERT
KO     1
DT B1DIV  400.00     0.0
DI    0.0    100.0    250.0    500.0    750.0  1000.0  2000.0  4000.0  6000.0 10000.0
DQ    0.0    100.0    250.0    500.0    750.0  1000.0  2000.0  4000.0  6000.0 10000.0
*
ZZ
```

The output results are listed in Table A.28. There are several areas of interest in the results.

1. The Time-to-Peak (T_p) in column 4 for the last combine operation (C6) is 14.75 hours. Therefore, the total time base is 24 hours + 2.75 hours = 26.75 hours. The NQ value for the model could be reduced to: NQ = 26.75*60/5 = 321 minutes. The value used, 400, is a good estimate and does not need to be adjusted.
2. Check the Channel Route operations. In all cases the peak discharge is reduced because of attenuation in the reach. If any peak discharges had increased because of the route, the operation would need to be checked in detail as this is an indication of improper coding of parameters. The cross section should be plotted to make sure there are no input errors and all other parameters should be verified.

   Evaluate the combine operations. At C2 note that the combined peak discharge is less than the sum of the upstream peaks. The same is true for the combined runoff volume. All the combine operations show this result. This is due to the use of the HEC-1 JD record option. The combine operation increases the total watershed area at the concentration point. The increased watershed area results in a greater areal reduction factor applied to the rainfall value.

   The JD record option causes HEC-1 to compute what are called index hydrographs, one for each JD record used. Each JD record specifies a watershed area and corresponding areally-reduced point precipitation value. The index hydrographs represent the runoff hydrograph for that specific watershed area and precipitation value. When a sub-basin operation is performed, HEC-1 computes all the index hydrographs and then computes a log-based interpolated hydrograph using the actual sub-basin area. The interpolated hydrograph results are what are reported.

The index hydrographs are carried forward. When a hydrograph operation such as a combine is performed, the index hydrographs from the upstream hydrograph operations are added and then the log-based interpolation is performed using the total watershed area at the combine operation concentration point. This process results in the areally-reduced peak discharge at the combine being lower than the total of the peak discharges being added.

The unit peak discharges in column 6 represent the peak discharge in column 5 divided by the watershed area in column 3. The unit peak discharges are very useful for checking the reasonableness of the model results by indirect methods, as described in Section 7.11.

Table A.28 Unit hydrograph method example HEC-1 results

HEC-1 Operation	ID	Area, sm	Time to Peak, hrs	Peak Discharge, cfs	Unit Discharge, cfs/sq mi	Rainfall Excess, in	Runoff Volume, ac-ft
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HYDROGRAPH_AT	A1	8.36	13.92	3,183	381	1.952	871
ROUTED_TO	001002	8.30	14.50	3,105	374	1.952	870
HYDROGRAPH_AT	A2	11.60	14.42	3,754	324	2.139	1324
2_COMBINED_AT	C2	19.96	14.50	6,366	319	1.939	2064
ROUTED_TO	002003	19.90	14.50	6,357	319	1.939	2064
HYDROGRAPH_AT	A3	13.17	14.17	4,126	313	1.686	1184
HYDROGRAPH_AT	A4	7.96	14.42	2,092	263	1.818	772
3_COMBINED_AT	C3	41.09	14.42	10,634	259	1.917	4200
ROUTED_TO	003004	41.00	14.50	10,606	259	1.614	3536
HYDROGRAPH_AT	A5	4.67	13.58	2,426	519	1.782	444
2_COMBINED_AT	C4	45.75	14.42	11,455	250	1.571	3833
ROUTED_TO	004005	45.70	14.50	11,413	250	1.57	3832
HYDROGRAPH_AT	A6	8.69	14.67	2,505	288	2.239	1038
2_COMBINED_AT	C5L	54.44	14.50	12,987	239	1.582	4593
HYDROGRAPH_AT	A7	1.46	13.00	921	631	1.746	136
2_COMBINED_AT	C5	55.91	14.50	13,075	234	1.568	4677
ROUTED_TO	005006	55.90	14.83	12,986	232	1.567	4672
HYDROGRAPH_AT	A8	2.21	13.42	1,065	482	1.992	235
2_COMBINED_AT	C6	58.12	14.75	13,224	228	1.557	4828
HYDROGRAPH_AT	B1	4.67	12.42	6,874	1,472	3.333	831

A.5 CHANNEL ROUTING EXAMPLE

A.5.1 PROBLEM STATEMENT

Channel hydrograph routing parameters are needed for a HEC-1 model of a large watershed within, and south of, Kingman, AZ. The site is located as shown on Figure A.6, and is the same watershed used for the Appendixs A.3 and A.4 examples. Derive the parameters and prepare the HEC-1 channel route records for the model using the instructions set forth in Section 7.6.4. An excellent resource for guidance when performing hydrologic routing using HEC-1 is Hoggan (1997).

A.5.2 PROBLEM SOLUTION

The procedure consists of the following steps:

1. Watershed delineation.
2. Definition of the routing paths for each routing reach.
3. Evaluation the physical characteristics of each reach.
4. Determinations of the reach or sub-reach cross section.
5. Assignment of Manning's n-values.
6. Preparation of the HEC-1 channel route input records.
7. Estimation and optimization of routing computation steps.

Step 1. Watershed Delineation.

Refer to Appendix A.3.1.2, Step 1.

Step 2. Definition of the routing paths for each routing reach.

There are five (5) routing reaches for this example. They have been defined using the "blue" thalweg lines on the 7.5-minute USGS Quadrangle Maps and are shown on Figure A.21 and Figure A.22. Concentration points at the outlet of each sub-basin and at confluences have been defined and are also shown on Figure A.21 and Figure A.22. The routing reaches for this example are named by combining the concentration point identifiers for the upstream and downstream end of the reach. For example, the reach that routes the hydrograph from sub-basin A1 through sub-basin A2 is named '001002' because it connects concentration points C1 and C2. In HEC-1, the maximum length of a named for a hydrograph operation such as a reach route operation or a sub-basin designation is characters. Using this naming convention, a total of 999 concentration points could be defined for a given HEC-1 model. The reach names for this example are 001002, 002003, 003004, 004005, and 005006.

Step 3. Evaluation the physical characteristics of each reach.

The first characteristic to evaluate is slope. If there are significant changes in slope within the reach, it should be subdivided into sub-reaches. Reach 001002 is very long (33,573 feet) and does have significant change in slope. Before dividing up the reach, evaluate the second characteristic, which is the average cross section. Does it significantly change in configuration (ie. significant changes in the width, or the depth to width ratio)? Can the reach be subdivided to account for both characteristics? Other characteristics to consider are changes in roughness, soils, natural conditions versus constructed, and vegetation. All these characteristics affect travel time in the reach and potential storage, which are the effects being modeled with the normal depth channel route method. A detailed examination of reaches 001002 and 005006, including field reconnaissance, would likely result in subdivision of both reaches. For the purposes of this example, no further subdivision will be made, but the hydrologist/engineer is expected to break routing reaches into sub-reaches where appropriate.

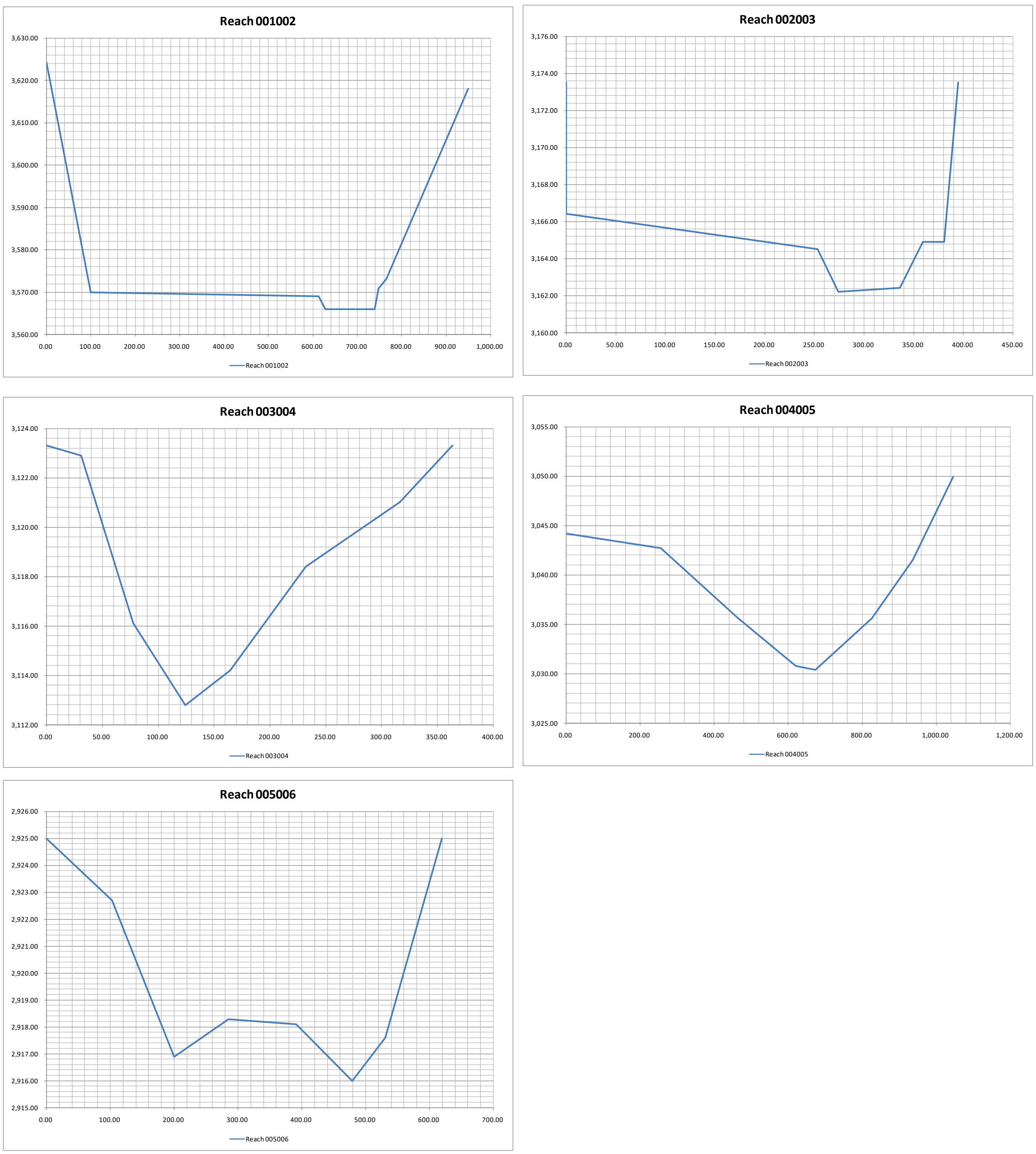
Table A.29 Reach route physical characteristics

Reach ID	In Sub-basin	Elevation		Length, ft	Slope, ft/ft
		Top	Bottom		
001002	A2	4068.0	3162.2	33,572.5	0.0270
002003	A4	3162.2	3131.1	1,585.7	0.0196
003004	A5	3131.1	3055.8	4,416.60	0.0170
004005	A6	3055.8	3001.6	4,644.1	0.0117
005006	A8	3001.6	2840.1	12,481.1	0.0129

Step 4. Determinations of the reach or sub-reach cross section.

The next step is to establish a cross section for each reach that is a reasonable approximation of the various cross section configurations present within the reach. This can be done by examining the available contour mapping covering each reach and by field reconnaissance. The cross sections for this example were defined using the USGS 7.5-minute Quadrangle Maps. In actual application, if the quad maps are the best available topography, the hydrologist/engineer should conduct a field reconnaissance and survey field cross sections at representative locations. Then a composite eight (8) point cross section that is representative of the reach can be prepared. HEC-1 normal depth routing reach cross sections are limited to eight (8) points to define cross section. The cross sections used for this example are shown in Figure A.27.

Figure A.27 Reach route cross sections



In general, use cross section points 1-3 and 6-8 to define the left and right overbank areas, respectively, and cross section points 3-6 should be used to define the main channel. As with HEC-2 and HEC-RAS, routing cross sections should be stationed from left to right looking downstream.

Step 5. Assignment of Manning's n-values.

Manning's n for the main channel and left and right overbanks should be determined using the procedures set forth in Chapter 13. For the purposes of this example, a value of 0.045 was used for the main channel for all five routing reaches. An n-value of 0.055 was assigned for the left and right overbank areas for all five reaches.

Step 6. Preparation of the HEC-1 channel route input records.

Using the data from Steps 1-5, the HEC-1 input data file records for reach route 001002 are coded as follows:

```
_______1_______2_______3_______4_______5_______6_______7_______8_______9______10
KK001002  ROUTE
RS    16    FLOW      -1
RC 0.055   0.045   0.055   33573  0.0270 3575.00
RX  0.00  100.00  614.00  629.00  739.00  748.60  765.80  950.40
RY3624.2 3570.00 3569.00 3566.00 3566.00 3570.90 3573.10 3618.00
```

The KK record defines the hydrograph operation name.

The RS record establishes that this is a storage route. The type of storage route is not yet specified. The Normal Depth channel route is actually a form of storage route based on the Modified Puls method (refer to Hoggan, 1997). Field 1, NSTPS, is set equal to eight (8), which is the number of steps to be used in the route operation. This value should be computed through an optimization process as described in Step 7. "FLOW" is entered in Field 2, which specifies that the discharge rate for the beginning of the first time period will be in the next field. The next field (Field 3) is set to -1, which specifies the initial outflow rate is set equal to the initial inflow rate.

The RC record establishes that this is a Normal Depth Channel Routing operation. The fields are:

1. ANL, Left overbank Manning's n-value.
2. ANCH, Channel Manning's n-value.
3. ANR, Right overbank Manning's n-value.

4. RLNTH, Reach length, in feet.
5. SEL, Energy gradeline slope in ft/ft. Can be computed from a HEC-RAS model. If unknown, estimate using the average channel slope for the reach.
6. ELMAX, Maximum elevation for which storage and outflow values are to be computed.

The RX record is used to define the ground stations for each point on the cross section, increasing from left to right looking downstream. Note that the left and right bank are assumed to be located at points 3 and 6, respectively, on the cross section. A maximum of eight (8) points are allowed per cross section.

The RY record is used to define the ground elevation of each point on the cross section, corresponding to the stations defined on the RX record.

Step 7. Estimation and optimization of routing computation steps.

The NSTPS parameter, entered in Field 1 of the RS record, should be optimized as described in Section 7.9.2.9. The DDMSW computer program will perform the optimization but it is important to understand how the program accomplishes the optimization and there may be times when the hydrologist/engineer needs to perform the optimization manually. The process for accomplishing the optimization of NSTPS manually for reach 001002 is presented here.

1. Initial Estimation of NSTEPS. Determine an initial estimate of NSTPS by assuming an average velocity for the reach and using Equation 7.23. Assume an average velocity of 7 fps and use the reach data from Table A.29. Assume an NMIN of 5-minutes is used for the HEC-1 model.

$$\mathrm{NSTPS} = \frac{L}{(V_{avg})(60)(NMIN)}$$

where:

L	=	the minimum reach length, in feet.
NSTPS	=	an integer with a minimum value of 1, but preferably more than 1.
V_{avg}	=	an estimate of the average velocity, in feet/second.
NMIN	=	the integer number of minutes for the computation interval.

$$\mathrm{NSTPS} = \frac{33{,}572.5}{(7)(60)(5)} = 16$$

Iteration 1. After an initial estimate of NSTPS has been made for all routing reaches, the NSTPS values should be coded on the RS record and the HEC-1 model run. Then open the HEC-1 Output file with a text editor such as Notepad or TextPAD (TextPad) and evaluate the RUNOFF SUMMARY table at the end of the file. Refer to Figure A.28 for an excerpt from the

the Runoff Summary table from the 100-year 24-hour HEC-1 model for this example using NSTPS = 16 for reach 001002.

Figure A.28 HEC-1 output Runoff Summary table excerpt, NSTPS=16

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
HYDROGRAPH AT							
	A1	3183.	13.92	1499.	437.	317.	8.36
ROUTED TO							
	001002	3144.	14.50	1478.	436.	317.	8.36

Using the data in Figure A.28, compute the reach travel time by subtracting the Time-to-Peak at the beginning of the route from the Time-to-Peak at the end of the route:

Travel Time = 14.50-13.92 = 0.58 hours.

Compute the new estimate of NSTPS:

NSTPS Iteration 2 = (0.58)(60)/5 = 7

Iteration 2. Revise the RS record for reach 001002 by changing the NSTPS value from 16 to 7. Rerun the HEC-1 model and determine NSTPS from the Runoff Summary table. The results are shown in Figure A.29. Note that the travel time of 0.58 hours remains unchanged, but that the routed peak discharge is reduced from 3183 cfs to 3093 cfs. The value of NSTPS = 7 is accepted for use in the model. NSTPS normally converges to no change within three (3) iterations. This technique is only accurate to +/- 1 time step. Sometimes the computed NSTPS value will oscillate by a value of +/- 1 between iterations. In this case, use engineering judgment to select which of the two values to use.

The current version of DDMSW uses the 100-year storm frequency to perform the NSTPS optimization. The optimized NSTPS values from 100-year HEC-1 model are then used for any other frequencies run. The hydrologist/engineer should keep this in mind when checking the results for frequencies other than the 100-year. The Runoff Summary table results for other frequencies should be checked to be sure the NSTPS values computed by HEC-1 are not significantly different than input. Manual adjustment may be necessary.

Figure A.29 HEC-1 output Runoff Summary table excerpt, NSTPS=7

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA
	HYDROGRAPH AT							
+		A1	3183.	13.92	1499.	437.	317.	8.36
	ROUTED TO							
+		001002	3093.	14.50	1469.	436.	317.	8.36

Other items to check when evaluating the HEC-1 results of reach route operations are:

a. The routed peak discharge should not increase because of the routing operation. If it does, the cross section and other routing parameters should be carefully reviewed for errors.

The peak discharge entering the routing reach should not exceed the normal depth flow capacity of the cross section. If it does, the cross section should be extended.

If the reach travel time is less than 1, consider using the HEC-1 lag operation instead of a Normal Depth Channel route or no routing operation at all.

Page Intentionally Left Blank

A.6 STORAGE ROUTING EXAMPLES

A.6.1 MODIFIED PULS METHOD

The Modified Puls Method HEC-1 option can be used to model the effects of stormwater storage facilities used as detention basins or flood retarding structures. The steps for application are as follows:

1. Determine the Stage-Storage characteristics of the basin.
2. Determine the Stage-Discharge characteristics of the outlet(s).
3. Code the HEC-1 input records.

Step 1. Determine the Stage-Storage characteristics of the basin.

A rating curve of the available storage for storm water within the basin should be developed. This can be accomplished using the design topography for the basin and computing the storage for the basin in depth increments appropriate for physical characteristics affecting storage such as changes side slope ratios and horizontal shape changes. An example of data computed for a storage basin is shown in Table A.30 and graphically on Figure A.30.

Table A.30 Example stage-storage curve data

Depth, ft	Stage, ft	Surface Area, acres	Volume, ac-ft	
			Incremental	Cumulative
0.0	3570.0	1.00	0.00	0.00
0.5	3570.5	1.05	0.51	0.51
1.0	3571.0	1.25	0.57	1.09
1.5	3571.5	1.50	0.69	1.77
2.0	3572.0	2.00	0.87	2.65
2.5	3572.5	3.00	1.24	3.89
3.0	3573.0	3.50	1.62	5.51
4.0	3574.0	4.00	3.75	9.26
5.0	3575.0	5.00	4.49	13.75

The volume data can be calculated using Equation A.2 (USACE, 1998).

$$\Delta V_{1,2} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right) \quad \text{A.2}$$

where:

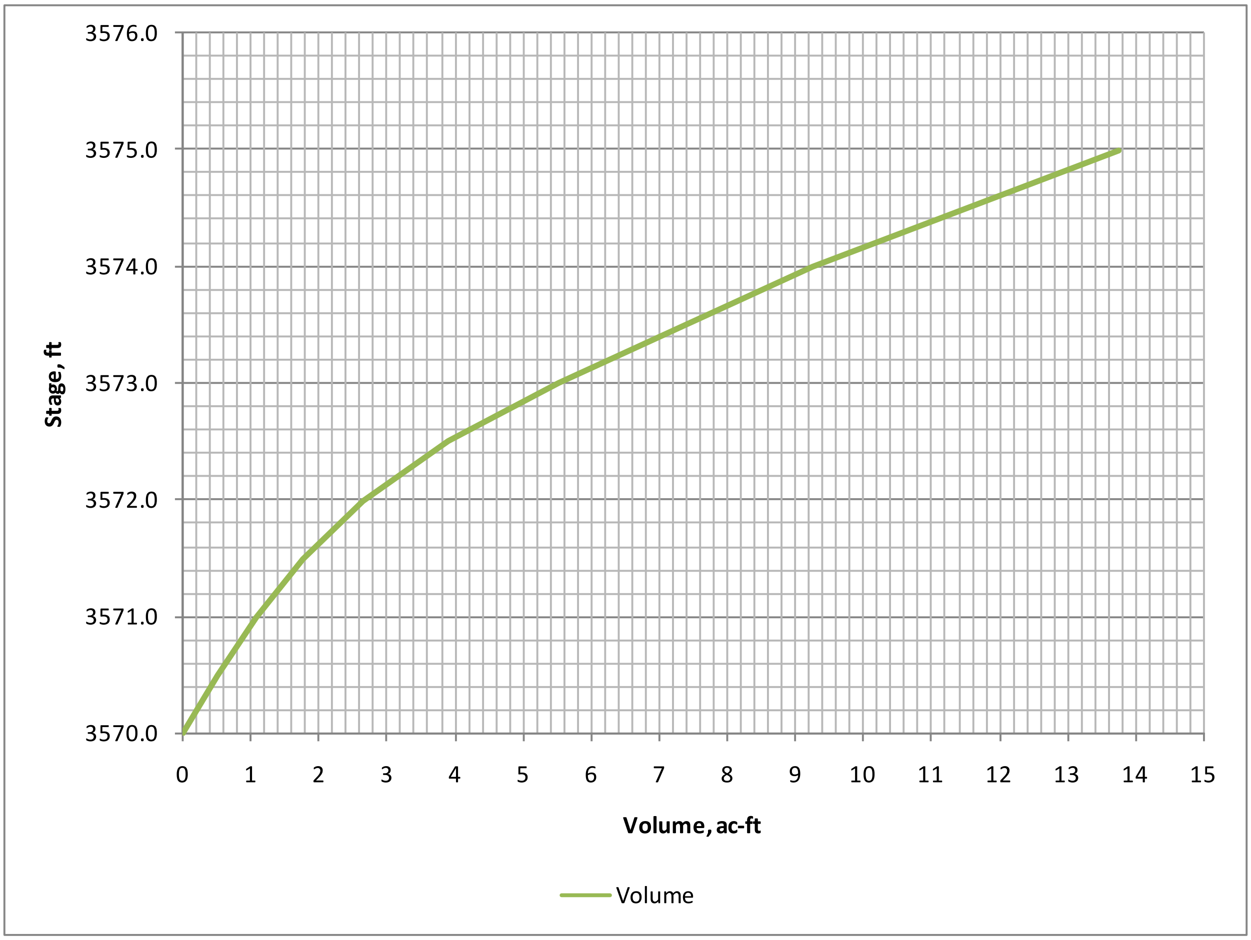
$\Delta A_{1,2}$ = volume between stage areas 1 and 2,

h = vertical distance (depth) between stage areas A1 and A2,

A_1 = surface area of stage 1, and

A_2 = surface area of stage 2.

Figure A.30 Example stage-storage rating curve



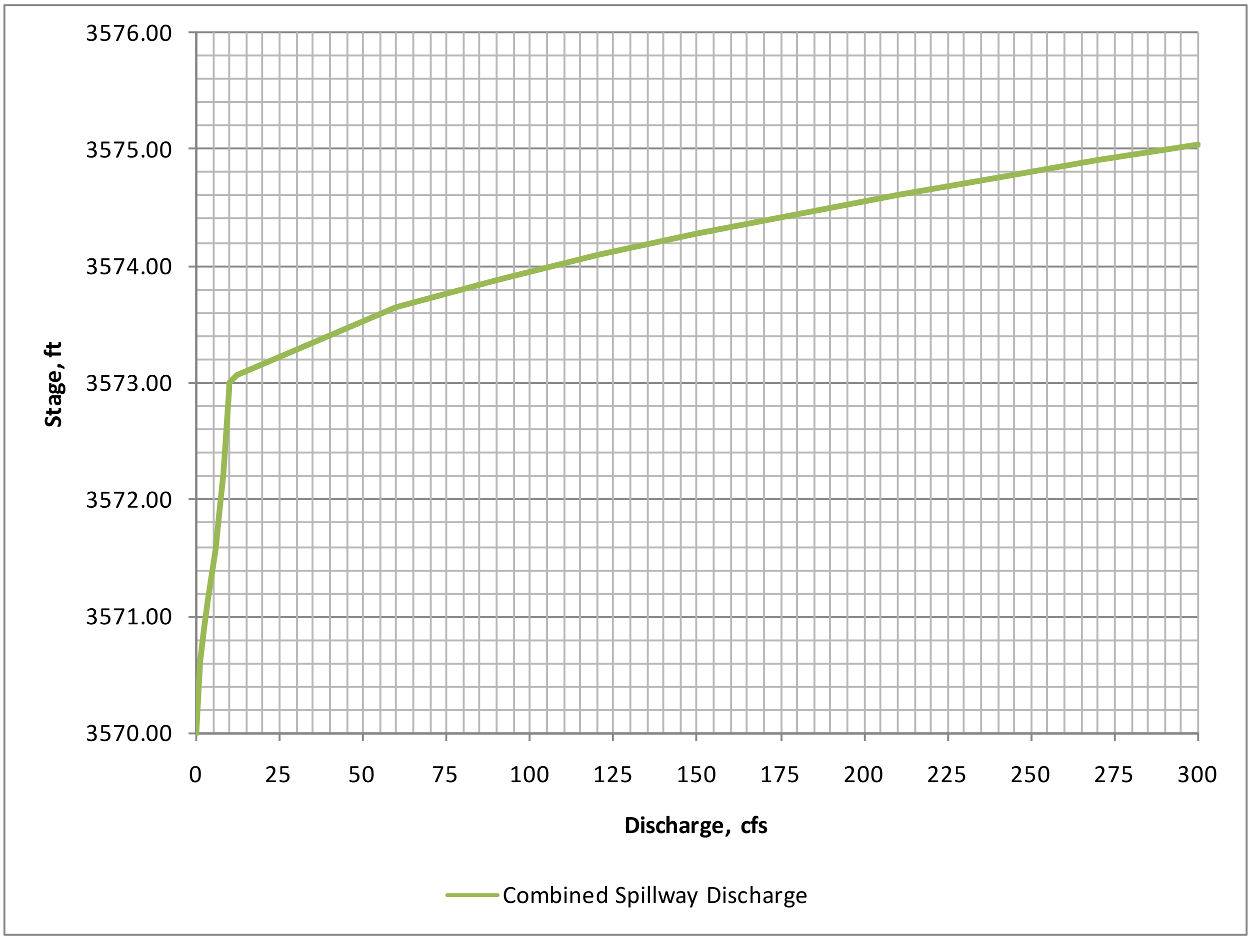
Step 2. Determine the Stage-Discharge characteristics of the outlet(s).

HEC-1 can model the effects of both principal spillways (culverts) and emergency spillways (overflow weirs or channels) through a combined hydraulic rating curve. The rating curves for both types of outlets should be developed using appropriate hydraulic modeling software such as HEC-RAS or HY-8 and then combined into a single rating table. For the above example, the principal spillway is an 18-inch CMP with headwalls on a slope of 1 percent. The culvert discharges into a riprap lined trapezoidal channel with 2:1 side slopes, a bottom width of 15 feet, and a slope of 0.8 percent. The emergency spillway is a broad-crested weir with a crest length of 25 feet, a crest width of 10 feet, and the flowline set at elevation 3573.0. HY-8 (USDOT, 2005b and 2007) was used to model the spillway hydraulics and the results are shown in Table A.31. The design criteria require that a total 100-year peak discharge of 100 cfs be passed through the spillways with a freeboard of 1 foot (ie. water surface cannot exceed elevation 3574.0). Also, the total spillway capacity is to be determined and the basin must drain completely within 36 hours.

Table A.31 Example stage-discharge curve data

Outlet Control Depth, ft	Stage, ft	Spillway Discharge, cfs		
		Principal	Emergency	Combined
0.00	3570.00	0.0	0.0	0.0
0.62	3570.62	1.2	0.0	1.2
0.90	3570.90	2.4	0.0	2.4
1.14	3571.14	3.6	0.0	3.6
1.36	3571.36	4.8	0.0	4.8
1.58	3571.58	6.0	0.0	6.0
1.91	3571.91	7.2	0.0	7.2
2.23	3572.23	8.0	0.0	8.0
2.95	3572.95	9.6	0.0	9.6
3.00	3573.00	9.7	0.0	9.7
3.08	3573.08	9.9	2.1	12.0
3.65	3573.65	11.0	49.0	60.0
3.89	3573.89	11.4	78.5	90.0
4.10	3574.10	11.7	108.2	120.0
4.29	3574.29	11.6	138.2	150.0
4.46	3574.46	11.6	168.3	180.0
4.62	3574.62	11.6	198.2	210.0
4.77	3574.77	11.5	228.3	240.0
4.91	3574.91	11.5	258.4	270.0
5.05	3575.05	11.5	288.5	300.0

Figure A.31 Example stage-discharge rating curve



Note from examination of Table A.31 that the principal spillway is functioning under outlet control for the entire rating. Also note from examination of Figure A.31 that at stage 3574 the combined spillway discharge is about 105 cfs and the total combined spillway capacity at the crest of the basin is about 300 cfs. The average discharge for the principal spillway can be assumed to be 5 cfs. At that flow rate, the time to drain the basin, assuming it is filled to the crest of the emergency spillway at elevation 3573, is estimated as follows:

Drain Time = (5.51 ac-ft)(43,560 sf/ac-ft)/(5 ft^3/s)(3600s/hr) = 13.3 hours. Therefore, OK.

If the estimated drain time were close to 36 hours, a more detailed computation of drain time would be necessary. This can be accomplished using HEC-1 as described in Chapter 9 of the Hydraulics Manual.

Step 3. Code the HEC-1 input records.

Using the data from Steps 1 and 2, the HEC-1 input data file records for a storage route through the basin are coded as follows:

```
_______1_______2_______3_______4_______5_______6_______7_______8_______9______10
KK BASIN STORAGE
RS     1    ELEV  3570.0
SV  0.00    0.51    1.09    1.77    2.65    3.89    5.51    9.26   13.75
SE3570.0  3570.5  3571.0  3571.5  3572.0  3572.5  3573.0  3574.0  3575.0
SQ   0.0     1.2     2.4     3.6     4.8     6.0     7.2     8.0     9.6     9.7
SQ  12.0    60.0    90.0   120.0   150.0   180.0   210.0   240.0   270.0   300.0
SE3570.0 3570.62 3570.90 3571.14 3571.36 3571.58 3571.91 3572.23 3572.95 3573.00
SE3573.1 3573.65 3573.89 3574.10 3574.29 3574.46 3574.62 3574.77 3574.91 3575.05
```

The KK record defines the hydrograph operation name.

The RS record establishes that this is a storage route. The type of storage route is not yet specified. Field 1, NSTPS, is set equal to one (1), which is the number of steps to be used in the route operation. "ELEV" is entered in Field 2, which specifies that the elevation for the beginning of the first-time period will be in the next field. The next field (Field 3) is set to 3570.0, which is the bottom elevation of the storage basin.

The SV record establishes that this is a Modified Puls storage operation. The values are the storage in acre-feet from column five (5) of Table A.30. A total of 20 values may be entered on two SV records.

The first SE record contains the stage elevation values corresponding to the storage values in the same field on the SV record. The values are from column two (2) of Table A.30.

The SQ record contains the peak discharge values in cfs from column five (5) of Table A.31. A total of 20 values may be entered on two SQ records.

The second SE record contains the stage elevation values corresponding to the peak discharge values in the same field on the SQ record. The values are from column two (2) of Table A.31.

A.6.2 RETENTION BASIN STORAGE DIVERSIONS

When stormwater storage is in place for developments in a watershed it is usually appropriate to account for it in a HEC-1 model of the watershed. Normally, stormwater storage basins have relatively small watersheds and, in Mohave County, are sized to retain the 100-year 2-hour storm runoff volume. Due to the small scale of such watersheds in comparison with the sub-basin size of most HEC-1 models, it is not practical to model the retention basins using the procedure described in Appendix A.6.1. The preferred approach is to make an estimate of the total design storage capacity of the retention basins in each HEC-1 sub-basin and then divert that volume from the rising limb of the sub-basin runoff hydrograph. This is accomplished in HEC-1 using the diversion operation records.

Consider the B1 HEC-1 sub-basin from the example in Appendix A.4 that is 79 percent developed and has retention basins in place designed to retain all runoff from the 100-year 2-hour storm. The hydrologist has reviewed the as-built drawings for all the developments in the area and totaled the as-built retention basin design volumes. The hydrologist has also performed a field reconnaissance of the sub-basin to verify the retention basins are in place and sized per the as-built drawings. It was noted that on average the basins have 25 percent less capacity than the as-built drawings indicate due to sedimentation and changes made during landscaping. The total as-built storage volume is 533 ac-ft. Reduce this storage capacity by 25 percent and use 400 ac-ft.

The HEC-1 runoff computation records for sub-basin B1 are:

```
_______1_______2_______3_______4_______5_______6_______7_______8_______9______10
KK    B1   BASIN
BA 4.672
LG  0.16    0.16   10.30    0.10      55
UC 0.713   0.357
UA     0     5.0    16.0    30.0    65.0    77.0    84.0    90.0    94.0    97.0
UA   100
```

This HEC-1 operation generates the runoff hydrograph for sub-basin B1. Next, the retention volume is diverted from the B1 runoff hydrograph, which has the effect of removing it from the rising limb. The following KK record set is used to accomplish the diversion:

```
_______1_______2_______3_______4_______5_______6_______7_______8_______9______10
KK  B1DS  DIVERT
KO     1
DT B1DIV   400.0     0.0
DI   0.0   100.0   250.0   500.0   750.0  1000.0  2000.0  4000.0  6000.0 10000.0
DQ   0.0   100.0   250.0   500.0   750.0  1000.0  2000.0  4000.0  6000.0 10000.0
```

The KK record defines the name of the hydrograph that will continue downstream in the HEC-1 model after the diversion.

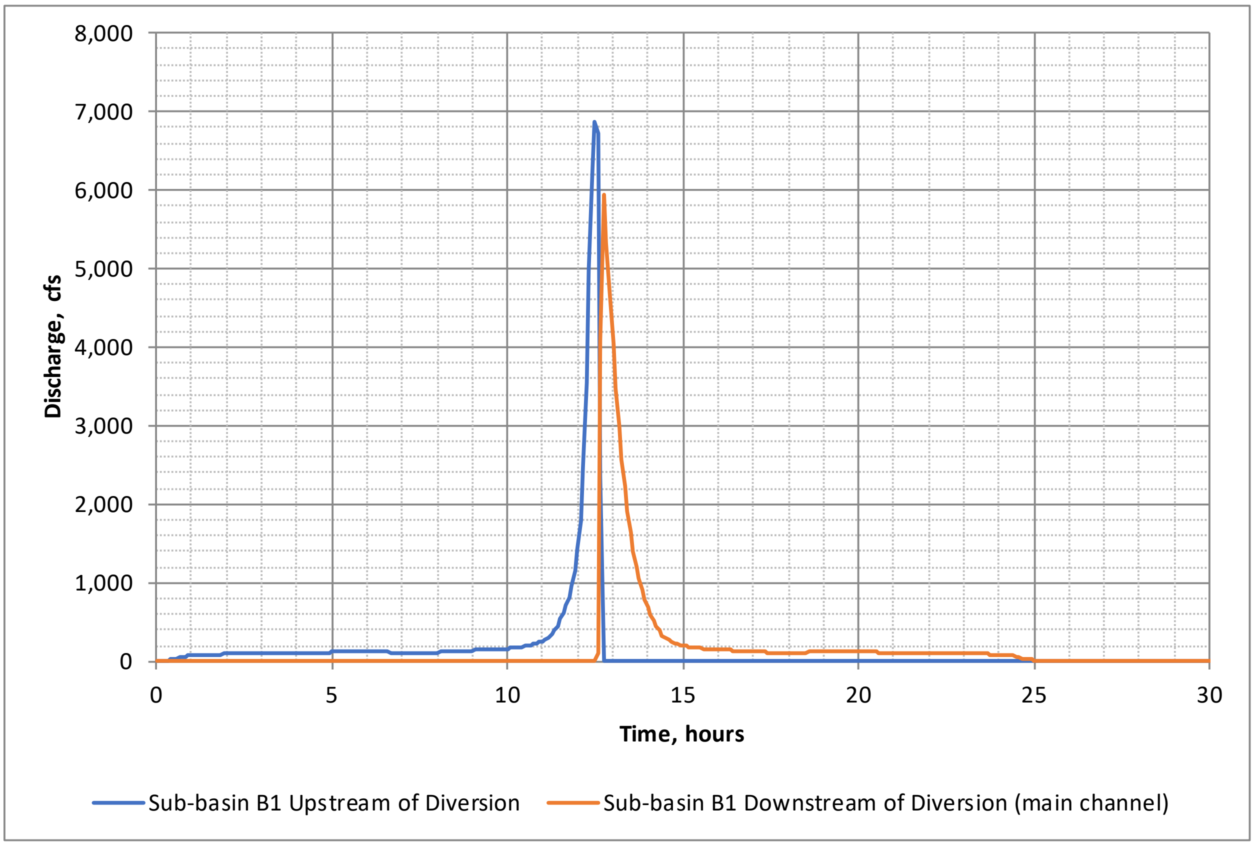
The DT record defines the name of the diverted flow hydrograph in Field 1 so it could be retrieved later in the model. However, for this example no retrieval is desired. Field 2 contains the total volume to be diverted in acre-feet.

The DI record contains a list of inflow values to the diversion operation.

The DQ record contains the list of flow rates to be diverted corresponding to the field values on the DI record. Note that for this example the flow rates are the same for both the DI and DQ records. This has the effect of diverting all flow up to 10,000 cfs until a total volume of 400 acre-feet have been diverted. Then no more flow is diverted.

The results are shown on Figure A.32. Note that the 100-year 24-hour peak discharge from sub-basin B1 is reduced from 6,874 cfs to 5,934 cfs because of the on-site retention.

Figure A.32 Example of retention basin diversion hydrographs



Page Intentionally Left Blank

A.7 INDIRECT METHODS EXAMPLE

The unit hydrograph method example results can be checked for reasonableness using indirect methods, as described in Section 7.11. The following is a discussion of the check made with each of the three methods. This approach is an example of what is expected by Mohave County for inclusion in drainage design reports when the unit hydrograph method is applied.

A.7.1 INDIRECT METHOD 1

The Method 1 check, shown on Figure A.33, is a comparison of the HEC-1 model results with unit peak discharge envelope curves of maximum observed floods of record from natural watersheds for differing hydrologic regions in the southwestern United States. As expected, note that all the model results except for sub-basin B1 fall below the envelope curves. Sub-basin B1 is predominately an urban watershed and is expected to have a higher unit discharge than the other sub-basins. This check yields no reason to suspect the model results are unreasonable.

A.7.2 INDIRECT METHOD 2

Indirect Method 2, shown on Figure A.34, is a comparison with 100-year peak discharges for Arizona analyzed by the USGS from streamflow data. The example peak discharges check very well against the data fit line and lie within the 90% confidence limits. Sub-basin B1 lies on the upper 90 percent confidence limit, which is treasonable as these data are from predominately natural watersheds. This check yields no reason to suspect the model results are unreasonable.

A.7.3 INDIRECT METHOD 3

Checks of the applicability of the Indirect Method 3 regression equations independent variable *PRECIP* and *ELEV* are shown on Figure A.35 and Figure A.36, respectively. The Indirect Method 3 peak discharge check is shown on Figure A.37. This is a check against the data used to generate the USGS regional regression equation for Region 3, which covers the example watershed. The example results compare favorably with the regression equation data points. The example results plot within the regression equation data points scatter. Sub-basin B1 again plots high but is within the scatter of LP3 data points. This check yields no reason to suspect the model results are unreasonable.

Figure A.33 Indirect Method 1 check of Unit Hydrograph Method example

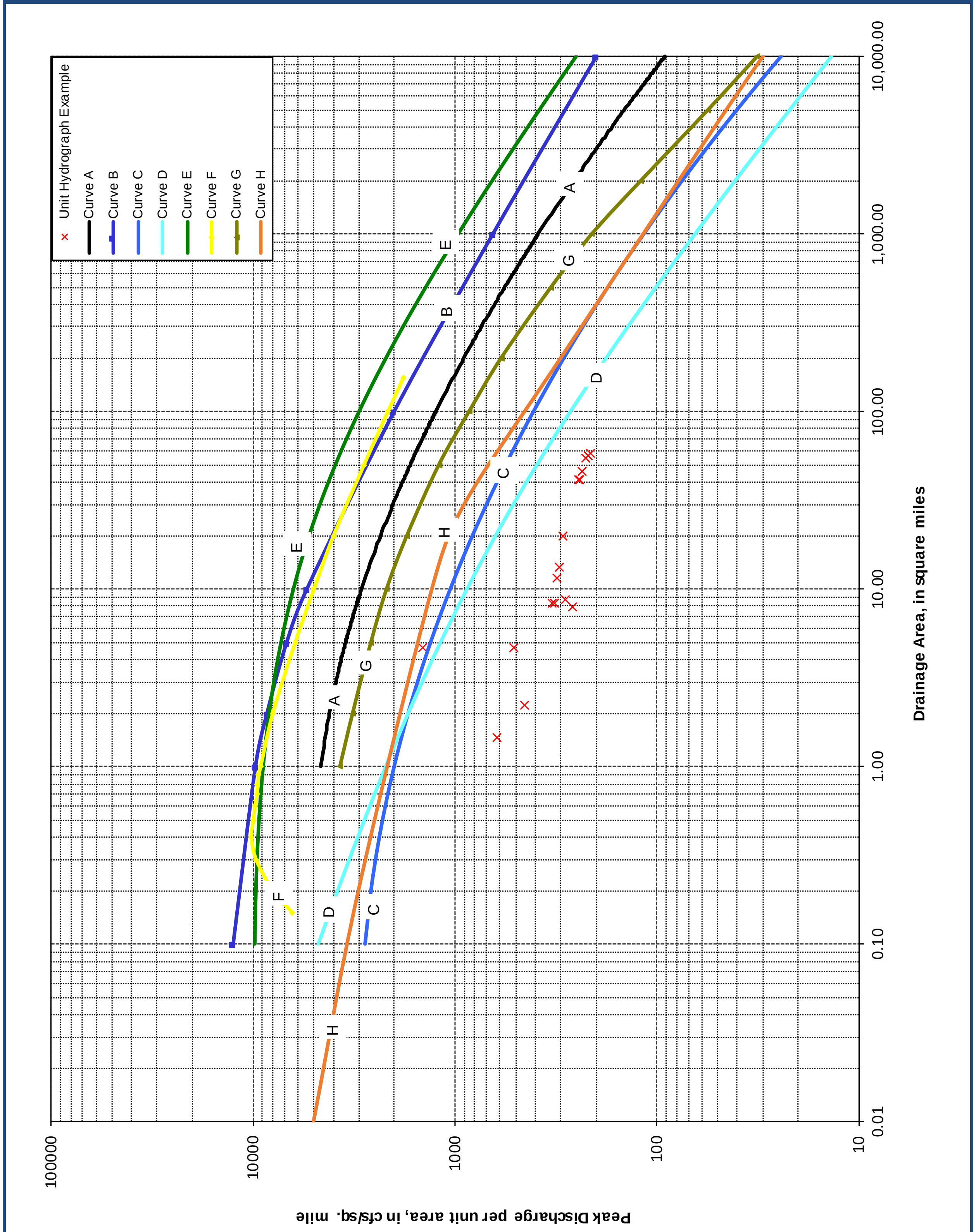


Figure A.34 Indirect Method 2 check of Unit Hydrograph Method example

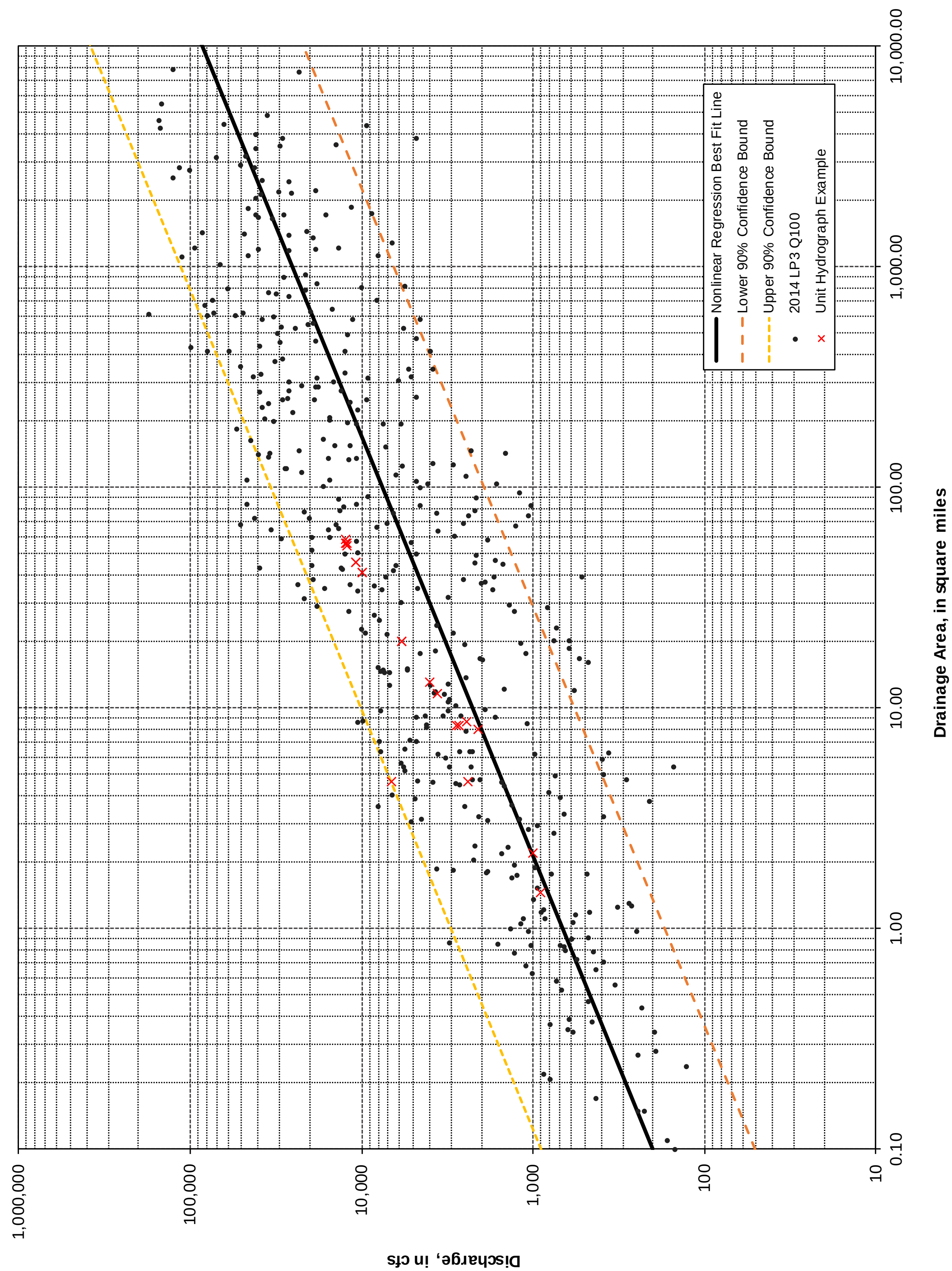


Figure A.35 Indirect Method 3 check of independent variable *PRECIP*

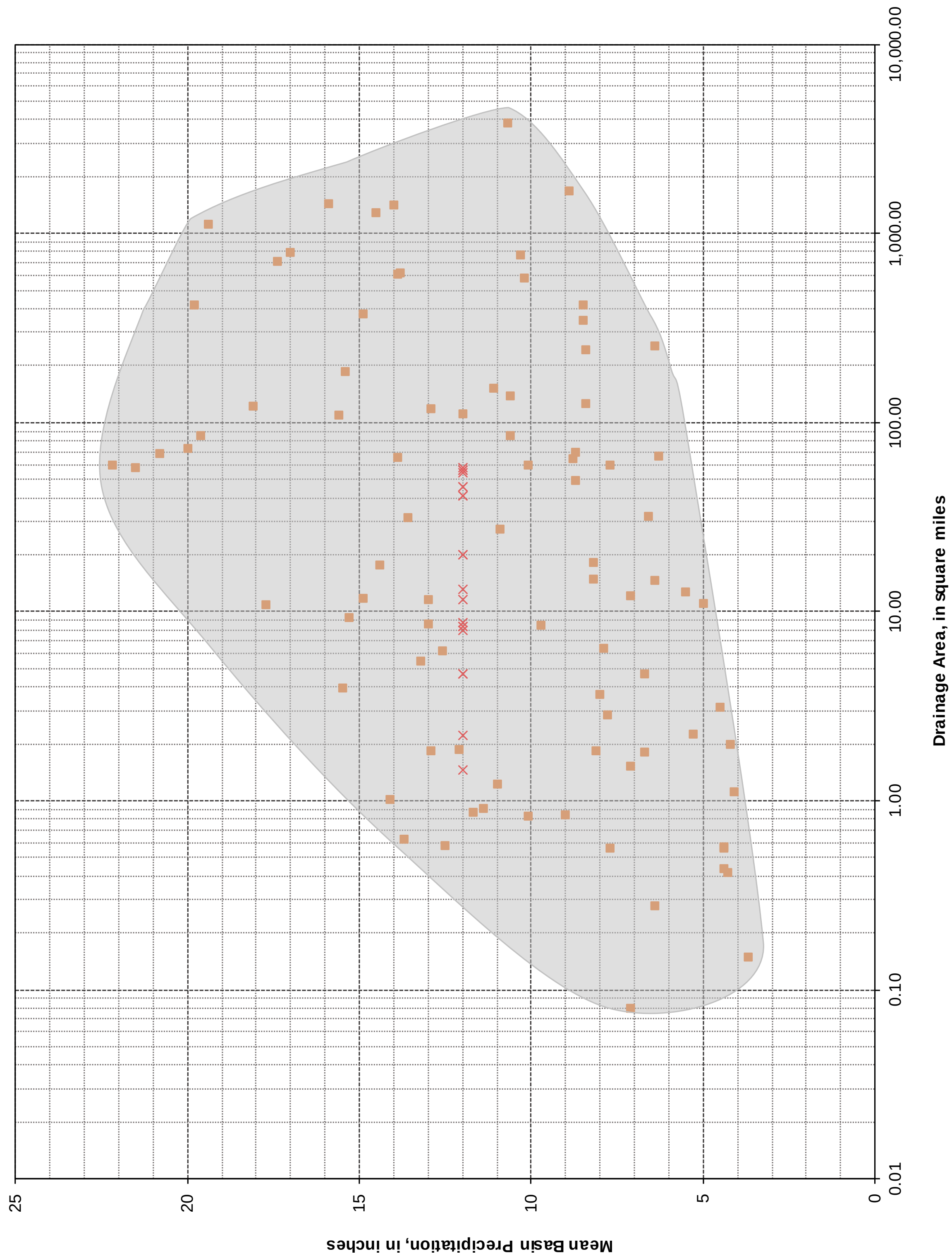


Figure A.36 Indirect Method 3 check of independent variable *ELEV*

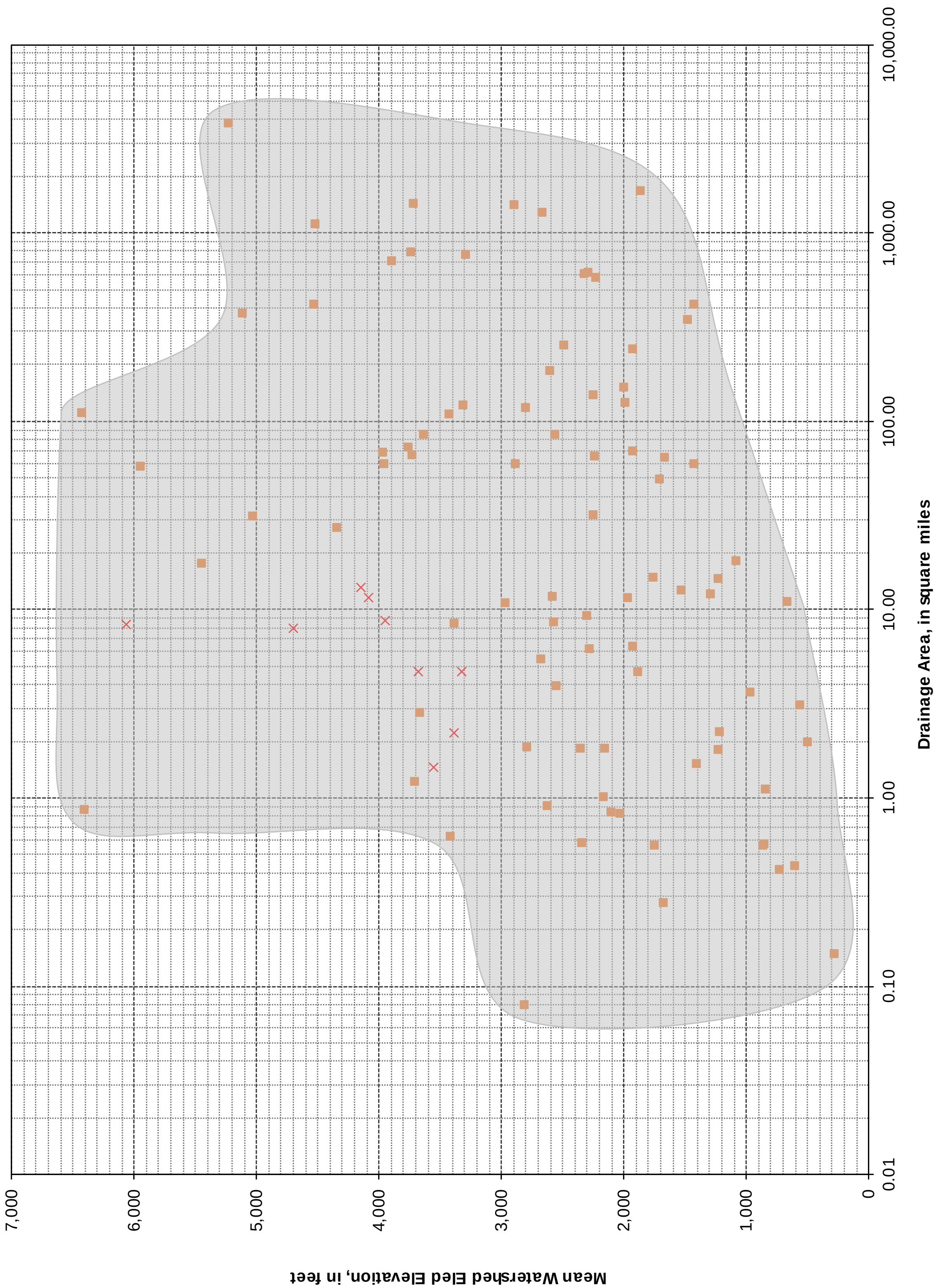
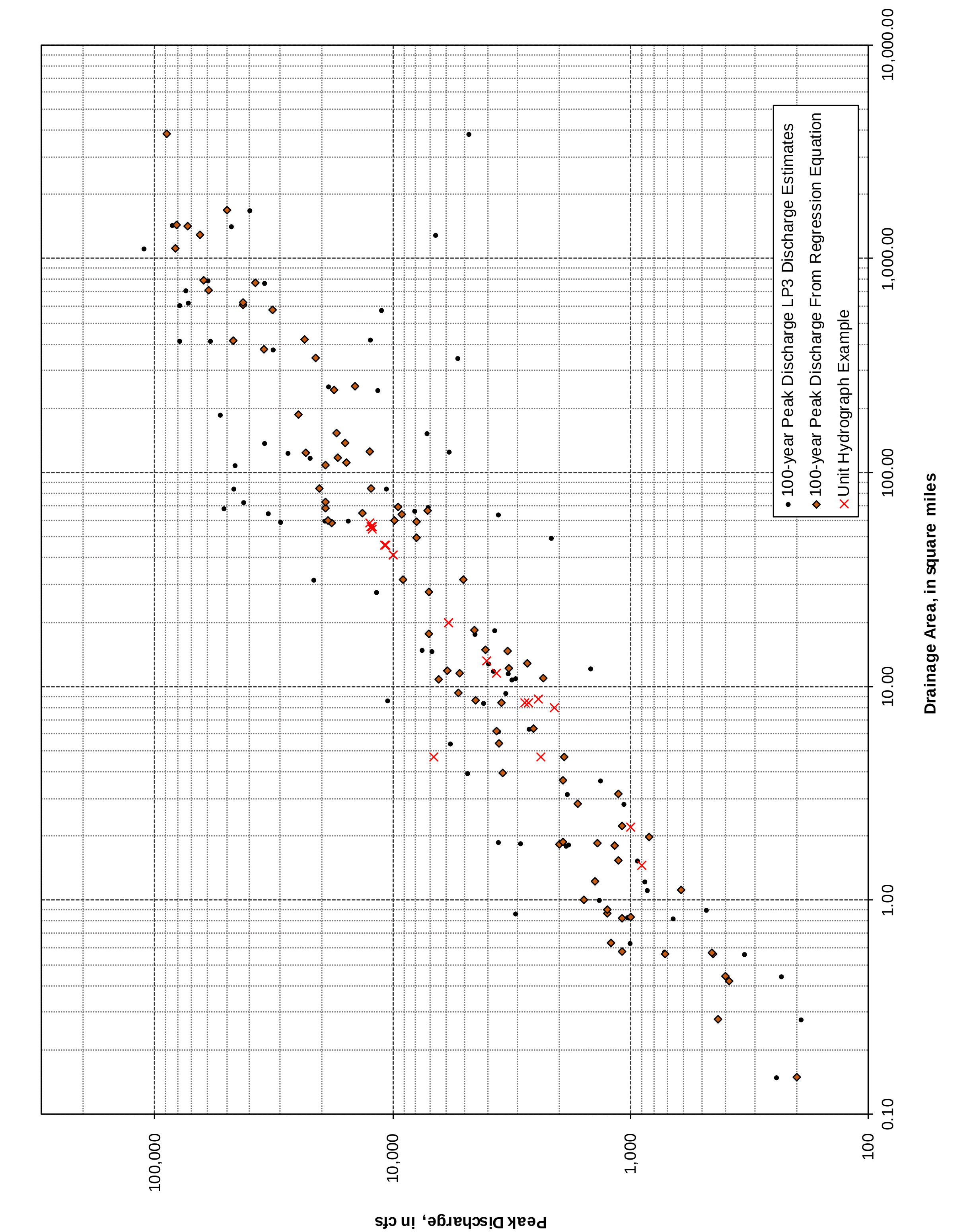


Figure A.37 Indirect Method 3 check of Unit Hydrograph Method example



A.8 STORMWATER STORAGE EXAMPLE

A.8.1 PROBLEM STATEMENT

A stormwater storage basin is needed for the commercial parcel within sub-basin C from the Rational Method example in Appendix A.2. Refer to Figure A.11. The design storage volume is to be determined and basin characteristics recommended based on drain time and Mohave County minimum requirements for inclusion in a Preliminary Design Report for the project.

A.8.2 PROBLEM SOLUTION

A.8.2.1 Given Information

The physical information for the solution is derived from Table A.15, Table A.17 and Table A.18 as follows:

1. 100-year 2-hour Storm Point Precipitation: 2.546 inches
2. Area of Commercial Site: 9.19 acres
3. Rational C coefficient for C1 zoning: 0.83

A.8.2.2 Basin Sizing

The retention basin must be designed to contain the entire runoff volume from the site from a 100-year 2-hour storm. The required minimum design storage volume is determined using Equation 7.7:

$$V = C\left(\frac{P}{12}\right)A$$

where:
- V = runoff volume, in acre-feet,
- C = runoff coefficient (or C_{comp}),
- P = rainfall depth, in inches, and
- A = drainage area, in acres.

$$V = 0.83\left(\frac{2.546}{12}\right)9.19 = 1.62\ acre-feet$$

Prior to scheduling geotechnical testing for the proposed site, approximate basin dimensions are needed. The basin should have the following characteristics:

1. Depth: 4 feet total, 3-feet of depth at the crest of the emergency spillway.
2. Side slopes: 3:1

Approximate land area required is estimated as follows, assuming a square basin and applying Equation A.2:

Bottom area = x^2

Top area = $(x+2*3*3)^2$

$$\Delta V_{B,T} = \frac{d}{3}\left(A_B + A_T + \sqrt{A_B A_T}\right)$$

where:

$\Delta A_{1,2}$	=	volume between the top and bottom of the basin,
d	=	vertical distance (depth) between top and bottom,
A_B	=	surface area of bottom of basin, and
A_T	=	surface area of top of basin.

$$(1.62)(43560) = \frac{3}{3}\left(x^2 + (x+18)^2 + \sqrt{x^2(x+18)^2}\right)$$

Solving for x:

$$x^2 + (x^2 + 36x + 324) + \sqrt{x^2(x+18)^2} = 70{,}567.2$$

$$2x^2 + 54x + 324 = 70{,}567.2$$

$$3x^2 + 36x + 324 + x(x+18) = 70{,}567.2$$

$$x^2 + 18x - 23{,}414.4 = 0$$

Solving the quadratic, X=144.28. Use X=150 feet

The basin bottom area is therefore = 150*150 = 22,500 sq ft

Per Table 15.2, the minimum number of soil log hole/percolation tests required for a basin bottom area of 22,500 feet is four.

A geotechnical firm was retained to perform testing in conformance with Section 15.4.1.4. The following are the results of the geotechnical investigation:

Test Location 1:

14-foot deep soil log hole (10 feet below bottom of basin).

0 to 5 inches	Gravelly sandy loam
5-inches to 9-feet	Gravelly loam
9-feet to 13-feet	Caliche
13-feet to 14-feet	Gravelly Clay loam

Measured percolation rate: 1.2 inches/hour

Test Location 2:

14-foot deep soil log hole (10 feet below bottom of basin).

0 to 5 inches Gravelly sandy loam

5-inches to 10-feet Gravelly loam

10-feet to 12-feet Caliche

12-feet to 14-feet Gravelly Clay loam

Measured percolation rate: 1.5 inches/hour

Test Location 3:

14-foot deep soil log hole (10 feet below bottom of basin).

0 to 8 inches Gravelly sandy loam

8-inches to 10-feet Gravelly loam

10-feet to 13-feet Caliche

13-feet to 14-feet Gravelly Clay loam

Measured percolation rate: 1.2 inches/hour

Test Location 4:

14-foot deep soil log hole (10 feet below bottom of basin).

0 to 5 inches Gravelly sandy loam

5-inches to 9-feet Gravelly loam

9-feet to 12-feet Caliche

12-feet to 14-feet Gravelly Clay loam

Measured percolation rate: 1.2 inches/hour

The lowest percolation rate of 1.2 inches/hour is selected for use in the design. An impermeable layer was found in the soil log hole at a depth of 6- to 9-feet below the basin bottom.

From Table 15.3, a Design Factor, D_r, of 4.0 is selected.

Applying Equation 15.1 to determine the design percolation rate:

$$P_d = \frac{P}{D_r}$$

where:

P_d = Design percolation rate, in inches/hour,
P = Lowest measured percolation rate, in inches/hour, and
D_r = Design Factor from Table 15.3.

$$P_d = \frac{1.2}{4} = 0.3\ inches/hour$$

Next, applying Equation 15.2 to estimate the minimum required basin bottom area:

$$T_d = \frac{V}{A_p \frac{P_d}{12}}$$

where:

T_d	=	Retention basin drain time in hours,
A_p	=	Percolation area (basin bottom), in acres
P_d	=	Design percolation rate, in inches/hour, and
V	=	Retention basin design storage volume, in acre-feet.

$$A_p = \frac{V}{T_d \frac{P_d}{12}}$$

$$A_p = \frac{1.62}{(36)\left(\frac{0.3}{12}\right)} = 1.80\ acres$$

The required basin bottom area is significantly greater than the minimum area of 2,500 sf. The new approximate basin dimensions are:

Design Ponding Depth = 36(0.3/12) = 0.9 feet

Design Freeboard = 1 foot.

Total Basin Design Depth = 1.9 feet

Side Slope = 3:1

Top Area = $((2)(1.9)(3)+280)^2$ = 84,914 sf or 1.95 acres

If a basin with a smaller land requirement is desired, the design will need to be supplemented with dry wells.

A.8.2.3 Emergency Spillway Design

In accordance with Section 15.4.3.7, all stormwater storage basins shall have an emergency spillway. The spillway must be designed to safely pass the 100-year peak discharge, which is 42 cfs for sub-basin C. In this case, the spillway discharges into a trapezoidal channel with the following characteristics:

Slope (S): 0.006 ft/ft

Base width (w): 10 feet

Available depth (d): 2 feet

Side slopes = 2:1

Lining: rock rip rap with a d_{50} of 6-inches

The spillway cannot have a flow depth greater than 1 foot without exceeding the maximum design basin depth of 4 feet. Assuming normal depth in the channel and no constrictions downstream that result in backwater effects that could impact the spillway area, the Manning equation may be used to determine the spillway characteristics. Assuming a flow depth of 1 foot:

$$Q = \left(\frac{1.486R^{0.67}S^{0.5}}{n}\right)A$$

A = (12)(1) = 12 sf

P = 2(2.24)+10 = 14.5 ft

R = A/P = 12/14.5 = 0.83 ft

n = 0.040 (from Table 13.4)

$$Q = \left(\frac{1.486(0.83^{0.67})(0.006^{0.5})}{0.040}\right)12 = 30.5\ cfs$$

30.5 cfs<42 cfs therefore no good.

Try w = 15 feet

A = 17 sf

P = 19.5 ft

R = 17/19.5 = 0.87 ft

$$Q = \left(\frac{1.486(0.87^{0.67})(0.006^{0.5})}{0.040}\right)17 = 44.6\ cfs$$

44.6 cfs>42 cfs, therefore OK

The velocity is 2.6 fps. By inspection use of 6-inch riprap is acceptable.

Page Intentionally Left Blank

B. RAINFALL

B.1 2-YEAR STORM ISOPLUVIALS

Page Intentionally Left Blank

Figure B.1 NOAA Atlas 14 2-year 5-minute isopluvial map

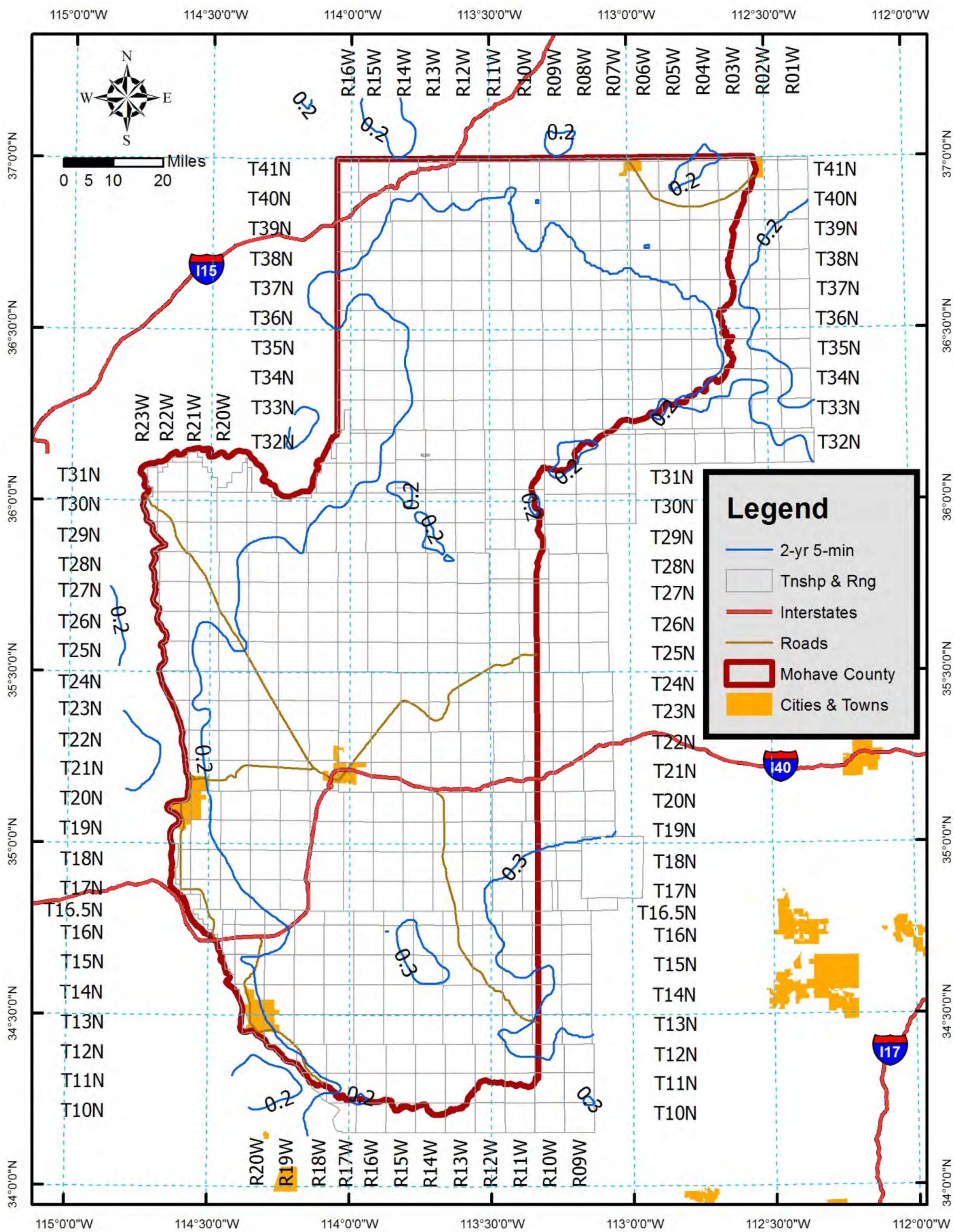


Figure B.2 NOAA Atlas 14 2-year 10-minute isopluvial map

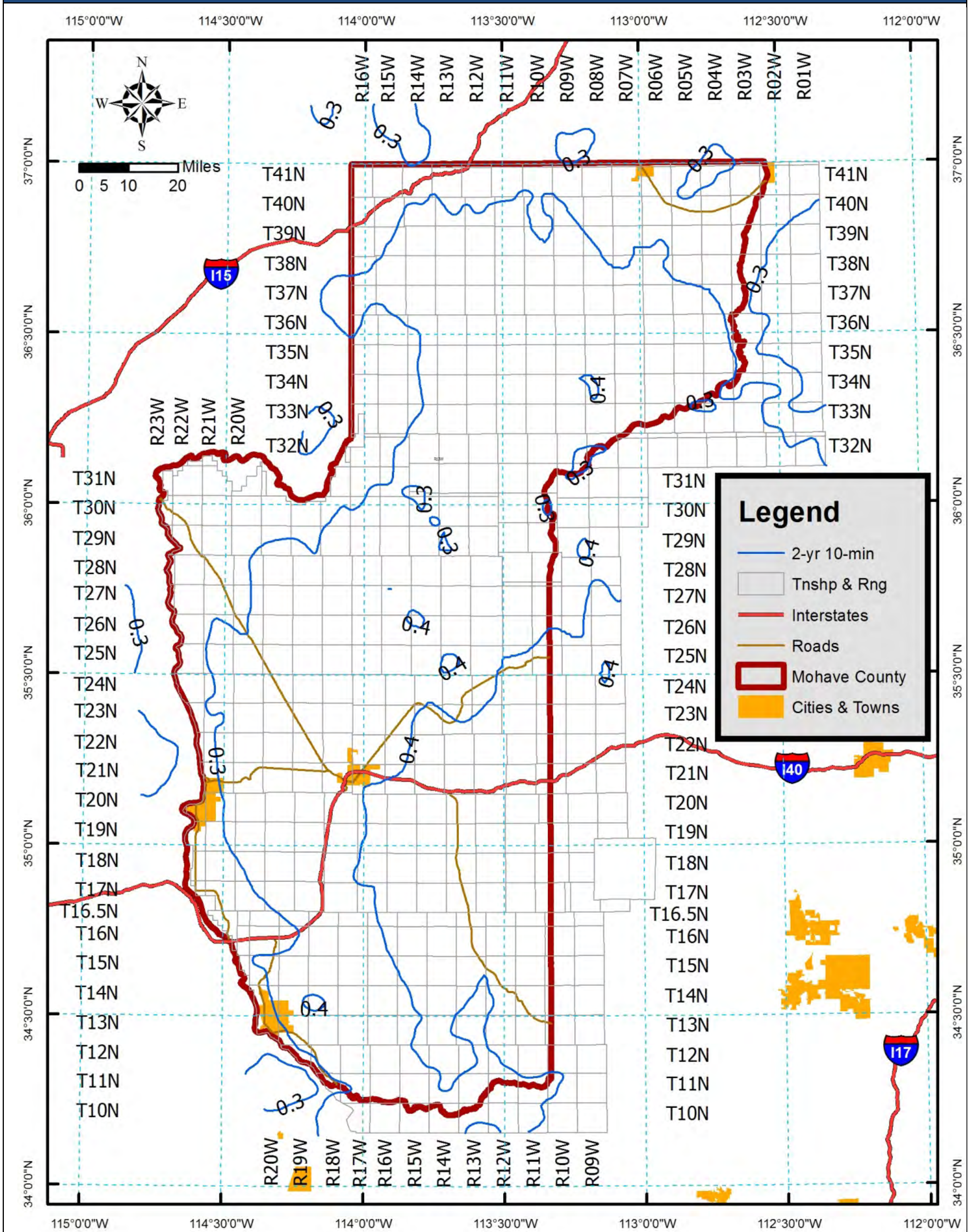


Figure B.3 NOAA Atlas 14 2-year 15-minute isopluvial map

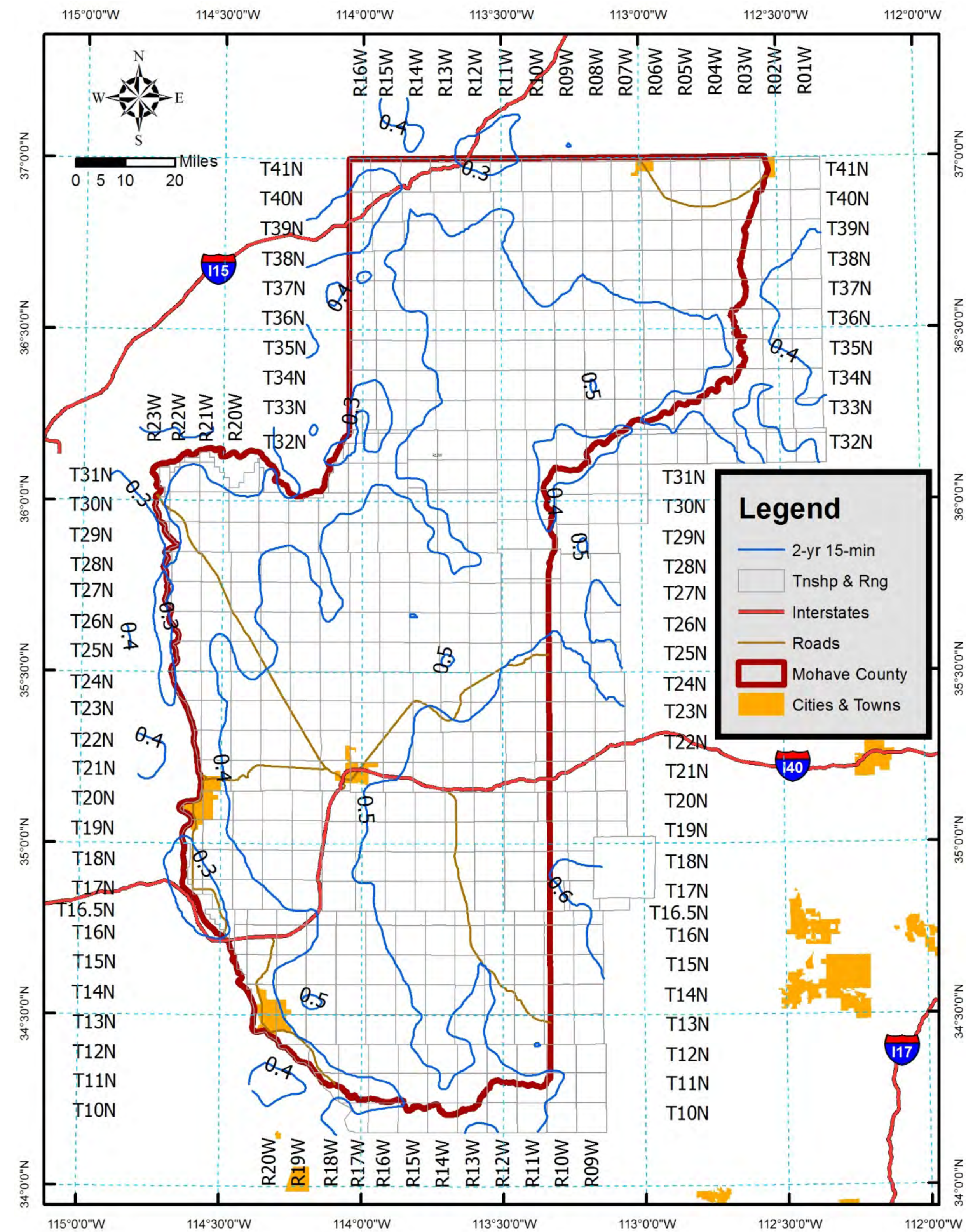


Figure B.4 NOAA Atlas 14 2-year 30-minute isopluvial map

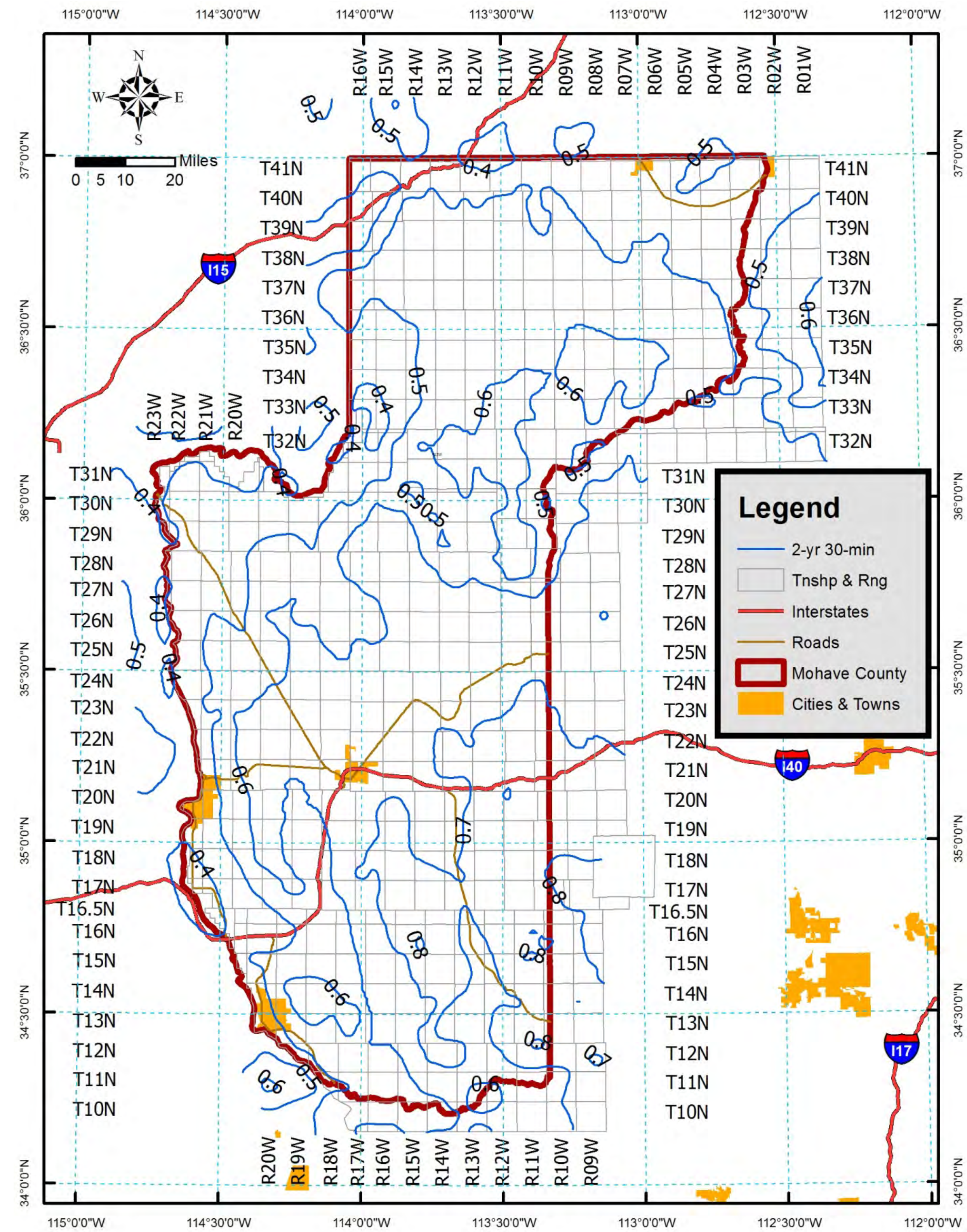


Figure B.5 NOAA Atlas 14 2-year 1-hour isopluvial map

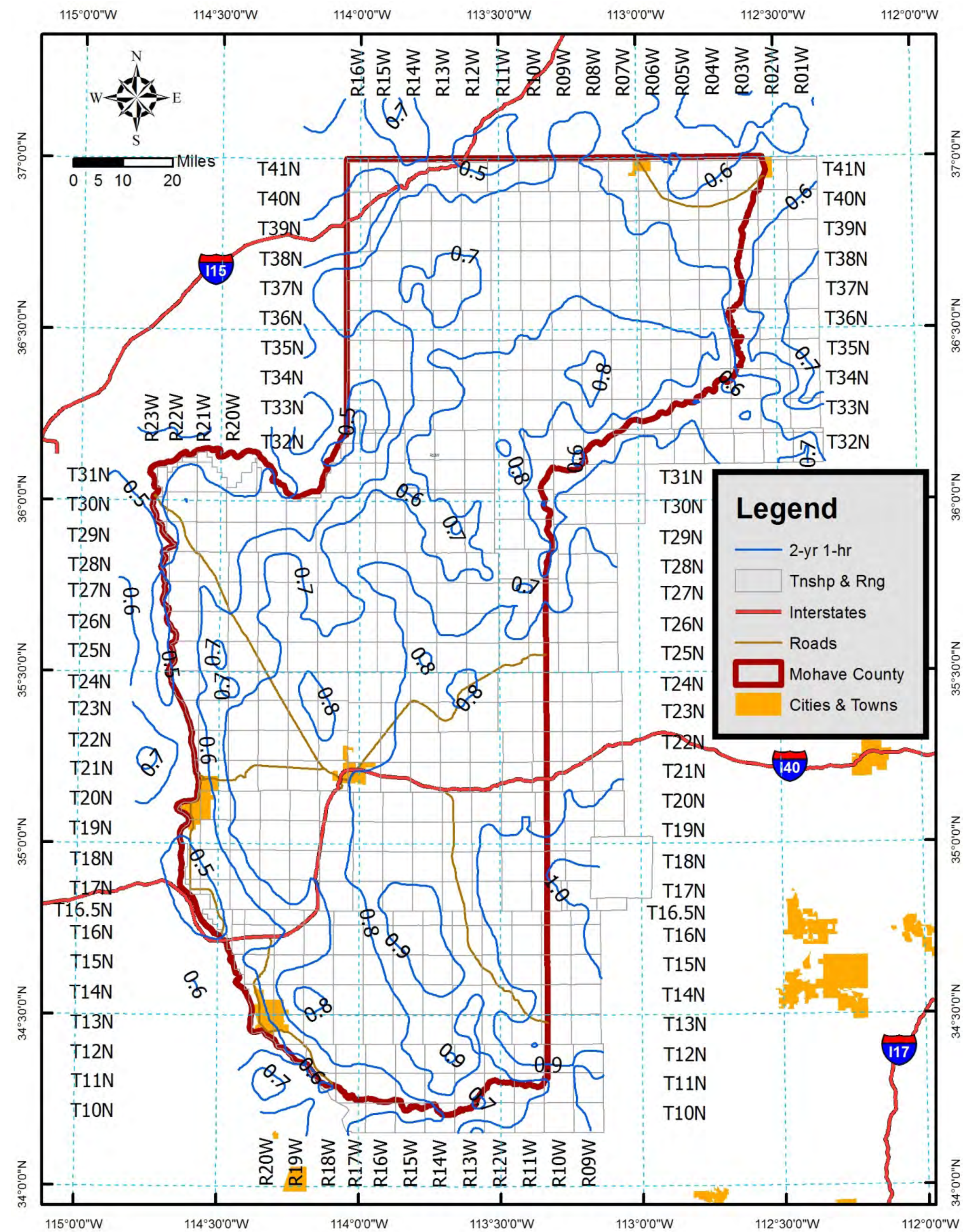


Figure B.6 NOAA Atlas 14 2-year 2-hour isopluvial map

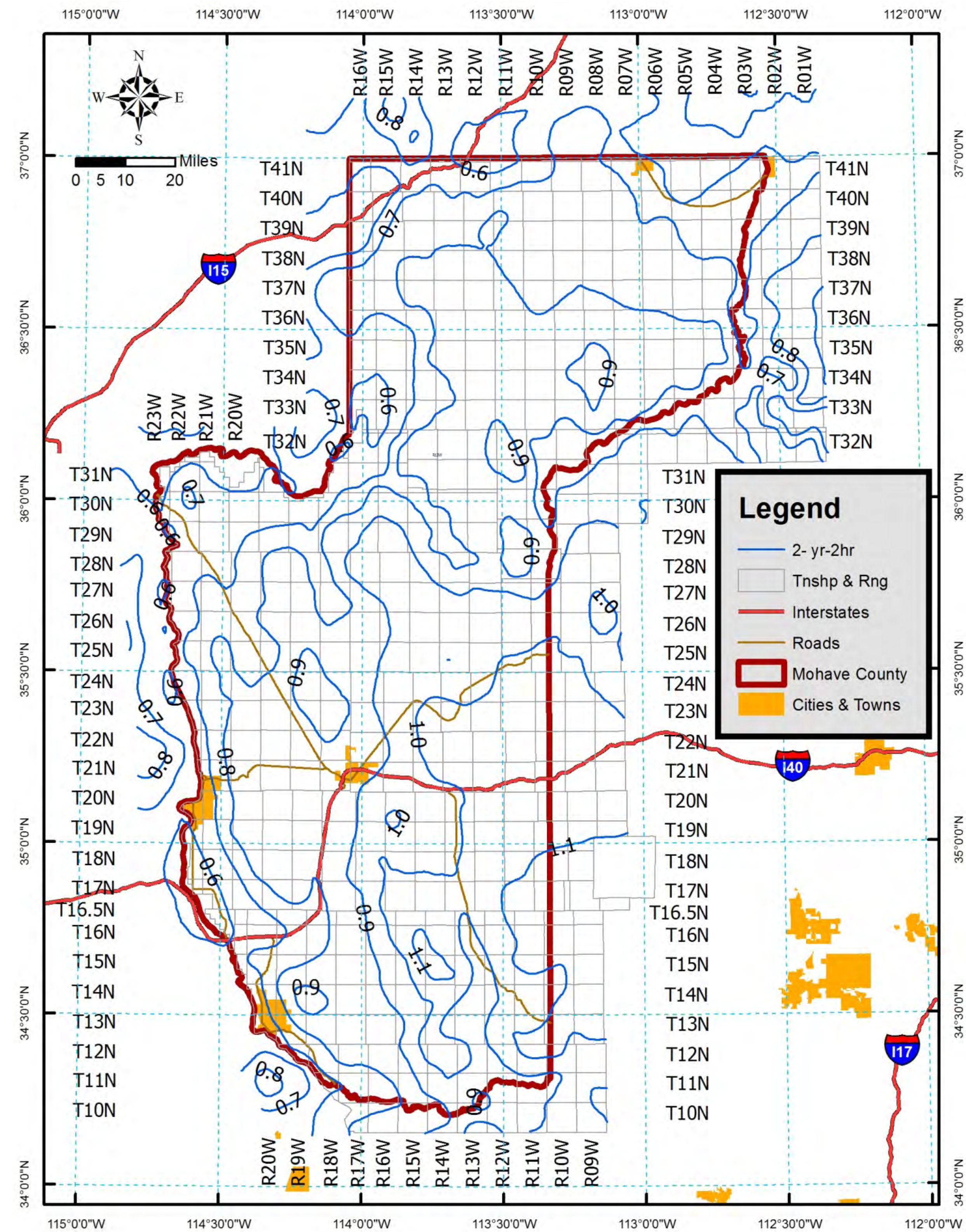


Figure B.7 NOAA Atlas 14 2-year 3-hour isopluvial map

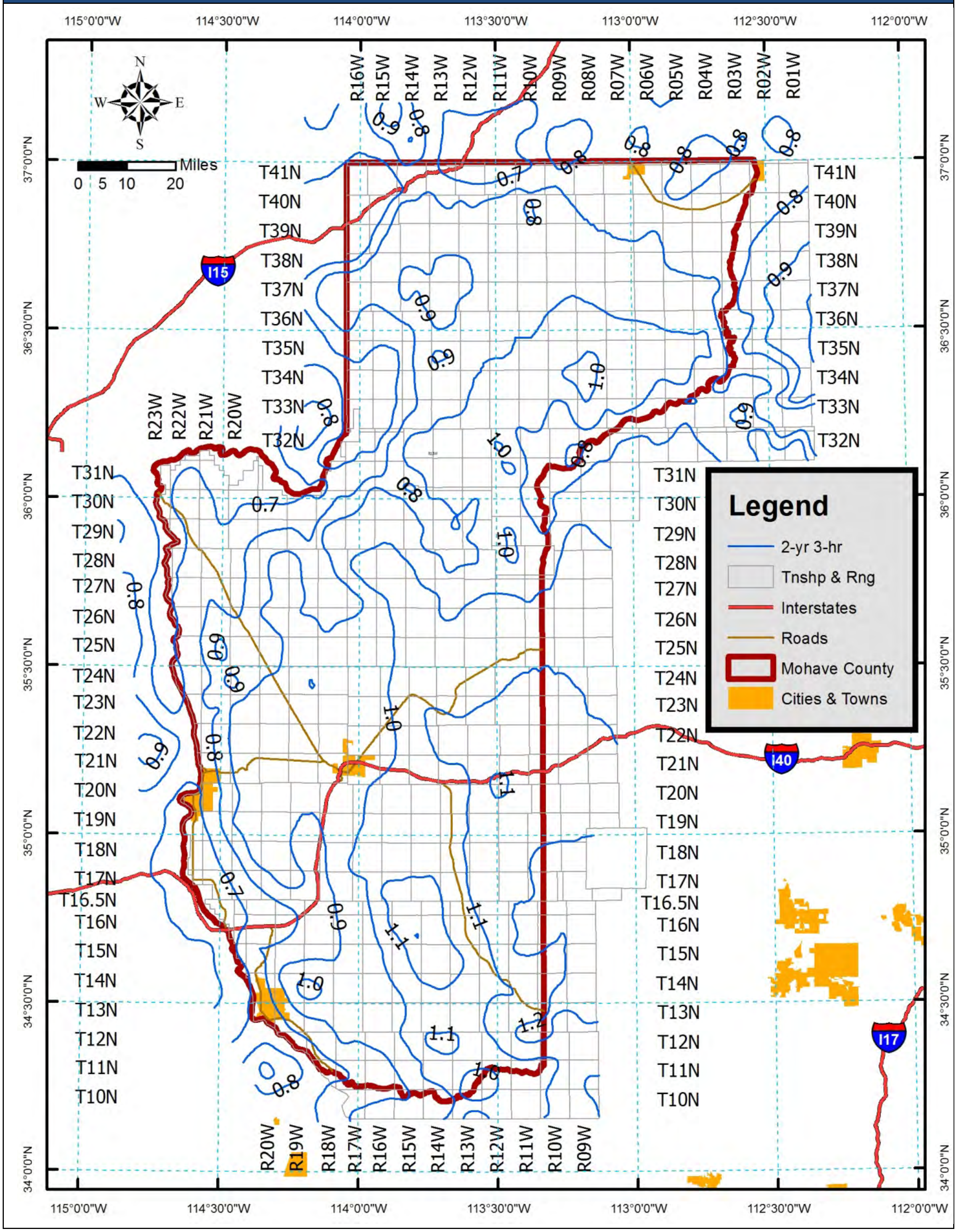


Figure B.8 NOAA Atlas 14 2-year 6-hour isopluvial map

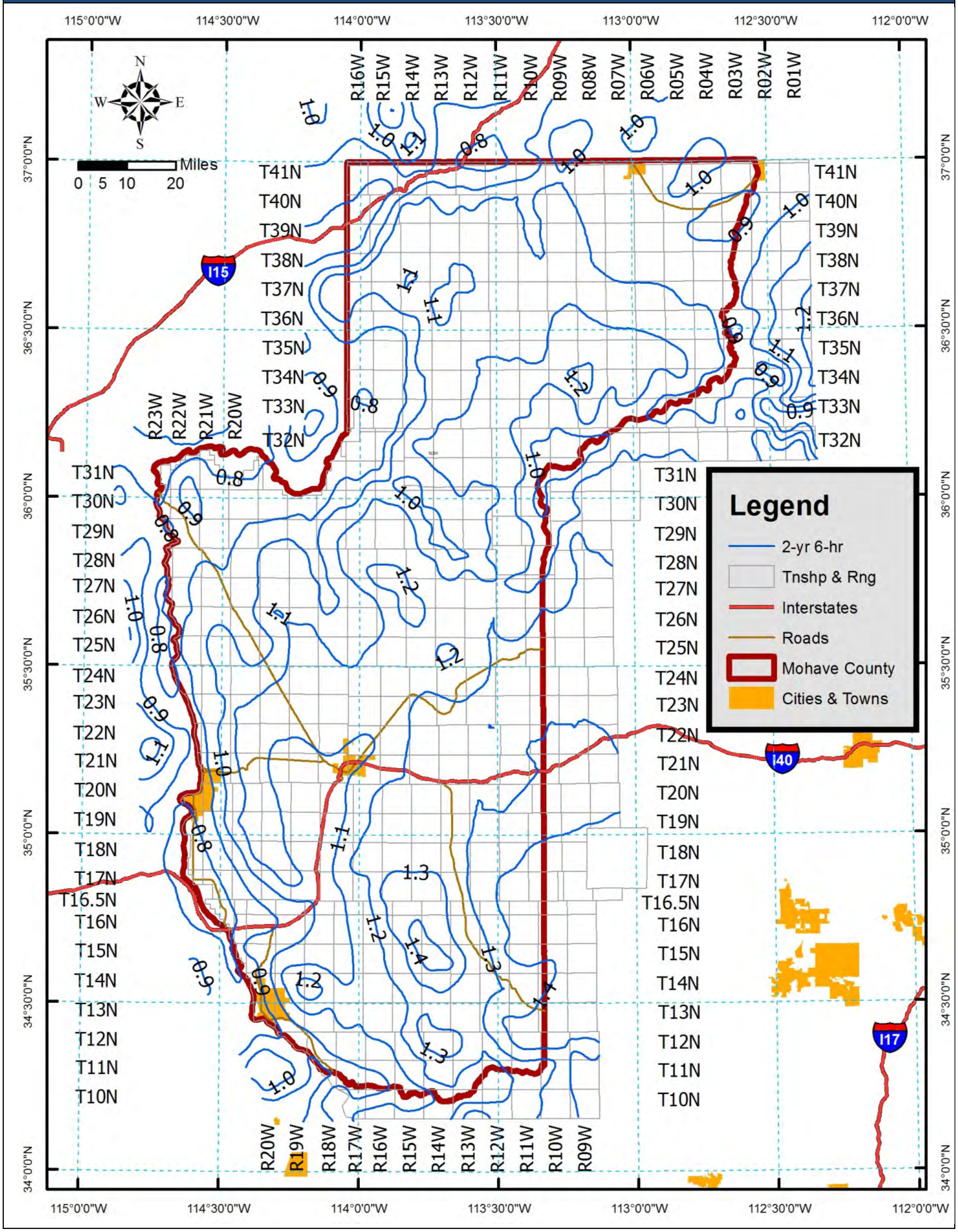


Figure B.9 NOAA Atlas 14 2-year 12-hour isopluvial map

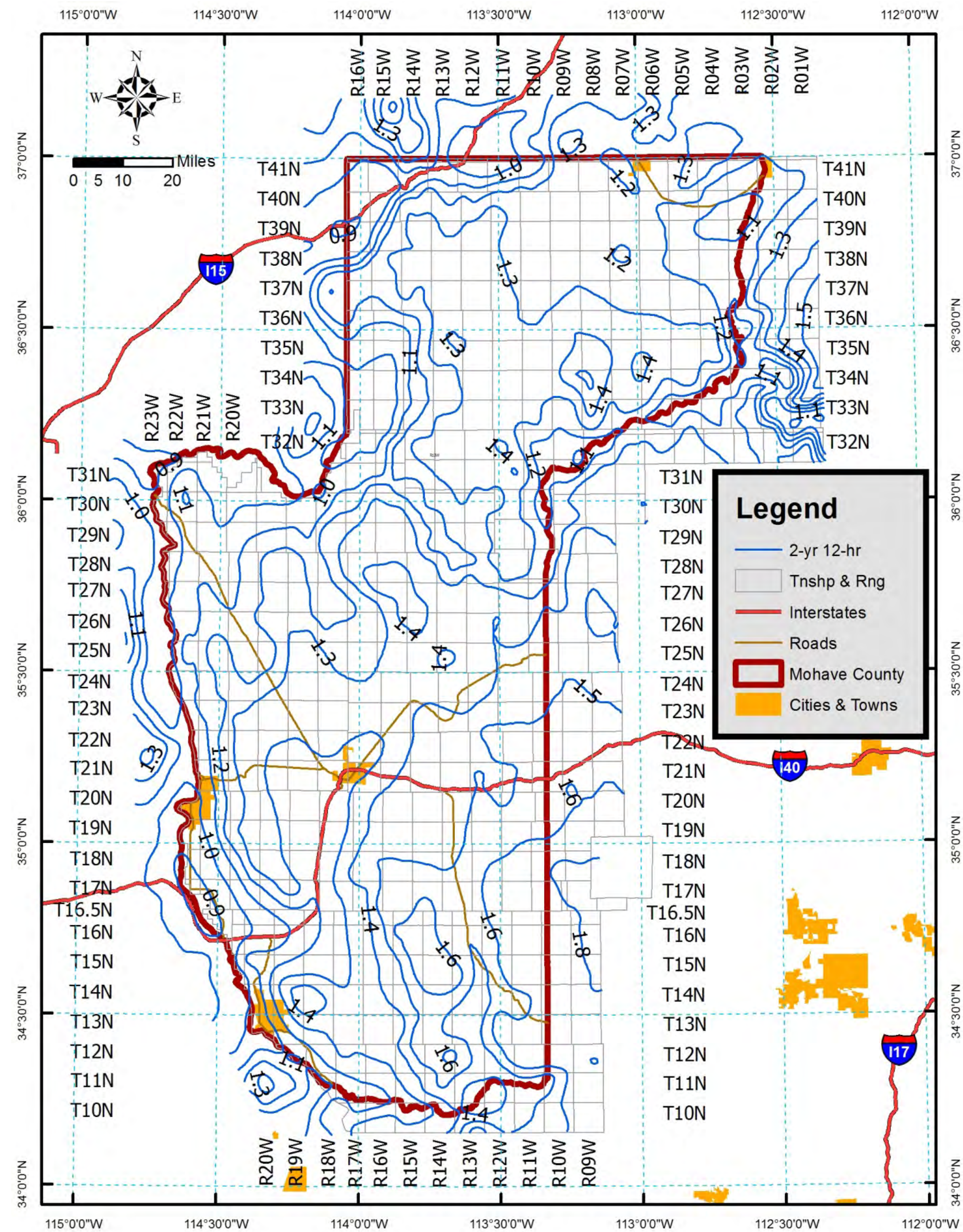
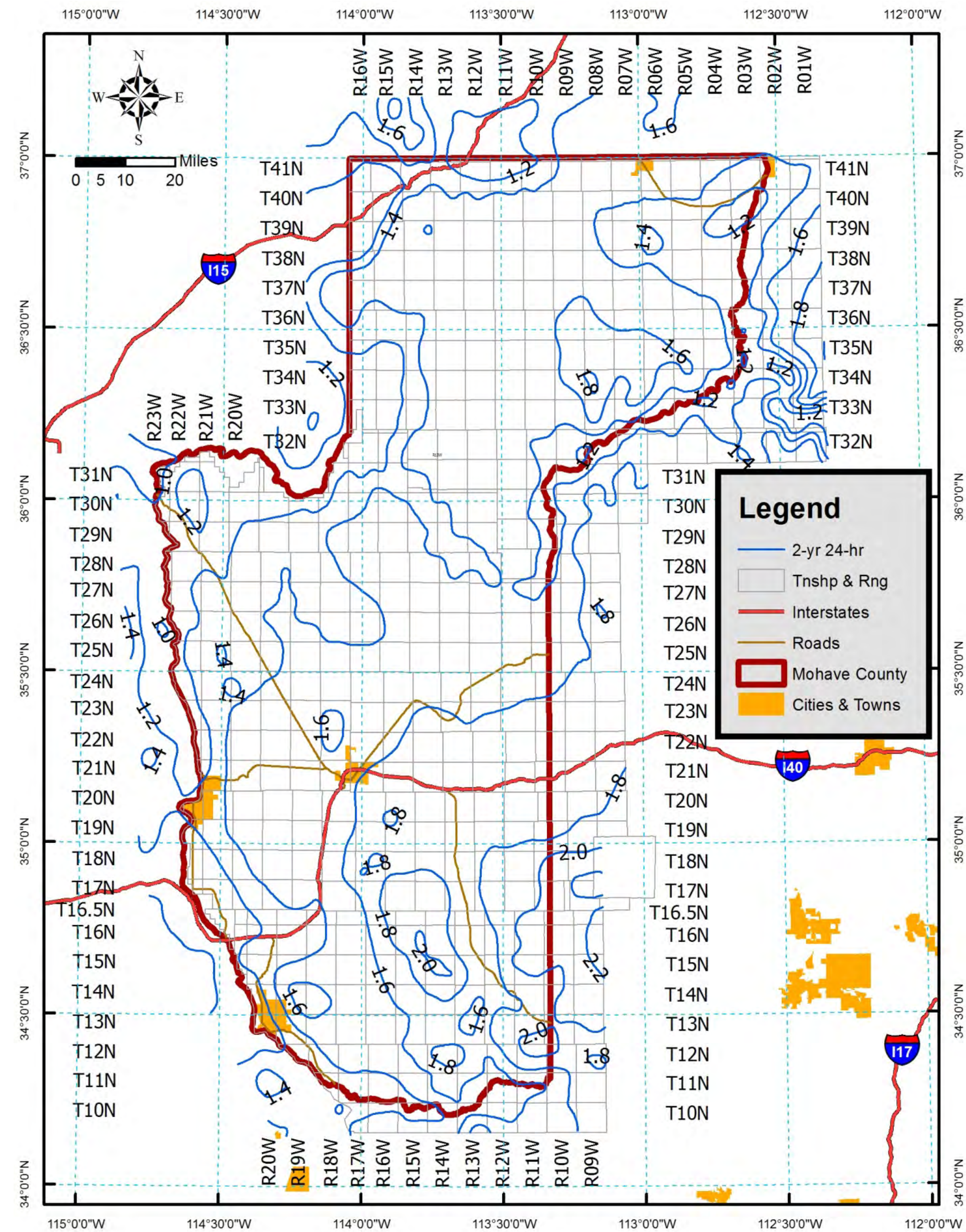


Figure B.10 NOAA Atlas 14 2-year 24-hour isopluvial map



B.2 5-YEAR STORM ISOPLUVIALS

Page Intentionally Left Blank

Figure B.11 NOAA Atlas 14 5-year 5-minute isopluvial map

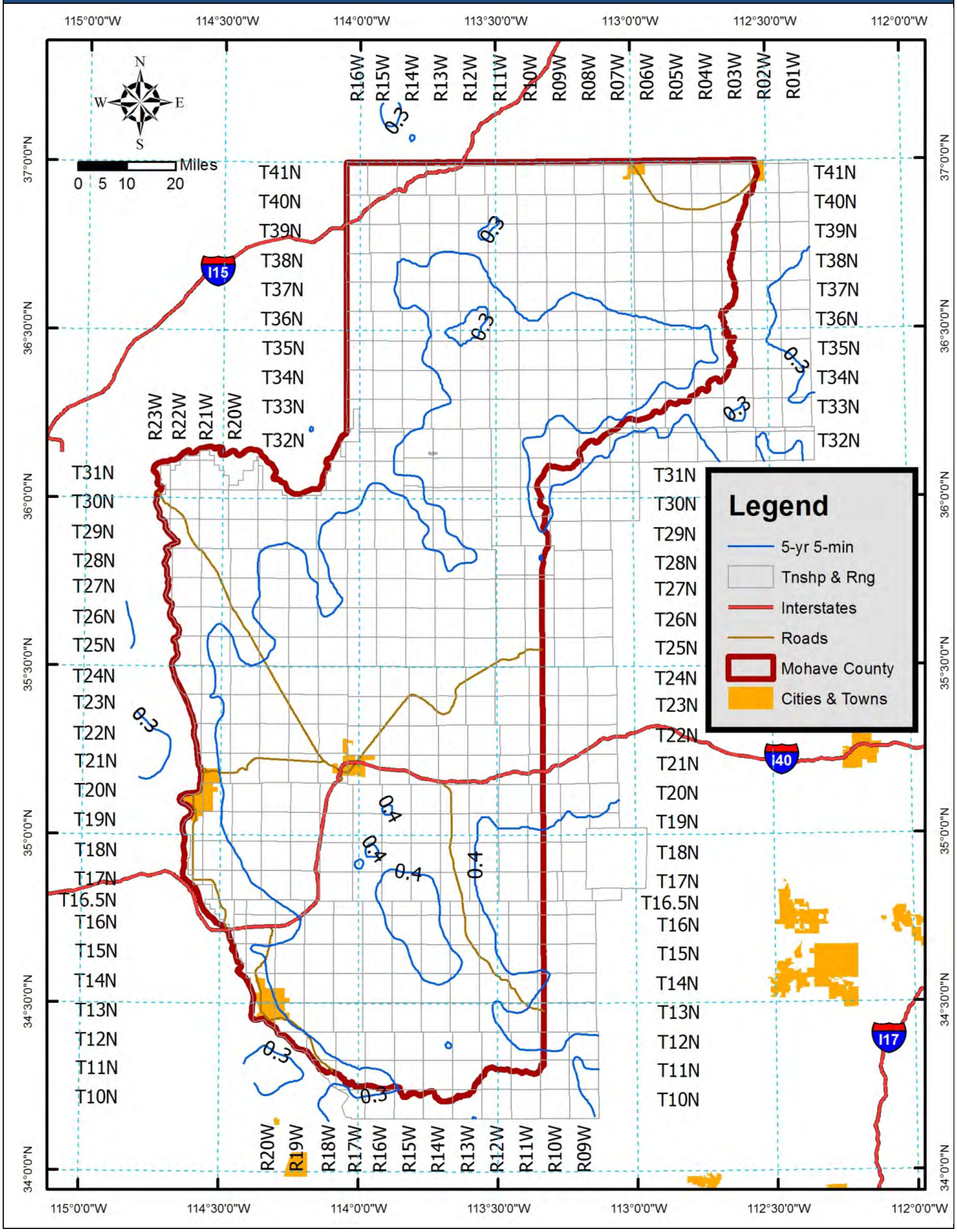


Figure B.12 NOAA Atlas 14 5-year 10-minute isopluvial map

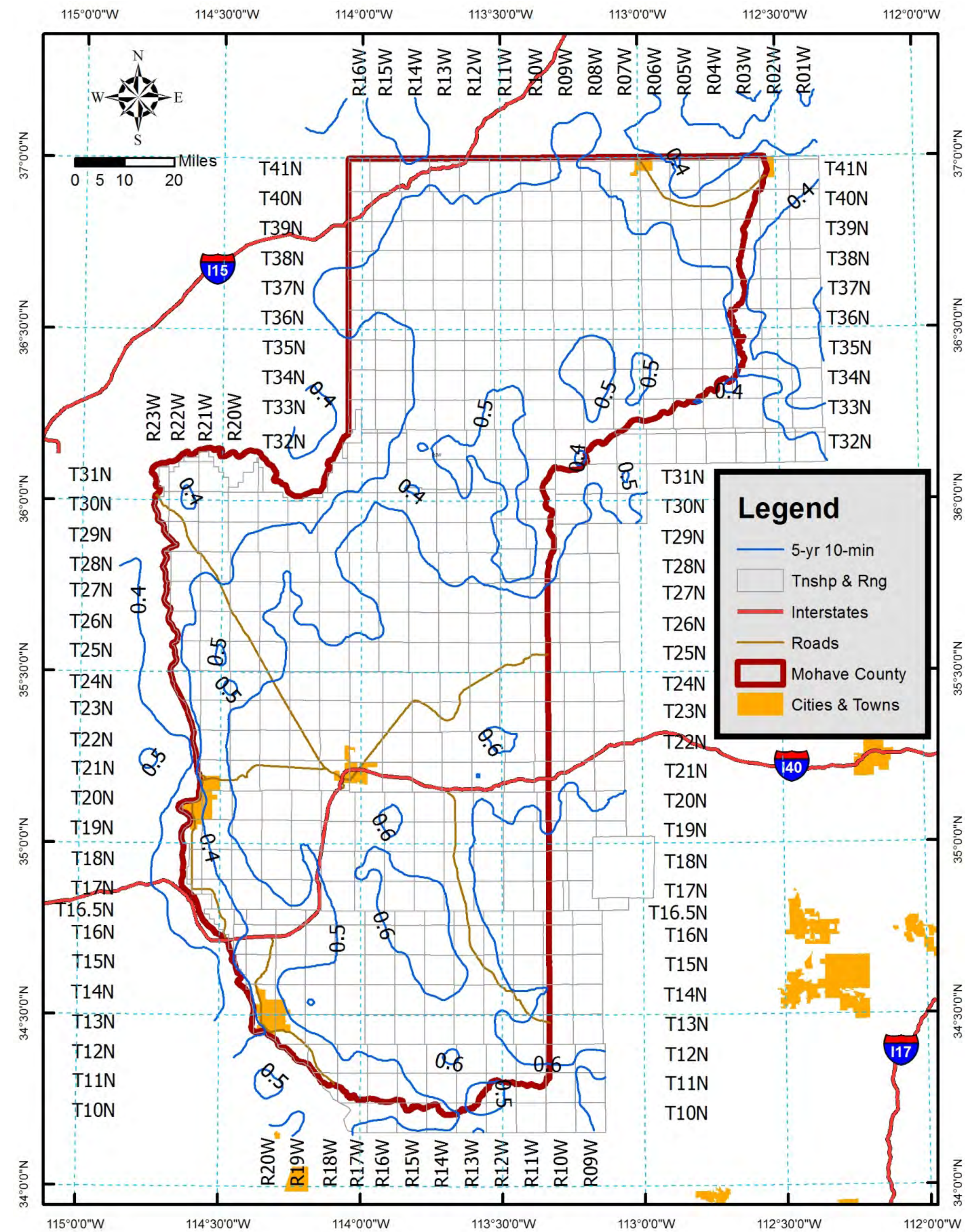


Figure B.13 NOAA Atlas 14 5-year 15-minute isopluvial map

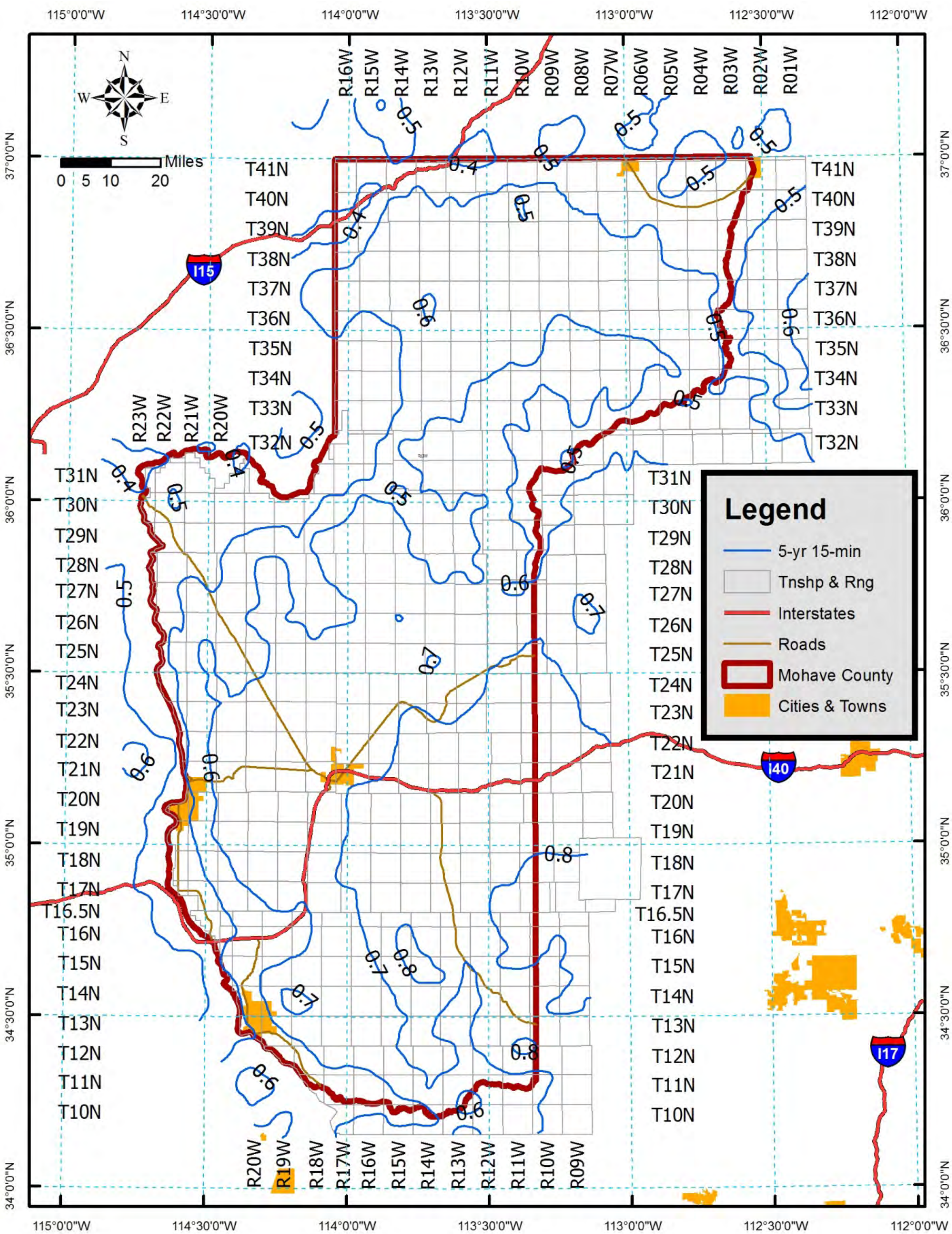


Figure B.14 NOAA Atlas 14 5-year 30-minute isopluvial map

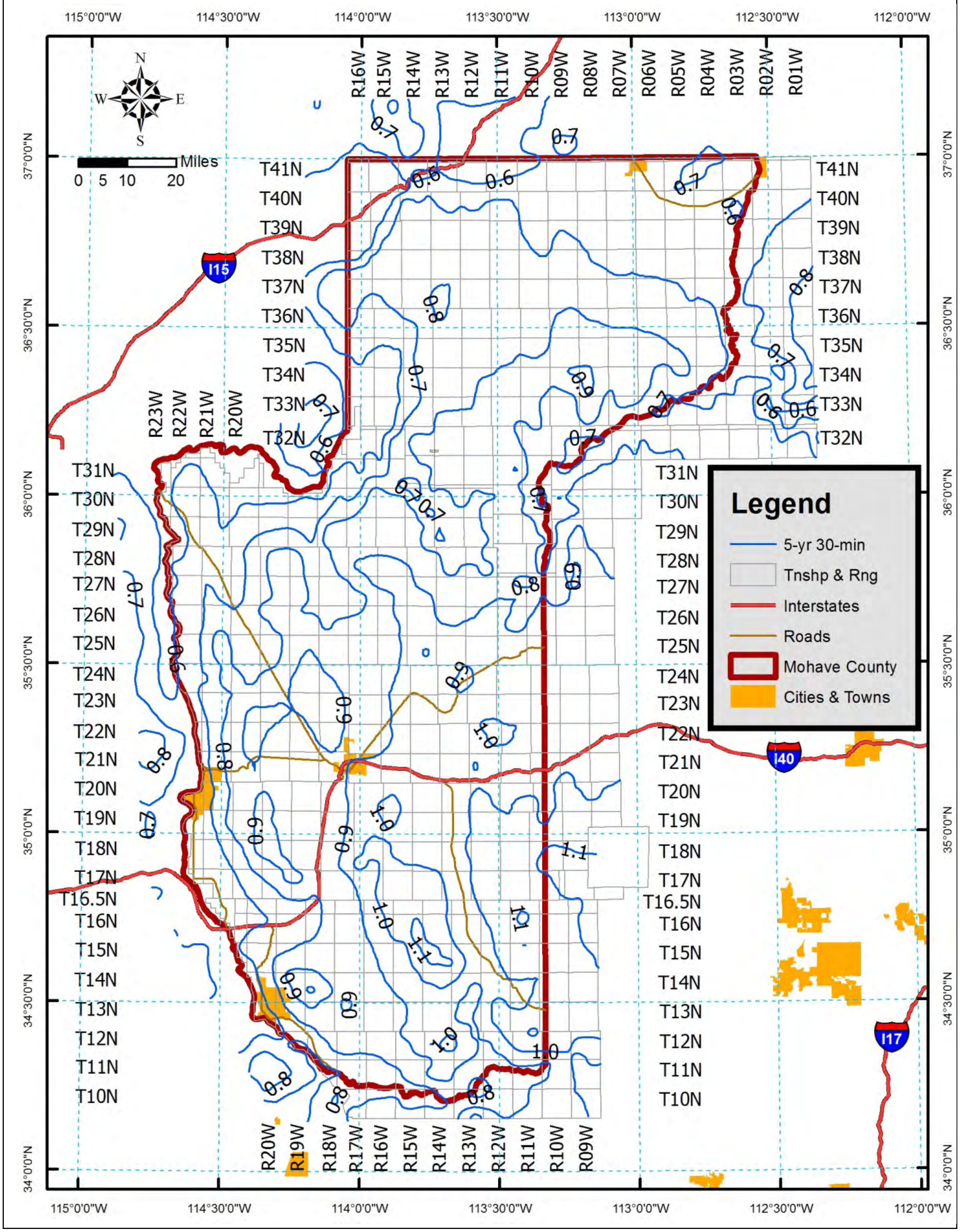


Figure B.15 NOAA Atlas 14 5-year 1-hour isopluvial map

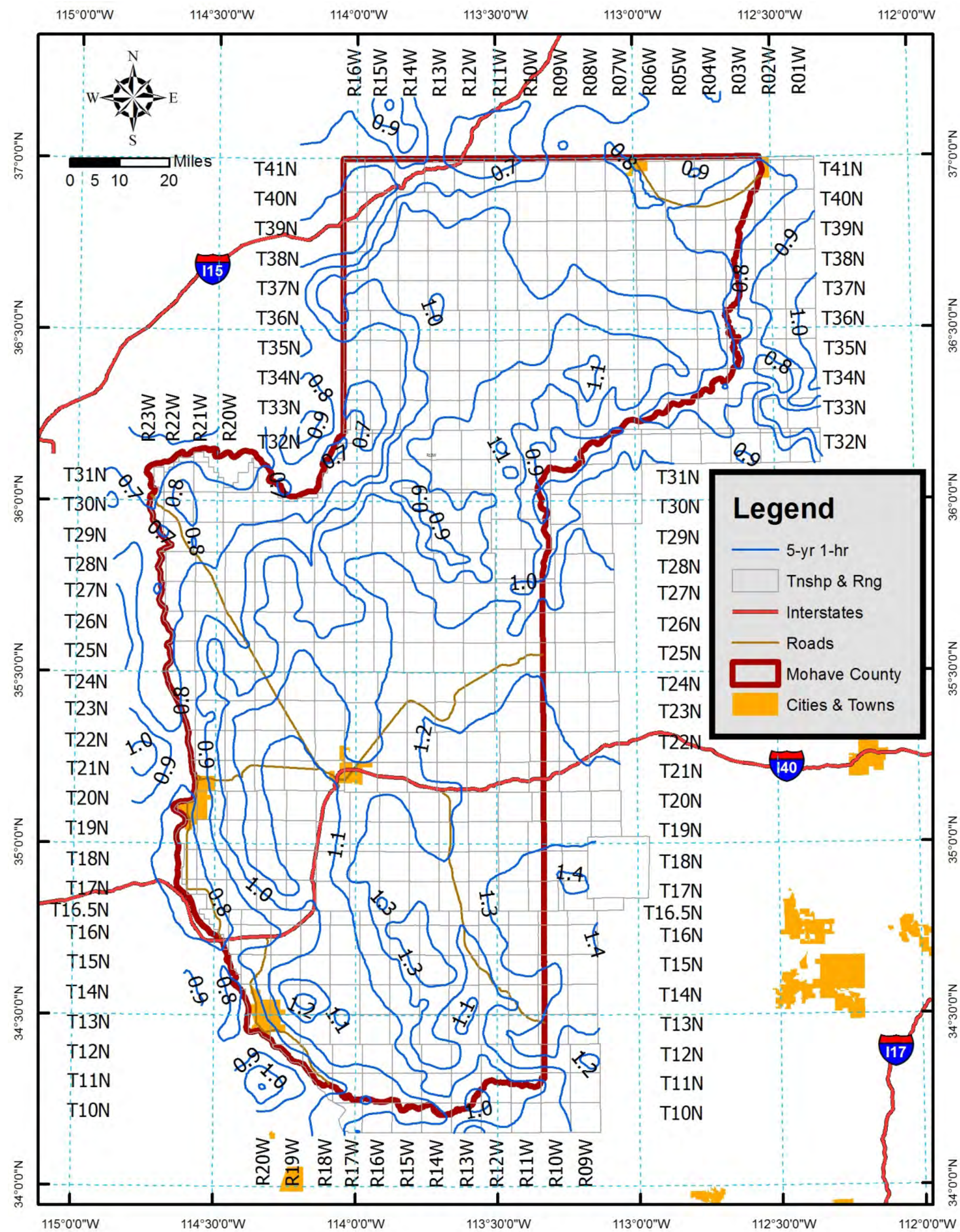


Figure B.16 NOAA Atlas 14 5-year 2-hour isopluvial map

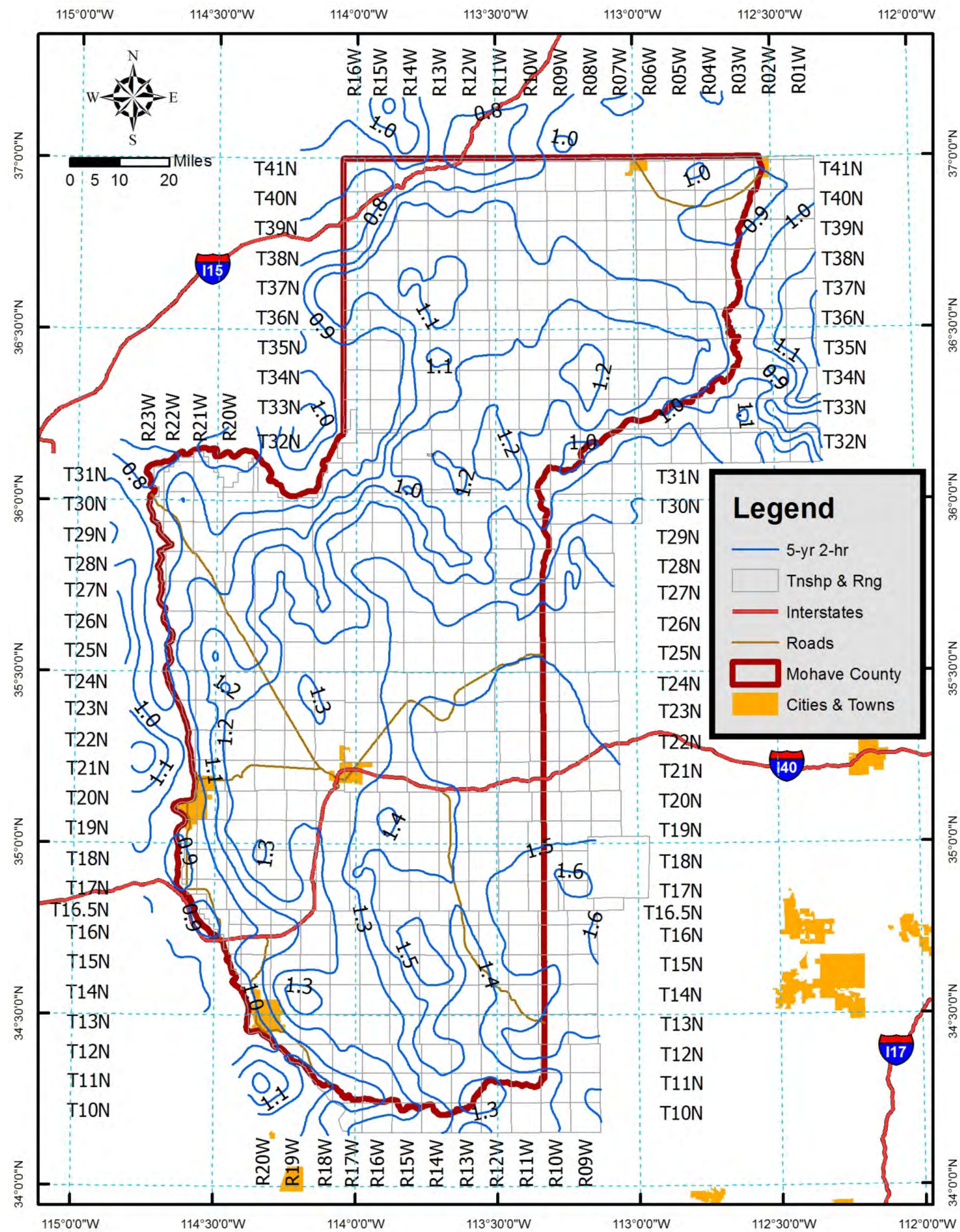


Figure B.17 NOAA Atlas 14 5-year 3-hour isopluvial map

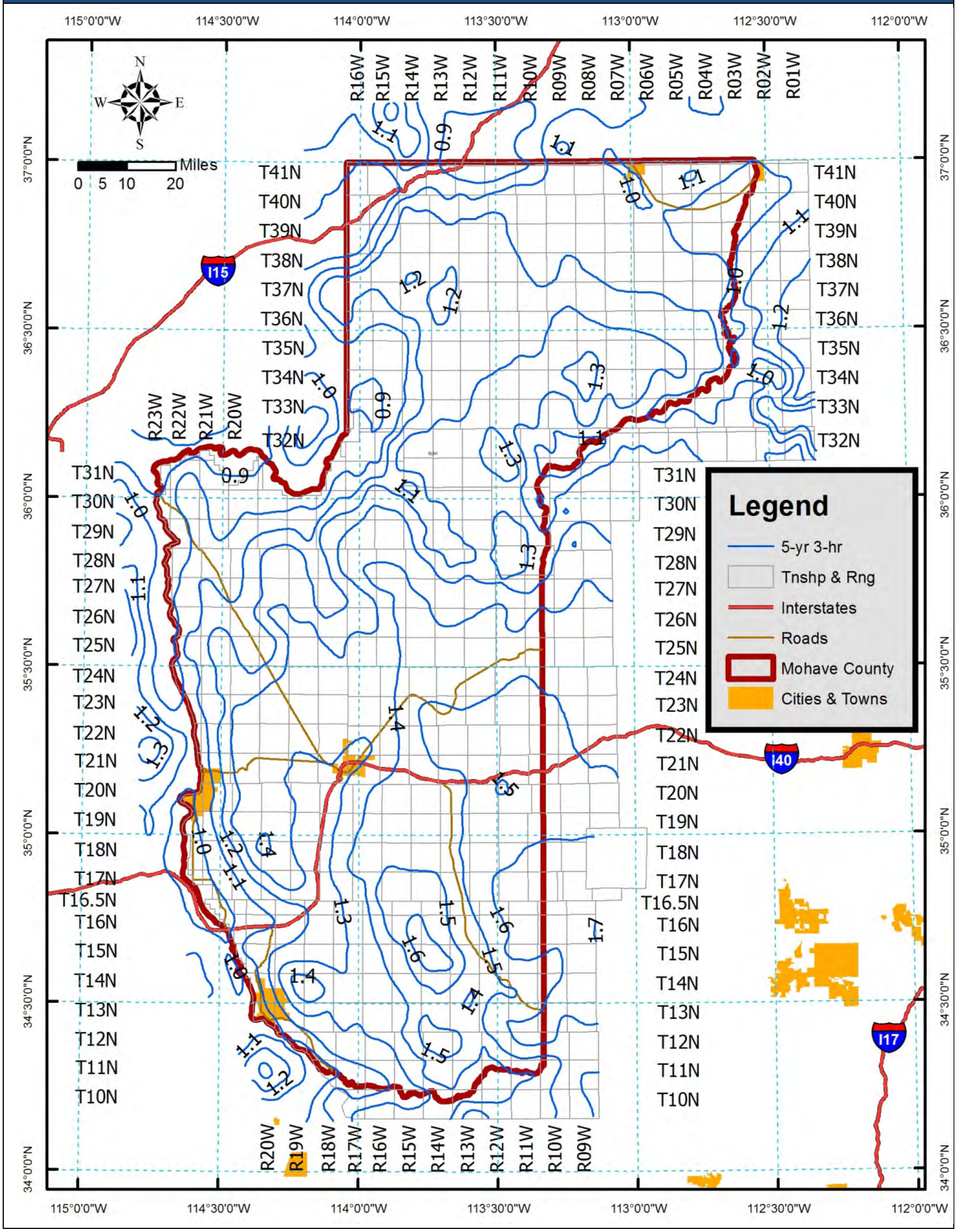


Figure B.18 NOAA Atlas 14 5-year 6-hour isopluvial map

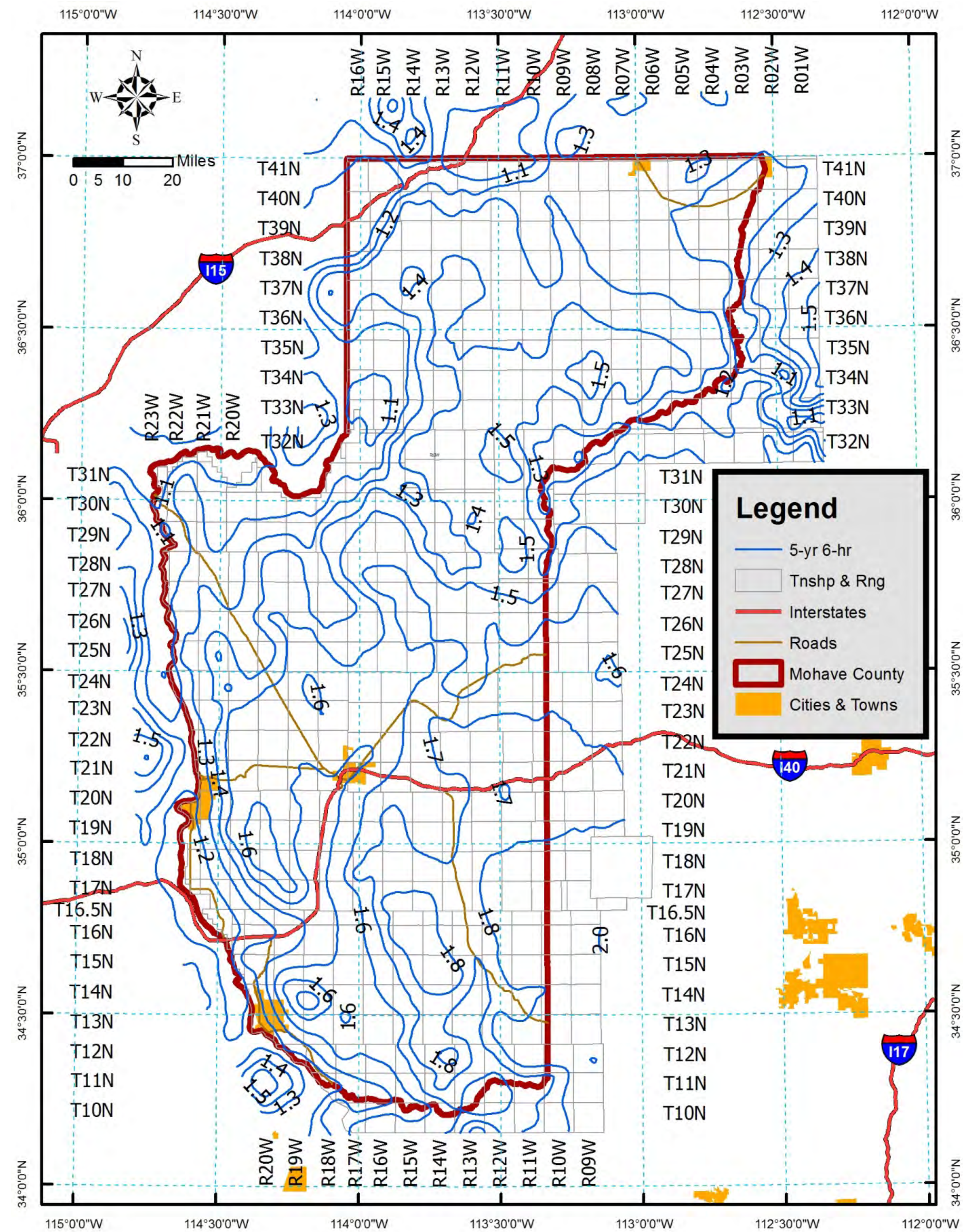


Figure B.19 NOAA Atlas 14 5-year 12-hour isopluvial map

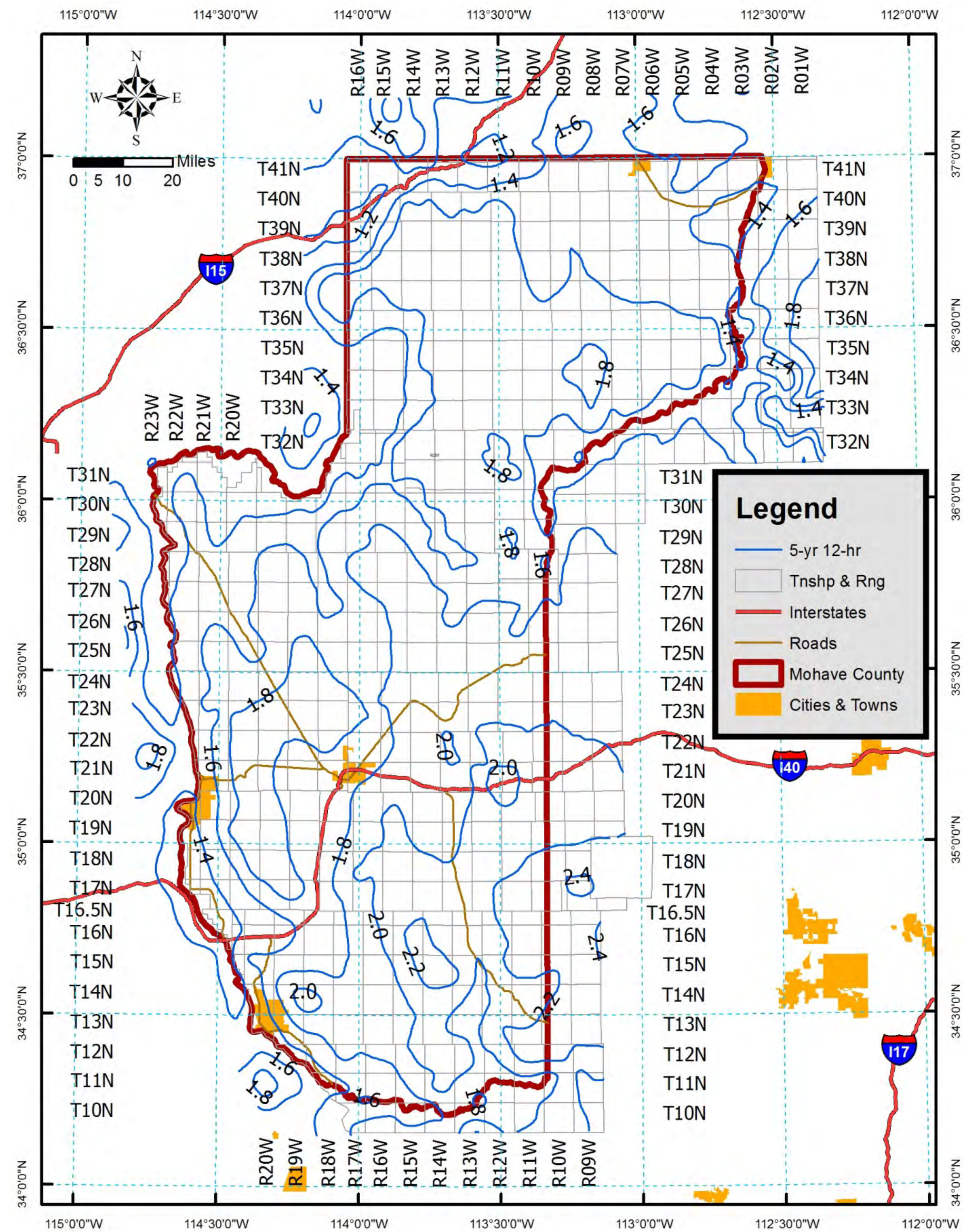
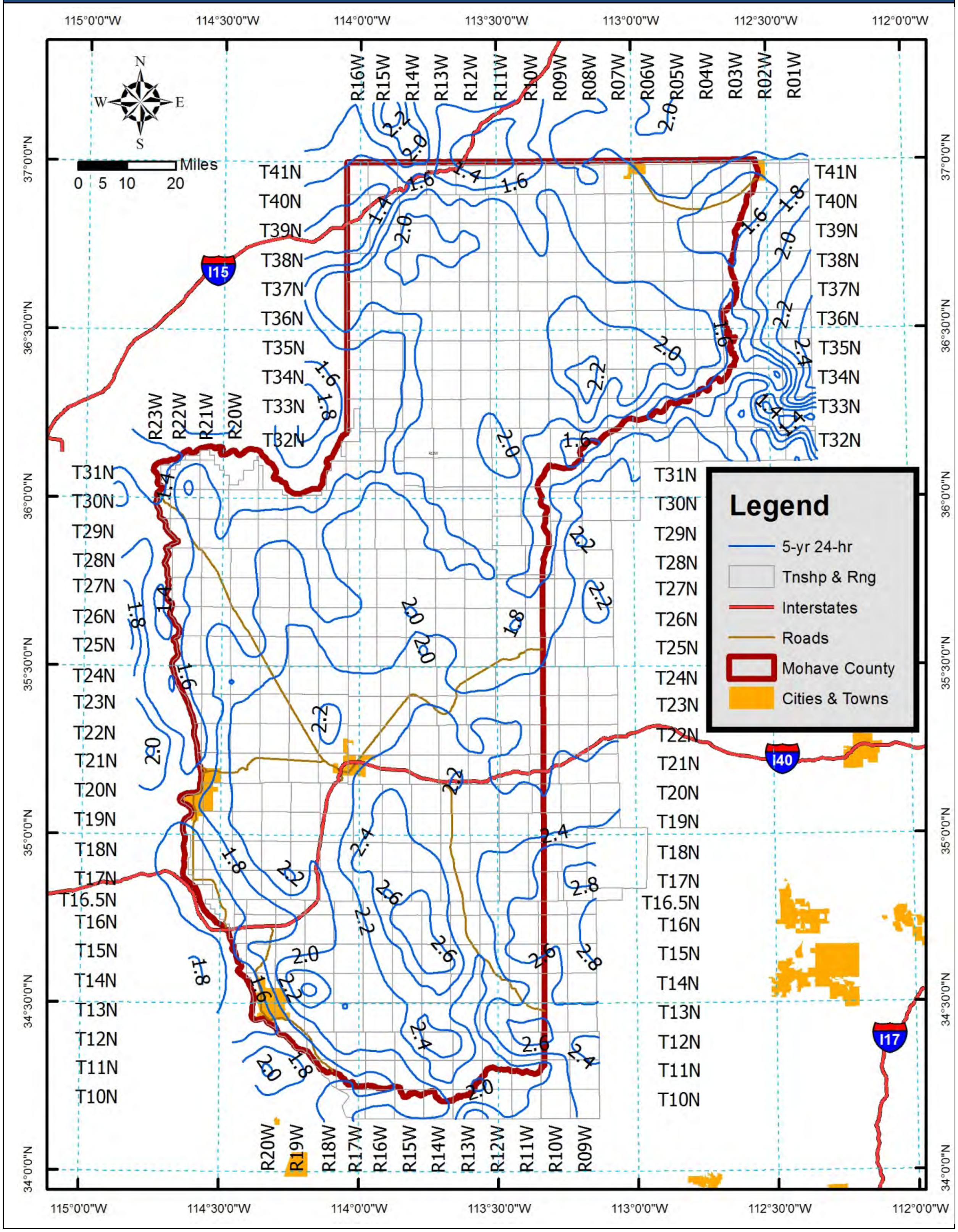


Figure B.20 NOAA Atlas 14 5-year 24-hour isopluvial map



B.3 10-YEAR STORM ISOPLUVIALS

Page Intentionally Left Blank

Figure B.21 NOAA Atlas 14 10-year 5-minute isopluvial map

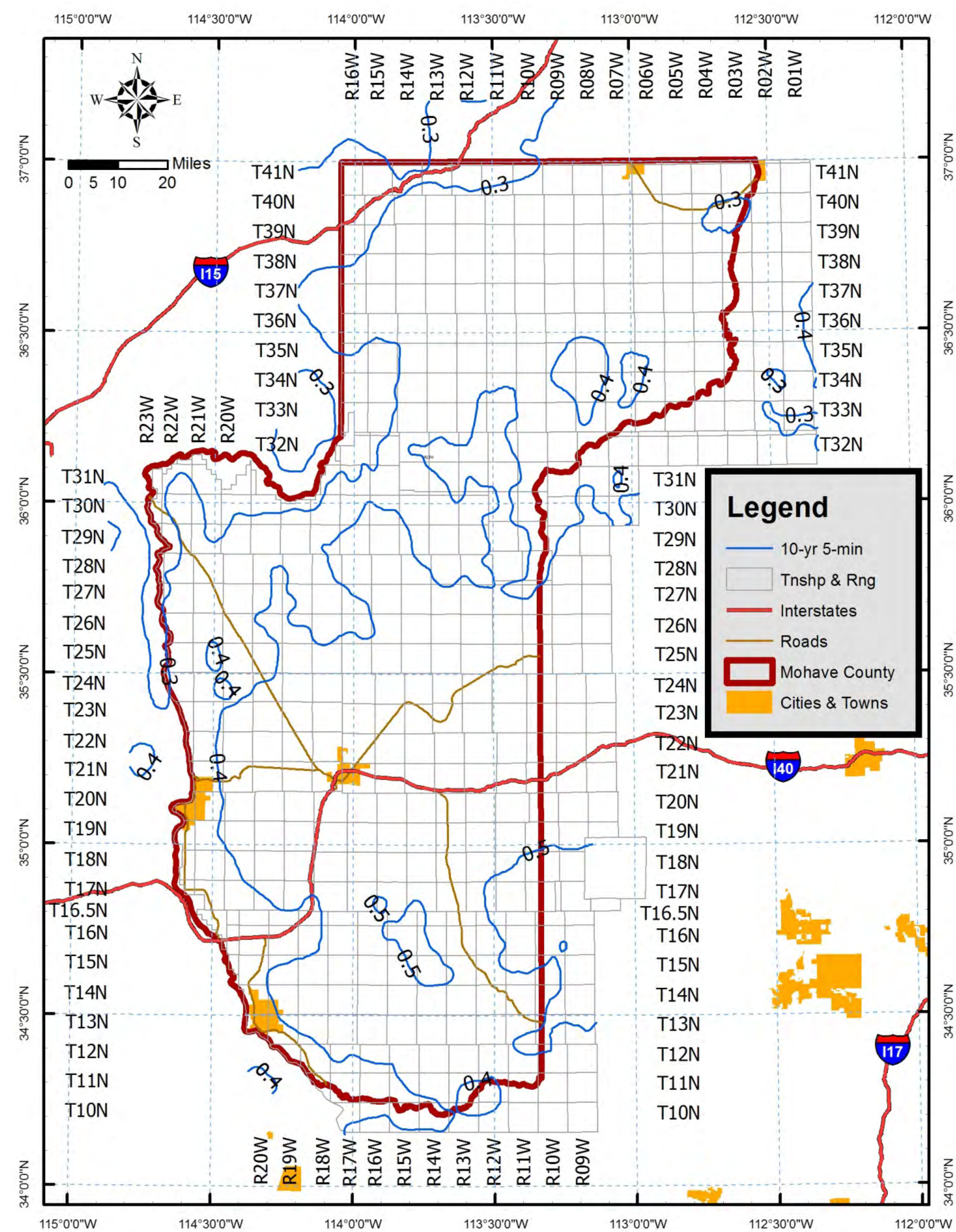


Figure B.22 NOAA Atlas 14 10-year 10-minute isopluvial map

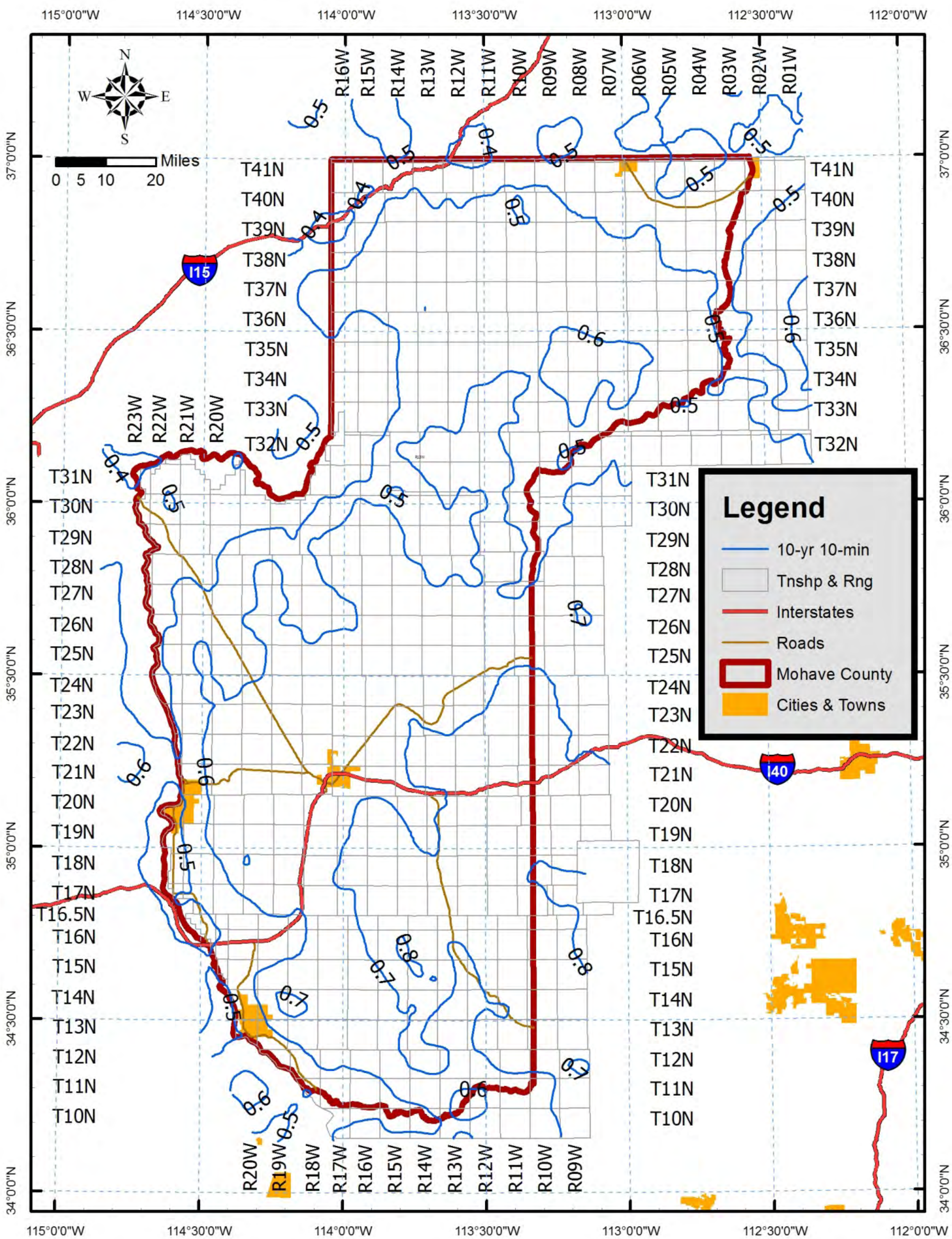


Figure B.23 NOAA Atlas 14 10-year 15-minute isopluvial map

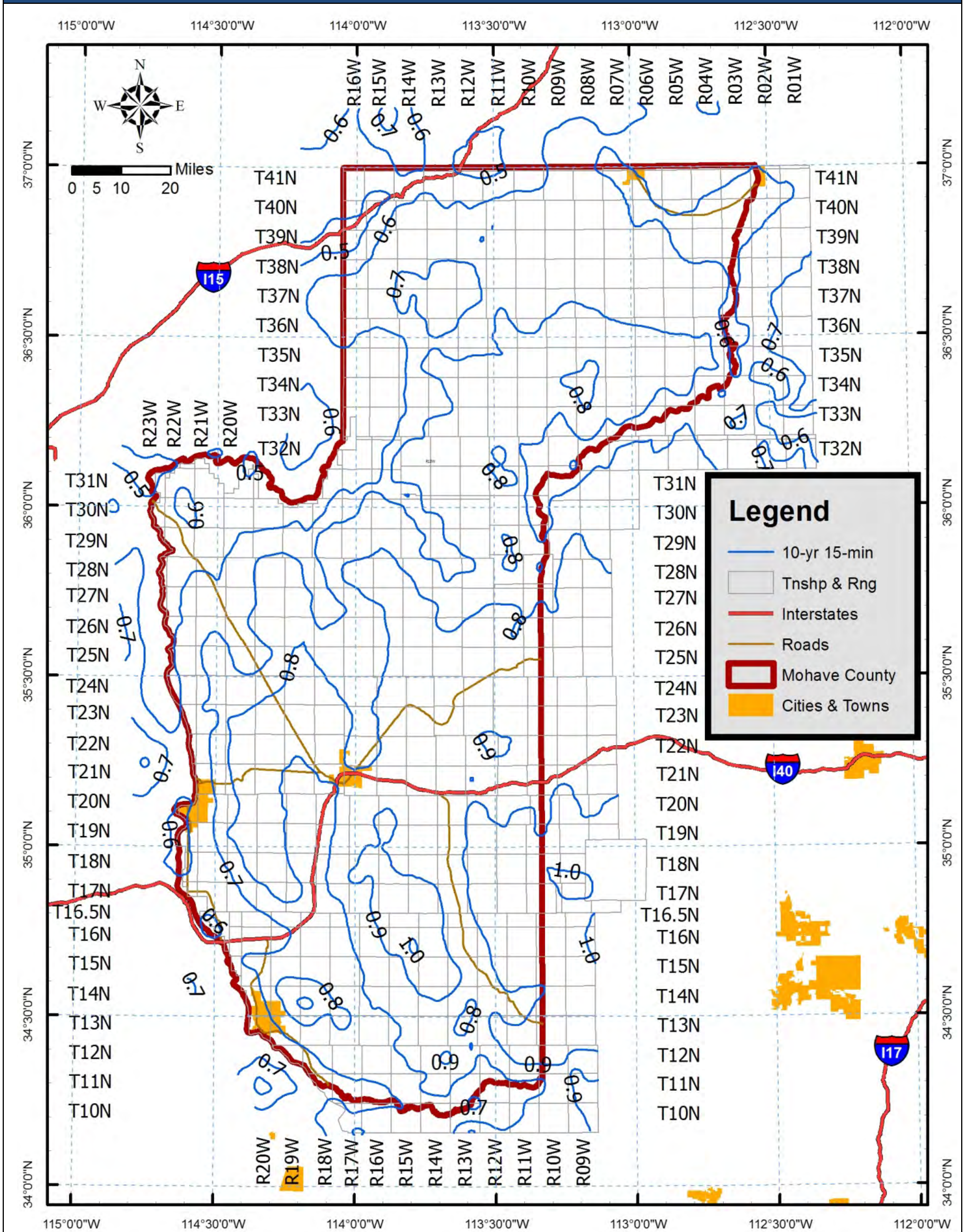


Figure B.24 NOAA Atlas 14 10-year 30-minute isopluvial map

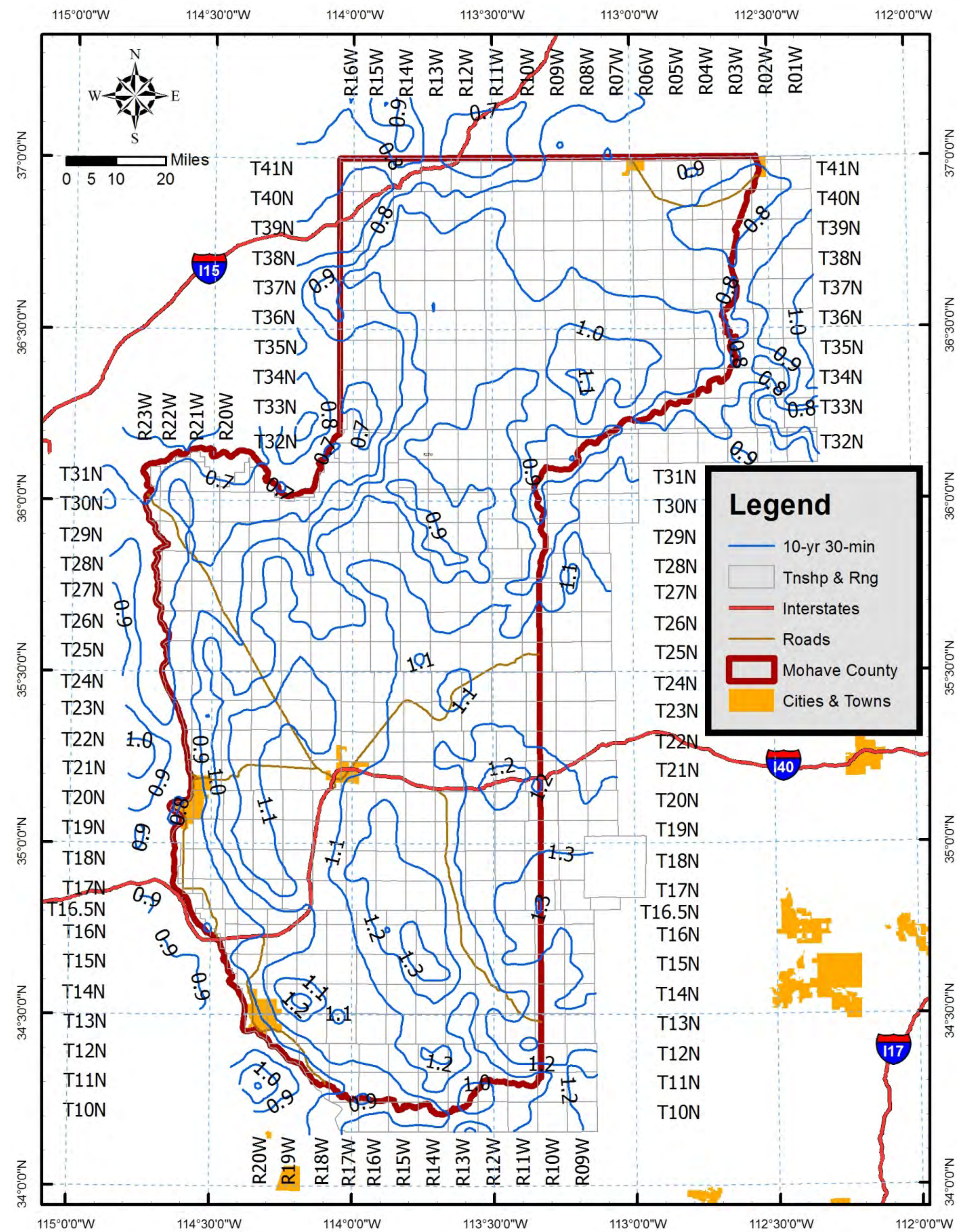


Figure B.25 NOAA Atlas 14 10-year 1-hour isopluvial map

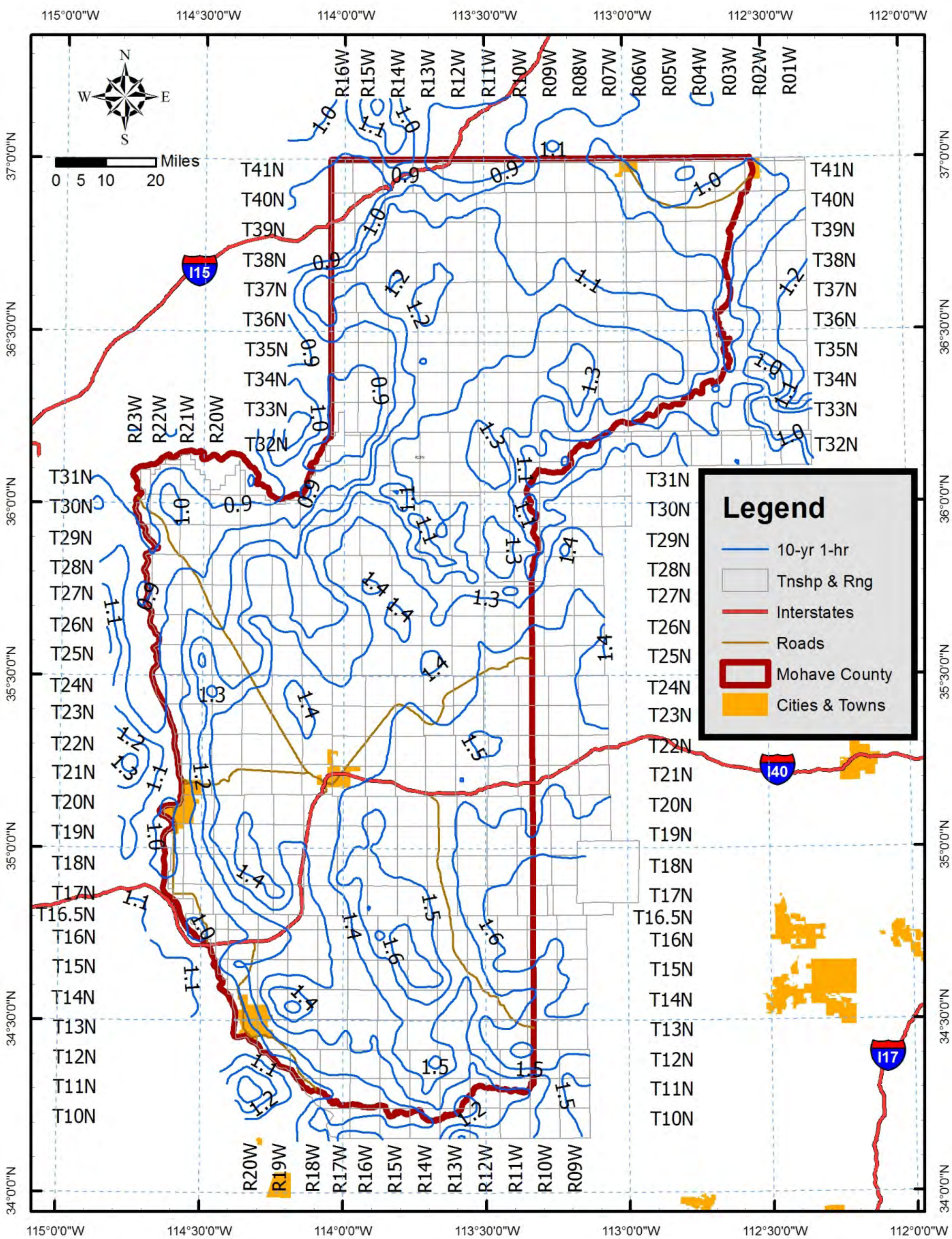


Figure B.26 NOAA Atlas 14 10-year 2-hour isopluvial map

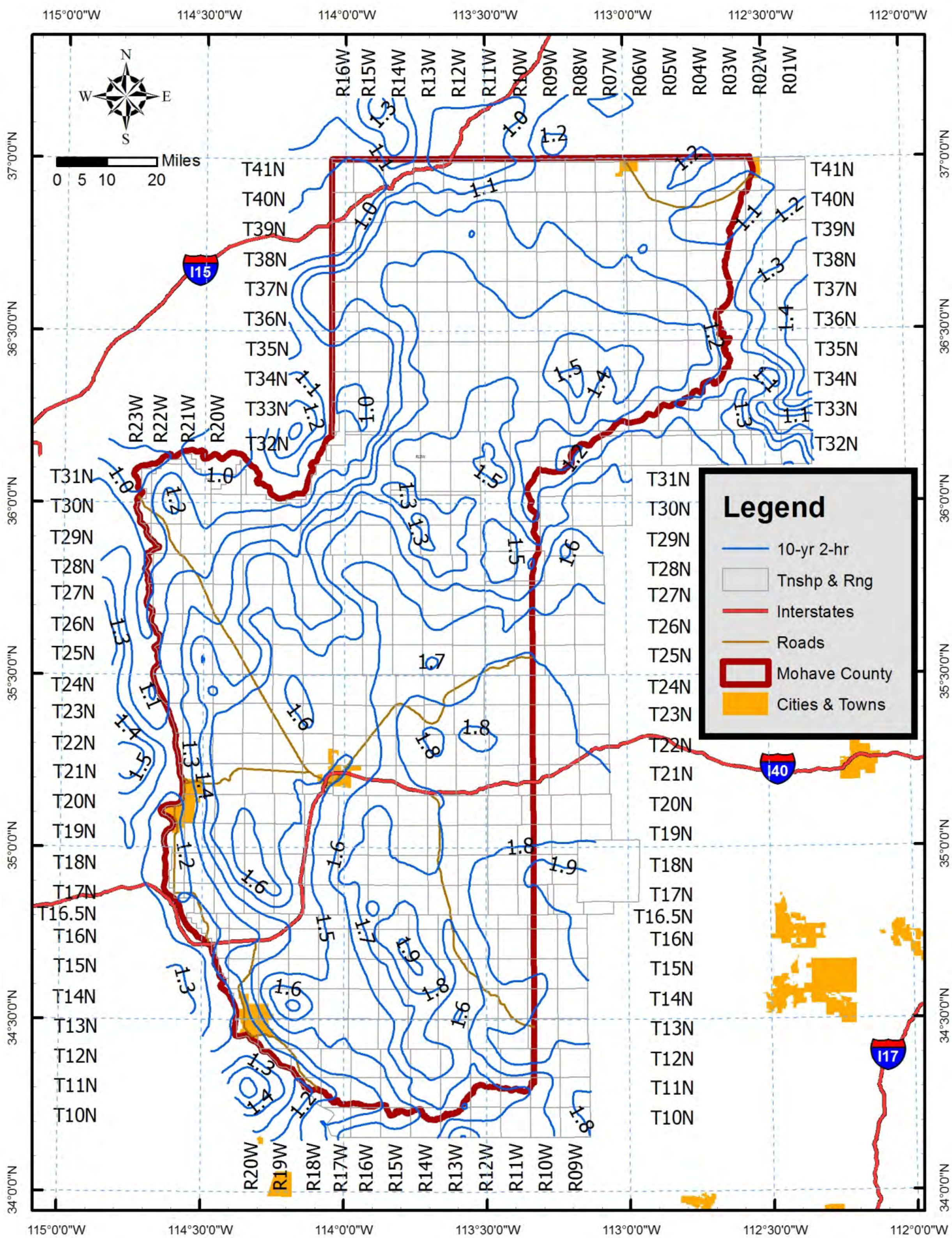


Figure B.27 NOAA Atlas 14 10-year 3-hour isopluvial map

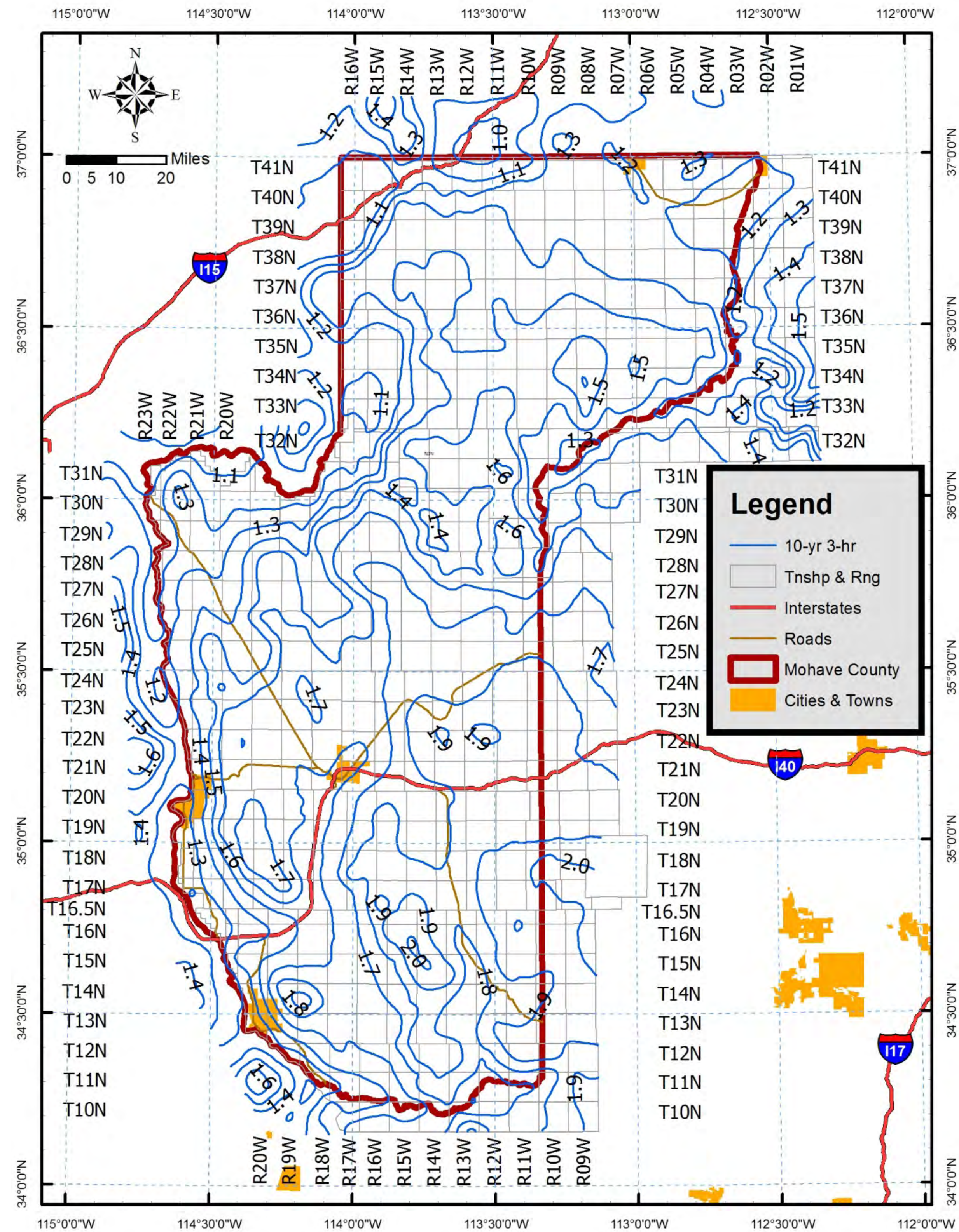


Figure B.28 NOAA Atlas 14 10-year 6-hour isopluvial map

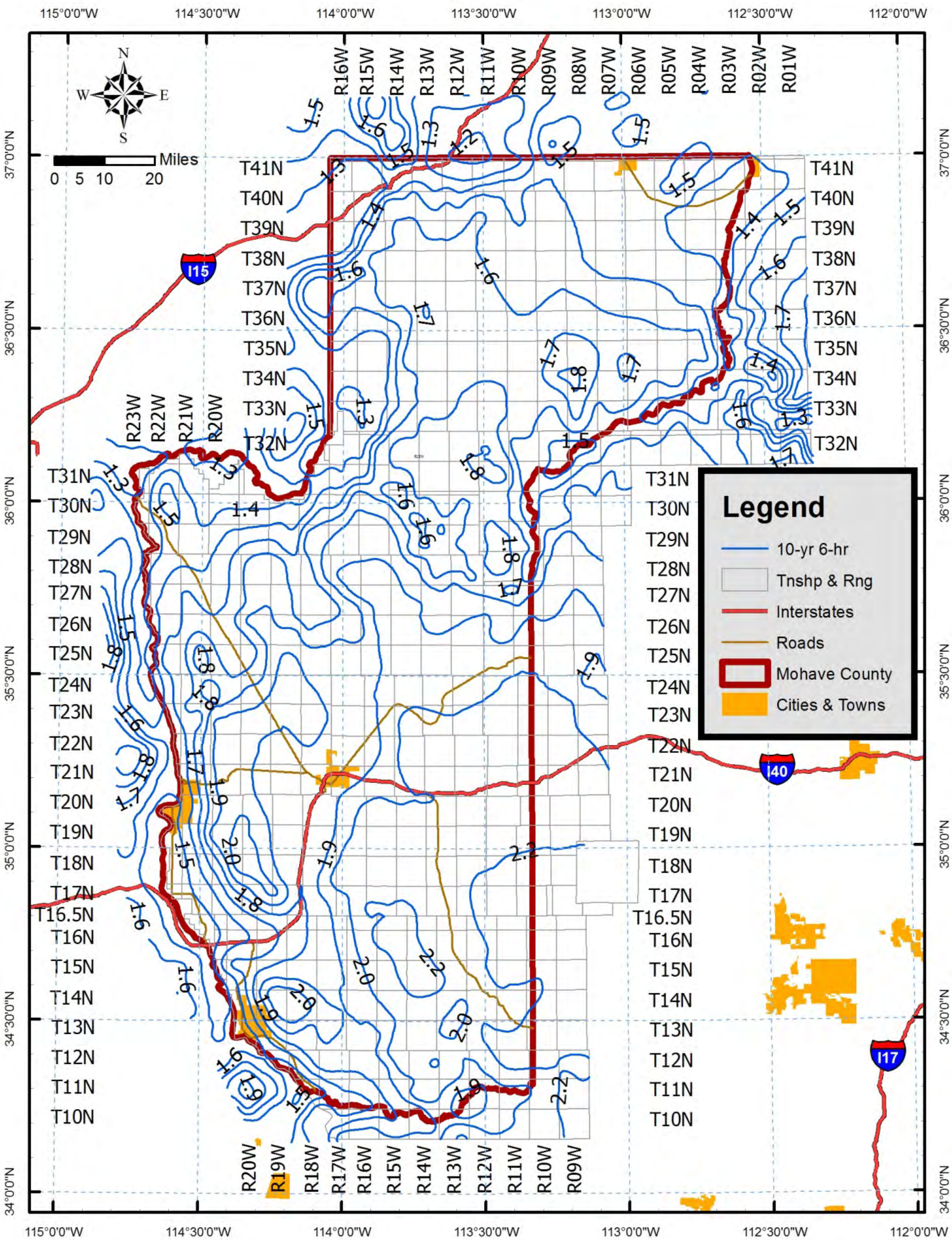


Figure B.29 NOAA Atlas 14 10-year 12-hour isopluvial map

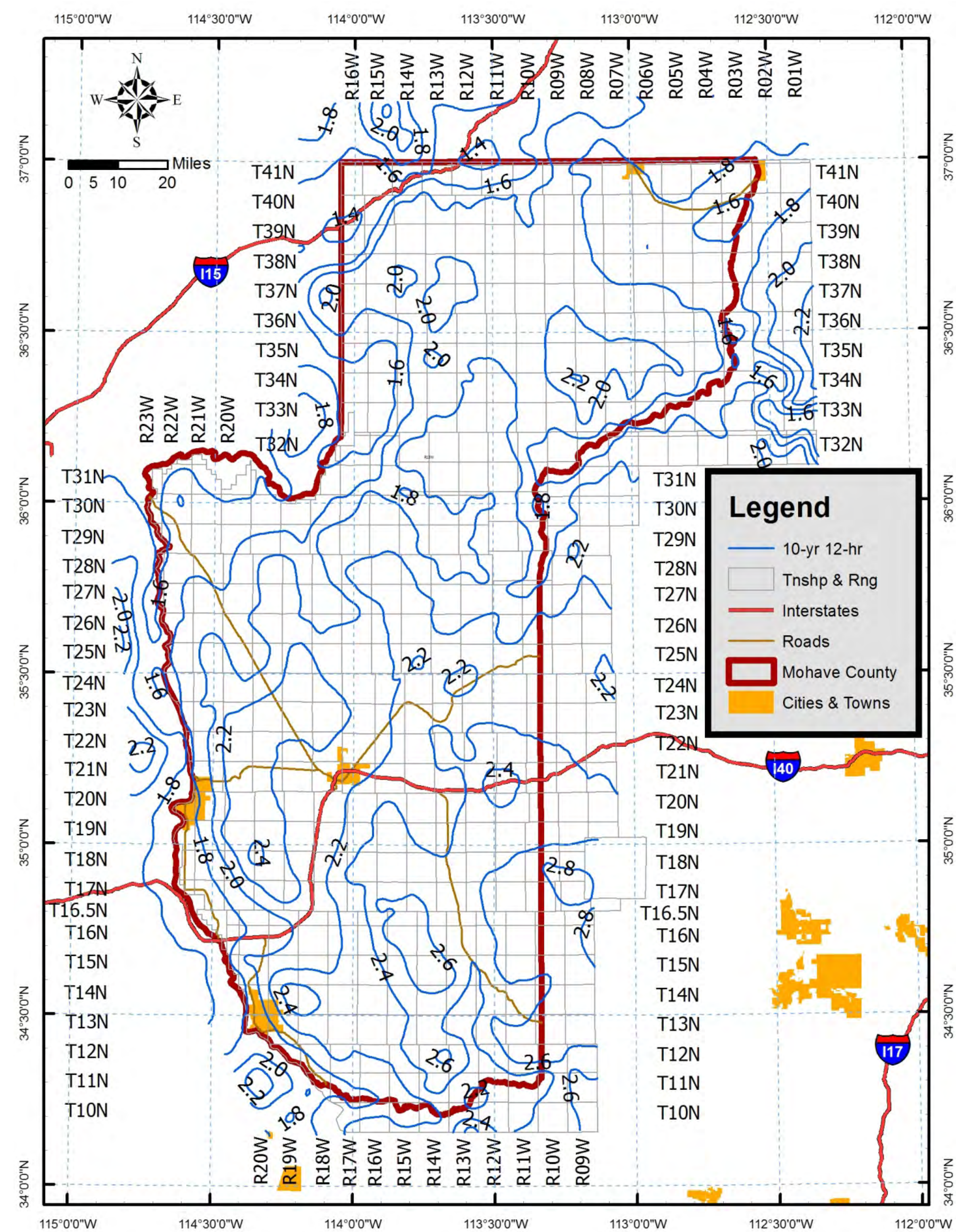
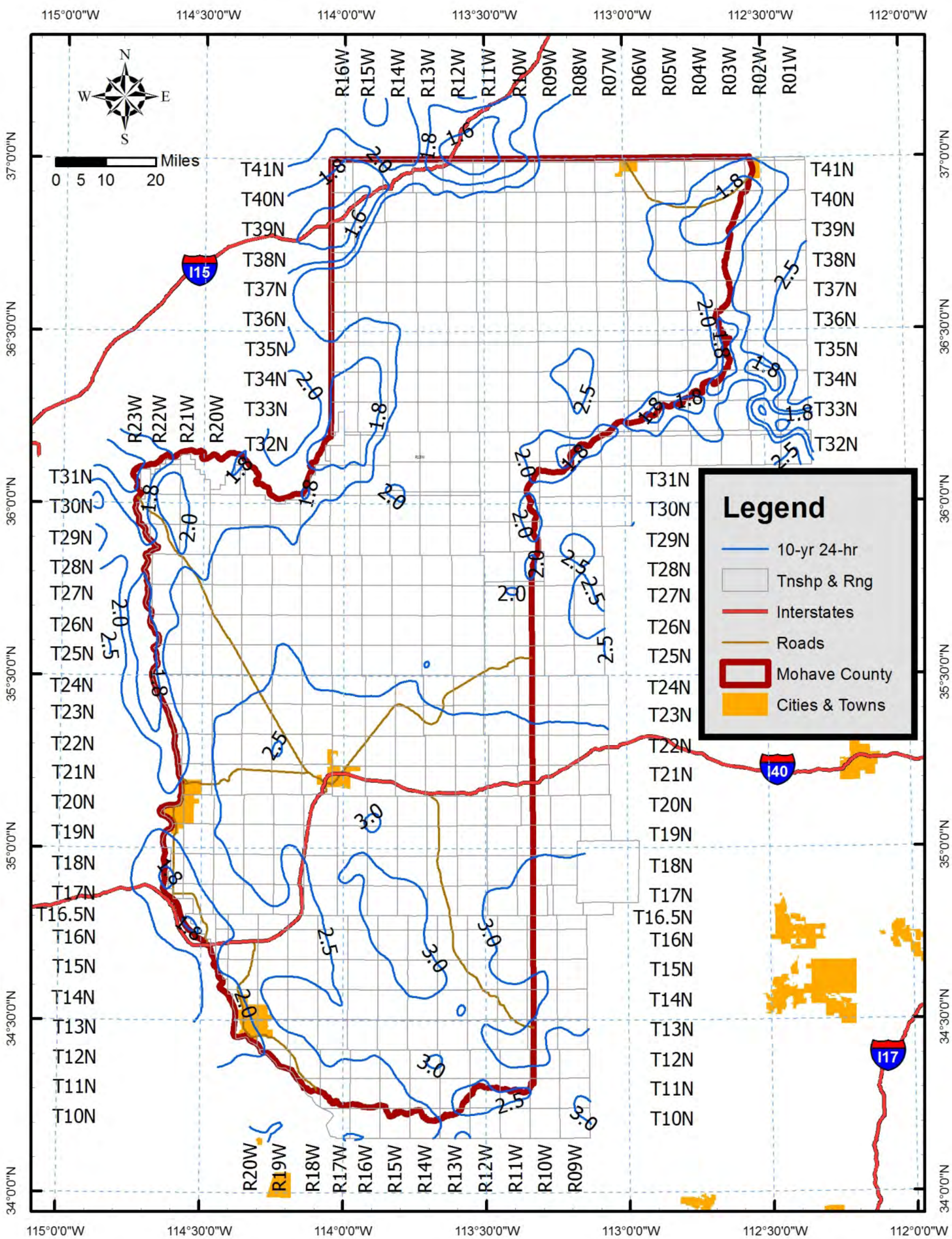


Figure B.30 NOAA Atlas 14 10-year 24-hour isopluvial map



B.4 25-YEAR STORM ISOPLUVIALS

Page Intentionally Left Blank

Figure B.31 NOAA Atlas 14 25-year 5-minute isopluvial map

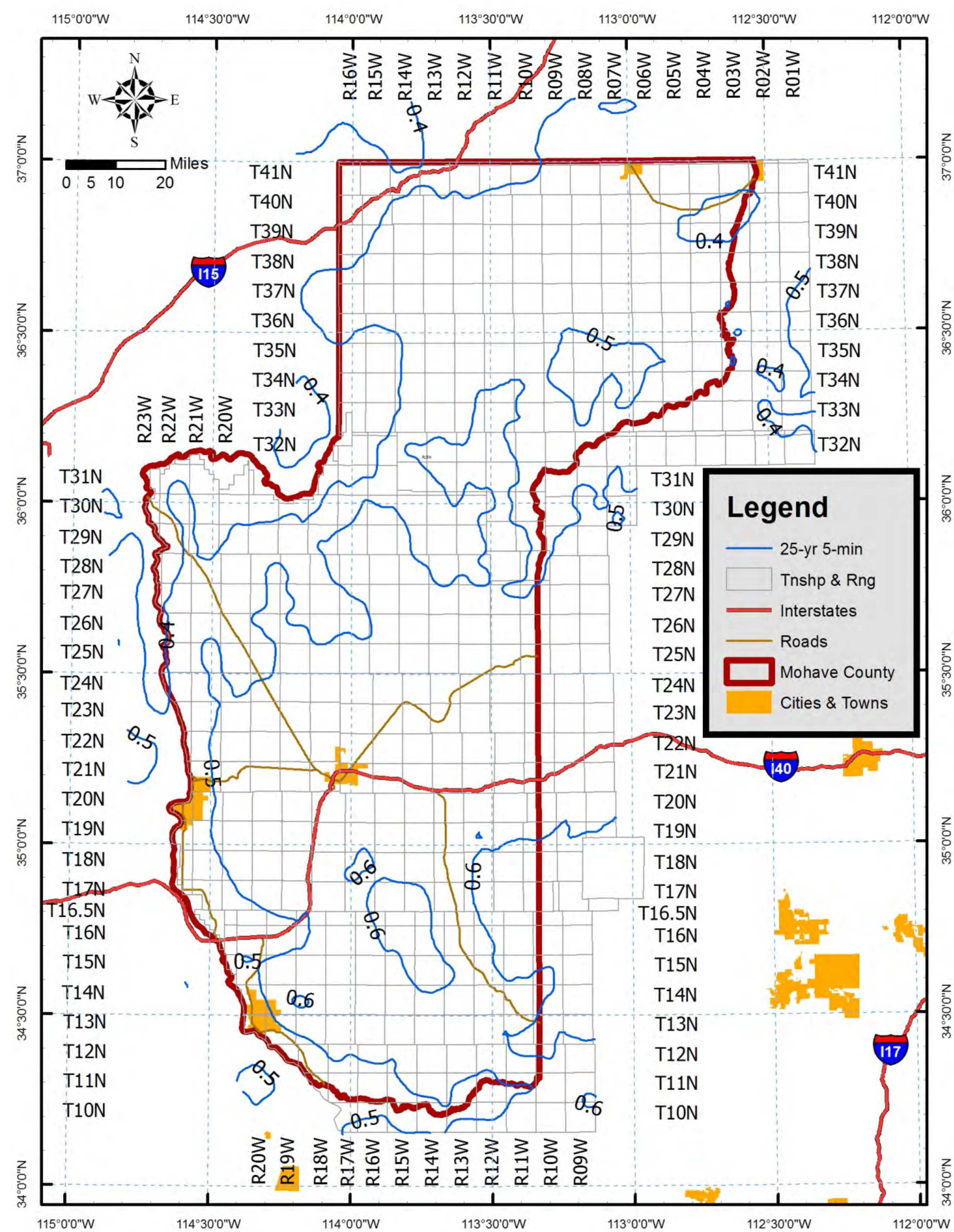


Figure B.32 NOAA Atlas 14 25-year 10-minute isopluvial map

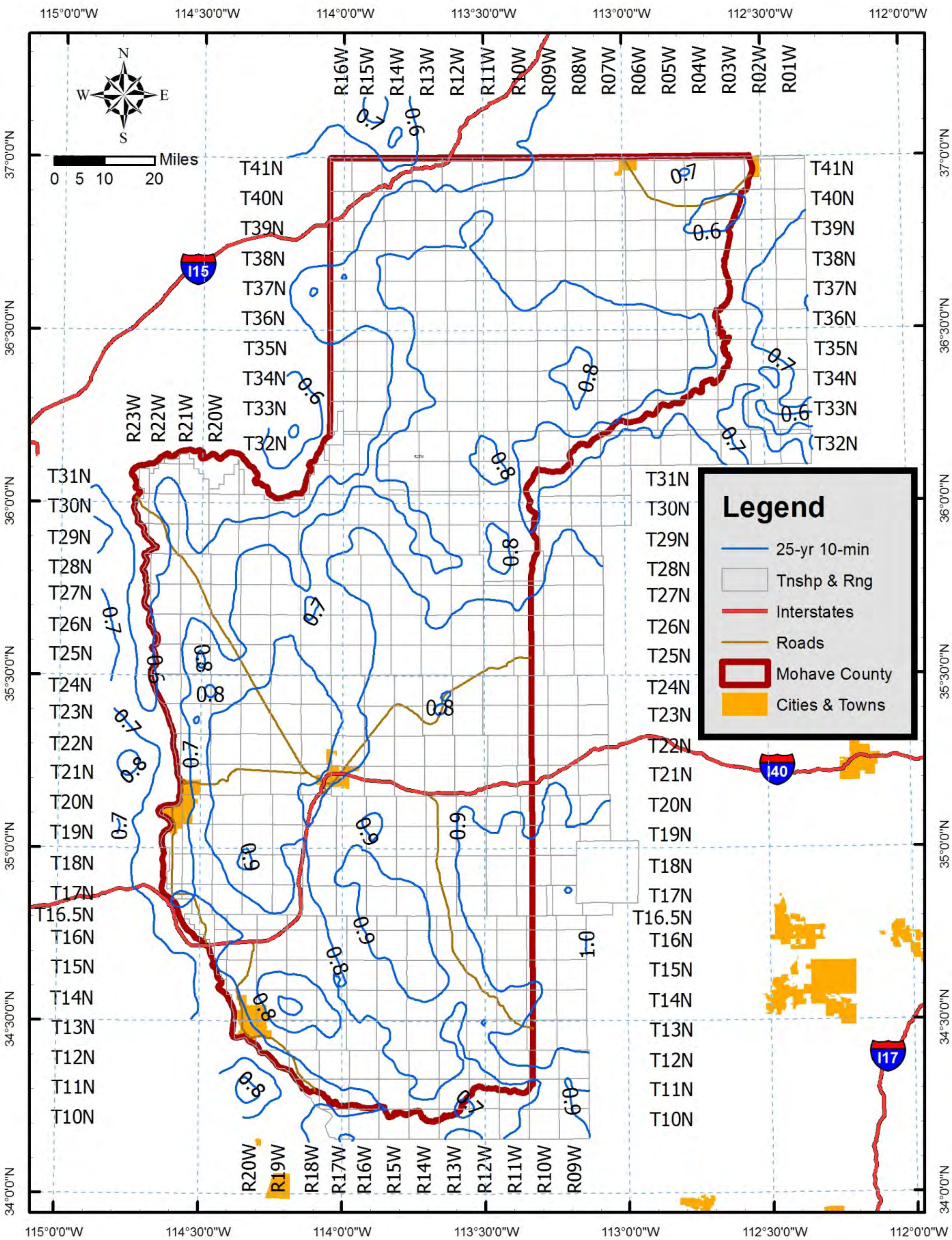


Figure B.33 NOAA Atlas 14 25-year 15-minute isopluvial map

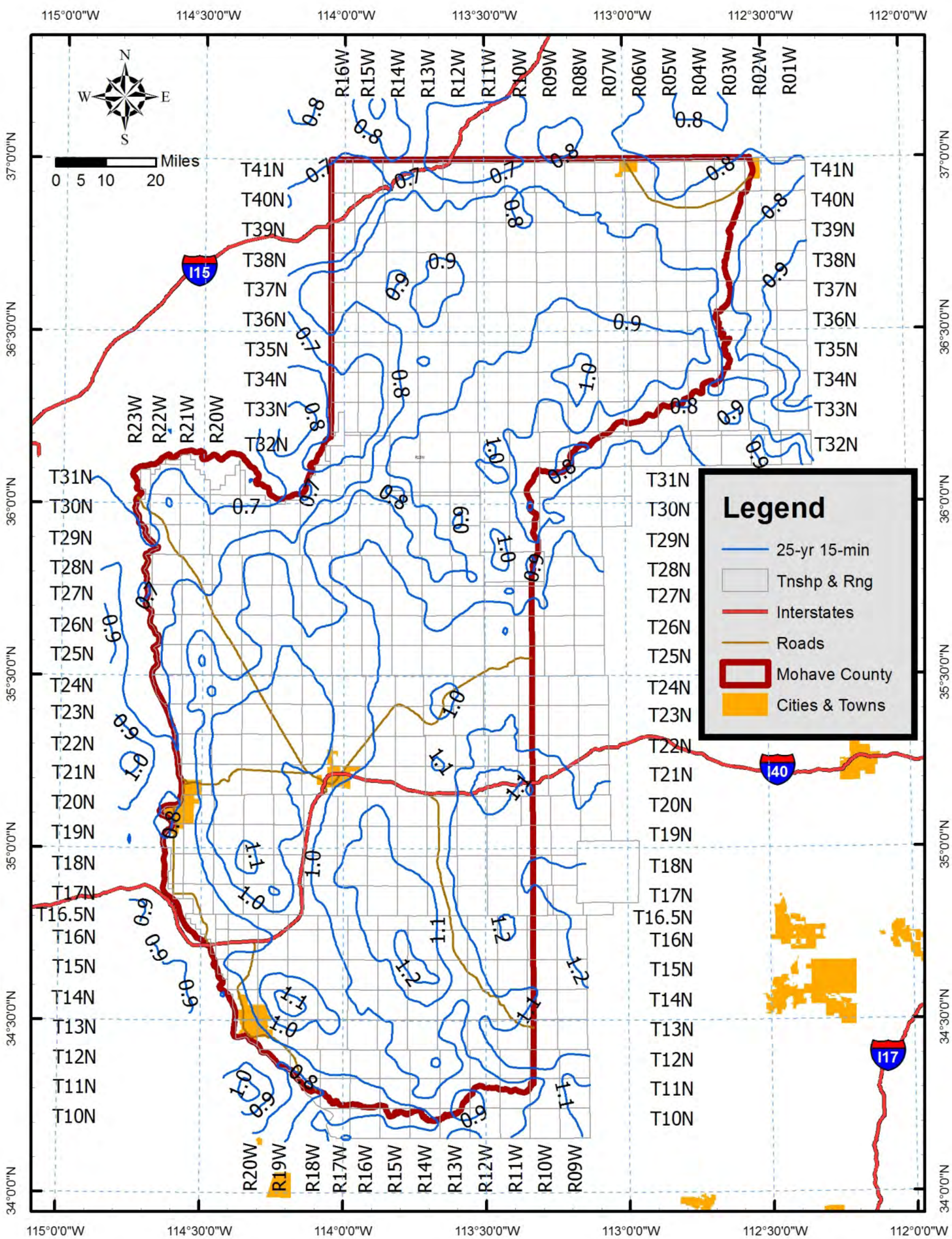


Figure B.34 NOAA Atlas 14 25-year 30-minute isopluvial map

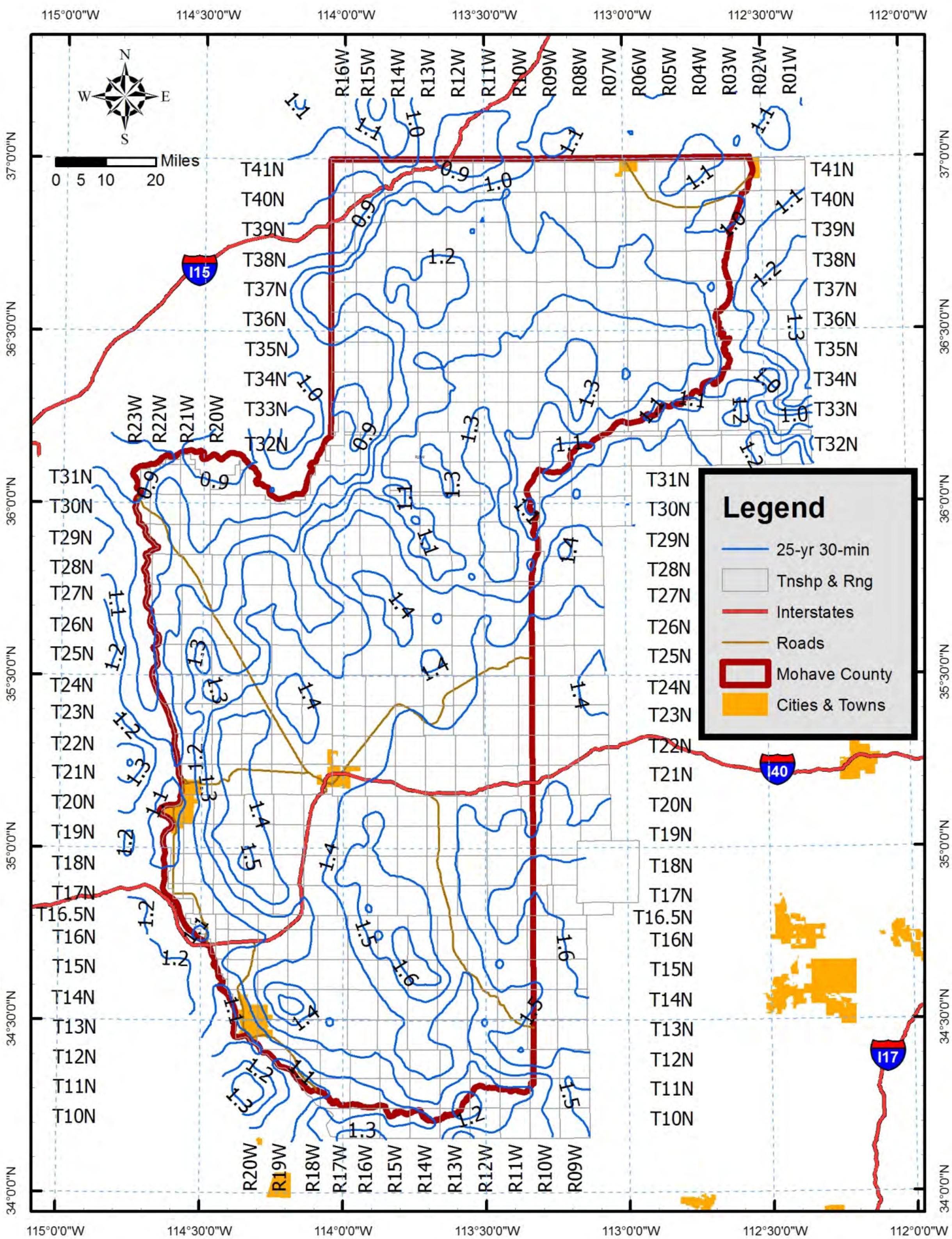


Figure B.35 NOAA Atlas 14 25-year 1-hour isopluvial map

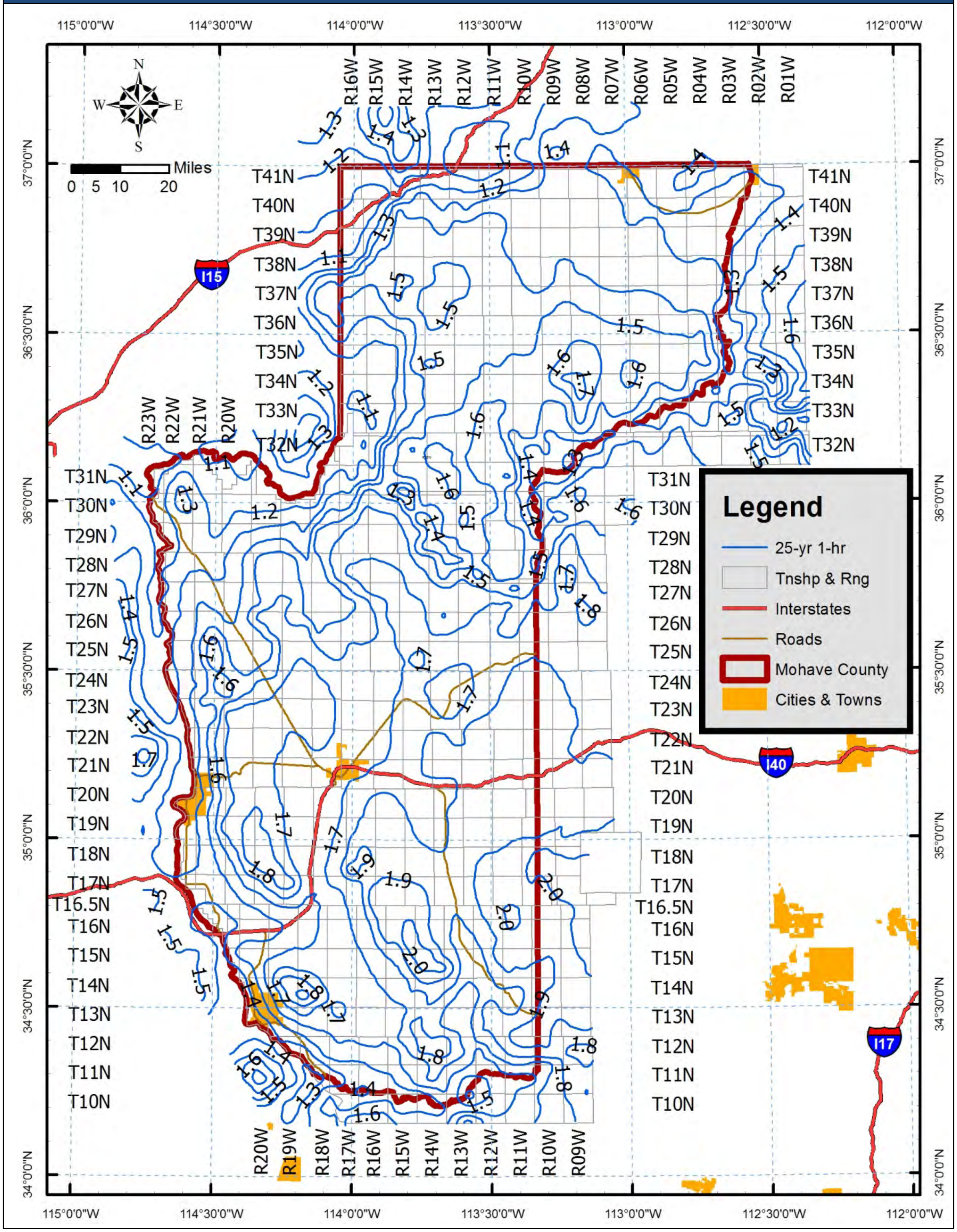


Figure B.36 NOAA Atlas 14 25-year 2-hour isopluvial map

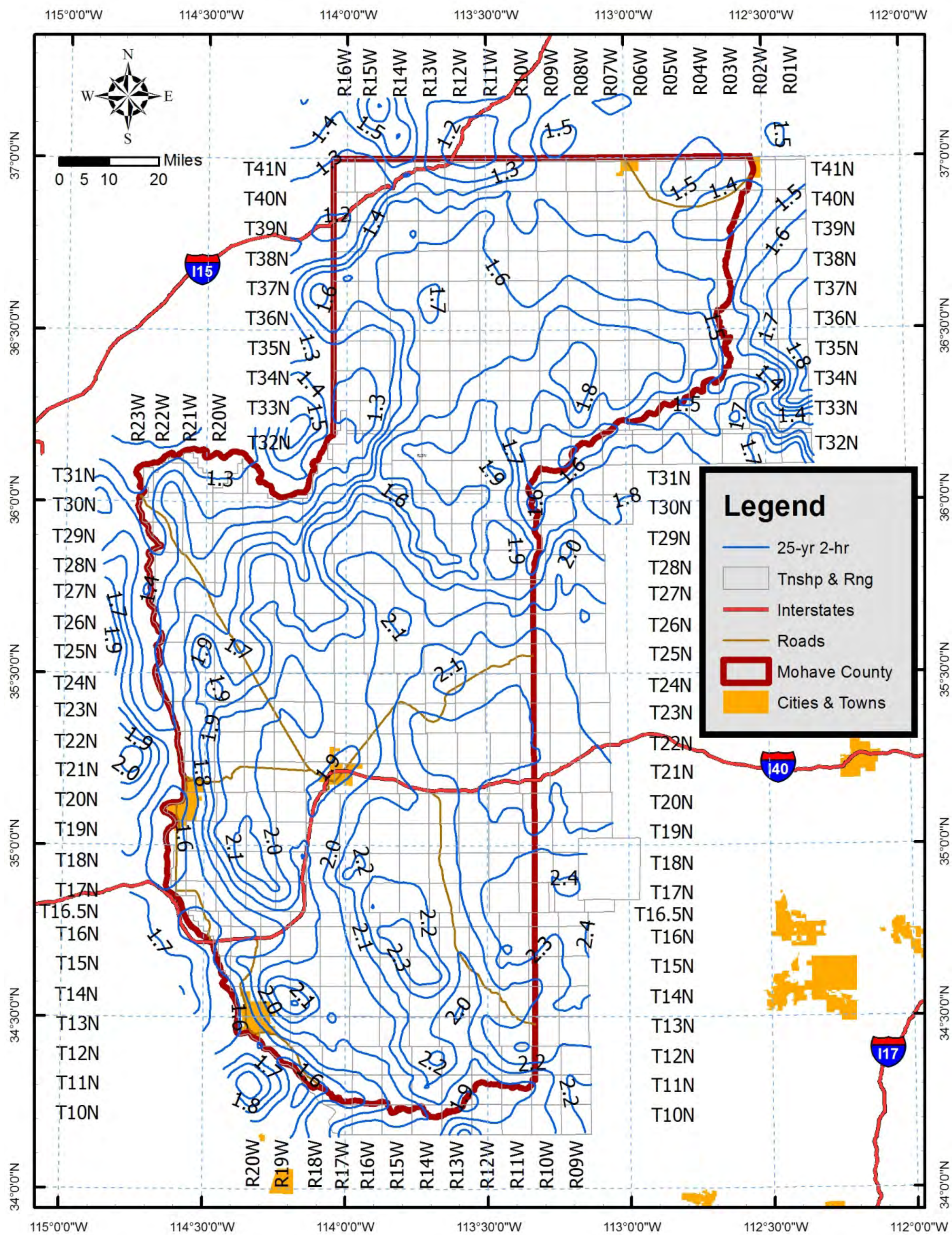


Figure B.37 NOAA Atlas 14 25-year 3-hour isopluvial map

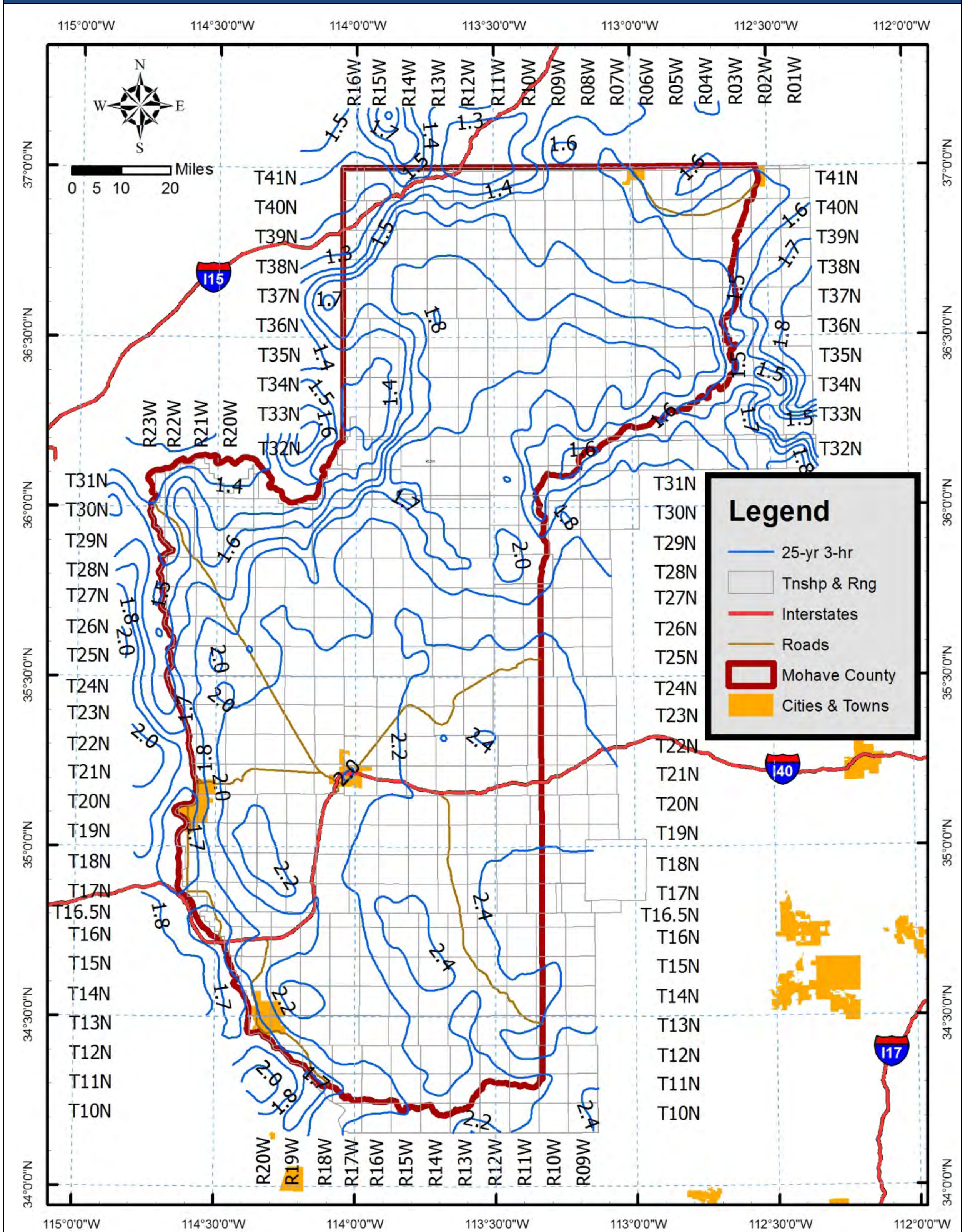


Figure B.38 NOAA Atlas 14 25-year 6-hour isopluvial map

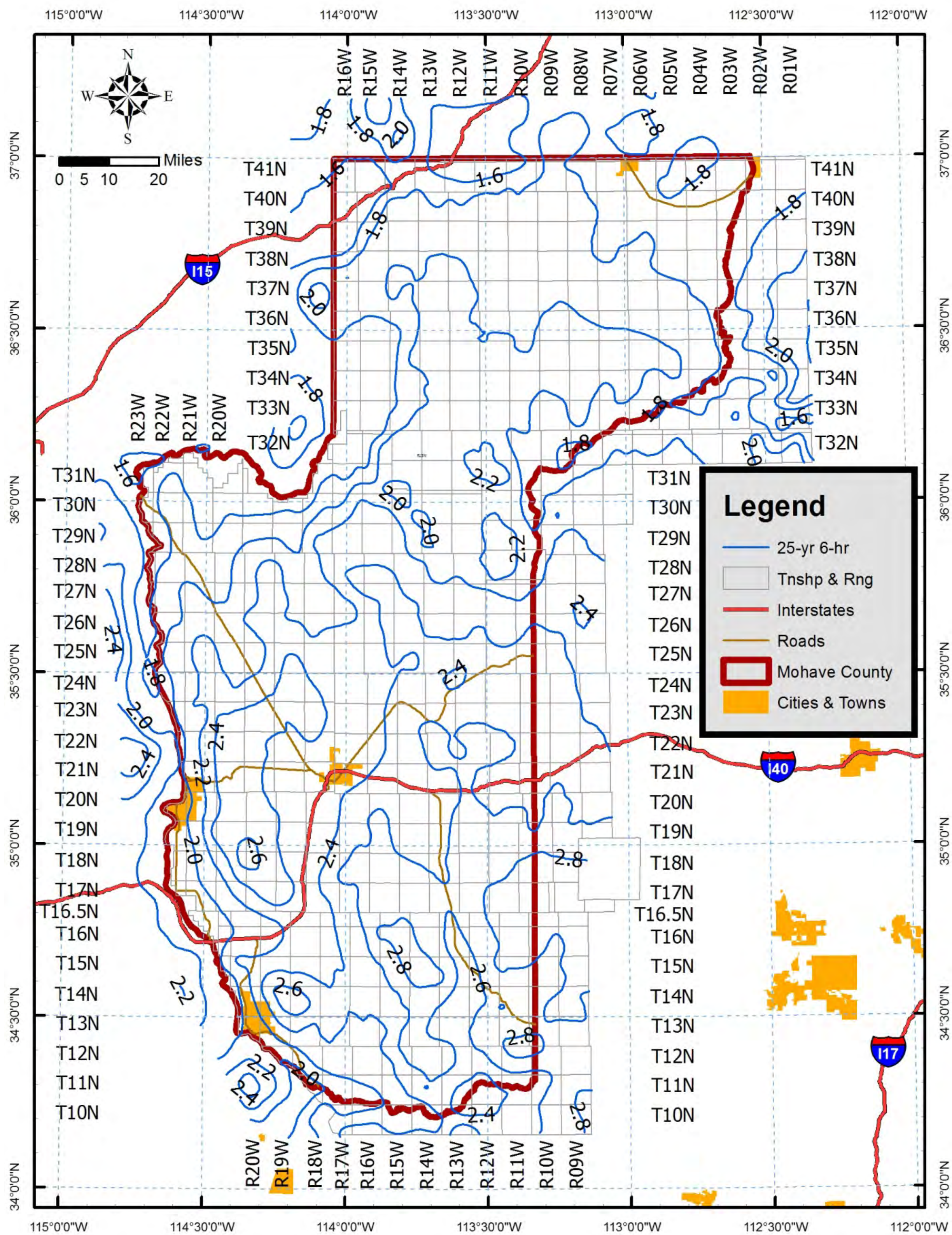


Figure B.39 NOAA Atlas 14 25-year 12-hour isopluvial map

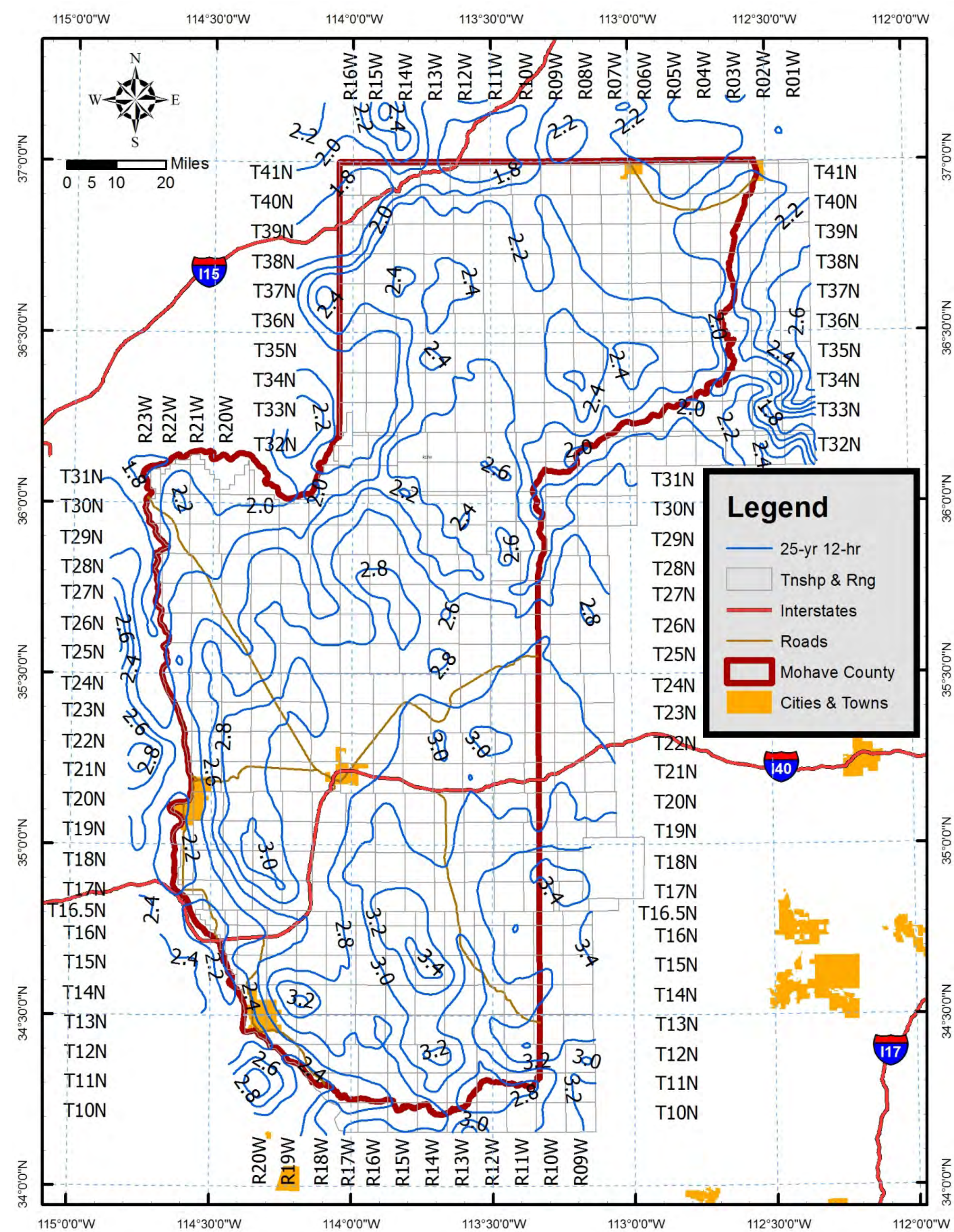
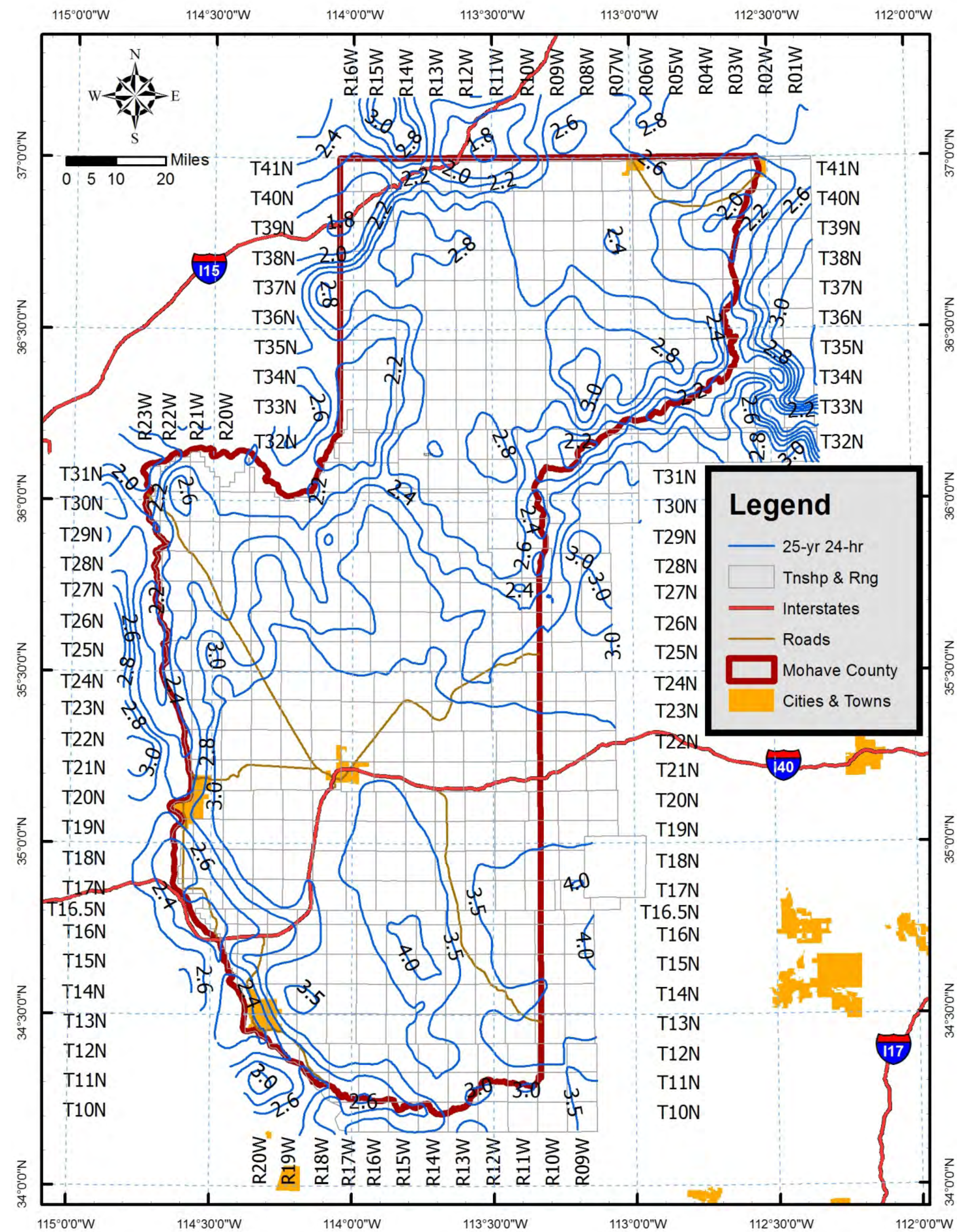


Figure B.40 NOAA Atlas 14 25-year 24-hour isopluvial map



B.5 50-YEAR STORM ISOPLUVIALS

Page Intentionally Left Blank

Figure B.41 NOAA Atlas 14 50-year 5-minute isopluvial map

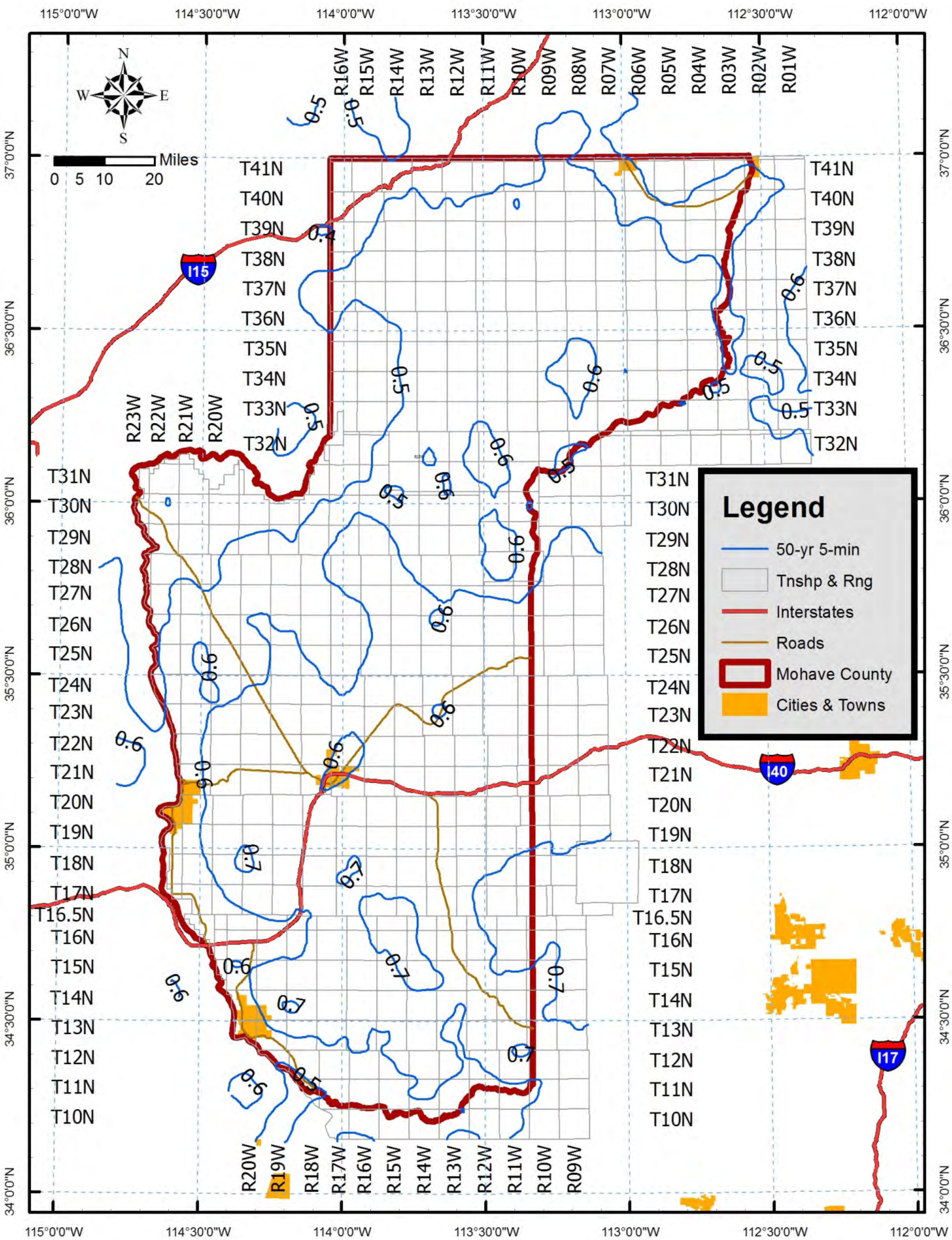


Figure B.42 NOAA Atlas 14 50-year 10-minute isopluvial map

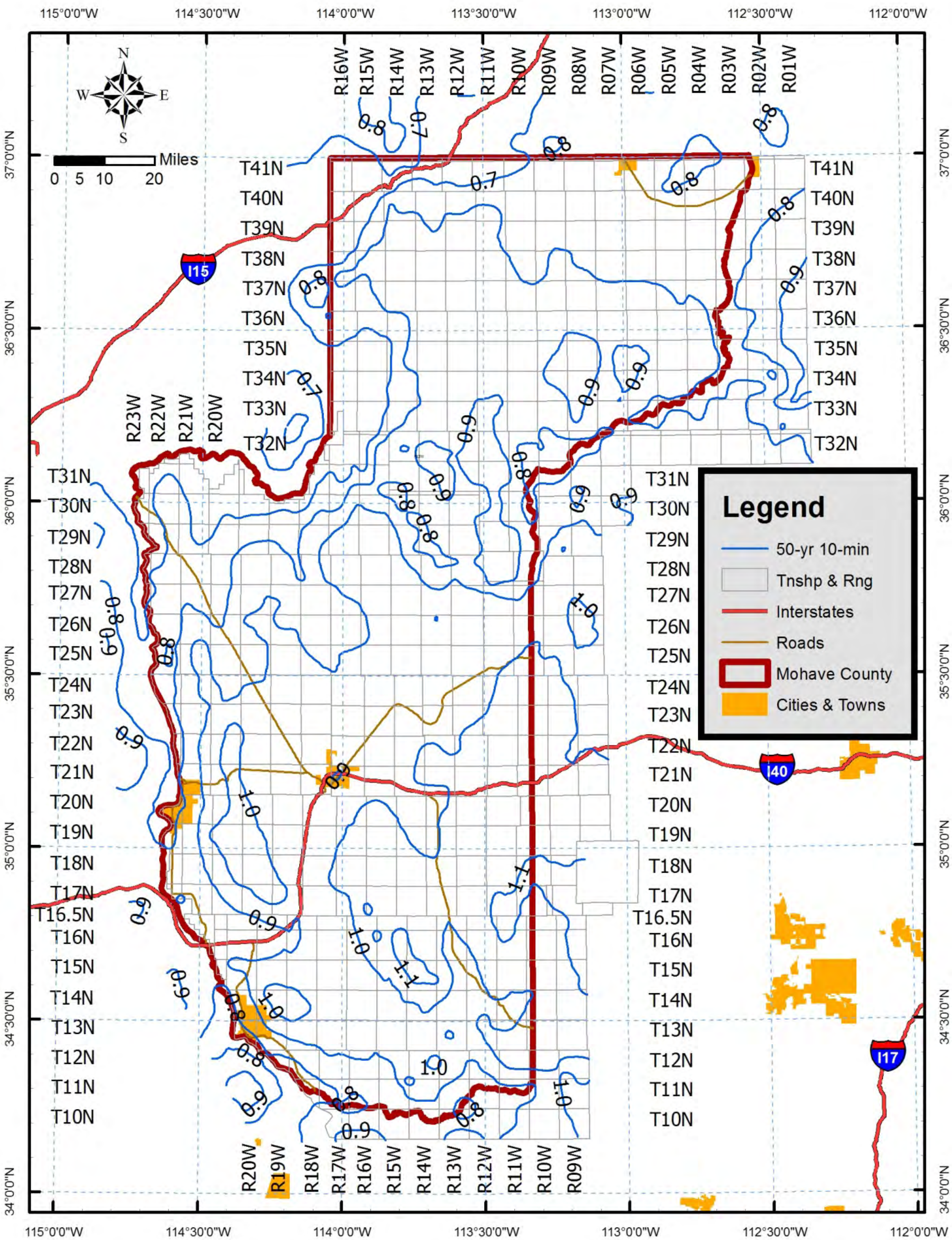


Figure B.43 NOAA Atlas 14 50-year 15-minute isopluvial map

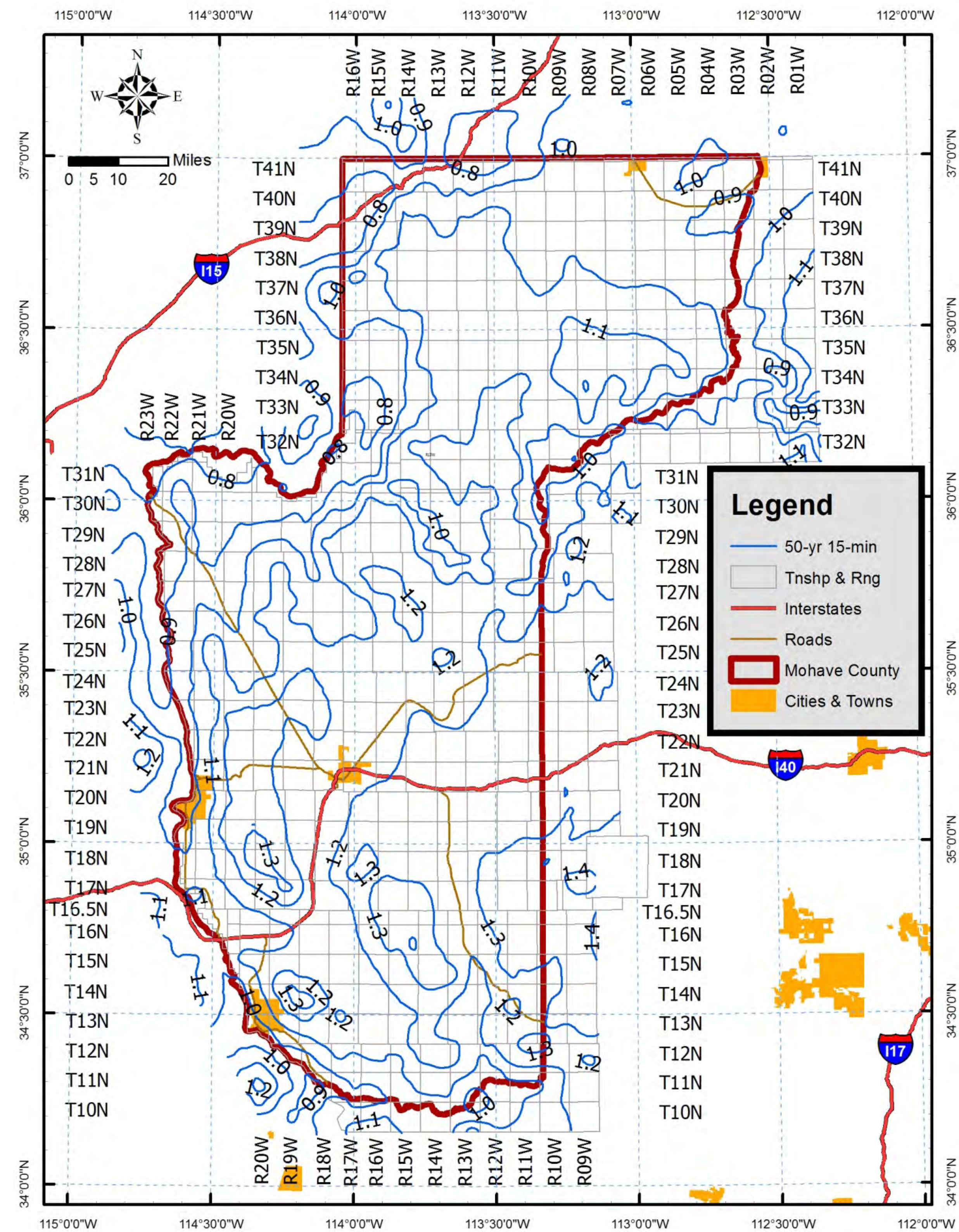


Figure B.44 NOAA Atlas 14 50-year 30-minute isopluvial map

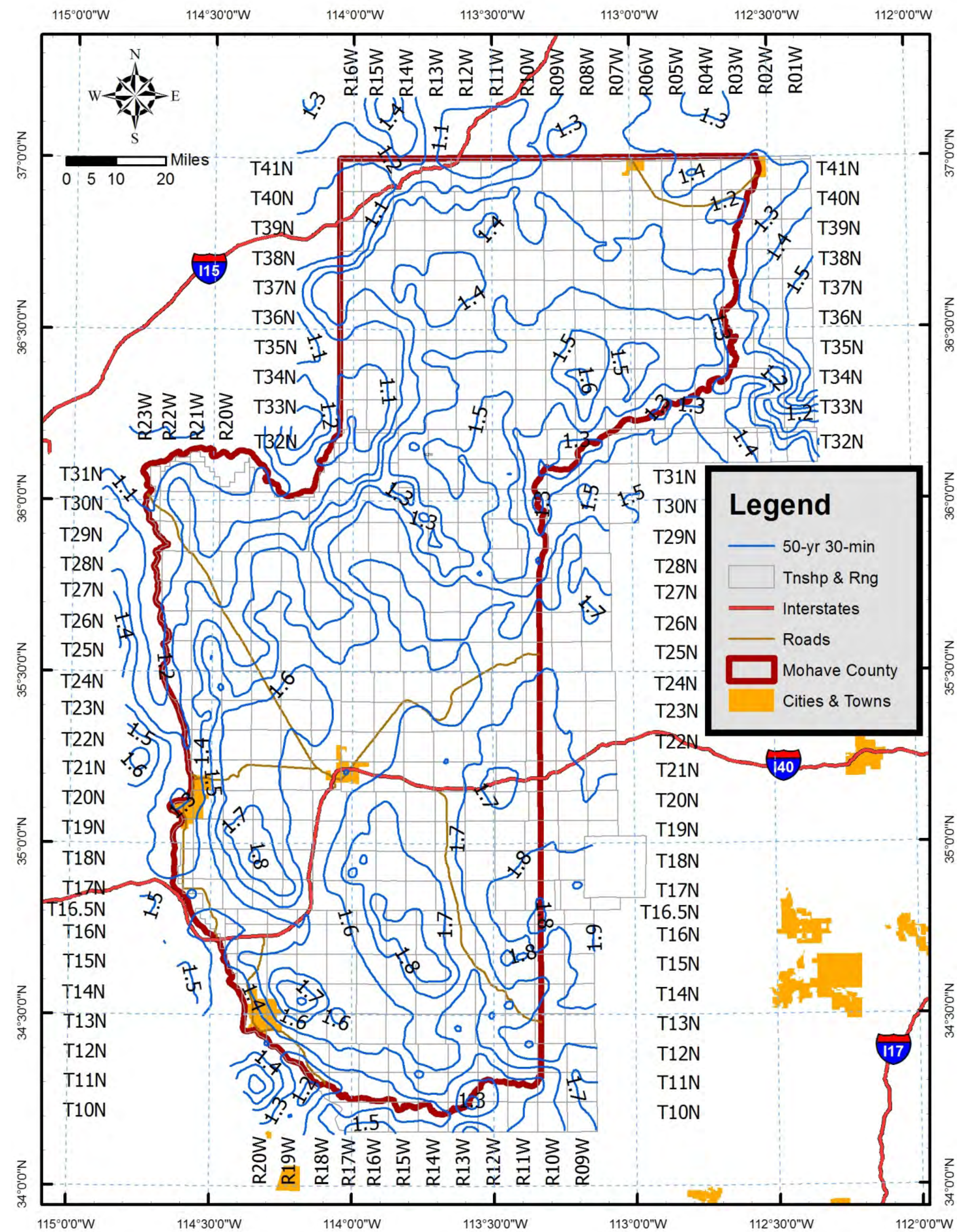


Figure B.45 NOAA Atlas 14 50-year 1-hour isopluvial map

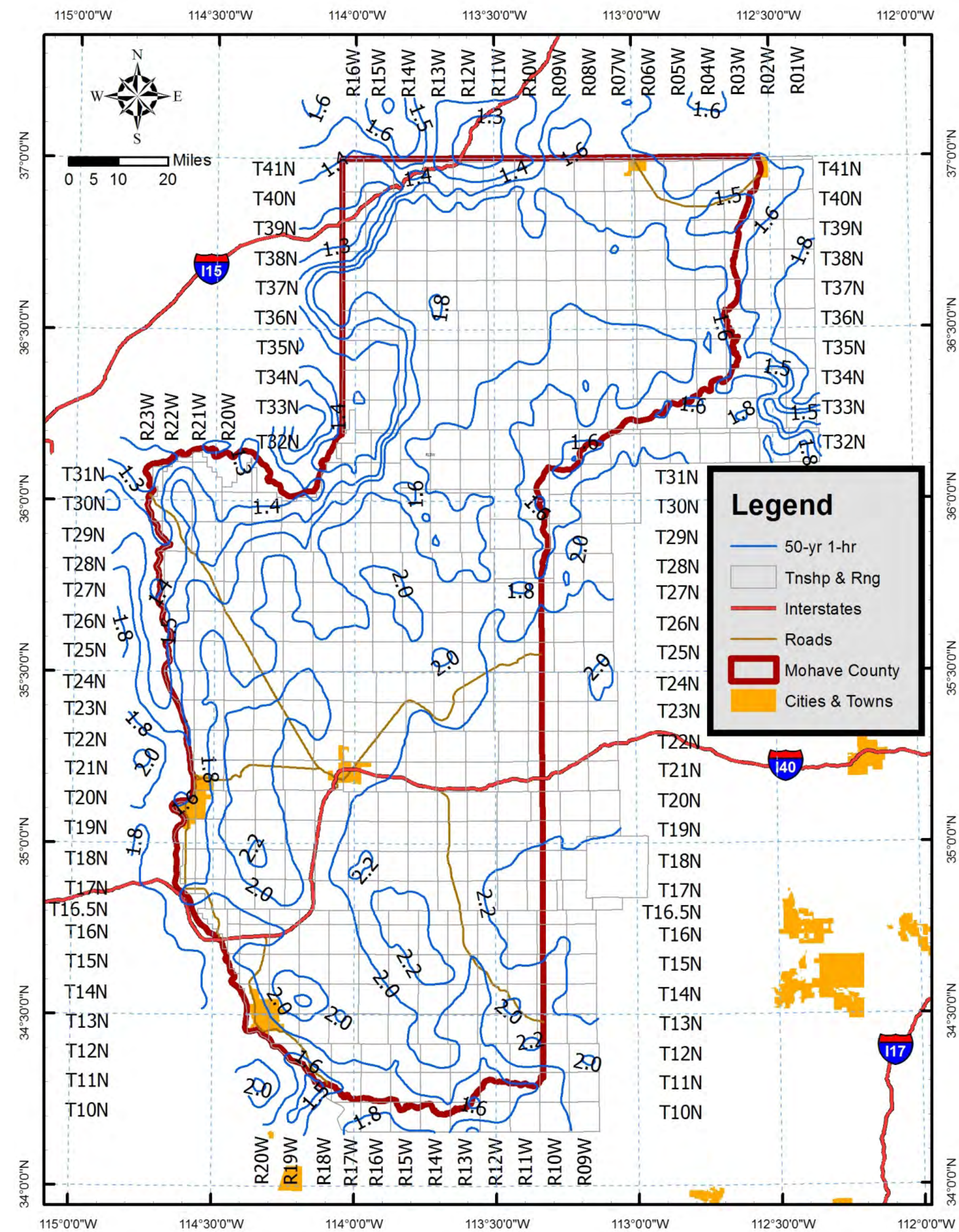


Figure B.46 NOAA Atlas 14 50-year 2-hour isopluvial map

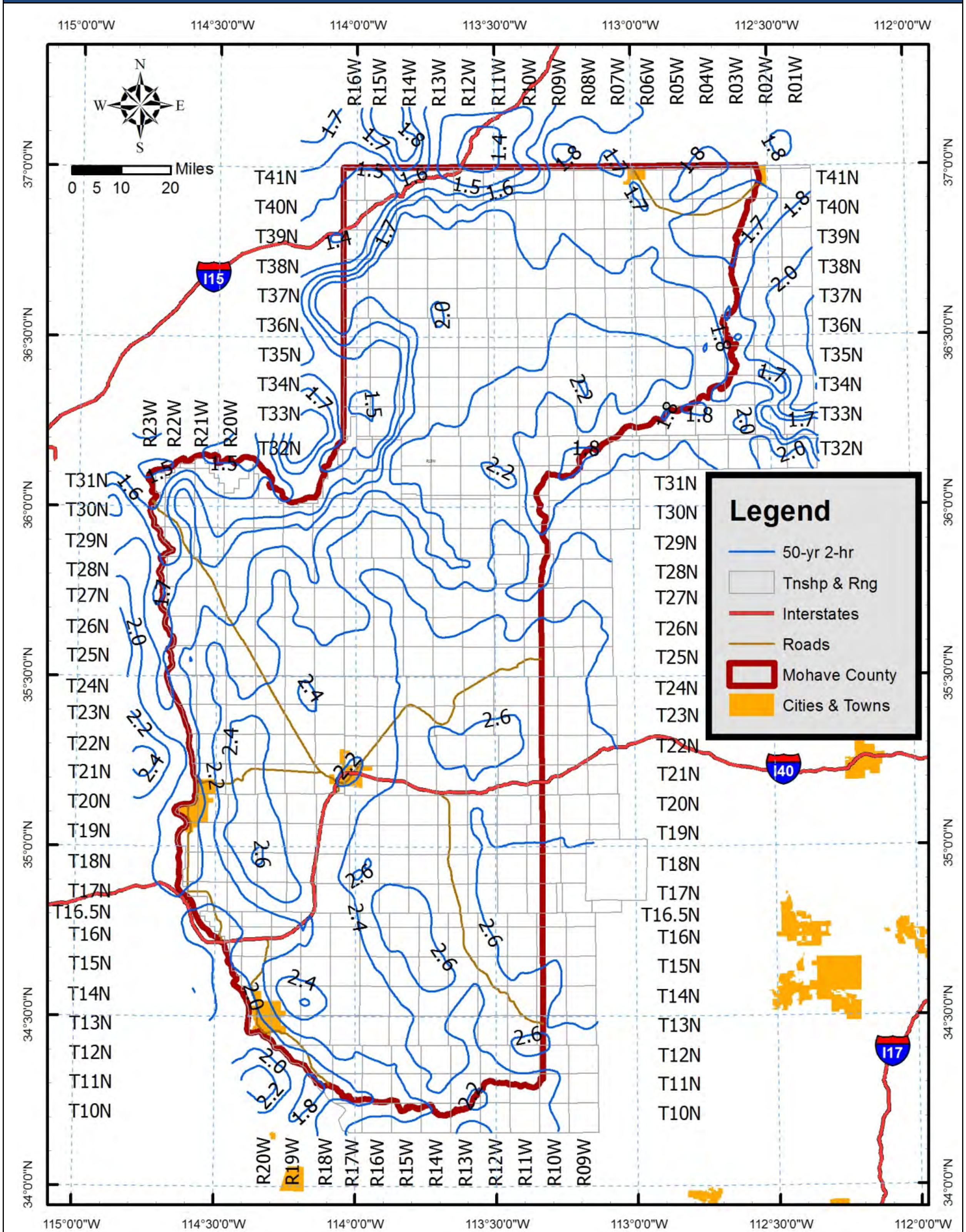


Figure B.47 NOAA Atlas 14 50-year 3-hour isopluvial map

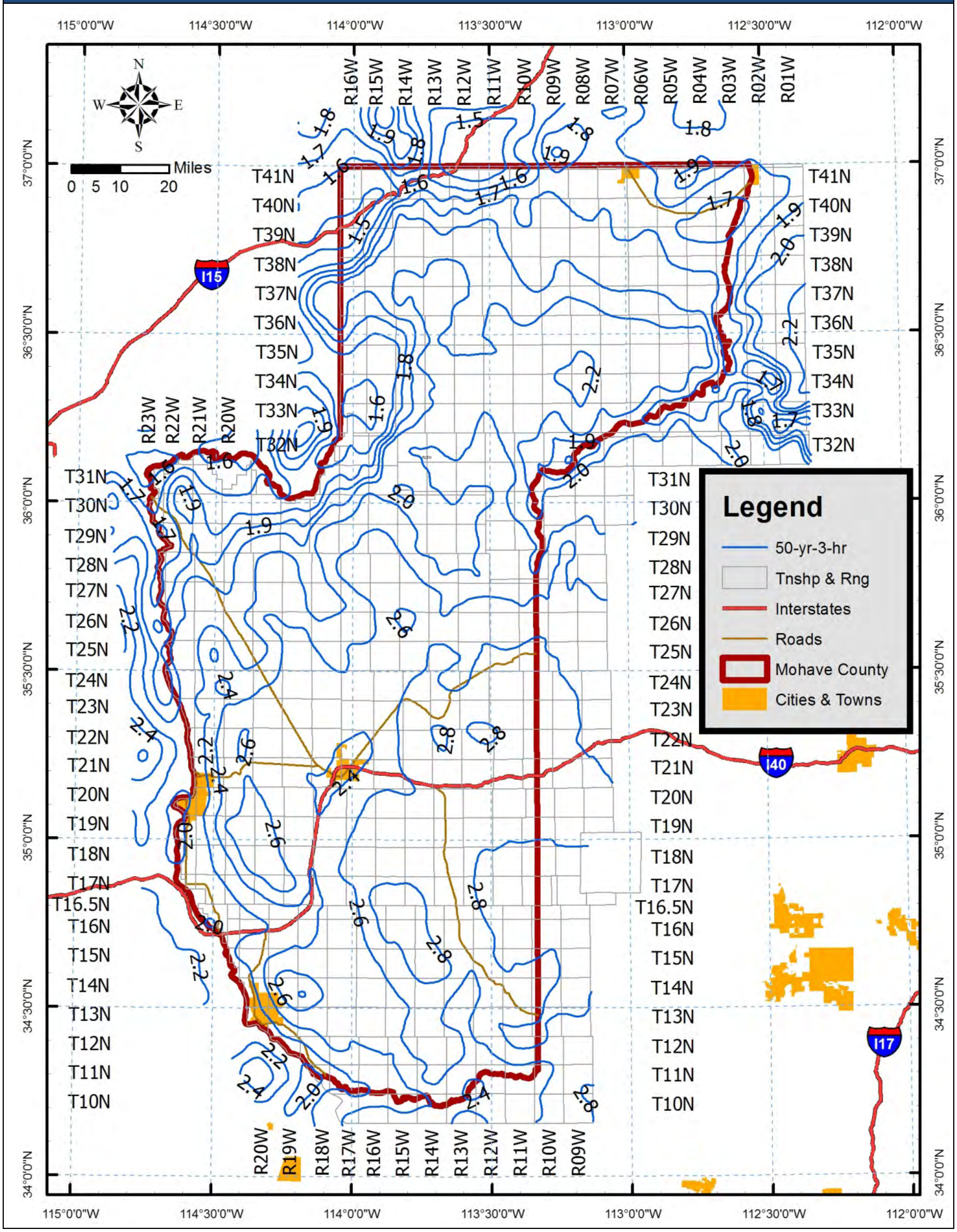


Figure B.48 NOAA Atlas 14 50-year 6-hour isopluvial map

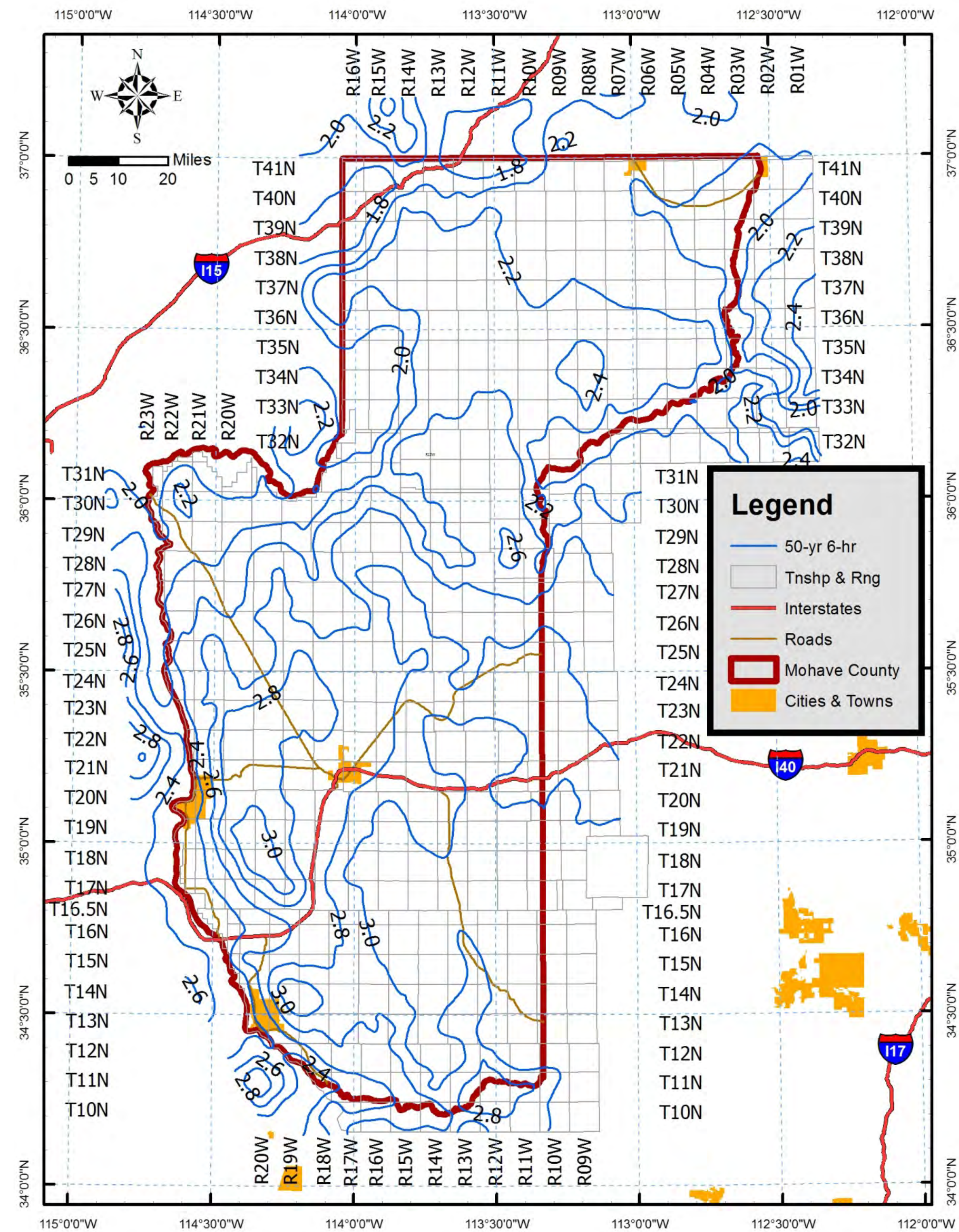


Figure B.49 NOAA Atlas 14 50-year 12-hour isopluvial map

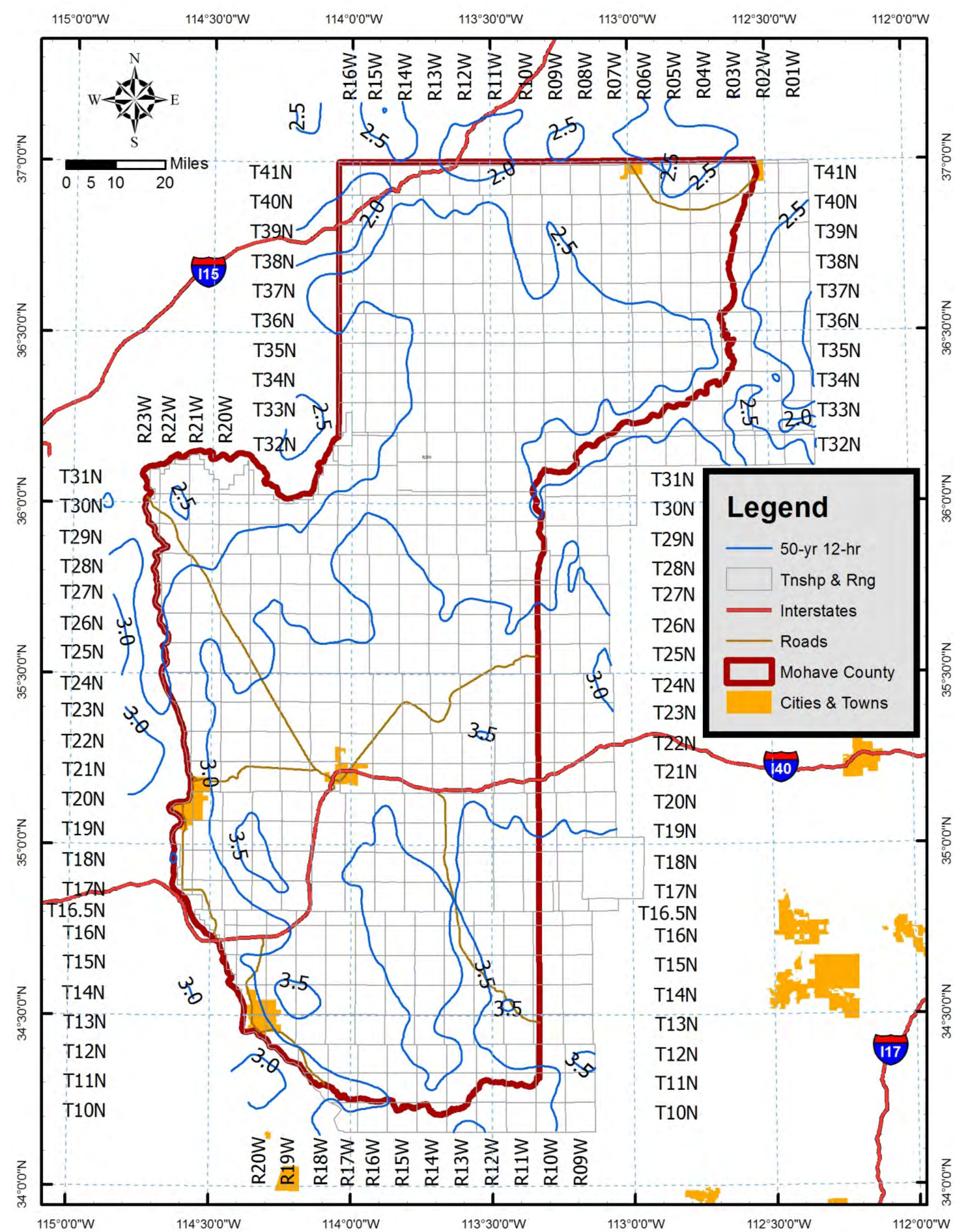
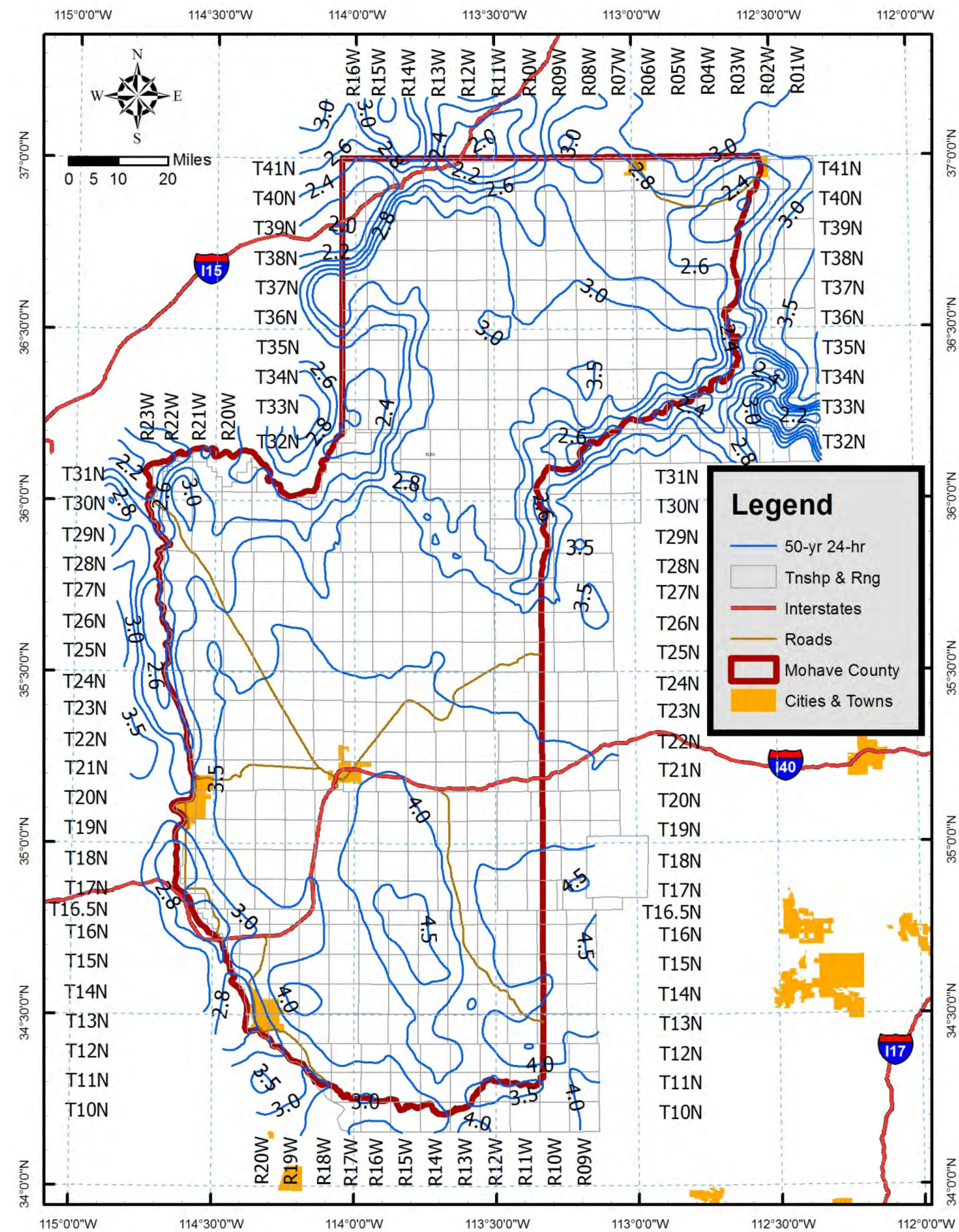


Figure B.50 NOAA Atlas 14 50-year 24-hour isopluvial map



B.6 100-YEAR STORM ISOPLUVIALS

Page Intentionally Left Blank

Figure B.51 NOAA Atlas 14 100-year 5-minute isopluvial map

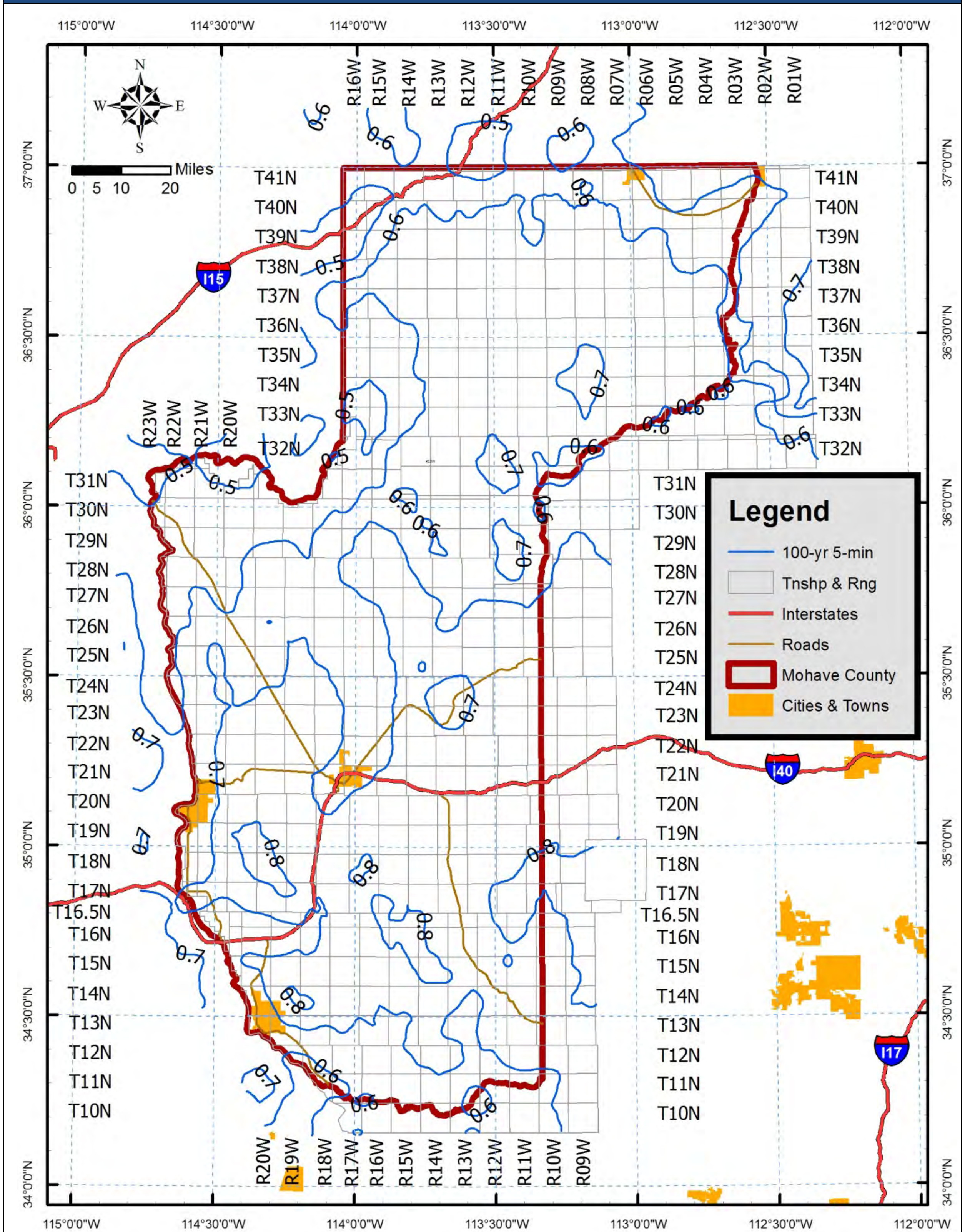


Figure B.52 NOAA Atlas 14 100-year 10-minute isopluvial map

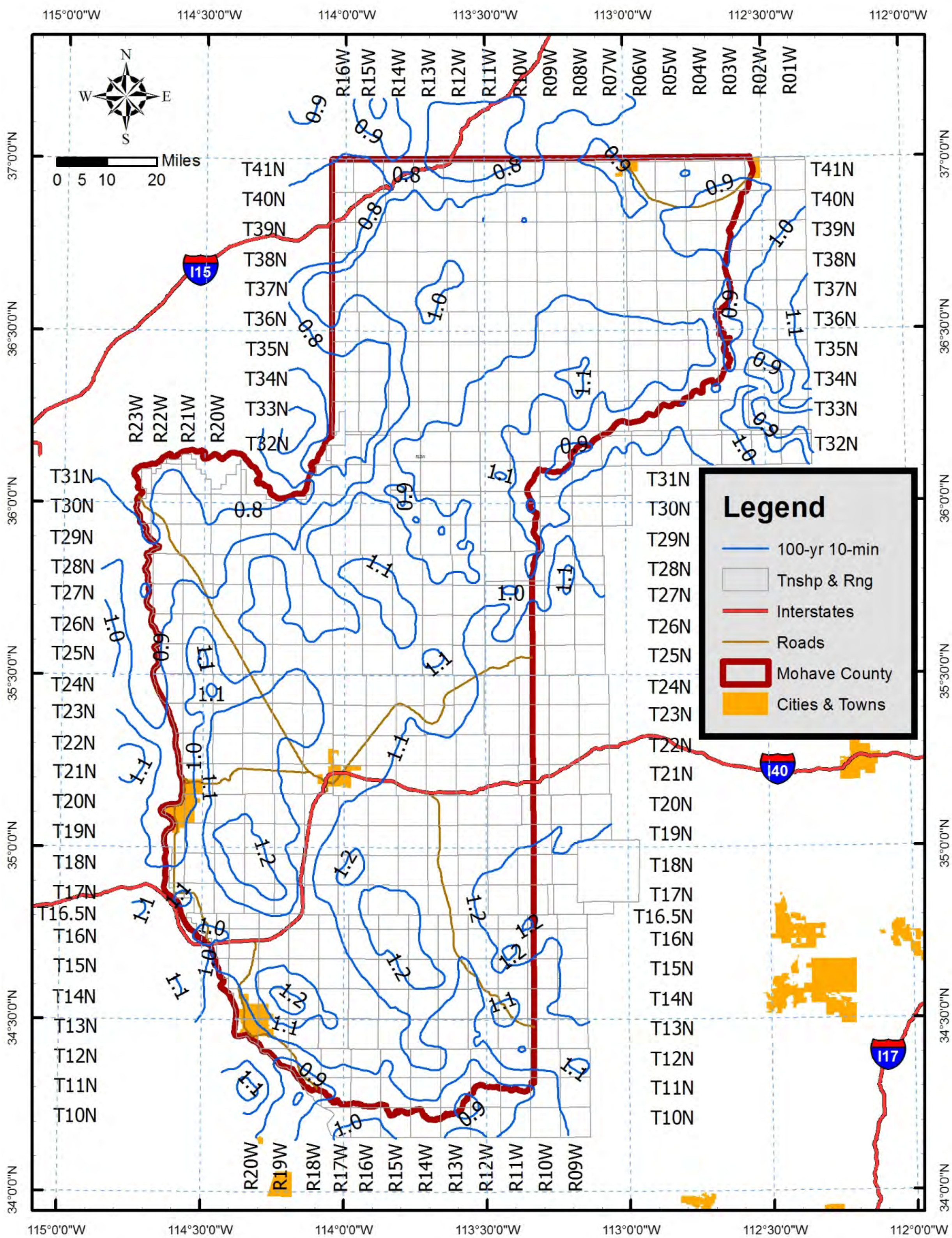


Figure B.53 NOAA Atlas 14 100-year 15-minute isopluvial map

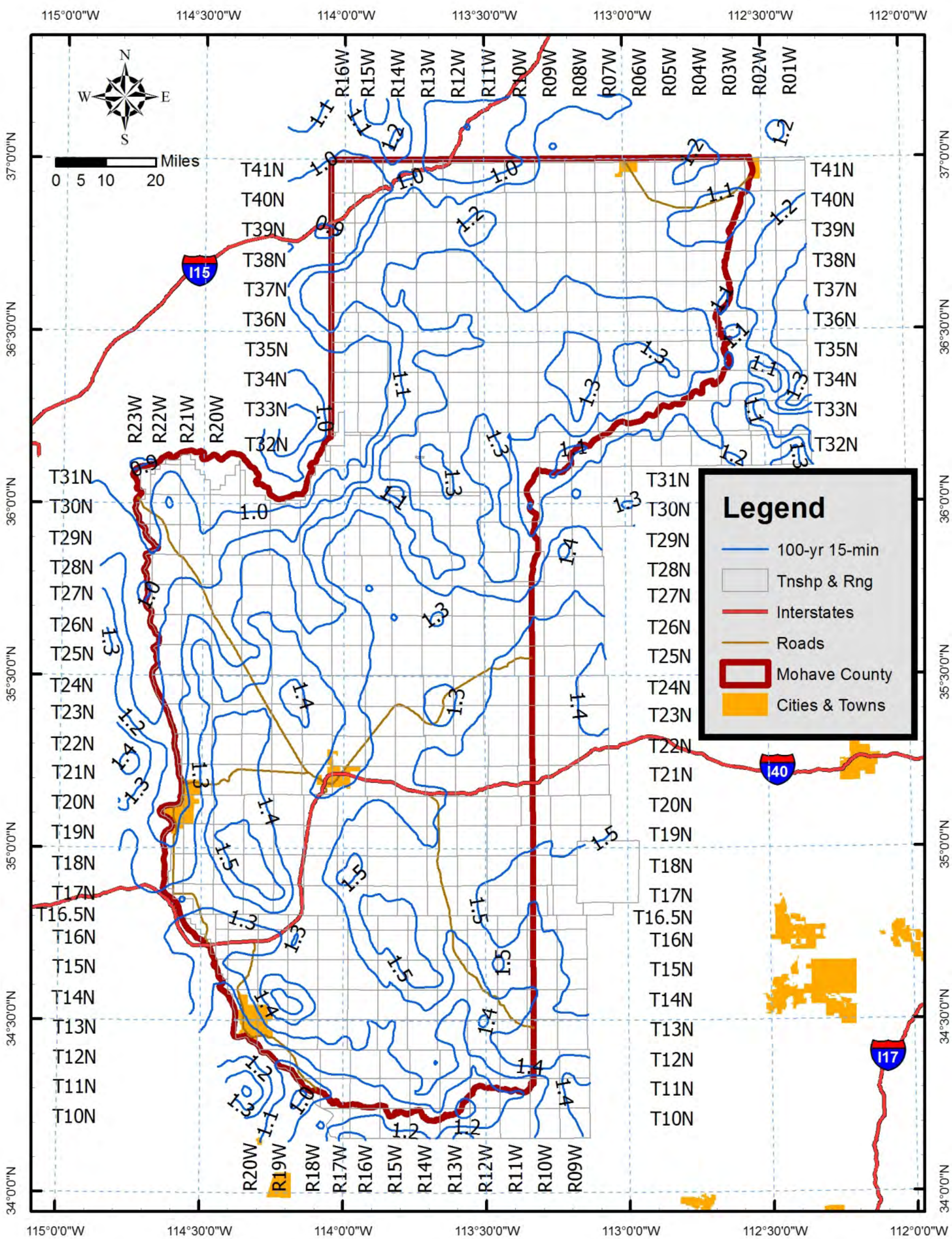


Figure B.54 NOAA Atlas 14 100-year 30-minute isopluvial map

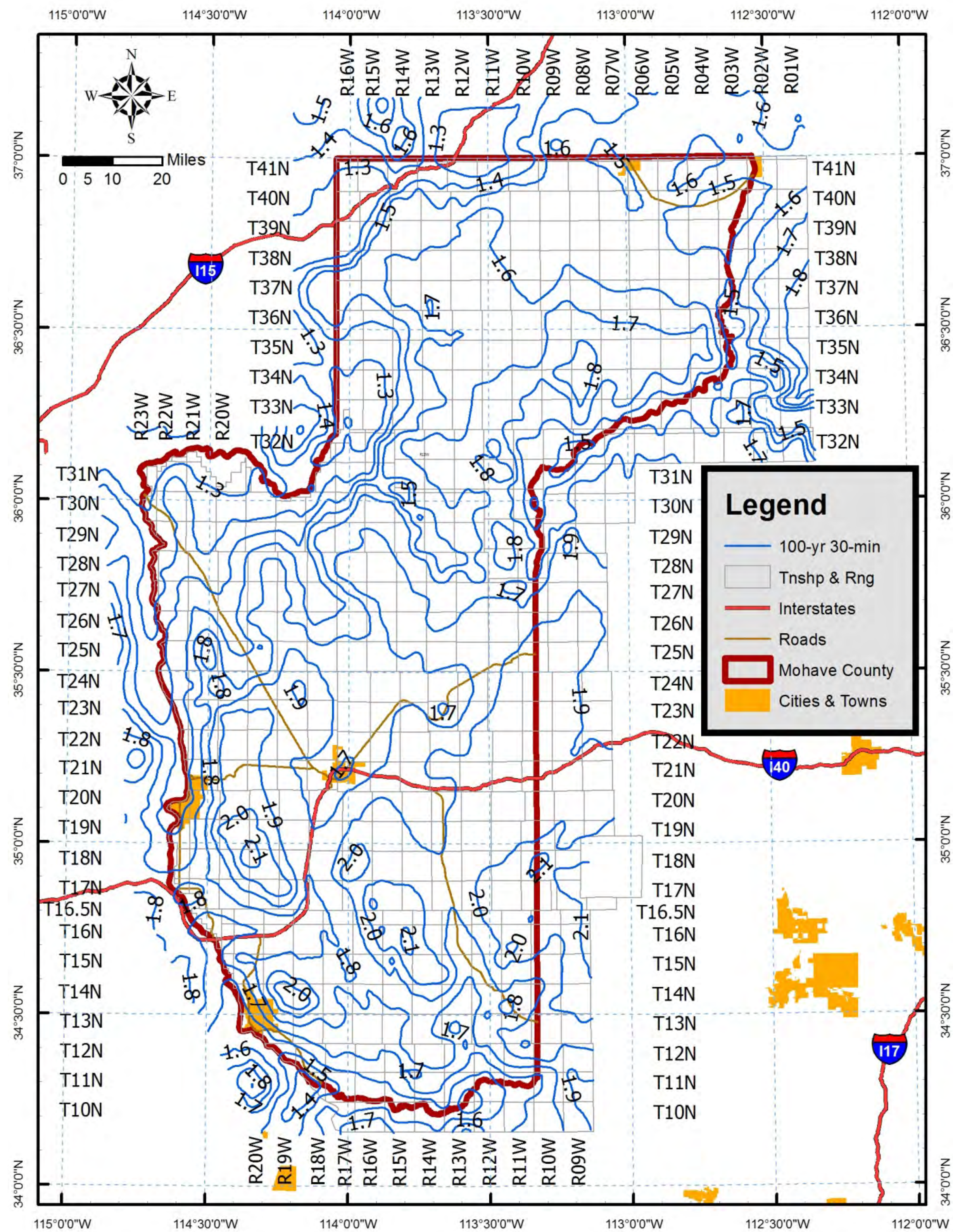


Figure B.55 NOAA Atlas 14 100-year 1-hour isopluvial map

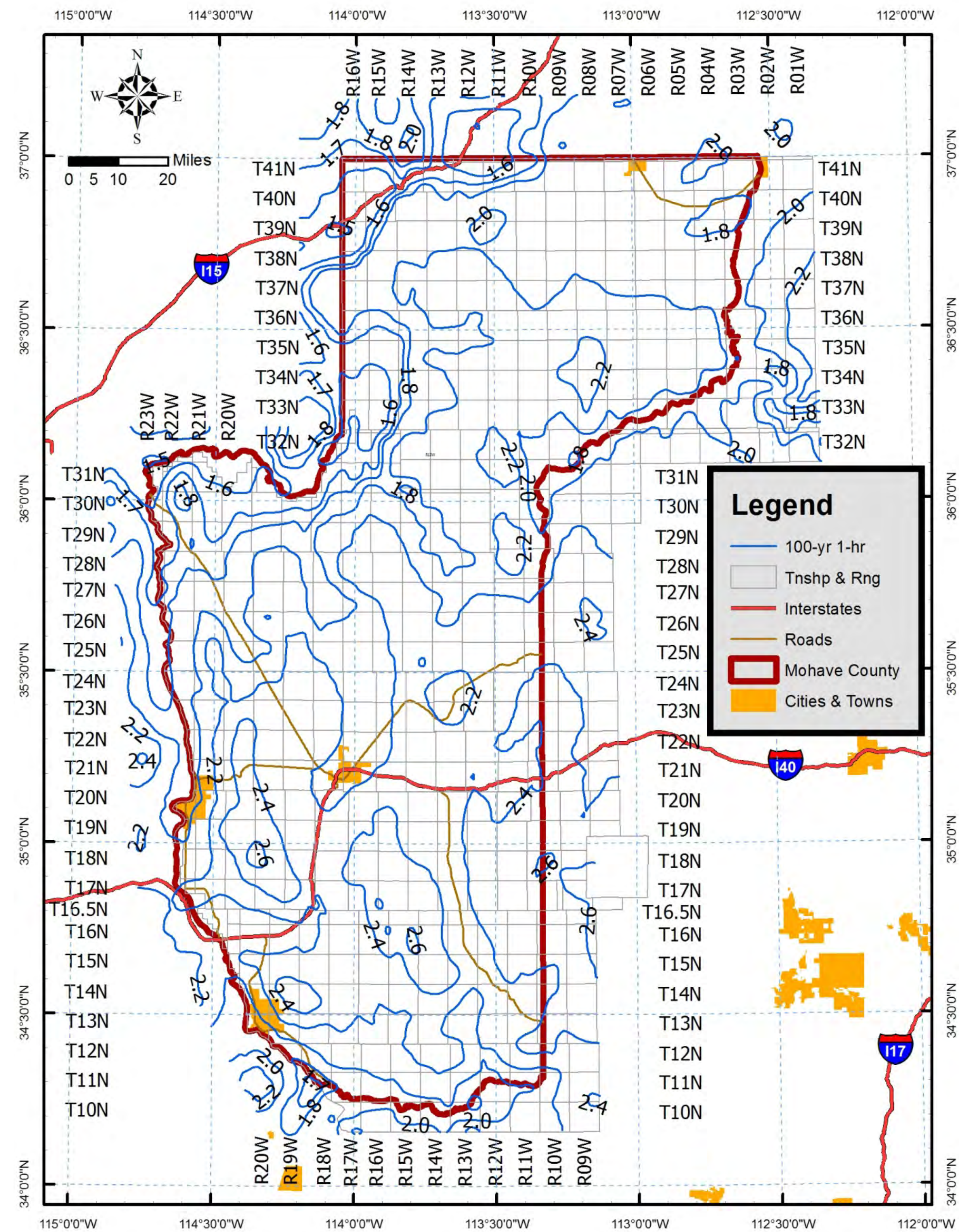


Figure B.56 NOAA Atlas 14 100-year 2-hour isopluvial map

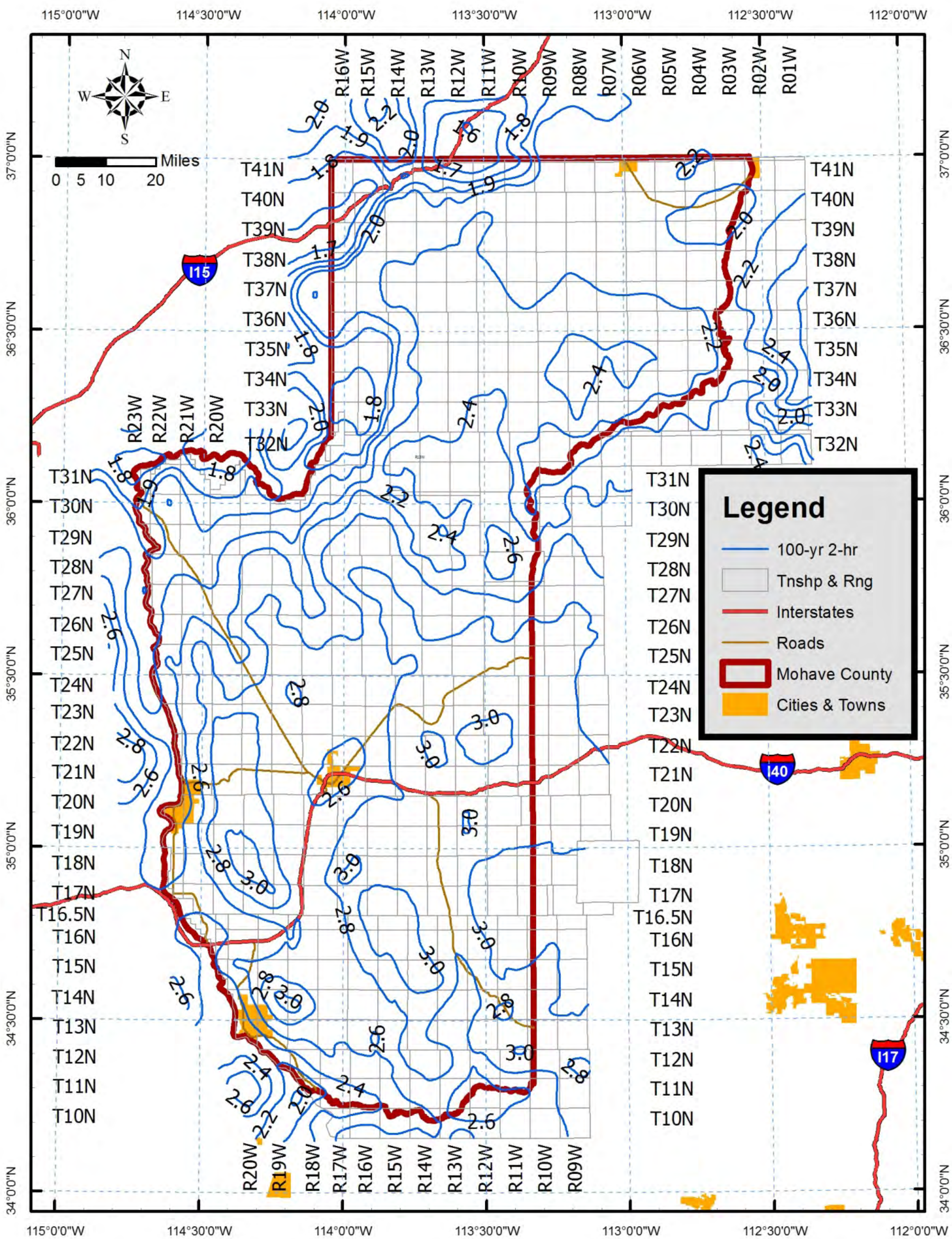


Figure B.57 NOAA Atlas 14 100-year 3-hour isopluvial map

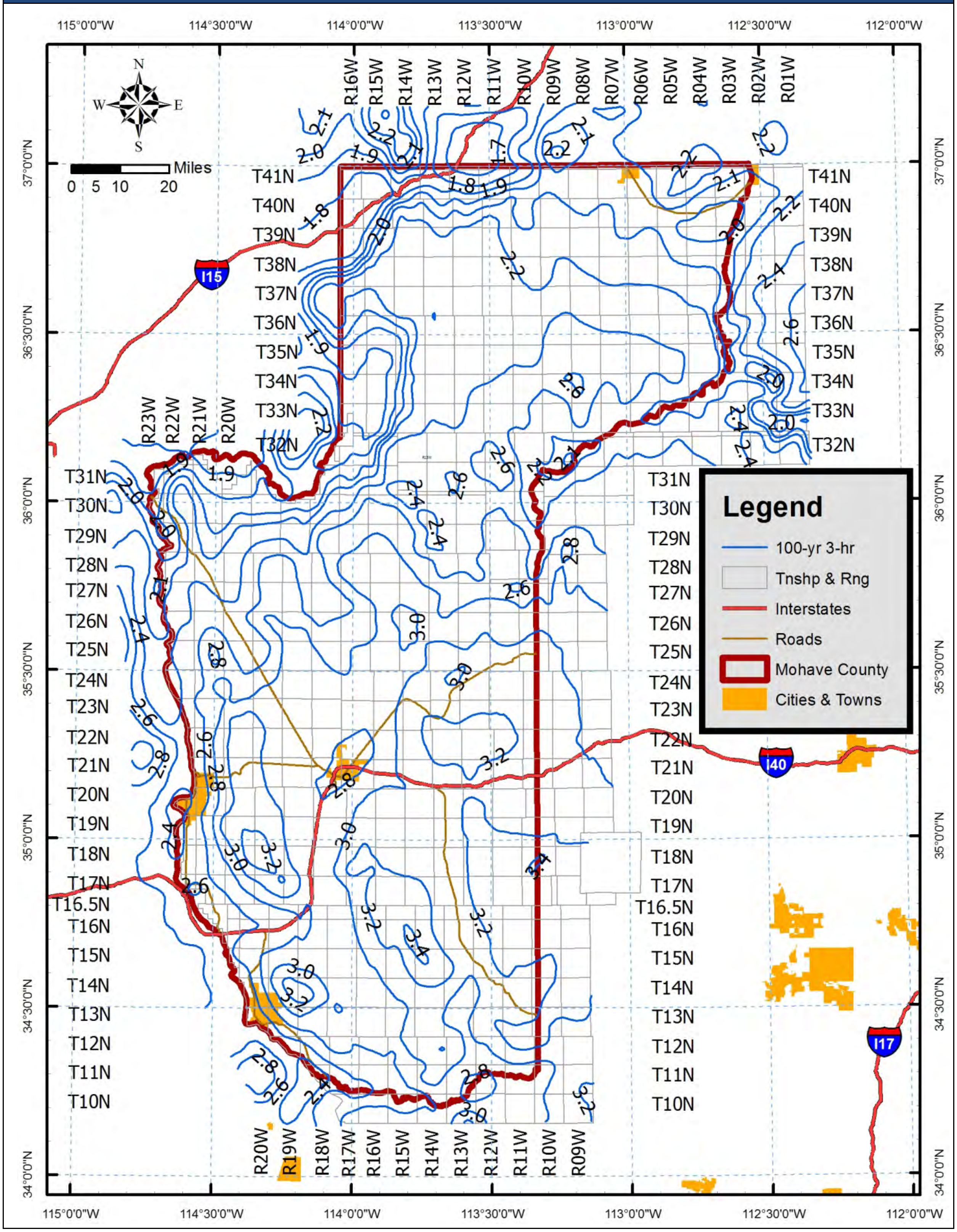


Figure B.58 NOAA Atlas 14 100-year 6-hour isopluvial map

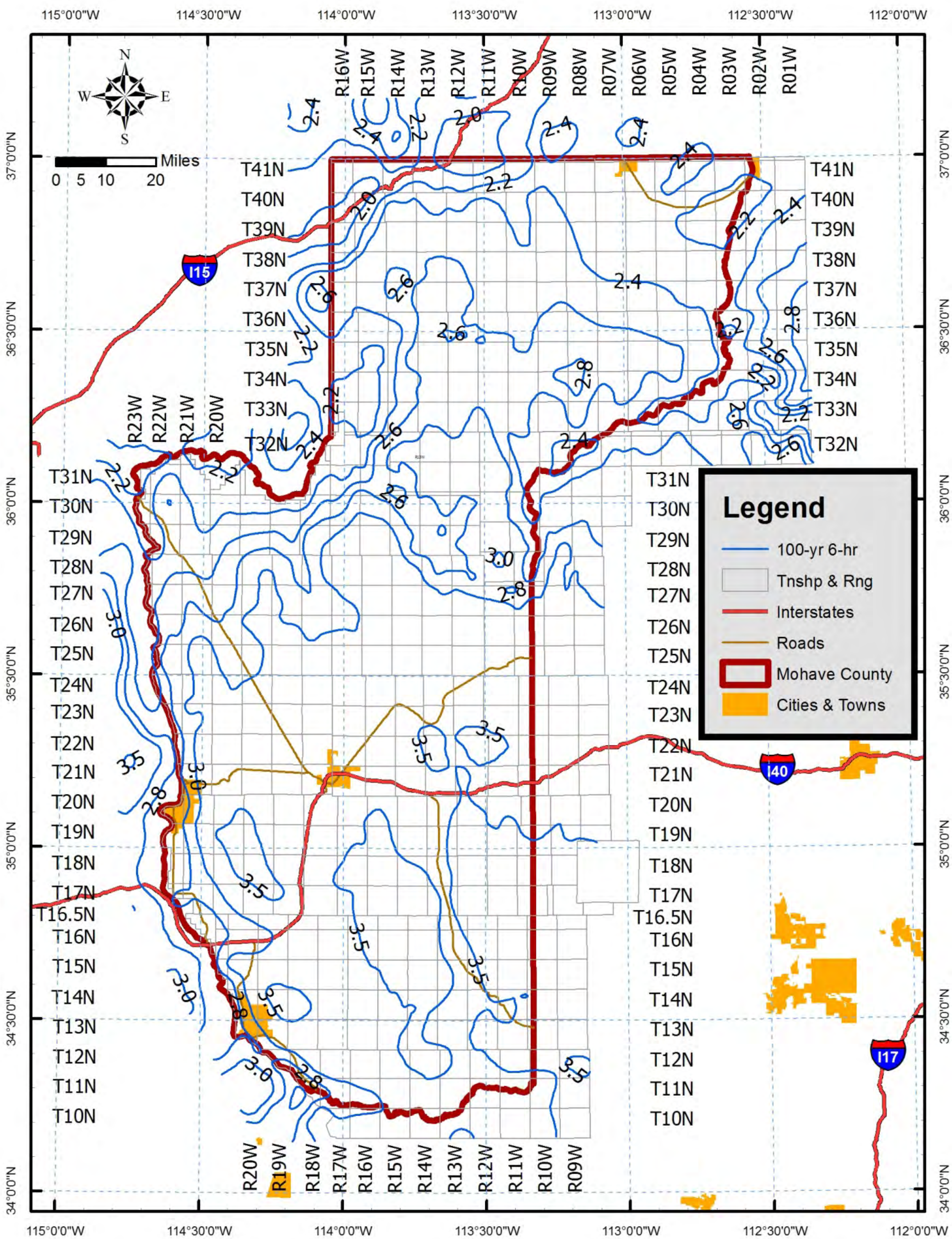


Figure B.59 NOAA Atlas 14 100-year 12-hour isopluvial map

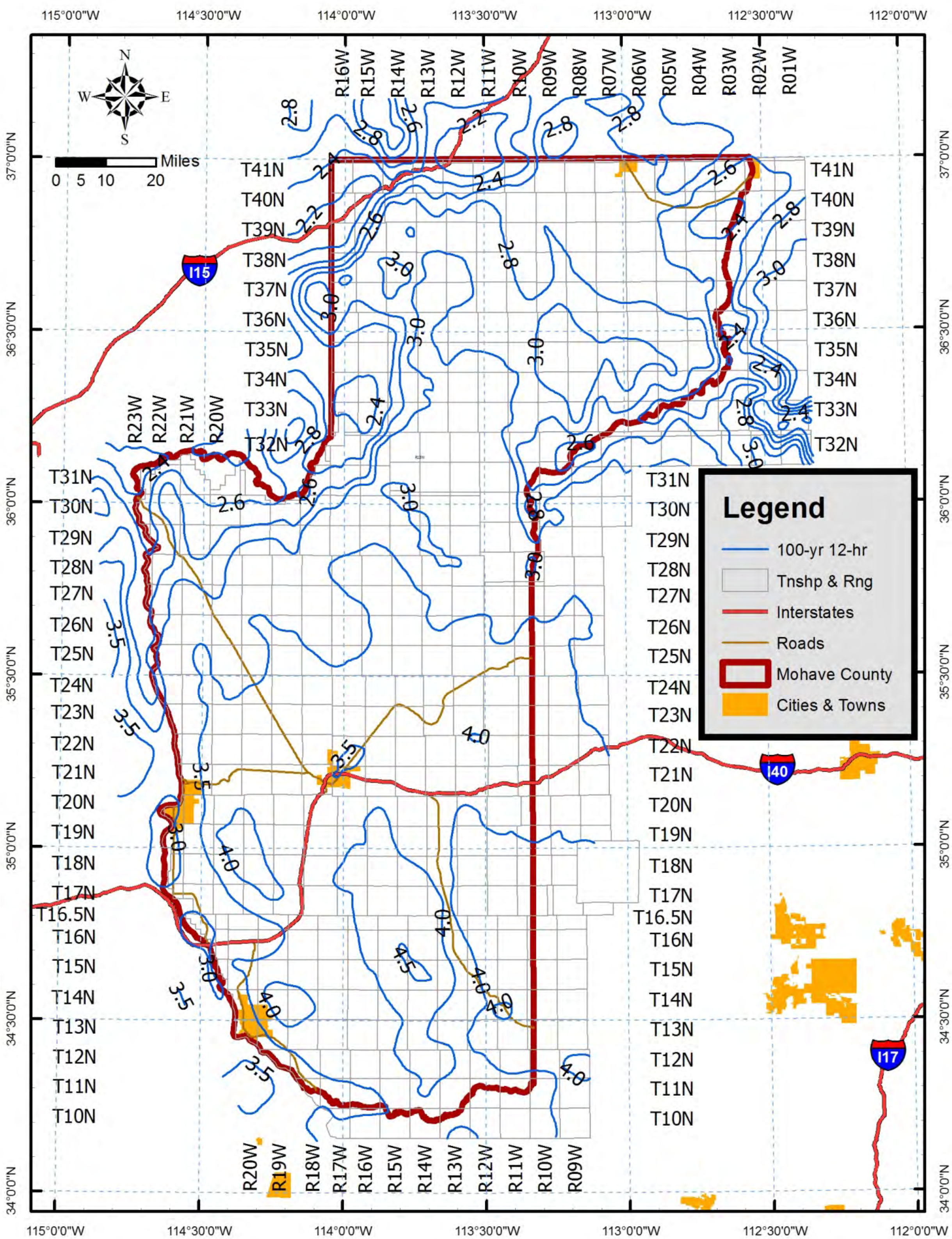
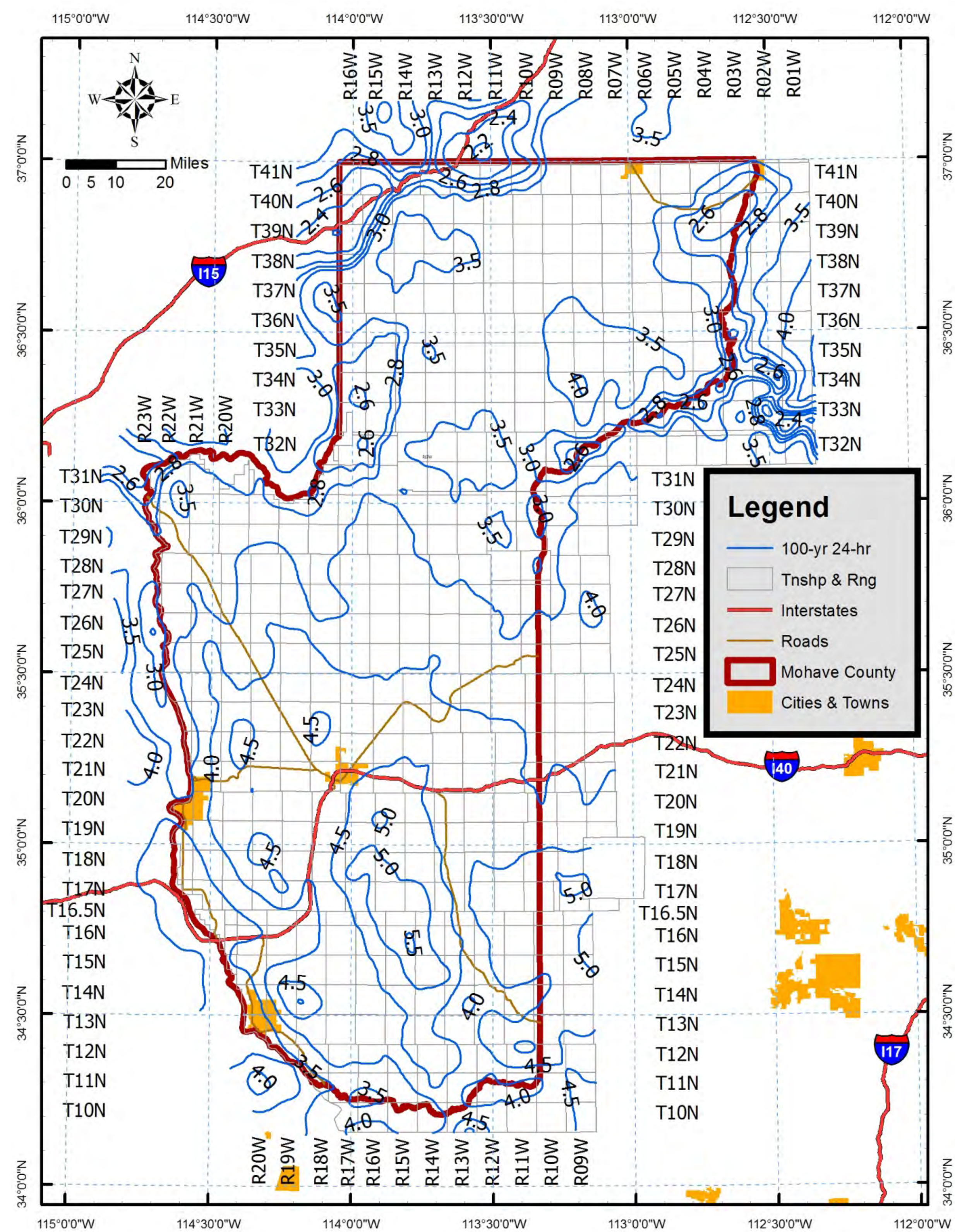


Figure B.60 NOAA Atlas 14 100-year 24-hour isopluvial map



B.7 RAINFALL FORMS AND GRAPH PAPER

Page Intentionally Left Blank

Rainfall Depth-Duration-Frequency Table						
Project No:			Date:			
Project Name:						
Location/Watershed:						
Designer:			Checked by:			
	Rainfall Depth$_{(i,j)}$, in inches					
	Storm Frequency$_{(j)}$, in years					
Duration$_{(i)}$	2	5	10	25	50	100
(1)	(2)	(3)	(4)	(5)	(6)	(7)
5-min						
10-min						
15-min						
30-min						
1-hour						
2-hour						
3-hour						
6-hour						
12-hour						
24-hour						

Rainfall Intensity-Duration-Frequency Table						
Project No:			Date:			
Project Name:						
Location/Watershed:						
Designer:			Checked by:			
	Rainfall Intensity$_{(i,j)}$, in inches/hour					
	Storm Frequency$_{(j)}$, in years					
Duration$_{(i)}$	2	5	10	25	50	100
(1)	(2)	(3)	(4)	(5)	(6)	(7)
5-min						
10-min						
15-min						
30-min						
1-hour						
2-hour						
3-hour						
6-hour						
12-hour						
24-hour						

The rainfall intensity is computed as follows: $$Intensity_{(i,j)} = \frac{Depth_{(i,j)}}{(Duration_{(i)})(60)}$$

where:

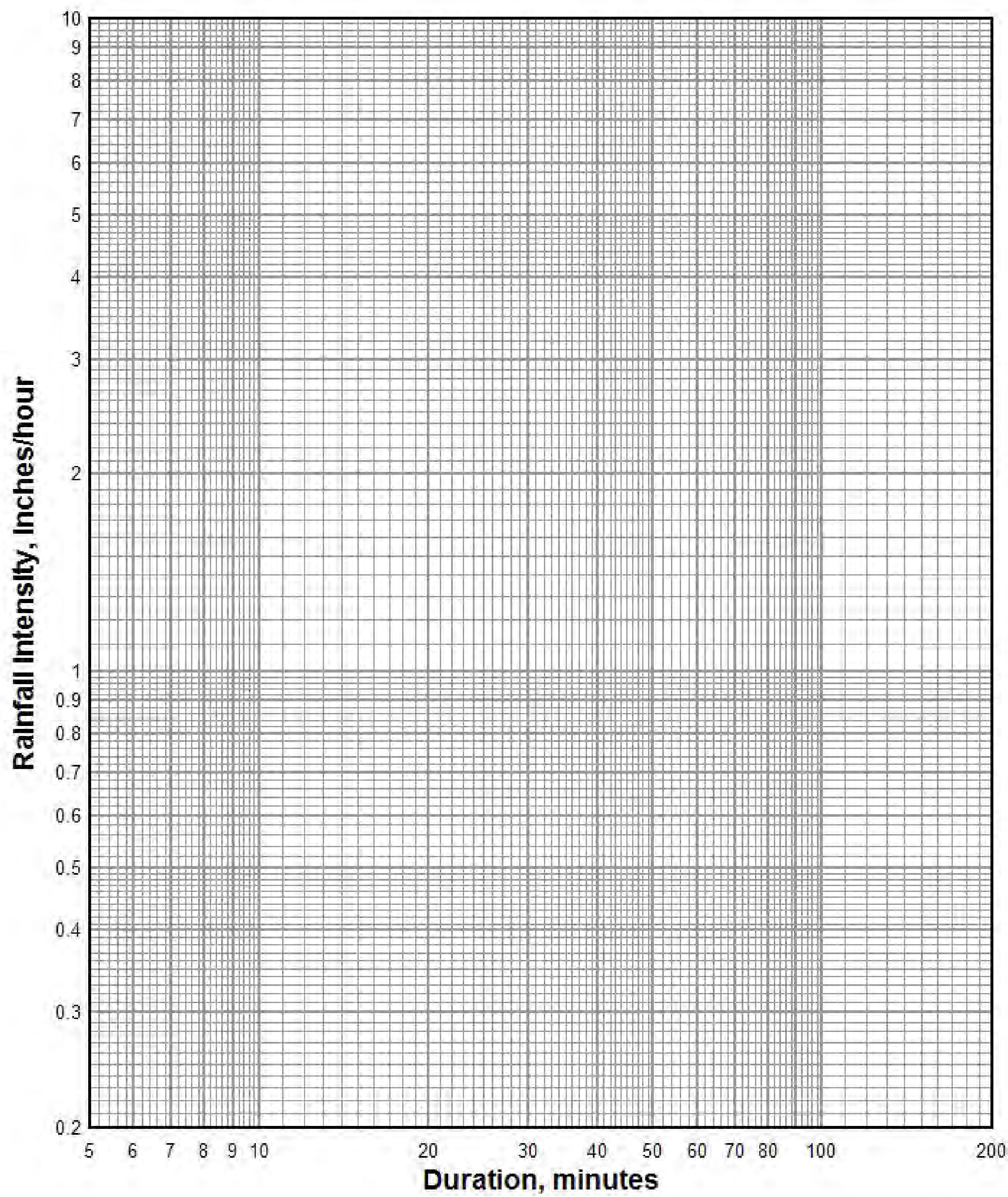
Depth$_{(i,j)}$ = Point rainfall corresponding to Duration$_{(i)}$ and Frequency$_{(j)}$ in inches.

Duration$_{(i)}$ = Duration of point rainfall for Frequency$_{(j)}$ in minutes.

Intensity$_{(i,j)}$ = Rainfall intensity corresponding to Duration$_{(i)}$ and Frequency$_{(j)}$ in inches/hour.

Figure B.61 Intensity-Duration-Frequency Graph

Location/Watershed:



Page Intentionally Left Blank

C. PROCEDURE FOR ESTIMATION OF VEGETATIVE COVER

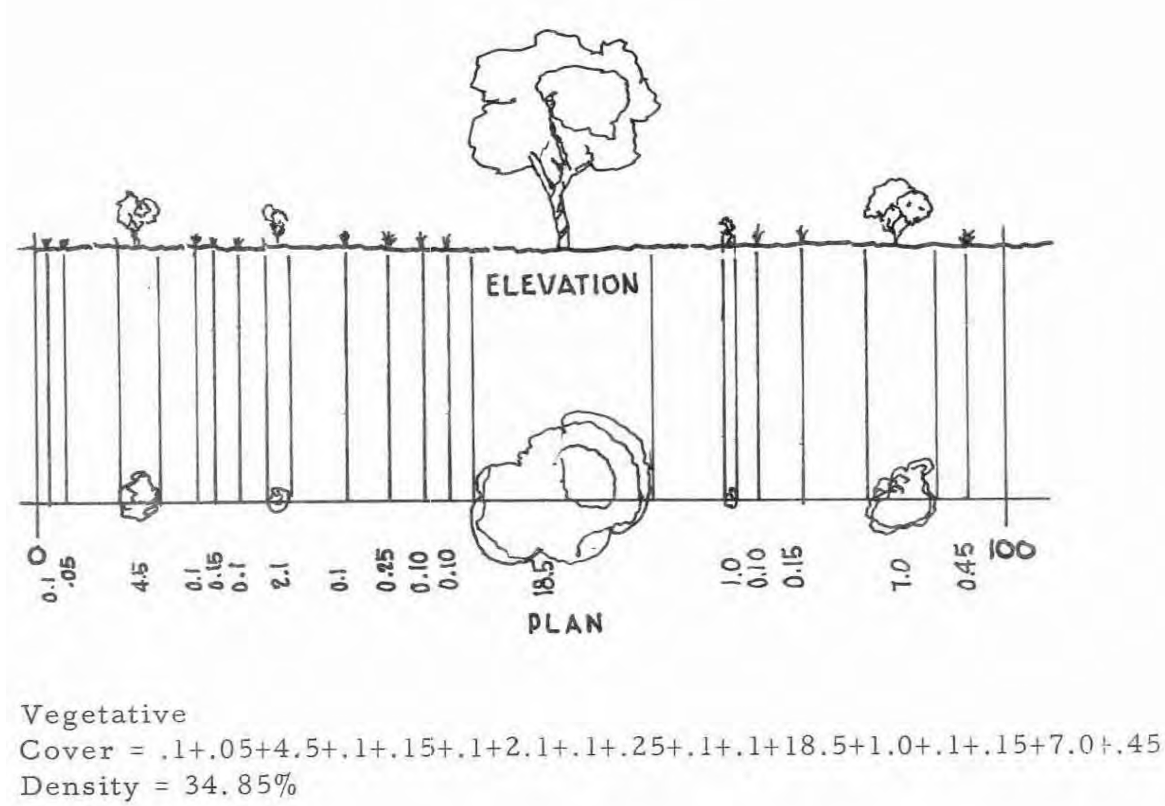
Vegetative cover densities are determined using one or both of the two following methods:

C.1 METHOD 1: PHYSICAL MEASUREMENT

1. An area representing the typical vegetative cover density for the drainage sub-basin or sub-area is selected.
2. A 100-foot chain is stretched out on the ground in a straight line in the area selected.
3. The intercepts of the vegetative canopy along the 100-foot length are noted.
4. The total distances covered by vegetation canopy along the 100-foot length are summed up and repre sent the percent of vegetative cover for the selected area.
5. Several determinations mayhave to be made to compute the average percent of cover for the drainage sub-basin or sub-area.

The following sketch (Jencsok, 1969) illustrates the field procedure:

Figure C.1 Physical measurement of vegetative canopy cover schematic



C.2 METHOD 2: AERIAL PHOTOGRAPH GIS/CAD POLYGONS

Fully rectified and scaled digital aerial photographs of the sub-basins or sub-areas can be used to estimate vegetative canopy cover. The photographs are used to define polygons covering the various areas of visible vegetation using CAD or GIS software. Then the percent coverage area of each sub-basin or sub-area is computed using CAD or GIS tools. This method should be verified and/or calibrated using Method 1 above.

D. RAINFALL LOSSES

D.1 PROCEDURES USED TO ASSIGN G&A PARAMETERS

D.1.1 BASE SOILS DATA

D.1.1.1 Source

The data used for estimation of Green and Ampt parameters was the SSURGO detailed soil survey data obtained from the NRCS. The web site the data was downloaded from is:

NRCS Web Soil Survey.

The information consisted of GIS polygon files in ESRI shape file format, and Microsoft Access format databases for the following soil surveys:

Table D.1 List of soil surveys

ID	Soil Survey Title
AZ623	SHIVWITS AREA, ARIZONA, PART OF MOHAVE COUNTY
AZ625	MOHAVE COUNTY AREA, AZ, NORTHEASTERN PART, AND PART OF COCONINO COUNTY
AZ627	MOHAVE COUNTY, AZ, SOUTHERN PART
AZ629	COCONINO COUNTY AREA, ARIZONA, NORTH KAIBAB PART
AZ631	COCONINO COUNTY AREA, ARIZONA, CENTRAL PART
AZ637	YAVAPAI COUNTY, ARIZONA, WESTERN PART
AZ639	Black Hills-Sedona Area, Arizona, Parts of Coconino and Yavapai Counties. Database not available yet. The AZ STATSGO feature class was used and clipped to AZ639 boundary.
AZ657	KOFA AREA, ARIZONA, PARTS OF LA PAZ AND YUMA COUNTIES: Databaseis only partially available. Where data is not provided, the AZ STATSGO feature class was used to fill in the missing areas.
AZ695	KAIBAB NATIONAL FORESTS, ARIZONA, PARTS OF COCONINO, MOHAVE AND YAVAPAI COUNTIES. Database not available yet. The AZ STATSGO feature class was used and clipped to AZ695 boundary.
AZ697	MOHAVE COUNTY, AZ. CENTRAL PART
AZ699	HUALAPAI-HAVASUPAI AREA, PARTS OF COCONINO, MOHAVE, AND YAVAPAI COUNTIES

Table D.1 List of soil surveys	
ID	Soil Survey Title
AZ701	GRAND CANYON AREA, ARIZONA, PARTS OF COCONINO AND MOHAVE COUNTIES
NV608	VIRGIN RIVER AREA, NEVADA AND ARIZONA
NV713	MEADOW VALLEY AREA, NEVADA AND UTAH
NV754	LINCOLN COUNTY, NEVADA, SOUTH PART
NV755	CLARK COUNTY AREA, NEVADA
UT634	IRON-WASHINGTON AREA, UTAH, PARTS OF IRON, KANE, AND WASHINGTON COUNTIES
UT636	PANGUITCH AREA, PARTS OF GARFIELD, IRON, KANE AND PIUTE COUNTIES, UTAH
UT641	WASHINGTON COUNTY AREA, UTAH
UT642	KANE COUNTY, UTAH: : The UT STATSGO feature class was used and clipped to UT642 boundary
UT646	DIXIE NATL.FOREST-PARTS OF GARFIELD, WASHINGTON, IRON, KANE & WAYNE COUNTIES. Database not available yet. The UT STATSGO feature class was used and clipped to UT646 boundary.
UT686	GRAND STAIRCASE - ESCALANTE NATIONAL MONUMENT, PARTS OF KANE AND GARFIELD COUNTIES, UTAH
AZ	ARIZONA GENERAL SOIL SURVEY
UT	UTAH GENERAL SOIL SURVEY

D.1.2 DATA EXTRACTION

The NRCS databases are very complex and contain a large amount of data in numerous tables. The data necessary for computation of Green and Ampt parameters was extracted from each soils database and stored in a new separate database file containing two tables. The procedures used to accomplish this are as follows. Familiarity with Microsoft Access 2003 is required, and these instructions are specific to MS Access 2003. MS Access 2007 can also be used but the location of the commands is often slightly different.

1. Populate the NRCS template database with data using the procedures provided by the NRCS.
2. Extract the physical soil properties data needed to compute XKSAT, PSIF, and DTHETA.

   Create a new empty database named "?????_XKSAT.mdb". Use the NRCS soil survey ID number from Table D.1 in place of the question marks.

Make a copy of the NRCS database and name it: soil?????db_US_2002.mdb. Again, use the NRCS soil survey ID number from Table D.1 in place of the question marks. Open the copy of the NRCS database.

Create a new Query using the "Simple Wizard" and adding the fields listed below. Name it "Query - XKSAT Computation Data."

	1	**2**	**3**	**4**	**5**	**6**	**7**
Source Table:	mapunit		component		chtexturegrp	chtexture	
Source Field:	musym	muname	cokey	compname	texdesc	texcl	lieutex
Description:	SMU	Map Unit Name	Component Key	Component Name	Texture Description	Texture Class	in lieu Texture

	8	9	10	11	12	13	14
Source Table:	chorizon						chfrags
Source Field:	ksat_r	hzdept_r	hzdepb_r	sandtotal_r	silttotal_r	claytotal_r	fragsize_r
Description:	KSAT micrometers/s	Horizon, inches		Total Percentage by weight < 2mm			Gravel Size, mm
		Top	Bottom	Sand	Silt	Clay	

	15	16	17	18	19	20	21
Source Table:	chfrags	chorizon			Component	chtexture	Chorizon
Source Field:	fragvol_r	om_r	dbthirdbar_r	dbovendry_r	mukey	chtgkey	chkey
Description:	Gravel percent of total volume	Organic Matter percent of total volume	Oven dried weight of < 2mm material		Map unit key	Horizon texture key	Horizon key
			at a water tension of 1/3 Bar	exclusive of desication cracks, measured on a coated clod			

	22
Source Table:	Chfrags
Source Field:	chfragskey
Description:	Horizon fragments key

In "Design View", sort ascending on the fields "musym", "cokey", "hzdept_r", and "fragsize_r".

In "Design View", set criteria for "hzdept_r": <=6.

In "Design View", select the link between the "chorizon" and "chfrags" tables, right-click on the link, and select "Join Properties". Set radio button 2, "Include ALL records from 'chorizon'…"

Save Query.

Go to "Datasheet View". Copy and Paste Query. Rename copy to "Make-Table Query XKSAT Computation Data."

Open the Make-Table Query and enter "Design View".

Click on the "Query Type" icon and select "Make-Table Query." (in Access 2007, click on "Make Table")

Use the "Another Database" option and use table name ="XKSAT". Point to the "????_XKSAT" database file from Step 1.

Save the Query and hit the "Run" icon.

Save the work and open the new "????_XKSAT" database. Explore the database to verify the data was processed correctly.

3. Extract the percentage of each component soil within each soil map unit.

Re-open the NRCS database.

Create a new Query using the “Simple Wizard” and adding the fields listed below. Name it "Query – SMU Component Percentages."

	1	2	3	4	5	6	7
Source Table:	mapunit		component				mapunit
Source Field:	musym	muname	compname	comppct_r	slope_r	cokey	mukey
Description	SMU	Map Unit Name	Component Name	Component Percentage	Average Slope	Keys	
						Component	Map Unit

In "Design View", sort ascending on the fields “musym” and “compname”.

Save Query and go to "Datasheet View".

Copy and Paste Query. Rename copy to "Make-Table Query SMU Component Percentages."

Open the Make-Table Query and enter Design mode.

Click on the "Query Type" icon and select "Make-Table Query SMU Component Percentages." (in Access 2007, click on "Make Table")

Use the "Another Database" option and use table name ="SMU_Comp". Point to the "????_XKSAT" database file from Step 1.

Save the Query and hit the "Run" icon.

Save the work and open the new "????_XKSAT" database. Explore the database to verify the data was processed correctly.

4. Create queries in the XKSAT database.

Create a query named “Query_XKSAT” in the "????_XKSAT" database and populate it with all the fields in the XKSAT table. In "Design View", sort ascending on the fields “musym”, “cokey”, “hzdept_r”, and “fragsize_r”. Save and return to "Datasheet View."

Create a query named "Query_SMU" in the "????_XKSAT" database and populate it with all the fields in the SMU_Comp table. In "Design View", sort ascending on the fields "musym" and "compname". Save and return to "Datasheet View."

Check for records in the XKSAT table (not the Query) for blank "texcl" fields. Assign a texture if possible and appropriate. Use Saxton's equations or program to determine the texture class based on the percent sand and clay if either the sand OR clay fields are populated. If both sand and clay are not populated, the component must become a Miscellaneous Component Soil or sand and clay percentages must be estimated based on texture and ksat_r. If the component is a Miscellaneous Component Soil, then delete the record from the database unless perhaps a value for clay has been assigned. Make sure the value assigned corresponds with the texture class. Check for XKSAT2006 values of "NaN." Manually assign values for these SMU's.

This data was used as described in Appendix D.2.2 below. Note that not all SMU's and Component soils listed in the SMU_Comp database are included in the XKSAT database. There are a large number of miscellaneous soils for which no laboratory data is available. These are addressed in Appendix D.2.5.

Page Intentionally Left Blank

D.2 COMPUTATION OF GREEN AND AMPT PARAMETERS

D.2.1 METHOD

D.2.1.1 General

The Green and Ampt parameters were computed using a computer program called XKSAT that uses data from the NRCS soil survey databases. A summary of the procedures used to compute Green and Ampt parameters follows:

1. Data necessary to implement the Saxton and Rawls (2006) pedotransfer function is extracted from NRCS soils databases and saved in MS Access format. The NRCS data used is structured as follows:
    a. Soil Map Units (SMU). This is the identifier for a soil type and the name comes from the “musys” field. An SMU is composed of one or more major and minor soil types. The minor soils are neglected for these procedures, unless included within the NRCS soils database. The newer NRCS soil surveys do not distinguish between major and minor component soils. Each major soil is called a Component soil with the name coming from the “compname” field. The physical data needed for computation of Green and Ampt parameters, and specific to each Component of an SMU, are contained within multiple tables. The required data extracted from the various NRCS tables and stored in a separate Access database in a table named *XKSAT*. The percentages of the area of each Component within each SMU are also extracted from the NRCS database tables and stored in the same separate Access database in a table named *SMU_Comp*. Each component soil is made up of vertical soil layers called Horizons. The thickness of each Horizon is measured in inches and the depth to the top and bottom of each Horizon comes from the “hzdept_r” and “hzdepb_r” fields, respectively. The top 6-inches of each Component is evaluated to determine which Horizon is the limiting soil layer for infiltration. The XKSAT value for that layer is used to represent the infiltration ability of that Component.
    b. Sand, Silt and Clay. The percentage of sand, silt, and clay provided by the NRCS is the percentage by weight of the matric soil (all particles <2mm). This data is provided in fields “sandtotal_r”, “silttotal_r”, and “claytotal_r”.
    c. Gravel. The gravel size in mm is provided in the field “fragsize_r” and the percentage by volume of the bulk soil in field “fragvol_r”. Each Horizon soil contains either none, or one or more gravel size fractions.
2. Total the gravel for each Horizon. The total gravel volume for each Horizon must be computed by totaling the volumes for the size fractions. There are often multiple duplicate records for each size fraction in the NRCS database table. Multiple duplicate records of a given size fraction are ignored.
3. Compute XKSAT, PSIF and DTHETA for each horizon.
4. Determine the control horizon for each component.
5. Total RTIMP for each Horizon where multiple records exist.

6. Compute an area log-averaged value of XKSAT for each SMU.
7. Assign PSIF and DTHETA values to each SMU based on the relationship to XKSAT using equations developed by regression analysis.

D.2.1.2 XKSAT by the 1983 Method

Sabol (1993) refers to the *Drainage Design Manual for Maricopa County – Hydrology*, by George V. Sabol, first published in 1993. The relationships between soil texture and saturated hydraulic conductivity, XKSAT, from that publication are used to assign XKSAT to each Component Horizon based on texture only. In the GIS soils files and spreadsheets for Mohave County, XKSAT values assigned using this method are referred to as “XKSAT 1983”. These values are not approved for use within Mohave County. Instead, they are provided for reference and comparison with the current ADOT and Maricopa values. The basis for Sabols’ work is a paper by Walter J. Rawls, Donald L. Brakensiek, and Norman Miller titled *Green-Ampt Infiltration Parameters From Soils Data* published in the ASCE Journal of Hydraulic Engineering, Volume 109, Number 1, January 1983 (Rawls, Brakiensiek and Miller, 1983).

D.2.1.3 XKSAT by Saxton and Rawls (2006)

The Mohave County Green and Ampt parameters are based on a paper titled *Soil Characteristic Estimates by Texture and Organic Matter for Hydrologic Solutions* by K.E. Saxton and W.J. Rawls (Saxton and Rawls (2006). This is a continuation of the 1983 work by Rawls, Brakensiek and Miller. XKSAT may now be computed based on the percent volume by weight of sand and clay for a given matric soil and corrected based on the percentage of gravel and organic matter in the bulk soil, and the relative level of compaction of the bulk soil. The new procedures are based on extensive research using 2,000 A-Horizon and 2,000 B-Horizon samples from the NRCS. The A Horizon is the top soil layer, and the B Horizon the second layer below the surface. These two Horizons cover the top 6-inches of the surface soils, which is the area of concern for this analysis. The new procedure also provides the necessary information to directly compute PSIF and DTHETA for each Horizon using the equations included in Rawls, Brakensiek and Miller (1983). Refer to Appendix D.2.7. The equations used for computation of XKSAT, PSIF and DTHETA and the corrections for gravel content, organic matter and compaction are listed below:

D.2.1.4 Green and Ampt Parameters Equations

The equations from Saxton and Rawls (2006), as applied for the Mohave County Method and implemented using the XKSAT computer program, are summarized as follows:

```
Wilting Point

Predict = -0.024 * Sand + 0.487 * Clay + 0.006 * OrgMat + 0.005 * Sand
* OrgMat - 0.013 * Clay * OrgMat + 0.068 * Sand * Clay + 0.031
WPoint = Predict + (0.14 * Predict - 0.02)

Field Capacity

Predict = -0.251 * Sand + 0.195 * Clay + 0.011 * OrgMat + 0.006 * Sand
* OrgMat - 0.027 * Clay * OrgMat + 0.452 * Sand * Clay + 0.299
FCapac = Predict + (1.283 * Predict ^ 2 - 0.374 * Predict - 0.015)

Saturation

Predict = 0.278 * Sand + 0.034 * Clay + 0.022 * OrgMat - 0.018 * Sand *
OrgMat - 0.027 * Clay * OrgMat - 0.584 * Sand * Clay + 0.078
S33 = Predict + (0.636 * Predict - 0.107)
Sat = FCapac + S33 - 0.097 * Sand + 0.043


Adjustment for organic matter and compaction

DensityO = (1 - Sat) * 2.65
DensityC = DensityO * DensityFactor
PorO = 1 - (DensityC / 2.65)
PorC = PorO - (1 - DensityO / 2.65)
M33C = FCapac + 0.25 * PorC
PM33C = PorO - M33C
If PM33C < 0 Then PM33C = 0

XKSAT CALCULATION

Gadj = (1 - Gravel) / (1 - Gravel * (1 - 1.5 * ((DensityC) / 2.65)))
B = (Math.Log(1500) - Math.Log(33)) / (Math.Log(M33C) -
Math.Log(WPoint))
A = Math.Exp(Math.Log(33) + (B * Math.Log(M33C)))
Lamda = 1 / B
XKSAT = 1930 * (PM33C ^ (3 - Lamda)) * 0.0393700787 * Gadj
sngKsCF = CSng(frmOptions.txtKsCF.Text)
XKSAT = XKSAT * sngKsCF
If XKSAT < 0.01 Then
    XKSAT = 0.01
End If

DTHETA(dry And normal)CALCULATION

DTHETAdry = Sat - WPoint
DTHETAnormal = Sat - FCapac

PSIF CALCULATIONS
```

```
BubblingPressure = -21.674 * Sand - 27.932 * Clay - 81.975 * PM33C +
71.121 * Sand * PM33C + 8.294 * Clay * PM33C + 14.05 * Sand * Clay +
27.161
BPadj = BubblingPressure + (0.02 * BubblingPressure ^ 2 - 0.113 *
BubblingPressure - 0.7)
If BubblingPressure >= 0 Then
    PSIF = (2 * Lamda + 3) / (2 * Lamda + 2) * BubblingPressure / 2 *
4.014630787
Else
    PSIF = -999
End If
If BPadj >= 0 Then
    PSIFadj = (2 * Lamda + 3) / (2 * Lamda + 2) * BPadj / 2 *
4.014630787
Else
    PSIFadj = -999
End If
PSIFscp = Math.Exp(6.53 - 7.326 * PorO + 0.00158 * (Clay * 100) ^ 2 +
3.809 * PorO ^ 2 + 0.000344 * Sand * 100 * Clay * 100 - 0.04989 * Sand
* 100 * PorO + 0.0016 * (Sand * 100) ^ 2 * PorO ^ 2 + 0.0016 * (Clay *
100) ^ 2 * PorO ^ 2 - 0.0000136 * (Sand * 100) ^ 2 * Clay - 0.00348 *
(Clay * 100) ^ 2 * PorO - 0.000799 * (Sand * 100) ^ 2 * PorO) *
0.393700787
```

The documentation for Saxton and Rawls (2006) is found at: Saxton and Rawls SPAW Download Page.

The documentation is included as a part of the SPAW computer program available on that web page. A spreadsheet available as a part of the "Soil Water Characteristics" portion of the SPAW download from this website can be used to check the computations made using these equations.

D.2.2 COMPUTATION OF PARAMETERS FOR EACH HORIZON

An Adobe PDF file for each soil survey area has been prepared that contains the data used for computation of the Green and Ampt parameters and lists the assigned XKSAT parameters. These files are available upon request to Mohave County Flood Control District. The PDF files contain groups of data for each NRCS Soil Survey as listed in Table D.2. The PDF files were created from corresponding Excel spreadsheets that are written by the XKSAT computer program. The Excel spreadsheets contain the raw XKSAT program output and formatted worksheets that are printed to create the PDF files. The Excel spreadsheets are also available upon request to the Mohave County Flood Control District.

Table D.2 List of summary results files

Data Group Number	Data Group Name	Description
1	List of All NRCS Soil Map Unit XKSAT Computation Data	Contains the data from the NRCS Soil Survey database tables used for computation of XKSAT, DTHETA, and PSIF.
2	List of All NRCS Soil Map Unit Components	Contains the Component percentages from the NRCS component database table for each SMU.
3	Table of All Horizons Covering the Top 6-inches, Processed Total Gravel Volumes and Computed Green and Ampt Parameters (DF 1.0)	Contains a list of all Horizons with the gravel volumes totaled, including the computed XKSAT, PSIF and DTHETA values from both the 1983 and 2006 methods using Density Factor 1.0.
4	Table of All Horizons Covering the Top 6-inches, Processed Total Gravel Volumes and Computed Green and Ampt Parameters (DF 1.1)	Contains a list of all Horizons with the gravel volumes totaled, including the computed XKSAT, PSIF and DTHETA values from both the 1983 and 2006 methods using Density Factor 1.1.
5	Table of Control Horizons Using Rawls et al 1983 (DF 1.0)	Contains a listing of the results of the determination of the control Horizon for each Component based on 1983 method for Density Factor 1.0.
6	Table of Control Horizons Using Rawls et al 1983 (DF 1.1). This is a place holder only. Currently only contains a copy of the Density Factor 1.0 results.	Contains a listing of the results of the determination of the control Horizon for each Component based on 1983 method for Density Factor 1.1.
7	Table of Control Horizons Using Saxton and Rawls 2006 (DF 1.0)	Contains a listing of the results of the determination of the control Horizon for each Component based on the Saxton and Rawls (2006) method for Density Factor 1.0.
8	Table of Control Horizons Using Saxton and Rawls 2006 (DF 1.1)	Contains a listing of the results of the determination of the control Horizon for each Component based on the Saxton and Rawls (2006) method for Density Factor 1.1.
9	Table of Composite XKSAT & RTIMP Values Using Rawls 1983 & Saxton and Rawls 2006	Contains the computed area log-averaged values of XKSAT for each SMU for the 1983 method, and Saxton and Rawls (2006) method for both Density Factor 1.0 and 1.1.

D.2.3 COMPUTING GREEN AND AMPT PARAMETERS FOR EACH COMPONENT HORIZON

The data in Group Number 1 was used to create the data in Group Number 3. The gravel volumes for each horizon were totaled, and XKSAT, PSIF and DTHETA computed. The following are key assumptions made when implementing the Saxton and Rawls (2006) method using the XKSAT computer program:

1. The maximum percentage of gravel used is 50%. The Saxton and Rawls (2006) equations are not valid for gravel percentages greater than 50%. When the NRCS data contained a soil horizon with greater than 50% gravel content, the value was set to 50%.
2. The maximum percentage of organic matter used is 8%. The Saxton and Rawls (2006) equations are not valid for organic matter percentages greater than 8%. When the NRCS data contained a soil horizon with greater than 8% organic matter, the value was set to 8%.
3. The Saxton and Rawls (2006) equations have a correction for salinity. This correction was not used in the Mohave County method.
4. The Saxton and Rawls (2006) equations contain a correction for relative soil density, varying from 0.9 to 1.3, where a value of 1.0 represents a normal condition. For the Mohave County Method, a density factor of 1.0 was used to compute XKSAT for natural soils. A density factor of 1.1 was used to compute XKSAT for developed land uses where the soil has been disturbed and recompacted and various activities.
5. The Saxton and Rawls (2006) equations yield K_s, not XKSAT. The correction of of 0.5 was multiplited times K_s to obtain XKSAT.
6. The XKSAT value for very sandy soils is often a large value, which could result in unrealistic values of total infiltration. As a conservative assumption for hydrogic modeling purposes, XKSAT values greater than 2.0 in/hr were set to 2.0 in/hr for the 2006 method. The 1983 method implemented by ADOT and Maricopa County use a limit of 1.2 in/hr, so this limit was used for the 1983 values assigned by the XKSAT computer program.

7. XKSAT assigned using the 1983 method was done using the values in Table D.3. No adjustments were made based on adjectives to the soil texture classification, such as “fine”, “very fine”, “gravelly” or “very gravelly”.

8. The XKSAT program relies on the physical soil properties data being available to apply the Saxton and Rawls (2006) equations. In some cases, the needed data was not present in the NRCS databases. The following is a summary of how these situations were addressed:

    a. Sand and clay percentage not supplied, but texture class was. The texture class was used to assign XKSAT from the data in Table D.6.

    b. Sand and clay percentage, and texture class, not supplied. The component soil was classified as a Miscellaneous Component soil and default XKSAT values for Density Factor 1.0 were assigned based on research and engineering judgment. Refer to Section D.2.5 for documentation. Values for Density Factor 1.1 were computed using a regression equation developed from all the computed values of Ks for both Density Factors 1.0 and 1.1. The equations used are:

    For XKSAT1.0 >= 0.05:

    $$XKSAT1.1 = (a + b*LN(XKSAT1.0)^2 + c/(XKSAT1.0)^{0.5}) * XKSAT1.0$$

    For XKSAT1.0 < 0.05:

    $$XKSAT1.1 = d * XKSAT1.0$$

    For XKSAT1.0 <= 0.01:

    $$XKSAT10 = XKSAT1.1 = 0.01$$

    where:

    a = 0.790158322734567
    b = 0.0515810075083139
    c = -0.23269790642807
    d = 0.212411

    c. Sand and clay percentage not supplied for a component soil in a particular soil map unit, but data was supplied for that component soil in a different soil map unit in the same NRCS soil survey. For this case, there was usually no physical data record, but a component percentage was supplied. New physical data records were added based on the physical data available from another soil map unit. That data was used to compute XKSAT for the missing component.

Table D.3 Green and Ampt parameters as a function of soil texture

(Source: Sabol, 1993)

Soil Texture Classification (1)	XKSAT inches/hour (2)	PSIF inches (3)	DTHETA[1] Dry (4)	DTHETA[1] Normal (5)	DTHETA[1] Saturated (6)
loamy sand & sand	1.20	2.4	0.35	0.30	0
sandy loam	0.40	4.3	0.35	0.25	0
loam	0.25	3.5	0.35	0.25	0
silty loam	0.15	6.6	0.40	0.25	0
silt	0.10	7.5	0.35	0.15	0
sandy clay loam	0.06	8.6	0.25	0.15	0
clay loam	0.04	8.2	0.25	0.15	0
silty clay loam	0.04	10.8	0.30	0.15	0
sandy clay	0.02	9.4	0.20	0.10	0
silty clay	0.02	11.5	0.20	0.10	0
clay	0.01	12.4	0.15	0.05	0

otes:
Selection of DTHETA

Dry = Nonirrigated lands, such as desert and rangeland;
Normal = Irrigated lawn, turf, and permanent pasture;
Saturated = Irrigated agricultural land.

D.2.4 DETERMINING THE CONTROL HORIZON FOR EACH COMPONENT SOIL

The control horizon for each Component is listed in Group Number 5, 7 and 8, for the 1983 method and Saxton and Rawls (2006) methods, respectively. The assignments were made using the data in Group Numbers 3 and 4. The Horizon with the lowest value of XKSAT was selected as the control Horizon.

D.2.5 MISCELLANEOUS COMPONENT SOILS

The miscellaneous component soils were addressed before computing the composite values of XKSAT. A list of missing component soil types from the soil surveys evaluated is shown in Table D.4. Only the missing component soil types for SMU's within the stady area are listed. A texture class was assigned for each missing Component using one of three approaches:

1. If the Component was listed in another soil survey, the texture was assigned based on that survey.
8. The NRCS Soil Taxonomy Handbook was consulted and the assignment made based on the typical texture for the soil order corresponding to that Component.
9. If methods 1 or 2 above could not be used, then the texture was assigned based on a Google rearch and/or engineering judgment.

Assignment of XKSAT for both the 1983 method and Saxton and Rawls (2006) methods was made using the assigned texture and the values of K_s in Table D.5 after correction to K_e. All the miscellaneous component soils for each NRCS soil survey are included; therefore, there are many more listings than shown in Table D.4.

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
AZ	s1126	rock outcrop
AZ	s1129	badland
AZ	s289	rock outcrop
AZ	s293	rock outcrop
AZ	s316	rock outcrop
AZ	s318	rock outcrop
AZ	s351	rock outcrop
AZ	s362	cinder land
AZ	s403	rock outcrop
AZ	s404	rock outcrop
AZ	s407	rock outcrop
AZ	s411	rock outcrop
AZ	s412	rock outcrop
AZ	s415	rock outcrop
AZ	s455	lithic ustorthents family
AZ	s461	rock outcrop
AZ	s8196	rock outcrop
AZ	s8197	rock outcrop
AZ	s8198	rock outcrop
AZ	s8369	water
AZ623	6	badland
AZ623	10	rock outcrop
AZ623	17	rock outcrop
AZ623	20	rock outcrop
AZ623	28	badland

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
AZ623	32	gypsiorthids
AZ623	34	rock outcrop
AZ623	42	rock outcrop
AZ623	45	rock outcrop
AZ623	51	rock outcrop
AZ623	52	rock outcrop
AZ623	55	rock outcrop
AZ623	56	rock outcrop
AZ623	57	rock outcrop
AZ623	64	riverwash
AZ623	65	rock outcrop
AZ623	74	rock outcrop
AZ623	78	calciorthids
AZ623	80	rock outcrop
AZ623	84	rock outcrop
AZ623	86	rock outcrop
AZ623	87	rock outcrop
AZ623	93	rock outcrop
AZ623	94	rock outcrop
AZ625	1	badland
AZ625	6	rock outcrop
AZ625	15	gypsiorthids
AZ625	26	lava flows
AZ625	51	riverwash
AZ625	63	rock outcrop
AZ625	64	rock outcrop
AZ625	65	rock outcrop
AZ625	70	rock outcrop
AZ627	1	rock outcrop
AZ627	2	rock outcrop
AZ627	8	rock outcrop
AZ627	9	riverwash
AZ627	10	riverwash
AZ627	20	riverwash
AZ627	21	riverwash
AZ627	22	riverwash
AZ627	25	rock outcrop
AZ627	26	rock outcrop

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
AZ627	27	rock outcrop
AZ627	40	rock outcrop
AZ627	41	rock outcrop
AZ627	42	rock outcrop
AZ627	48	rock outcrop
AZ627	49	rock outcrop
AZ627	55	rock outcrop
AZ627	58	rock outcrop
AZ627	62	rock outcrop
AZ627	63	rock outcrop
AZ627	69	riverwash
AZ627	70	riverwash
AZ627	73	rock outcrop
AZ627	74	rock outcrop
AZ627	75	rock outcrop
AZ627	79	marshes
AZ627	90	rock outcrop
AZ627	92	rock outcrop
AZ627	93	rock outcrop
AZ627	94	rock outcrop
AZ627	95	rock outcrop
AZ627	96	rock outcrop
AZ627	102	fluvaquents
AZ627	103	rock outcrop
AZ627	104	rock outcrop
AZ627	105	rock outcrop
AZ627	106	rock outcrop
AZ627	107	rock outcrop
AZ627	108	torriorthents
AZ627	109	torriorthents
AZ627	117	rock outcrop
AZ627	119	torriorthents
AZ627	120	torriorthents
AZ627	127	water
AZ627	132	rock outcrop
AZ627	133	rock outcrop
AZ627	134	rock outcrop
AZ627	137	rock outcrop

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
AZ627	138	rock outcrop
AZ629	6	rock outcrop
AZ629	9	torriorthents
AZ629	40	pits borrow
AZ629	41	rock outcrop
AZ629	43	rock outcrop
AZ629	47	torriorthents
AZ629	48	rock outcrop
AZ631	12	rock outcrop
AZ631	20	rock outcrop
AZ631	48	rock outcrop
AZ631	64	rock outcrop
AZ631	65	rock outcrop
AZ631	73	water
AZ637	AwE	rock outcrop
AZ637	Ba	badland
AZ637	BoF	rock outcrop
AZ637	CnC	rock outcrop
AZ637	CnF	rock outcrop
AZ637	CvB	loamy alluvial land
AZ637	DrC	rock outcrop
AZ637	FaC	rock outcrop
AZ637	JaC	rock outcrop
AZ637	JaD	rock outcrop
AZ637	Lh	rock outcrop
AZ637	LvE	rock land
AZ637	LxD	rock outcrop
AZ637	MkF	rock outcrop
AZ637	MoD	rock outcrop
AZ637	Ro	rock land
AZ637	Rr	rock land
AZ637	Rs	rough broken land
AZ637	Sa	gravelly alluvial land
AZ637	TmD	rock outcrop
AZ637	TnF	rock outcrop
AZ637	W	water
AZ657	210	riverwash
AZ657	245	rock outcrop

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
AZ657	390	riverwash
AZ657	425	rock outcrop
AZ697	4	aridic argiustolls
AZ697	6	riverwash
AZ697	7	riverwash
AZ697	8	riverwash
AZ697	9	riverwash
AZ697	10	riverwash
AZ697	16	riverwash
AZ697	17	riverwash
AZ697	22	riverwash
AZ697	23	rock outcrop
AZ697	33	rock outcrop
AZ697	34	rock outcrop
AZ697	40	rock outcrop
AZ697	41	rock outcrop
AZ697	42	rock outcrop
AZ697	46	rock outcrop
AZ697	53	gypsids
AZ697	54	haplogypsids
AZ697	55	rock outcrop
AZ697	56	rock outcrop
AZ697	59	rock outcrop
AZ697	65	rock outcrop
AZ697	67	rock outcrop
AZ697	68	rock outcrop
AZ697	75	rock outcrop
AZ697	82	riverwash
AZ697	83	rock outcrop
AZ697	86	rock outcrop
AZ697	91	rock outcrop
AZ697	99	rock outcrop
AZ697	108	rock outcrop
AZ697	109	rock outcrop
AZ697	112	pits-dumps mine
AZ697	113	playa
AZ697	114	rock outcrop
AZ697	117	rock outcrop

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
AZ697	118	rock outcrop
AZ697	122	rock outcrop
AZ697	123	rock outcrop
AZ697	124	rock outcrop
AZ697	125	rock outcrop
AZ697	126	rock outcrop
AZ697	127	rock outcrop
AZ697	129	rock outcrop
AZ697	130	rock outcrop
AZ697	139	rock outcrop
AZ697	142	rock outcrop
AZ697	144	torriorthents
AZ697	145	haplocambids
AZ697	146	rock outcrop
AZ697	155	urban land
AZ697	156	rock outcrop
AZ697	158	rock outcrop
AZ697	162	rock outcrop
AZ697	163	rock outcrop
AZ697	164	water
AZ697	169	rock outcrop
AZ697	170	rock outcrop
AZ699	10	rock outcrop
AZ699	18	rock outcrop
AZ699	23	rock outcrop
AZ699	33	rock outcrop
AZ699	36	rock outcrop
AZ699	38	rock outcrop
AZ699	39	rock outcrop
AZ699	43	rock outcrop
AZ699	47	rock outcrop
AZ699	52	rock outcrop
AZ699	54	rock outcrop
AZ699	55	rock outcrop
AZ699	57	rock outcrop
AZ699	59	rock outcrop
AZ699	60	water
AZ701	3	argic petrocalcids

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
AZ701	4	aridic haplustalfs
AZ701	5	aridic haplustepts
AZ701	6	aridic lithic ustorthents
AZ701	10	rock outcrop
AZ701	14	calcic petrocalcids
AZ701	15	calcic petrocalcids
AZ701	16	calcic petrocalcids
AZ701	17	calcic petrocalcids
AZ701	20	lava flows
AZ701	33	rock outcrop
AZ701	39	rock outcrop
AZ701	40	fluvaquents
AZ701	41	fluvaquents
AZ701	46	rock outcrop
AZ701	48	rock outcrop
AZ701	56	rock outcrop
AZ701	57	lava flows
AZ701	58	lithic haplargids
AZ701	59	lithic haplargids
AZ701	60	lava flows
AZ701	61	lithic haplocalcids
AZ701	62	lithic haplocalcids
AZ701	63	lithic haplargids
AZ701	64	lava flows
AZ701	65	lithic haplustolls
AZ701	66	lithic calciargids
AZ701	67	lithic calciargids
AZ701	68	lithic torriorthents
AZ701	69	lithic torriorthents
AZ701	70	lithic torriorthents
AZ701	71	lithic torriorthents
AZ701	72	lithic ustic torriorthents
AZ701	73	lithic ustic torriorthents
AZ701	74	lithic ustic torriorthents
AZ701	80	rock outcrop
AZ701	82	rock outcrop
AZ701	88	orthents
AZ701	90	rock outcrop

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
AZ701	101	rock outcrop
AZ701	102	rock outcrop
AZ701	103	lithic torriorthents
AZ701	105	lithic torriorthents
AZ701	106	lithic torriorthents
AZ701	110	lithic torriorthents
AZ701	111	lithic ustic torriorthents
AZ701	112	lithic ustic torriorthents
AZ701	113	rock outcrop
AZ701	114	rock outcrop
AZ701	115	lithic torriorthents
AZ701	119	rock outcrop
AZ701	120	rock outcrop
AZ701	126	lava flows
AZ701	127	haplogypsids
AZ701	128	lithic haplargids
AZ701	129	rock outcrop
AZ701	134	lava flows
AZ701	135	typic haplocalcids
AZ701	136	typic haplocalcids
AZ701	138	typic haplocalcids
AZ701	139	typic haplocalcids
AZ701	140	typic haplogypsids
AZ701	141	haplogypsids
AZ701	142	rock outcrop
AZ701	143	typic torrifluvents
AZ701	144	typic torrifluvents
AZ701	145	typic torrifluvents
AZ701	147	typic torriorthents
AZ701	148	typic haplogypsids
AZ701	149	lava flows
AZ701	150	ustic haplocalcids
AZ701	151	rock outcrop
AZ701	152	ustic haplocambids
AZ701	153	ustic haplocambids
AZ701	154	badlands
AZ701	155	ustic torriorthents
AZ701	156	ustic torriorthents

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
AZ701	157	ustic torriorthents
AZ701	158	lithic ustic haplargids
AZ701	160	vitrandic haplocalcids
AZ701	161	vitrandic haplocalcids
AZ701	162	water
AZ701	165	rock outcrop
AZ701	166	rock outcrop
AZ701	171	rock outcrop
AZ701	172	rock outcrop
AZ701	173	rock outcrop
AZ701	174	rock outcrop
AZ701	175	rock outcrop
AZ701	176	rock outcrop
NV608	BD	badland
NV608	BHC	badland
NV608	BLB	badland
NV608	BP	pits
NV608	BSG	rock outcrop
NV608	BZF	rock outcrop
NV608	GHF	rock outcrop
NV608	GP	pits
NV608	HHD	rock outcrop
NV608	HUF	badland
NV608	MAE	rock outcrop
NV608	MBG	badland
NV608	PME	rock outcrop
NV608	RBG	rock outcrop
NV608	RHF	rock outcrop
NV608	Ri	water
NV608	RME	rock land
NV608	RTF	rock land
NV608	SEG	rock outcrop
NV608	STE	rock outcrop
NV608	Ty	badland
NV608	USE	badland
NV608	UWD	badland
NV608	VFG	rock outcrop
NV608	W	water

Table D.4 List of miscellaneous component soils within the study area		
NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
NV608	WHE	badland
NV608	ZAG	rock outcrop
NV713	1173	rock outcrop
NV713	1182	rock outcrop
NV713	1364	rock outcrop
NV713	1460	rock outcrop
NV713	1464	rock outcrop
NV713	1539	badlands
NV713	1542	badlands
NV713	1544	badlands
NV713	1704	rock outcrop
NV713	1706	rock outcrop
NV713	1825	rock outcrop
NV713	1828	rock outcrop
NV713	1829	rock outcrop
NV713	1898	rock outcrop
NV713	1922	rock outcrop
NV713	1924	rock outcrop
NV713	1994	rock outcrop
NV713	1998	rock outcrop
NV713	2010	rock outcrop
NV713	2011	rock outcrop
NV713	2129	rock outcrop
NV713	2130	rock outcrop
NV713	2132	rock outcrop
NV713	3674	rock outcrop
NV754	1040	rock outcrop
NV754	1060	rock outcrop
NV754	1061	rock outcrop
NV754	1063	rock outcrop
NV754	1065	rock outcrop
NV754	1066	rock outcrop
NV754	1110	rock outcrop
NV754	1270	rock outcrop
NV754	1420	rock outcrop
NV754	1430	badland
NV754	1570	rock outcrop
NV754	1810	rock outcrop

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
NV754	1833	rock outcrop
NV754	1890	rock outcrop
NV754	1920	rock outcrop
NV754	1990	rock outcrop
NV754	1992	rock outcrop
NV754	1993	rock outcrop
NV754	1994	rock outcrop
NV754	1998	rock outcrop
NV754	2011	rock outcrop
NV754	2129	rock outcrop
NV755	100	rock outcrop
NV755	105	rock outcrop
NV755	106	rock outcrop
NV755	115	badland
NV755	134	rock outcrop
NV755	140	rock outcrop
NV755	141	rock outcrop
NV755	144	rock outcrop
NV755	165	badland
NV755	167	badland
NV755	175	rock outcrop
NV755	176	rock outcrop
NV755	178	rock outcrop
NV755	205	badland
NV755	207	badland
NV755	225	badland
NV755	226	badland
NV755	228	badland
NV755	232	badland
NV755	235	badland
NV755	241	rock outcrop
NV755	255	rock outcrop
NV755	270	rock outcrop
NV755	271	rock outcrop
NV755	272	rock outcrop
NV755	288	badland
NV755	289	badland
NV755	290	rock outcrop

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
NV755	298	rock outcrop
NV755	320	rock outcrop
NV755	321	rock outcrop
NV755	330	badland
NV755	335	rock outcrop
NV755	340	rock outcrop
NV755	341	rock outcrop
NV755	343	rock outcrop
NV755	351	rock outcrop
NV755	360	badland
NV755	365	badland
NV755	375	rock outcrop
NV755	376	rock outcrop
NV755	405	water
NV755	415	rock outcrop
NV755	460	badland
NV755	475	badland
NV755	477	badland
NV755	478	badland
NV755	501	dams
NV755	504	pits
NV755	506	dumps
NV755	508	dumps
NV755	520	rock outcrop
NV755	521	rock outcrop
NV755	522	rock outcrop
NV755	530	rock outcrop
NV755	531	rock outcrop
NV755	532	rock outcrop
NV755	535	rock outcrop
NV755	540	rock outcrop
NV755	541	rock outcrop
NV755	542	badland
NV755	552	rock outcrop
NV755	560	rock outcrop
NV755	565	badland
NV755	603	rock outcrop
NV755	604	rock outcrop

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
NV755	605	badland
NV755	606	rock outcrop
NV755	610	rock outcrop
NV755	612	rock outcrop
NV755	613	rock outcrop
NV755	640	rock outcrop
NV755	645	rock outcrop
NV755	646	rock outcrop
NV755	670	rock outcrop
NV755	673	rock outcrop
NV755	750	rock outcrop
NV755	751	rock outcrop
NV755	753	rock outcrop
NV755	810	rock outcrop
NV755	820	rock outcrop
NV755	821	rock outcrop
NV755	833	rock outcrop
NV755	900	urban land
NV755	911	badland
NV755	930	badland
NV755	940	rock outcrop
NV755	951	badland
NV755	952	badland
NV755	955	badland
NV755	965	badland
NV755	981	rock outcrop
NV755	982	rock outcrop
NV755	998	miscellaneous water
NV755	999	water
UT	s351	rock outcrop
UT	s362	cinder land
UT	s5563	rock outcrop
UT	s5598	rock outcrop
UT	s8173	rock outcrop
UT	s8175	rock outcrop
UT	s8176	rock outcrop
UT	s8179	rock outcrop
UT	s8185	rock outcrop

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
UT	s8186	rock outcrop
UT	s8187	cinder land
UT	s8194	rock outcrop
UT	s8195	rock outcrop
UT	s8196	rock outcrop
UT	s8197	rock outcrop
UT	s8198	rock outcrop
UT	s8201	rock outcrop
UT	s8209	rock outcrop
UT	s8217	rock outcrop
UT	s8218	rock outcrop
UT	s8219	rock outcrop
UT	s8232	rock outcrop
UT	s8233	badland
UT	s8234	badland
UT	s8235	badland
UT634	313	badland
UT634	314	badland
UT634	319	rock outcrop
UT634	330	blown out land
UT634	332	blown out land
UT634	347	rock outcrop
UT634	348	rock outcrop
UT634	350	cinder land
UT634	377	poorly drained soils
UT634	403	lava flows
UT634	426	rock outcrop
UT634	429	rock outcrop
UT634	442	rock outcrop
UT634	448	dumps
UT634	459	rock outcrop
UT634	467	badland
UT634	493	rock outcrop
UT634	495	rock outcrop
UT634	496	rock outcrop
UT634	497	rock outcrop
UT634	502	rock outcrop
UT634	510	rock outcrop

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
UT634	518	water
UT634	1364	rock outcrop
UT636	8	badland
UT636	9	badland
UT636	16	rock outcrop
UT636	34	rock outcrop
UT636	37	alldown clay
UT636	39	rock outcrop
UT636	43	alldown clay
UT636	53	rock outcrop
UT636	54	alldown clay
UT636	55	alldown clay
UT636	72	alldown clay
UT636	75	lava flows
UT636	76	badland
UT636	77	ahlstrom silt
UT636	78	ahlstrom silt
UT636	79	rock outcrop
UT636	80	alldown clay
UT636	105	rock outcrop
UT636	107	limestone rock outcrop
UT636	110	limestone rock outcrop
UT636	111	limestone rock outcrop
UT636	115	rock outcrop
UT636	116	rock outcrop
UT636	122	rock outcrop
UT636	124	rubble land
UT636	126	rock outcrop
UT636	129	rock outcrop
UT636	130	limestone rock outcrop
UT636	135	rock outcrop
UT636	138	rock outcrop
UT636	140	rock outcrop
UT636	144	lava flows
UT636	145	rock outcrop
UT636	149	rock outcrop
UT636	157	rock outcrop
UT636	158	rock outcrop

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
UT636	159	rock outcrop
UT636	162	badland
UT636	163	badland
UT636	173	rock outcrop
UT636	174	water
UT636	175	pits gravel
UT636	177	miscellaneous water
UT641	1922	rock outcrop
UT641	BA	badland
UT641	BB	badland
UT641	BF	rock land
UT641	BP	borrow pits
UT641	CI	cinder land
UT641	CUF	rock outcrop
UT641	DU	dune land
UT641	EA	eroded land
UT641	EB	eroded land
UT641	GA	gullied land
UT641	GP	gravel pit
UT641	HD	rock land
UT641	HG	rock land
UT641	LA	lava flows
UT641	MBG	rock outcrop
UT641	MEG	rock outcrop
UT641	MOG	rock outcrop
UT641	PKE	rock outcrop
UT641	RE	rock land
UT641	RO	rock land
UT641	RP	rock land
UT641	RR	rock land
UT641	RT	rock outcrop
UT641	RU	rough broken land
UT641	SY	stony colluvial land
UT641	TG	rock land
UT641	W	water
UT641	WCF	rock outcrop
UT686	5004	rock outcrop
UT686	5007	rock outcrop

Table D.4 List of miscellaneous component soils within the study area

NRCS Soil Survey	SMU	Miscellaneous Component Soil
(1)	(2)	(3)
UT686	5011	badland
UT686	5020	rock outcrop
UT686	5026	rock outcrop
UT686	5027	badland
UT686	5029	rock outcrop
UT686	5038	rock outcrop
UT686	5087	rock outcrop
UT686	5095	rock outcrop
UT686	5096	rock outcrop
UT686	5102	badland
UT686	5105	rock outcrop
UT686	5106	badland
UT686	5117	badland
UT686	5118	rock outcrop
UT686	5121	riverwash
UT686	5137	rock outcrop
UT686	5149	rock outcrop
UT686	5150	badland
UT686	5158	rock outcrop
UT686	5164	badland
UT686	5169	rock outcrop
UT686	5180	rock outcrop
UT686	5182	rock outcrop
UT686	5183	rock outcrop
UT686	5190	rock outcrop
UT686	5191	rock outcrop
UT686	5192	rock outcrop
UT686	5207	riverwash
UT686	5210	hetz

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
10 t0 20 inches deep over bedrock soils	Engineering judgment		silt loam	No	0.3	0.63	0.32	Yes
10 to 20 inches deep over bedrock soils	Engineering judgment		silt loam	No	0.3	0.63	0.32	Yes
20 t0 40 inches deep over bedrock soils	Engineering judgment		silt loam	No	0.3	0.63	0.32	Yes
20 to 40 inches deep	Engineering judgment		silt loam	No	0.3	0.63	0.32	Yes
20 to 40 inches deep over bedrock soils	Engineering judgment		silt loam	No	0.3	0.63	0.32	Yes
20 to 60 inches deep over bedrock soils	Engineering judgment		silt loam	No	0.3	0.63	0.32	Yes
40 to 60 inches deep over bedrock soils	Engineering judgment		silt loam	No	0.3	0.63	0.32	Yes
40 to 60 inches deep over hardpan soils	Engineering judgment		silt loam	No	0.3	0.63	0.32	Yes
40 to 60 inches over bedrock soils	Engineering judgment		silt loam	No	0.3	0.63	0.32	Yes
abela	UT634		sandy loam	No	0.8	1.92	1.24	Yes
acord	UT634		loam	No	0.5	0.61	0.31	Yes
ahlstrom silt	Description		Silt	No	0.20	0.80	0.43	Yes
alhstrom	Ahlstrom		silt	No	0.2	0.8	0.43	Yes
alldowm clay	Description		Clay	No	0.02	0.04	0.01	Yes
alldown	UT636		clay loam	No	0.08	0.17	0.07	Yes
alldown alkali loam	Description		Clay	No	0.02	0.04	0.01	Yes
alldown clay	Description		Clay	No	0.02	0.04	0.01	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
alluvial land	Engineering judgement		Silt	No	0.20	0.80	0.43	Yes
anabella	UT634		loam	No	0.5	0.61	0.31	Yes
andys	UT636		loam	No	0.5	0.61	0.31	Yes
andys loam	Description		loam	No	0.5	0.61	0.31	Yes
aned	UT634		sandy loam	No	0.8	1.92	1.24	Yes
annabella	UT634		loam	No	0.5	0.61	0.31	Yes
antelope	UT634		loam	No	0.5	0.61	0.31	Yes
antelope springs	UT634		silt loam	No	0.3	0.63	0.32	Yes
aquents	NRCS Soil Taxonomy Handbook	Entisols, pg 138	Sand	No	4.60	4.03	3.12	Yes
aquic argiustolls	NRCS Soil Taxonomy Handbook	Mollisols, pg 174	Silt loam	No	0.30	0.63	0.32	Yes
aquic haplustolls	NRCS Soil Taxonomy Handbook	Mollisols, pg 147	Silt loam	No	0.30	0.63	0.32	Yes
aquic ustipsamments	NRCS Soil Taxonomy Handbook	Entisols, pg 139	Sand	No	4.60	4.03	3.12	Yes
aquolls	NRCS Soil Taxonomy Handbook	Mollisols, pg 144	Silt loam	No	0.30	0.63	0.32	Yes
arabrab	UT686		loamy sand	No	2.4	3.6	2.71	Yes
arches	UT686		sandy loam	No	0.8	1.92	1.24	Yes
arches family	Engineering judgment		sandy loam	No	0.8	1.92	1.24	Yes
ardnas	UT634		loam	No	0.5	0.61	0.31	Yes
arents earthen dam	Engineering judgement	Entisols	Sand	No	4.60	4.03	3.12	Yes
argic petrocalcids	NV755		Loam	No	0.50	0.61	0.31	Yes
argillic horizon soils	Google		clay	No	0.02	0.04	0.01	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006 DF =1.0	2006 DF =1.1	
aridic argiustolls	NRCS Soil Taxonomy Handbook	Mollisols, pg 174	Silt loam	No	0.30	0.63	0.32	Yes
aridic haplustalfs	AZ		Loam	No	0.50	0.61	0.31	Yes
aridic haplustepts	NRCS Soil Taxonomy Handbook	Inceptisols, pg 143	Sandy clay loam	No	0.12	0.44	0.21	Yes
aridic lithic ustorthents	NRCS Soil Taxonomy Handbook	Entisols, pg 140	Sand	No	4.60	4.03	3.12	Yes
aridic ustorthents	Engineering judgment		loamy sand	No	2.4	3.6	2.71	Yes
arnas	UT634		loam	No	0.5	0.61	0.31	Yes
ashdown	UT634		silt loam	No	0.3	0.63	0.32	Yes
atrac	UT686		sandy loam	No	0.8	1.92	1.24	Yes
badland	AZ, UT, NV713		loam	No	0.50	0.61	0.31	Yes
badland very steep	Engineering judgment		clay	No	0.02	0.04	0.01	Yes
badlands	AZ, UT, AZ701		loam	No	0.50	0.61	0.31	Yes
baird hollow	UT634		loam	No	0.5	0.61	0.31	Yes
baldfield	UT636		clay	No	0.02	0.04	0.01	Yes
baldfield clay	Description		clay	No	0.02	0.04	0.01	Yes
baldfield family	UT686		clay	No	0.02	0.04	0.01	Yes
bamos	UT634		loam	No	0.5	0.61	0.31	Yes
bandag	UT634		loam	No	0.5	0.61	0.31	Yes
bannion	UT634		sandy loam	No	0.8	1.92	1.24	Yes
barx	UT636		sandy clay loam	No	0.12	0.44	0.21	Yes
bayfield	UT636		clay	No	0.02	0.04	0.01	Yes
befar	UT636		clay	No	0.02	0.04	0.01	Yes
befar	UT636		clay	No	0.02	0.04	0.01	Yes
behanim	Behanin		loam	No	0.5	0.61	0.31	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006 DF =1.0	2006 DF =1.1	
behanin	UT636		loam	No	0.5	0.61	0.31	Yes
berent	UT634		loamy sand	No	2.4	3.6	2.71	Yes
bermesa	UT641		loamy sand	No	2.4	3.6	2.71	Yes
beron	UT634		sandy loam	No	0.8	1.92	1.24	Yes
beryl	UT634		sandy loam	No	0.8	1.92	1.24	Yes
bess	UT634		sandy loam	No	0.8	1.92	1.24	Yes
bibleqprings	UT634		sandy loam	No	0.8	1.92	1.24	Yes
biblesprings	UT634		loam	No	0.5	0.61	0.31	Yes
bigpack	UT686		clay loam	No	0.08	0.17	0.07	Yes
billings	UT686		clay loam	No	0.08	0.17	0.07	Yes
birdow	UT634		loam	No	0.5	0.61	0.31	Yes
bispen	UT686		sand	No	4.6	4.03	3.12	Yes
blown out land	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
blown-out land	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
bluegyp	Engineering judgement	Aridisols, pg 137	Silt loam	No	0.30	0.63	0.32	Yes
bodacious	UT634		loam	No	0.5	0.61	0.31	Yes
bodot	UT686		silty clay	No	0.04	0.15	0.06	Yes
bodot family	UT686		silty clay	No	0.04	0.15	0.06	Yes
bond	UT641		sandy loam	No	0.8	1.92	1.24	Yes
borohemists ponded	NRCS Soil Taxonomy Handbook	Histosols, pg 142	Loam	No	0.50	0.61	0.31	Yes
borolic natrargids	ADOT		clay	No	0.02	0.04	0.01	Yes
borollic natragrids	ADOT		clay	No	0.02	0.04	0.01	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
						2006		
					1983	DF =1.0	DF =1.1	
borrow pit	Engineering judgement		Sandy loam	No	0.80	1.92	1.24	Yes
borrow pits	Engineering judgement		Sandy loam	No	0.80	1.92	1.24	Yes
bowdish family	UT686		loam	No	0.5	0.61	0.31	Yes
bracken	NRCS ksat		Sandy loam	No	0.80	1.92	1.24	Yes
braffits	UT634		loam	No	0.5	0.61	0.31	Yes
briefly flooded soils	Engineering judgment		sandy loam	No	0.8	1.92	1.24	Yes
broncho	UT636		sandy loam	No	0.8	1.92	1.24	Yes
bruman	UT636		loam	No	0.5	0.61	0.31	Yes
brumley	UT686		sandy loam	No	0.8	1.92	1.24	Yes
brycan	UT636		sandy loam	No	0.8	1.92	1.24	Yes
budland	UT641		sandy loam	No	0.8	1.92	1.24	Yes
bullion	UT634		silt loam	No	0.3	0.63	0.32	Yes
bushvalley	UT634		loam	No	0.5	0.61	0.31	Yes
cabinpine	Google		sand	No	4.6	4.03	3.12	Yes
calcic petrocalcids	NV755		Sandy loam	No	0.80	1.92	1.24	Yes
calciorthids	Engineering judgement		Sandy loam	No	0.80	1.92	1.24	Yes
calcross	UT634		silty clay loam	No	0.08	0.23	0.10	Yes
callings	UT636		loam	No	0.5	0.61	0.31	Yes
cannonville	UT636		clay	No	0.02	0.04	0.01	Yes
cannonville clay	Description		clay	No	0.02	0.04	0.01	Yes
cannonville family	UT686		clay	No	0.02	0.04	0.01	Yes
cannonville member entrada formation badland	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
						2006		
					1983	DF =1.0	DF =1.1	
cannonville very stony clay	Description		clay	No	0.02	0.04	0.01	Yes
carbonate subsoils	Engineering judgment		clay	No	0.02	0.04	0.01	Yes
carmel and entrada formation badland	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
carmel formation badland	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
carmel formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
castino	UT636		silt loam	No	0.3	0.63	0.32	Yes
castino extremely cobbly loam	Description		Loam	No	0.5	0.61	0.31	Yes
castino gravelly silt loam	Description		silt loam	No	0.3	0.63	0.32	Yes
catahoula	UT686		loam	No	0.5	0.61	0.31	Yes
catahoula family	UT686		loam	No	0.5	0.61	0.31	Yes
caval	UT641		sandy loam	No	0.8	1.92	1.24	Yes
cave	AZ637		Sandy loam	No	0.80	1.92	1.24	Yes
cavel	UT641		sandy loam	No	0.8	1.92	1.24	Yes
charkiln	NV755		sandy loam	No	0.8	1.92	1.24	Yes
check canyon	UT634		loam	No	0.5	0.61	0.31	Yes
checkett	UT634		loam	No	0.5	0.61	0.31	Yes
chilton	UT641		loam	No	0.5	0.61	0.31	Yes
chinle formation badland	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
chipeta	UT686		silty clay loam	No	0.08	0.23	0.10	Yes
cinder land	AZ, UT		Sand	No	4.60	4.03	3.12	Yes
circleville	UT636		clay loam	No	0.08	0.17	0.07	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils								
					K_s, in/hr			
						2006		
Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	1983	DF =1.0	DF =1.1	Include
clapper	UT686		loam	No	0.5	0.61	0.31	Yes
clapper cobbly loam	Description		Loam	No	0.5	0.61	0.31	Yes
clay subsoils	UT634		loam	No	0.5	0.61	0.31	Yes
clayey aridic ustorthents	Engineering judgment		clay	No	0.02	0.04	0.01	Yes
clayey lithic haplustalfs	Engineering judgment		clay	No	0.02	0.04	0.01	Yes
clayey lithic ustic haplargids	Engineering judgment		clay	No	0.02	0.04	0.01	Yes
clayey shallow aridic ustorthents	Engineering judgment		clay	No	0.02	0.04	0.01	Yes
clovis	UT641		sandy loam	No	0.8	1.92	1.24	Yes
coarse textured soils	ADOT		Sandy loam	No	0.8	1.92	1.24	Yes
coarse-loamy torrifluvents	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
coarse-loamy typic haplustalfs	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
coarse-loamy ustic calciargids	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
coarse-loamy ustic haplargids	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
coarse-loamy ustic haplocalcids	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
coarse-loamy ustic torriorthents	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
cobbly clay loam soils	Engineering judgment		clay loam	No	0.08	0.17	0.07	Yes
codely silt	Description		Silt	No	0.2	0.8	0.43	Yes
codley	UT636		silt loam	No	0.3	0.63	0.32	Yes
collbran	UT641		clay loam	No	0.08	0.17	0.07	Yes
colskel family	UT686		loam	No	0.5	0.61	0.31	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	Ks, in/hr			Include
						2006		
					1983	DF =1.0	DF =1.1	
comodore	UT636		clay loam	No	0.08	0.17	0.07	Yes
crestline	UT636		sandy loam	No	0.8	1.92	1.24	Yes
cryaquents	NRCS Soil Taxonomy Handbook	Entisols, pg 138	Sand	No	4.60	4.03	3.12	Yes
cryaquolls loamy-skeletal	NRCS Soil Taxonomy Handbook	Mollisols, pg 144	Silt loam	No	0.30	0.63	0.32	Yes
cryofibrists	NRCS Soil Taxonomy Handbook	Histosols, pg 141	Loam	No	0.50	0.61	0.31	Yes
cryohemists	NRCS Soil Taxonomy Handbook	Histosols, pg 142	Loam	No	0.50	0.61	0.31	Yes
cumulic haplaquolls	Engineering judgement	Mollisols, aquolls	Silt loam	No	0.30	0.63	0.32	Yes
curecanti	UT686		loam	No	0.5	0.61	0.31	Yes
curecanti family	UT686		loam	No	0.5	0.61	0.31	Yes
curhollow	UT641		sandy loam	No	0.8	1.92	1.24	Yes
dag flat	UT641		sandy loam	No	0.8	1.92	1.24	Yes
daklos	UT686		loam	No	0.5	0.61	0.31	Yes
dakota and morrison formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
dakota formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
dalcan	UT636		clay loam	No	0.08	0.17	0.07	Yes
dam	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
dams	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
decca	UT634		sandy loam	No	0.8	1.92	1.24	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
deep clay in dperssional areas	Description		Clay	No	0.02	0.04	0.01	Yes
deep grayish brown very stony loam	Description		Loam	No	0.5	0.61	0.31	Yes
deep sandy soils that have a subsoil of calcareous loam	ADOT		Sandy loam	No	0.8	1.92	1.24	Yes
deep soils	UT641		loam	No	0.5	0.61	0.31	Yes
deep soils similar to andys	Andys		Loam	No	0.5	0.61	0.31	Yes
deep very gravelly loam soils	UT641		loam	No	0.5	0.61	0.31	Yes
deerlodge	UT634		loam	No	0.5	0.61	0.31	Yes
denied access	Engineering judgement		Loam	No	0.50	0.61	0.31	Yes
denmard	UT634		loam	No	0.5	0.61	0.31	Yes
denmark	UT634		loam	No	0.5	0.61	0.31	Yes
dennot	UT634		loam	No	0.5	0.61	0.31	Yes
denpark	UT634		loam	No	0.5	0.61	0.31	Yes
descot	UT636		sandy loam	No	0.8	1.92	1.24	Yes
detra	UT634		loam	No	0.5	0.61	0.31	Yes
detra	UT641		sandy loam	No	0.8	1.92	1.24	Yes
dient	UT686		sandy clay loam	No	0.12	0.44	0.21	Yes
dient family	UT686		sandy clay loam	No	0.12	0.44	0.21	Yes
dimyaw family soil	ADOT		Silty clay	No	0.04	0.15	0.06	Yes
dixie	UT634		loam	No	0.5	0.61	0.31	Yes
doyce	UT634		loam	No	0.5	0.61	0.31	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
dumps	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
dune land	AZ, UT		Sand	No	4.60	4.03	3.12	Yes
earlweed	UT686		loamy sand	No	2.4	3.6	2.71	Yes
earlweed family	UT686		loamy sand	No	2.4	3.6	2.71	Yes
elenore	UT634		loam	No	0.5	0.61	0.31	Yes
elias	UT686		sandy loam	No	0.8	1.92	1.24	Yes
elledge family	AZ701		sandy loam	No	0.8	1.92	1.24	Yes
emlin	UT686		loam	No	0.5	0.61	0.25	Yes
endoaquolls	Engineering judgement	Inceptisols, Xerepts, pgs 142, 491	Silt loam	No	0.30	0.63	0.32	Yes
entrada and carmel formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
entrada sandstone rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
eroded land	Engineering judgement		Sandy loam	No	0.80	1.92	1.24	Yes
escalante	UT634		sandy loam	No	0.8	1.92	1.24	Yes
esplin	UT641		loam	No	0.5	0.61	0.31	Yes
ess	UT636		sandy loam	No	0.8	1.92	1.24	Yes
evanston	UT636		loam	No	0.5	0.61	0.31	Yes
evpark	UT686		sandy loam	No	0.8	1.92	1.24	Yes
evpark family	UT686		sandy loam	No	0.8	1.92	1.24	Yes
excalante	UT634		loam	No	0.5	0.61	0.31	Yes
faim	UT634		clay loam	No	0.08	0.17	0.07	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
						2006		
					1983	DF =1.0	DF =1.1	
festus	UT634		sandy loam	No	0.8	1.92	1.24	Yes
fewtus	UT634		sandy loam	No	0.8	1.92	1.24	Yes
filoa	UT636		loam	No	0.5	0.61	0.31	Yes
fine textured soils	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
fine-loamy aridic ustorthents	Engineering judgment	Google	loam	No	0.5	0.61	0.31	Yes
fine-loamy typic torriorthents	Engineering judgment	Google	loam	No	0.5	0.61	0.31	Yes
fine-loamy ustic haplocalcids	Engineering judgment	Structure and Function of a Chihuahuan Desert Ecosystem	loam	No	0.5	0.61	0.31	Yes
fine-loamy ustic torriorthents	Engineering judgment	NV755, UT, AZ701	loam	No	0.5	0.61	0.31	Yes
fluvaquentic haplaquoll	Engineering judgement	Mollisols, aquolls, pgs 147, 557	Silt loam	No	0.30	0.63	0.32	Yes
fluvaquentic haplaquolls	Engineering judgement	Mollisols, aquolls, pgs 147, 557	Silt loam	No	0.30	0.63	0.32	Yes
fluvaquentic haplustoll	NRCS Soil Taxonomy Handbook	Mollisols, pgs 147, 557	Silt loam	No	0.30	0.63	0.32	Yes
fluvaquentic haplustolls	NRCS Soil Taxonomy Handbook	Mollisols, pgs 147, 557	Silt loam	No	0.30	0.63	0.32	Yes
fluvaquents	UT641		Sand	No	4.60	4.03	3.12	Yes
fluvaquents frequently flooded	UT641		Sand	No	4.60	4.03	3.12	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
fluvents	Engineering judgment	Google	silt	No	0.2	0.8	0.43	Yes
frandsen	UT636		clay loam	No	0.08	0.17	0.07	Yes
frigid soils	UT634		loam	No	0.5	0.61	0.31	Yes
fughes	UT634		loam	No	0.5	0.61	0.31	Yes
garbo	UT634		sandy loam	No	0.8	1.92	1.24	Yes
gerst family	UT686		loam	No	0.5	0.61	0.31	Yes
gomine	UT634		loam	No	0.5	0.61	0.31	Yes
gravel piet	UT634		loam	No	0.5	0.61	0.31	Yes
gravel pit	Engineering judgement		Sand	No	4.60	4.03	3.12	Yes
gravelly alluvial land	Engineering judgement		Sandy loam	No	0.80	1.92	1.24	Yes
gravelly fine textured soil	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
gravelly sandy loam soils	UT634		sandy loam	No	0.8	1.92	1.24	Yes
gravelly soils	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
gravelly throughout soils	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
green river	UT686		sandy loam	No	0.8	1.92	1.24	Yes
greengrove	OSDs		sandy loam	No	0.8	1.92	1.24	Yes
greenhalgh	UT636		silt loam	No	0.3	0.63	0.32	Yes
greenhalgh silt	Description		Silt	No	0.2	0.8	0.43	Yes
grimm	UT636		sandy loam	No	0.8	1.92	1.24	Yes
guben	UT636		loam	No	0.5	0.61	0.31	Yes
guben gravelly loam	Description		Loam	No	0.5	0.61	0.31	Yes
gullied land	Engineering judgement		Sandy loam	No	0.80	1.92	1.24	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	Ks, in/hr 1983	Ks, in/hr 2006 DF =1.0	Ks, in/hr 2006 DF =1.1	Include
gypsids	NRCS Soil Taxonomy Handbook	Aridisols, pg 137	Sandy clay loam	No	0.12	0.44	0.21	Yes
gypsids shallow	NRCS Soil Taxonomy Handbook	Aridisols, pg 137	Sandy clay loam	No	0.12	0.44	0.21	Yes
gypsiorthids	Engineering judgement		Sandy clay loam	No	0.12	0.44	0.21	Yes
gypsum land	NRCS Soil Taxonomy Handbook	Aridisols, pg 137	Sandy clay loam	No	0.12	0.44	0.21	Yes
hanksville	UT686		silty clay loam	No	0.08	0.23	0.10	Yes
hanksville family	UT686		silty clay loam	No	0.08	0.23	0.10	Yes
hantz	UT641		silty clay loam	No	0.08	0.23	0.10	Yes
haplaquolls	NRCS Soil Taxonomy Handbook	Mollisols, pg 144	Silt loam	No	0.30	0.63	0.32	Yes
haplocalcids	NV755, AZ701		Loam	No	0.50	0.61	0.31	Yes
haplocambids	NRCS Soil Taxonomy Handbook	Aridisols, pg 138	Sandy clay loam	No	0.12	0.44	0.21	Yes
haplofibrists	NRCS Soil Taxonomy Handbook	Histosols, pg 141	Loam	No	0.50	0.61	0.31	Yes
haplogypsids	NRCS Soil Taxonomy Handbook	Aridisols, pg 137	Sandy clay loam	No	0.12	0.44	0.21	Yes
hardpan soils	Engineering judgment		clay	No	0.02	0.04	0.01	Yes
hardpan soils	Engineering judgment		clay	No	0.02	0.04	0.01	Yes
harol	UT636		clay loam	No	0.08	0.17	0.07	Yes
harrisburg	UT641		sandy loam	No	0.8	1.92	1.24	Yes
hatch	UT636		clay loam	No	0.08	0.17	0.07	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
hatu	UT634		silty clay	No	0.04	0.15	0.06	Yes
haulings	Engineering judgement		loam	No	0.50	0.61	0.31	Yes
henreville	henreville		Loam	No	0.5	0.61	0.31	Yes
henrieville	UT636		loam	No	0.5	0.61	0.31	Yes
henriville sandy loam	Description		Sandy loam	No	0.8	1.92	1.24	Yes
hetz	UT686		Sandy loam	No	0.80	1.92	1.24	Yes
hiko peak	UT634		sandy loam	No	0.8	1.92	1.24	Yes
hiko springs	OSDs		Sandy loam	No	0.8	1.92	1.24	Yes
hillburn family	UT686		sandy loam	No	0.8	1.92	1.24	Yes
hobog	UT641		loam	No	0.5	0.61	0.31	Yes
hogg	UT641		sandy loam	No	0.8	1.92	1.24	Yes
honlu	OSDs		Loam	No	0.5	0.61	0.31	Yes
hoodle	UT636		loam	No	0.5	0.61	0.31	Yes
horsemountain family	UT686		sandy loam	No	0.8	1.92	1.24	Yes
hoye	UT634		sandy loam	No	0.8	1.92	1.24	Yes
humbug	UT686		sandy loam	No	0.8	1.92	1.24	Yes
ikit	UT634		loam	No	0.5	0.61	0.31	Yes
intermittent water	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
ipson	UT636		loam	No	0.5	0.61	0.31	Yes
ironco	UT634		loam	No	0.5	0.61	0.31	Yes
isom	UT641		sandy loam	No	0.8	1.92	1.24	Yes
ivins	UT641		loamy sand	No	2.4	3.6	2.71	Yes
jigsaw	UT634		silty clay loam	No	0.08	0.23	0.10	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
jodero	UT636		loam	No	0.5	0.61	0.31	Yes
jodero loam	Description		Loam	No	0.5	0.61	0.31	Yes
junction	UT641		sandy loam	No	0.8	1.92	1.24	Yes
junkett	UT634		sandy loam	No	0.8	1.92	1.24	Yes
kaiparowits	AZ701		loam	No	0.5	0.61	0.31	Yes
kanabownits	AZ701		sandy loam	No	0.8	1.92	1.24	Yes
kanarra	UT634		sandy clay loam	No	0.12	0.44	0.21	Yes
kayenta formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
kenzo family	UT686		loam	No	0.5	0.61	0.31	Yes
kinesava	UT641		sandy loam	No	0.8	1.92	1.24	Yes
kinghorn	UT634		loam	No	0.5	0.61	0.31	Yes
kippers	AZ701		loam	No	0.5	0.61	0.31	Yes
kjar	Engineering judgement		Silty clay loam	No	0.08	0.23	0.10	Yes
kolob	UT634		loam	No	0.5	0.61	0.31	Yes
kolob	UT641		sandy loam	No	0.8	1.92	1.24	Yes
krudger	UT634		loam	No	0.5	0.61	0.31	Yes
kruegar	UT634		loam	No	0.5	0.61	0.31	Yes
krueger	UT634		loam	No	0.5	0.61	0.31	Yes
kruger	UT634		loam	No	0.5	0.61	0.31	Yes
kunz	UT634		sandy loam	No	0.8	1.92	1.24	Yes
ladyofsnow	NV755		siltloam	No	0.3	0.63	0.32	Yes
lagnaf	UT634		loam	No	0.5	0.61	0.31	Yes
las	muname		Loamy sand	No	2.40	3.60	2.71	Yes
lava	UT634		loam	No	0.5	0.61	0.31	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils								
					K_s, in/hr			
						2006		
Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	1983	DF =1.0	DF =1.1	Include
lava flows	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
lavate	UT641		sandy loam	No	0.8	1.92	1.24	Yes
laverkin	UT641		silty clay loam	No	0.08	0.23	0.10	Yes
lazear	UT636		loam	No	0.5	0.61	0.31	Yes
leeds	UT641		silty clay loam	No	0.08	0.23	0.10	Yes
lemrac	UT686		silt loam	No	0.3	0.63	0.32	Yes
less steep soils	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
levee	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
limestone rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
lithic calciargids	NRCS Soil Taxonomy Handbook		Loam	No	0.50	0.61	0.31	Yes
lithic haplargids	NV755		Loam	No	0.50	0.61	0.31	Yes
lithic haplocalcids	NV755		Sandy loam	No	0.80	1.92	1.24	Yes
lithic haplocambids	NRCS Soil Taxonomy Handbook	Aridisols, pg 138	Sandy clay loam	No	0.12	0.44	0.21	Yes
lithic haplustalfs	AZ		Clay loam	No	0.08	0.17	0.07	Yes
lithic haplustolls	AZ		Loam	No	0.50	0.61	0.31	Yes
lithic hapustalfs	lithic haplustalfs	Google	clay loam	No	0.08	0.17	0.07	Yes
lithic torriorthents	AZ, UT		Sandy loam	No	0.80	1.92	1.24	Yes
lithic torripsamments	Engineering judgment	Google	sandy loam	No	0.8	1.92	1.24	Yes
lithic ustic haplargids	NV755		Loam	No	0.50	0.61	0.31	Yes
lithic ustic haplocalcids	Engineering judgment	Google	silt	No	0.2	0.8	0.43	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils								
					K_s, in/hr			
						2006		
Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	1983	DF =1.0	DF =1.1	Include
lithic ustic torriorthents	NV755		Loam	No	0.50	0.61	0.31	Yes
lithic ustorthents	lithic ustic torriorthents	NV755, UT, AZ701	loam	No	0.5	0.61	0.31	Yes
lithic ustorthents family	NRCS Soil Taxonomy Handbook	Entisols,1 40	Sand	No	4.60	4.03	3.12	Yes
loam	Description		Loam	No	0.5	0.61	0.31	Yes
loam or silt loam soils	UT634		loam	No	0.5	0.61	0.31	Yes
loamy alluvial land	Engineering judgement		Loam	No	0.50	0.61	0.31	Yes
loamy lithic calciargids	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy lithic torriorthents	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy lithic ustic haplargids	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy lithic ustic torriorthents	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy shallow typic torriorthents	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy typic torrifluvents	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy-skeletal calcidic haplustalfs	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy-skeletal lithic ustic haplargids	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy-skeletal lithic ustic haplocalcids	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy-skeletal lithic ustic torriorthents	Engineering judgment		loam	No	0.5	0.61	0.31	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
						2006		
					1983	DF =1.0	DF =1.1	
loamy-skeletal shallow ustic torriorthents	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy-skeletal torrifluvents	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy-skeletal ustic haplocalcids	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy-skeletal ustic torriorthents	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
loamy-skeletel lithic torriorthents	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
lorhunt	UT634		loam	No	0.5	0.61	0.31	Yes
losee	UT636		clay loam	No	0.08	0.17	0.07	Yes
losee gravelly	OSDs		Loam	No	0.5	0.61	0.31	Yes
losee gravelly loam	Description		Loam	No	0.5	0.61	0.31	Yes
losee gravelly sandy loam	Description		sandy loam	No	0.8	1.92	1.24	Yes
lucero	UT634		loam	No	0.5	0.61	0.31	Yes
luhon	UT636		loam	No	0.5	0.61	0.31	Yes
mack	UT686		loamy sand	No	2.4	3.6	2.71	Yes
magotsu	UT641		loam	No	0.5	0.61	0.31	Yes
manderfield	UT634		sandy loam	No	0.8	1.92	1.24	Yes
manderfiels	UT634		sandy loam	No	0.8	1.92	1.24	Yes
manselo	UT634		loam	No	0.5	0.61	0.31	Yes
marshes	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
maryjane	NV755		loam	No	0.5	0.61	0.31	Yes
mathis	UT641		loamy sand	No	2.4	3.6	2.71	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
						2006		
					1983	DF =1.0	DF =1.1	
medburn	UT634		sandy loam	No	0.8	1.92	1.24	Yes
medium textured gravelly soils	Engineering judgement		Loam	No	0.5	0.61	0.31	Yes
medium textured soils taht have a loam surface	Description		Loam	No	0.5	0.61	0.31	Yes
medium textured soils that have a loam surface	UT636		loam	No	0.5	0.61	0.31	Yes
mellenthin	UT686		loam	No	0.5	0.61	0.31	Yes
melling	UT634		loam	No	0.5	0.61	0.31	Yes
menefee	UT634		clay loam	No	0.08	0.17	0.07	Yes
menefee	UT686		loam	No	0.5	0.61	0.31	Yes
menefee family	UT686		loam	No	0.5	0.61	0.31	Yes
mespun	UT641		sand	No	4.6	4.03	3.12	Yes
mespun	UT686		sand	No	4.6	4.03	3.12	Yes
mident	UT686		sand	No	4.6	4.03	3.12	Yes
mido	UT686		sand	No	4.6	4.03	3.12	Yes
mido family	UT686		sand	No	4.6	4.03	3.12	Yes
mikim	UT636		clay loam	No	0.08	0.17	0.07	Yes
mikim clay	Description		Clay	No	0.02	0.04	0.01	Yes
milok	UT686		loamy sand	No	2.4	3.6	2.71	Yes
mined land	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
minu	UT634		sandy loam	No	0.8	1.92	1.24	Yes
miscellaneous water	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
mitch	UT636		silt loam	No	0.3	0.63	0.32	Yes
mitch silt	Description		Silt	No	0.2	0.8	0.43	Yes
mivida	UT636		sandy loam	No	0.8	1.92	1.24	Yes
moderately deep soils	Engineering judgement		Loam	No	0.5	0.61	0.31	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006 DF =1.0	2006 DF =1.1	
moderately deep soils similar to lazear	OSDs		Loam	No	0.5	0.61	0.31	Yes
moderately deep soils similar to zyme	UT636		Loam	No	0.5	0.61	0.31	Yes
moderately well drained soils	Engineering judgment		sandy loam	No	0.8	1.92	1.24	Yes
moderatly deep soils	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
moenkopi formation badland	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
moenkopi formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
moenkopie	UT686		loam	No	0.5	0.61	0.31	Yes
moepitz	UT686		sandy loam	No	0.8	1.92	1.24	Yes
moffat	UT686		loamy sand	No	2.4	3.6	2.71	Yes
mollic fluvaquents	NRCS Soil Taxonomy Handbook	Entisols, pg 138	Sand	No	4.60	4.03	3.12	Yes
mollic halaquepts	NRCS Soil Taxonomy Handbook	Inceptisols, pg 142	Sandy clay loam	No	0.12	0.44	0.21	Yes
monox	UT634		sandy loam	No	0.8	1.92	1.24	Yes
monroe	UT634		silt loam	No	0.3	0.63	0.32	Yes
montoqua	UT641		sandy loam	No	0.8	1.92	1.24	Yes
mord	UT634		loam	No	0.5	0.61	0.31	Yes
morrison and entrada formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
morrison formation and romano mesa sandstone rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
morrison formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
mosida	UT634		sandy loam	No	0.8	1.92	1.24	Yes
motoqua	UT634		loam	No	0.5	0.61	0.31	Yes
motoqua	UT641		sandy loam	No	0.8	1.92	1.24	Yes
muleypoint	UT634		loam	No	0.5	0.61	0.31	Yes
musina	UT634		loam	No	0.5	0.61	0.31	Yes
musinia	UT634		silty clay loam	No	0.08	0.23	0.10	Yes
nakai	UT686		sand	No	4.6	4.03	3.12	Yes
nalcase	UT686		sand	No	4.6	4.03	3.12	Yes
naplene	UT641		silt loam	No	0.3	0.63	0.32	Yes
navajo sandstone and carmel formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
navajo sandstone rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
needle	UT686		loamy sand	No	2.4	3.6	2.71	Yes
nehar	UT641		sandy loam	No	0.8	1.92	1.24	Yes
nepalto	UT686		loamy sand	No	2.4	3.6	2.71	Yes
neto	UT636		sandy loam	No	0.8	1.92	1.24	Yes
nickey	UT641		sandy loam	No	0.8	1.92	1.24	Yes
nihelen	NV754		loam	No	0.5	0.61	0.31	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr 1983	K_s, in/hr 2006 DF =1.0	K_s, in/hr 2006 DF =1.1	Include
nikey	UT641		sandy loam	No	0.8	1.92	1.24	Yes
not complete	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
notcom	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
notcomm	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
notter	UT636		Clay loam	No	0.08	0.17	0.07	Yes
notter	UT636		sandy clay loam	No	0.12	0.44	0.21	Yes
notter gravelly loam	Description		Loam	No	0.5	0.61	0.31	Yes
notter variant	UT636		loam	No	0.5	0.61	0.31	Yes
nuhelen	NV754		loam	No	0.5	0.61	0.31	Yes
ocambee	UT634		loam	No	0.5	0.61	0.31	Yes
onaqui	UT634		loam	No	0.5	0.61	0.31	Yes
orcap	UT634		clay loam	No	0.08	0.17	0.07	Yes
orthents	NRCS Soil Taxonomy Handbook	Entisols,139	Sand	No	4.60	4.03	3.12	Yes
osote	UT636		silty clay loam	No	0.08	0.23	0.10	Yes
pachic argiustolls	Description	https://casoilresource.lawr.ucdavis.edu/	loam	No	0.5	0.58	0.29	Yes
pachic haplustolls	NV755		silt loam	No	0.3	0.63	0.32	Yes
page sandstone carmel formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
pagina	UT686		loamy sand	No	2.4	3.6	2.71	Yes
pagina family	UT686		loamy sand	No	2.4	3.6	2.71	Yes
pahreah	UT636		loam	No	0.5	0.61	0.31	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
pahreah gravelly loam	Description		Loam	No	0.5	0.61	0.31	Yes
palma	UT641		sandy loam	No	0.8	1.92	1.24	Yes
panguitch	UT636		clay loam	No	0.08	0.17	0.07	Yes
panguitch gravelly loam	Description		Loam	No	0.5	0.61	0.31	Yes
paragonah	UT634		silty clay loam	No	0.08	0.23	0.10	Yes
parkwash	UT686		loamy sand	No	2.4	3.6	2.71	Yes
parowan	UT634		silt loam	No	0.3	0.63	0.32	Yes
pass canyon	UT634		loam	No	0.5	0.61	0.31	Yes
pastura	UT641		loam	No	0.5	0.61	0.31	Yes
paunsaugunt	UT636		sandy loam	No	0.8	1.92	1.24	Yes
pausaugunt	UT641		silt loam	No	0.3	0.63	0.32	Yes
pavan	UT634		loam	No	0.5	0.61	0.31	Yes
pavant	UT634		loam	No	0.5	0.61	0.31	Yes
peekaboo	UT686		loamy sand	No	2.4	3.6	2.71	Yes
peteetneet	Engineering judgement		Silty clay loam	No	0.08	0.23	0.10	Yes
petrocalcic paleustalfs	Engineering judgment	Google	loam	No	0.5	0.61	0.31	Yes
pinntank	AZ701		loam	No	0.5	0.61	0.31	Yes
pintura	UT641		loamy sand	No	2.4	3.6	2.71	Yes
pits	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
pits borrow	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
pits gravel	Engineering judgement		Sand	No	4.60	4.03	3.12	Yes
pits quarry	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
pits-dumps complex	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
pits-dumps mine	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
playa	NV754, UT634		Silty clay loam	No	0.08	0.23	0.10	Yes
playas	NV754, UT634		Silty clay loam	No	0.08	0.23	0.10	Yes
plite	UT634		sandy loam	No	0.8	1.92	1.24	Yes
plite sandy loam	UT636		Sandy loam	No	0.80	1.92	1.24	Yes
plumasano	UT686		loamy sand	No	2.4	3.6	2.71	Yes
podo	UT636		loam	No	0.5	0.61	0.31	Yes
podo family	UT686		sandy loam	No	0.8	1.92	1.24	Yes
polychrome family	UT686		sand	No	4.6	4.03	3.12	Yes
poorly drained soils	UT636		Loam	No	0.50	0.61	0.31	Yes
poorly drained textured soils	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
progresso family	UT686		loam	No	0.5	0.61	0.31	Yes
psamments	NRCS Soil Taxonomy Handbook	Entisols,138	Sand	No	4.60	4.03	3.12	Yes
pyrat	UT634		loam	No	0.5	0.61	0.31	Yes
quazo	UT641		sandy loam	No	0.8	1.92	1.24	Yes
quichipa	UT634		silty clay loam	No	0.08	0.23	0.10	Yes
quilt	UT636		clay loam	No	0.08	0.17	0.07	Yes
radec	UT634		loam	No	0.5	0.61	0.31	Yes
radnik	UT686		sandy loam	No	0.8	1.92	1.24	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils								
					K_s, in/hr			
						2006		
Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	1983	DF =1.0	DF =1.1	Include
ramps	UT634		sandy loam	No	0.8	1.92	1.24	Yes
ranion	UT686		loamy sand	No	2.4	3.6	2.71	Yes
red butte	UT634		loam	No	0.5	0.61	0.31	Yes
redbank	UT641		silty clay loam	No	0.08	0.23	0.10	Yes
redcreek	UT636		loam	No	0.5	0.61	0.31	Yes
redcreek cobbly loam	Description		Loam	No	0.5	0.61	0.31	Yes
remorris	UT686		loam	No	0.5	0.61	0.31	Yes
renbac	UT641		clay loam	No	0.08	0.17	0.07	Yes
repmis	UT634		loam	No	0.5	0.61	0.31	Yes
retsabal	UT686		sandy loam	No	0.8	1.92	1.24	Yes
ripgut	UT634		loam	No	0.5	0.61	0.31	Yes
riverwash	All surveys		Sand	No	4.60	4.03	3.12	Yes
riverwash and water	All surveys		Sand	No	4.60	4.03	3.12	Yes
rizno	UT686		loam	No	0.5	0.61	0.31	Yes
rob roy	UT634		loam	No	0.5	0.61	0.31	Yes
rock land	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
rock land stony	Engineering judgment		clay	No	0.02	0.04	0.01	Yes
rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
rock outcrop with shale and sandstone	Description		Clay	Yes	0.02	0.04	0.01	Yes
rock outcrot	UT634		loam	No	0.5	0.61	0.31	Yes
rockland	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
rough broken land	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
rubble land	Engineering judgement		Loam	Yes	0.50	0.61	0.31	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006 DF =1.0	2006 DF =1.1	
rubbleland	Engineering judgement		Loam	Yes	0.50	0.61	0.31	Yes
ruko	UT636		clay	No	0.02	0.04	0.01	Yes
ruko clay	Description		Clay	No	0.02	0.04	0.01	Yes
ruko family	UT686		clay loam	No	0.08	0.17	0.07	Yes
rustico	UT634		silty clay loam	No	0.08	0.23	0.10	Yes
ruvaquents	NRCS Soil Taxonomy Handbook	Entisols,1 38	Sand	No	4.60	4.03	3.12	Yes
rypod	UT634		loam	No	0.5	0.61	0.31	Yes
sackett	UT634		loam	No	0.5	0.61	0.31	Yes
sandy alluvial land	Engineering judgement		Sandy loam	No	0.80	1.92	1.24	Yes
sandy and gravelly alluvial land	Engineering judgement		Sandy loam	No	0.80	1.92	1.24	Yes
sandy aridic ustorthents	aridic lithic ustorthents	NRCS Soil Taxonom y Handboo k, Entisols, pg 140	sand	No	4.6	4.03	3.12	Yes
sandy clay loams and clay loam soils	UT634		clay loam	No	0.08	0.17	0.07	Yes
sandy lithic ustic torriorthent	lithic ustic torriorthents	NV755, UT, AZ701	sandy loam	No	0.8	1.92	1.24	Yes
sandy loam surface texture soils	UT634		sandy loam	No	0.8	1.92	1.24	Yes
sandy soils	Description		Sandy loam	No	0.8	1.92	1.24	Yes
sandy ustic torriorthents	ustic torriorthents	NV755, UT, AZ701	sandy loam	No	0.8	1.92	1.24	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
sandy-skeletal lithic ustic torriorthents	lithic ustic torriorthents	NV755, UT, AZ701	sandy loam	No	0.8	1.92	1.24	Yes
sandy-skeletal shallow ustic torriorthents	ustic torriorthents	NV755, UT, AZ701	sandy loam	No	0.8	1.92	1.24	Yes
sandy-skeletal typic torrifluvents	typic torriorthents	NV754, AZ, AZ701, UT	sandy loam	No	0.8	1.92	1.24	Yes
sanostee	UT686		sandy loam	No	0.8	1.92	1.24	Yes
sanpete	UT634		loam	No	0.5	0.61	0.31	Yes
santrick	UT686		sand	No	4.6	4.03	3.12	Yes
saxby	UT634		loam	No	0.5	0.61	0.31	Yes
sazi	UT686		sandy loam	No	0.8	1.92	1.24	Yes
schauson	UT636		Loam	No	0.5	0.61	0.31	Yes
schmutz	UT641		loam	No	0.5	0.61	0.31	Yes
seeg	UT686		loamy sand	No	2.4	3.6	2.71	Yes
seth	UT634		loam	No	0.5	0.61	0.31	Yes
sevier	UT636		clay loam	No	0.08	0.17	0.07	Yes
sevy	UT634		loam	No	0.5	0.61	0.31	Yes
shalcar family	Engineering judgement		Silty clay	No	0.04	0.15	0.06	Yes
shalet	UT641		clay loam	No	0.08	0.17	0.07	Yes
shallow gravelly soils	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
shallow sandy loam soils	Engineering judgment		sandy loam	No	0.8	1.92	1.24	Yes
shallow sandy soils	Engineering judgment		sandy loam	No	0.8	1.92	1.24	Yes
shallow soils	Engineering judgment		clay loam	No	0.08	0.17	0.07	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
						2006		
					1983	DF =1.0	DF =1.1	
shallow soils that have less than 35 percent rock fragments	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
shalona family	UT686		sandy loam	No	0.8	1.92	1.24	Yes
sheckle	UT634		loam	No	0.5	0.61	0.31	Yes
sheege	UT636		loam	No	0.5	0.61	0.31	Yes
sheppard	UT686		sand	No	4.6	4.03	3.12	Yes
shinarump member chinle formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
showalter cobbly loam	Description		Loam	No	0.5	0.61	0.31	Yes
sielo	UT636		sandy loam	No	0.8	1.92	1.24	Yes
sielo fine sandy loam	Description		Sandy loam	No	0.8	1.92	1.24	Yes
sili	UT686		silty clay loam	No	0.08	0.23	0.10	Yes
simel	UT686		loam	No	0.5	0.61	0.31	Yes
simper	UT634		loam	No	0.5	0.61	0.31	Yes
siroco	UT634		loam	No	0.5	0.61	0.31	Yes
skumpah	UT634		silt loam	No	0.3	0.63	0.32	Yes
skutum	UT636		Sandy loam	No	0.80	1.92	1.24	Yes
slickspot	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
slickspots	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
small depressions	UT636		Sand	No	4.60	4.03	3.12	Yes
sodic haplocalcids	NRCS Soil Taxonomy Handbook	Aridisols, pg 137	Sandy clay loam	No	0.12	0.44	0.21	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
						2006		
					1983	DF =1.0	DF =1.1	
soils similar to jodero soil near panguitch	Jodero		Loam	No	0.5	0.61	0.31	Yes
soils similar to lazear soil	Lazear		Loam	No	0.5	0.61	0.31	Yes
soils similar to the gerst family soils	Gerst		Loam	No	0.5	0.61	0.31	Yes
soils similar to the podo soil	Podo		Loam	No	0.5	0.61	0.31	Yes
soils similar to these dimyaw soils	Dimyaw		Loam	No	0.5	0.61	0.31	Yes
soils that are shallow to moderately deep to a lime-cemented	Engineering judgement		Clay	No	0.02	0.04	0.01	Yes
soils that are similar to clapper soil	Clapper		Loam	No	0.5	0.61	0.31	Yes
soils that are similar to mikim soil	Mikim		Loam	No	0.5	0.61	0.31	Yes
soils that are similar to mitch soil	Mitch		Silt loam	No	0.3	0.63	0.32	Yes
soils that are similar to panguitch soil	Panguitch		Loam	No	0.5	0.61	0.31	Yes
soils that are similar to schauson soil	Schauson		Loam	No	0.5	0.61	0.31	Yes
soils that are similar to schauson soil but with lime	Schauson		Loam	No	0.5	0.61	0.31	Yes
soils with bedrock at 40-60 inches	Engineering judgement		Loam	No	0.5	0.61	0.31	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
soils with less than 35 percent rock fragments	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
soils with more than 35 percent rock fragments	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
soils with more than 35 percent rock fragments throughout	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
soils with more than 40 percent calcium carbonate	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
soils with very cobbly surface	Engineering judgement		Loam	No	0.5	0.61	0.31	Yes
sojourn family	UT686		loamy sand	No	2.4	3.6	2.71	Yes
somewhat poorly drained sils	Engineering judgment		clay loam	No	0.08	0.17	0.07	Yes
somewhat poorly drained soils	Engineering judgement		Silty clay	No	0.04	0.15	0.06	Yes
soutin	UT634		loam	No	0.5	0.61	0.31	Yes
sponiker	AZ701	Report	silty clay loam	No	0.08	0.23	0.10	Yes
spooky	UT686		loamy sand	No	2.4	3.6	2.71	Yes
springmeadow	NV713		silty clay loam	No	0.08	0.23	0.10	Yes
squawcave	UT634		silt loam	No	0.3	0.63	0.32	Yes
st george	UT641		clay	No	0.02	0.04	0.01	Yes
st. george	UT641		silty clay loam	No	0.08	0.23	0.10	Yes
steeper soils	UT634		sandy loam	No	0.8	1.92	1.24	Yes
stony colluvial land	Engineering judgement		Silt	No	0.20	0.80	0.43	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils								
					K_s, in/hr			
						2006		
Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	1983	DF =1.0	DF =1.1	Include
straight cliffs and dakota formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
straight cliffs and wahweap formation badland	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
straight cliffs and wahweap formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
straight cliffs formation burnt sandstone rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
straight cliffs formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
straight cliffs formation sandstone rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
streuling	UT634		loam	No	0.5	0.61	0.31	Yes
strych	UT686		sandy loam	No	0.8	1.92	1.24	Yes
studhorse	UT634		loam	No	0.5	0.61	0.31	Yes
suwanee	UT686		loam	No	0.5	0.61	0.31	Yes
swapps	UT636		loam	No	0.5	0.61	0.31	Yes
syrett	UT636		loam	No	0.5	0.61	0.31	Yes
tacan	UT641		sandy loam	No	0.8	1.92	1.24	Yes
taylorsflat	UT634		sandy loam	No	0.8	1.92	1.24	Yes
tebbs	UT636		loam	No	0.5	0.61	0.31	Yes
tepete	Engineering judgement		Silty clay loam	No	0.08	0.23	0.10	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
						2006		
					1983	DF =1.0	DF =1.1	
terric cryosaprists		Histosols, saprists, pgs 141, 485	Loam	No	0.50	0.61	0.31	Yes
timpoweap member moenkopi formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
tobish	UT641		clay loam	No	0.08	0.17	0.07	Yes
tobler	UT641		silty clay loam	No	0.08	0.23	0.10	Yes
tolman	UT636		clay loam	No	0.08	0.17	0.07	Yes
tombar	UT634		loam	No	0.5	0.61	0.31	Yes
toquerville	UT641		sand	No	4.6	4.03	3.12	Yes
torrifluvents	AZ, UT		Sand	No	4.60	4.03	3.12	Yes
torriorthents	NV755, AZ		Sandy loam	No	0.80	1.92	1.24	Yes
torripsamments	NRCS Soil Taxonomy Handbook	Entisols,139	Sand	No	4.60	4.03	3.12	Yes
trag	UT634		loam	No	0.5	0.61	0.31	Yes
tridell	UT636		loam	No	0.5	0.61	0.31	Yes
tropic formation shale badland	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
troughspring	NV755		loam	No	0.5	0.61	0.31	Yes
tryon	muname		Loamy sand	No	2.40	3.60	2.71	Yes
tsaya	UT686		loam	No	0.5	0.61	0.31	Yes
typic calciargids	NV755		Sandy loam	No	0.80	1.92	1.24	Yes
typic cryaquents	NRCS Soil Taxonomy Handbook	Entisols, pg 138	Sand	No	4.60	4.03	3.12	Yes
typic haplaquolls	NV754, NV613		Silt loam	No	0.30	0.63	0.32	Yes
typic haplargids	NV755		Loam	No	0.50	0.61	0.31	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	Ks, in/hr			Include
						2006		
					1983	DF =1.0	DF =1.1	
typic haplocalcids	NV755		Sandy loam	No	0.80	1.92	1.24	Yes
typic haplocambids	NV755		Sandy loam	No	0.80	1.92	1.24	Yes
typic haplogypsids	NV755		Sandy loam	No	0.80	1.92	1.24	Yes
typic natraquolls	NRCS Soil Taxonomy Handbook	Mollisols, pg 144	Silt loam	No	0.30	0.63	0.32	Yes
typic petrocalcids	NV755		Loam	No	0.50	0.61	0.31	Yes
typic psammaquents	NRCS Soil Taxonomy Handbook	Entisols,1 38	Sand	No	4.60	4.03	3.12	Yes
typic torrifluvents	NRCS Soil Taxonomy Handbook	Entisols,1 39	Sand	No	4.60	4.03	3.12	Yes
typic torrifolists	NRCS Soil Taxonomy Handbook	Histosols, pg 141	Loam	No	0.50	0.61	0.31	Yes
typic torriorthents	NV754, AZ, AZ701, UT		Sandy loam	No	0.80	1.92	1.24	Yes
typic torripsamments	NRCS Soil Taxonomy Handbook	Entisols,1 39	Sand	No	4.60	4.03	3.12	Yes
udic haplustolls	NRCS Soil Taxonomy Handbook	Mollisols, pg 174	Silt loam	No	0.30	0.63	0.32	Yes
urban land	Engineering judgement		Sandy loam	No	0.80	1.92	1.24	Yes
ustic calciargids	Engineering judgment	Google	loam	No	0.5	0.61	0.31	Yes
ustic haplargids	NV755		Loam	No	0.50	0.61	0.31	Yes
ustic haplocalcids	NV755		Sandy loam	No	0.80	1.92	1.24	Yes
ustic haplocambids	NRCS Soil Taxonomy Handbook	Entisols,1 38	Sand	No	4.60	4.03	3.12	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
						2006		
					1983	DF =1.0	DF =1.1	
ustic petrocalcids	NRCS Soil Taxonomy Handbook	Aridisols, pg 137	Sandy clay loam	No	0.12	0.44	0.21	Yes
ustic torrifluvents	Engineering judgment	Google	sand	No	4.6	4.03	3.12	Yes
ustic torriorthents	NV755, UT, AZ701		Loam	No	0.50	0.61	0.31	Yes
ustic torripsamments	Engineering judgment	Google	sand	No	4.6	4.03	3.12	Yes
ustifluvents	Engineering judgment	Google	sand	No	4.6	4.03	3.12	Yes
ustipsamments	Engineering judgment	Google	sand	No	4.6	4.03	3.12	Yes
ustorthents	NRCS Soil Taxonomy Handbook	Entisols,1 40	Sand	No	4.60	4.03	3.12	Yes
utaline	ADOT		Loam	No	0.5	0.61	0.31	Yes
vanet	UT636		clay loam	No	0.08	0.17	0.07	Yes
vennob	UT634		loam	No	0.5	0.61	0.31	Yes
venture	UT636		clay loam	No	0.08	0.17	0.07	Yes
vertic natrargids	Engineering judgment	Google	clay	No	0.02	0.04	0.01	Yes
very cobbly soils tat are 40 to 60 inches deep to bedrock	Engineering judgement		Loam	No	0.5	0.61	0.31	Yes
very deep and very gravelly clay soils	UT634		clay	No	0.02	0.04	0.01	Yes
very deep sand loam	UT634		sandy loam	No	0.8	1.92	1.24	Yes
very deep very gravelly soils	Engineering judgment		loam	No	0.5	0.61	0.31	Yes
very gravelly loamy coarse sand soils	UT634		loamy sand	No	2.4	3.6	2.71	Yes
very saline soils	Engineering judgement		Silt	No	0.20	0.80	0.43	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
					1983	2006		
						DF =1.0	DF =1.1	
very shallow sandy soils	Engineering judgment		sandy loam	No	0.8	1.92	1.24	Yes
very shallow soils	Engineering judgement		clay loam	No	0.08	0.17	0.07	Yes
very shallow to hardpan soils	UT634		clay	No	0.02	0.04	0.01	Yes
veyo	UT641		sandy loam	No	0.8	1.92	1.24	Yes
villy family soils	Villy		Silty clay loam	No	0.08	0.23	0.10	Yes
vitrandic haplocalcids	NRCS Soil Taxonomy Handbook	Aridisols, pg 137	Sandy clay loam	No	0.12	0.44	0.21	Yes
vitrandic haplocambids	NRCS Soil Taxonomy Handbook	Aridisols, pg 138	Sandy clay loam	No	0.12	0.44	0.21	Yes
wahweap formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
wales	UT634		sandy loam	No	0.8	1.92	1.24	Yes
walring	UT641		sandy loam	No	0.8	1.92	1.24	Yes
waltershow	UT634		loam	No	0.5	0.61	0.31	Yes
water	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
wayneco	UT686		sandy loam	No	0.8	1.92	1.24	Yes
well drained soils	Engineering judgment		sandy loam	No	0.8	1.92	1.24	Yes
wenzel	UT634		loam	No	0.5	0.61	0.31	Yes
whiteman	UT636		clay loam	No	0.08	0.17	0.07	Yes
widtsoe	UT636		sandy loam	No	0.8	1.92	1.24	Yes
widtsoe family	UT686		loam	No	0.5	0.61	0.31	Yes
wiggler	UT636		clay loam	No	0.08	0.17	0.07	Yes
wind deposited soils	Engineering judgment		silt loam	No	0.3	0.63	0.32	Yes

Table D.5 Assignment of XKSAT to miscellaneous component soils

Component Name	Source of Texture	Soil Order	Assumed Texture	Impervious	K_s, in/hr			Include
						2006		
					1983	DF =1.0	DF =1.1	
winetti	UT636		loamy sand	No	2.4	3.6	2.71	Yes
wingate formation rock outcrop	Engineering judgement		Clay	Yes	0.02	0.04	0.01	Yes
winkel	UT641		sandy loam	No	0.8	1.92	1.24	Yes
winnemucca	UT636		loam	No	0.5	0.61	0.31	Yes
winnemucca soils	UT634		loam	No	0.5	0.61	0.31	Yes
woodrow	UT634		silty clay loam	No	0.08	0.23	0.10	Yes
wye	UT634		loam	No	0.5	0.61	0.31	Yes
xeric torriorthents	NRCS Soil Taxonomy Handbook	Entisols, Orthents, pgs 138, 391	Sand	No	4.60	4.03	3.12	Yes
yaki	UT641		loam	No	0.5	0.61	0.31	Yes
yarts	UT636		sandy loam	No	0.8	1.92	1.24	Yes
yarts sandy loam	Description		sandy loam	No	0.8	1.92	1.24	Yes
yenlo	UT636		clay loam	No	0.08	0.17	0.07	Yes
zigzag	UT686		clay loam	No	0.08	0.17	0.07	Yes
zillion	UT636		clay loam	No	0.08	0.17	0.07	Yes
zinzer	UT636		loam	No	0.5	0.61	0.31	Yes
zukan	UT641		sandy loam	No	0.8	1.92	1.24	Yes
zyme clay	Description		clay loam	No	0.08	0.17	0.07	Yes

Table D.6 Average XKSAT values for bare ground			
	XKSAT		
	Rawls, et al (1983)	Saxton and Rawls (2006)	
Texture	in/hr	in/hr	mm/hr
1	2	3	4
Sand	4.60	2.02	51.18
Loamy sand	1.20	1.80	45.72
Sandy loam	0.40	0.96	24.38
Silt	0.10	0.40	10.16
Silt loam	0.15	0.32	8.00
Loam	0.25	0.31	7.75
Sandy clay loam	0.06	0.22	5.59
Silty clay Loam	0.04	0.12	2.92
Clay loam	0.04	0.09	2.16
Silty clay	0.02	0.08	1.91
Sandy clay	0.02	0.03	0.76
Clay	0.01	0.02	0.51

D.2.6 COMPUTATION OF COMPOSITE XKSAT FOR EACH SOIL MAP UNIT

The computed composite value of XKSAT for each SMU for both the 1983 and 2006 methods are listed in Group Number 9. The data in Numbers 3 and 4 in combination with the data in Group Numbers 5, 7 and 8 was used for the computation. The computations were done using equation 1.

$$\overline{XKSAT} = a\log\left(\frac{\sum A_i \log XKSAT_i}{A_T}\right) \qquad \text{Eqn 1}$$

where:

$\overline{XKSAT}$ = composite bare ground hydraulic conductivity for the SMU (or watershed sub-basin), inches/hour

$XKSAT_i$ = bare ground hydraulic conductivity of the SMU component soil, inches/hour

A_i = component area in % of SMU from File 2

A_T = Total % of the SMU components

When the SMU component percentages do not total 100%, the percentages were normalized to total 100%.

D.2.7 COMPUTATION OF PSIF AND DTHETA

PSIF is the Green and Ampt wetting front capillary pressure term. Per Rawls, Brakensiek and Miller (1983) equation 5, PSIF can be calculated from the estimated Brooks and Corey constants using equation D.1:

$$PSIF = \frac{2\lambda + 3}{2\lambda + 2}\left(\frac{\psi_b}{2}\right) \qquad \text{D.1}$$

where:

PSIF = wetting front capillary pressure, in inches,

λ = the pore-size distribution index (defined as the slope of the logarithmic tension-moisture curve in Saxton and Rawls, 2006), and

ψ_b = bubbling pressure (defined as the tension at air entry, ψ_e, in Saxton and Rawls, 2006), in inches of water. The value used for Mohave County is adjusted as shown in the Excel spreadsheet provided by Saxton and Rawls (2006).

DTHETA is the Green and Ampt volumetric soil moisture deficit at start of rainfall term (defined as effective porosity, θ_e, in Rawls, Brakensiek and Miller, 1983), in cubic inches per cubic inch. Per Rawls, Brakensiek and Miller (1983) equation 6, DTHETA can be calculated using equation D.2:

$$DTHETA = \phi - \phi_r \qquad \text{D.2}$$

where:

DTHETA = volumetric soil moisture deficit, in cubic inches per cubic inch,

ϕ = total porosity (defined as the slope of the logarithmic tension-moisture curve in Saxton and Rawls, 2006), and

ϕ_r = bubbling pressure (defined as the tension at air entry, ψ_e, in Saxton and Rawls, 2006), in inches of water. The value used for Mohave County is adjusted as shown in the Excel spreadsheet provided by Saxton and Rawls (2006).

The PSIF and DTHETA values for Saxton and Rawls (2006) listed in Group Numbers 3 and 4 for each horizon were used to prepare a relationship with XKSAT as an independent variable and PSIF and DTHETA as dependant variables. A nonlinear regression analysis was performed for each dependant variable. The results are shown on Figure D.1 and Figure D.2 in comparison with the curves from the 1983 method.

The regression equations recommended for computing PSIF and DTHETA are:

$$PSIF = 11.63103 * 0.15801^{XKSAT}$$

$$DTHETA_{dry} = 0.36180 + 0.03953 * \mathrm{LOG}_e(\mathrm{XKSAT})$$

$$DTHETA_{normal} = 0.28536 + 0.060058 * \mathrm{LOG}_e(\mathrm{XKSAT}) - 0.001009 * \mathrm{LOG}_e(\mathrm{XKSAT})^2 - 0.000615 * \mathrm{LOG}_e(\mathrm{XKSAT})^3$$

D.2.8 PROPOSED XKSAT METHOD

The Saxton and Rawls (2006) Green and Ampt parameter method is accepted for use in surface water hydrology in Mohave County. The values of bare ground XKSAT for each SMU are listed Appendix D.3, organized by NRCS soil survey.

Figure D.1 PSIF as a function of XKSAT

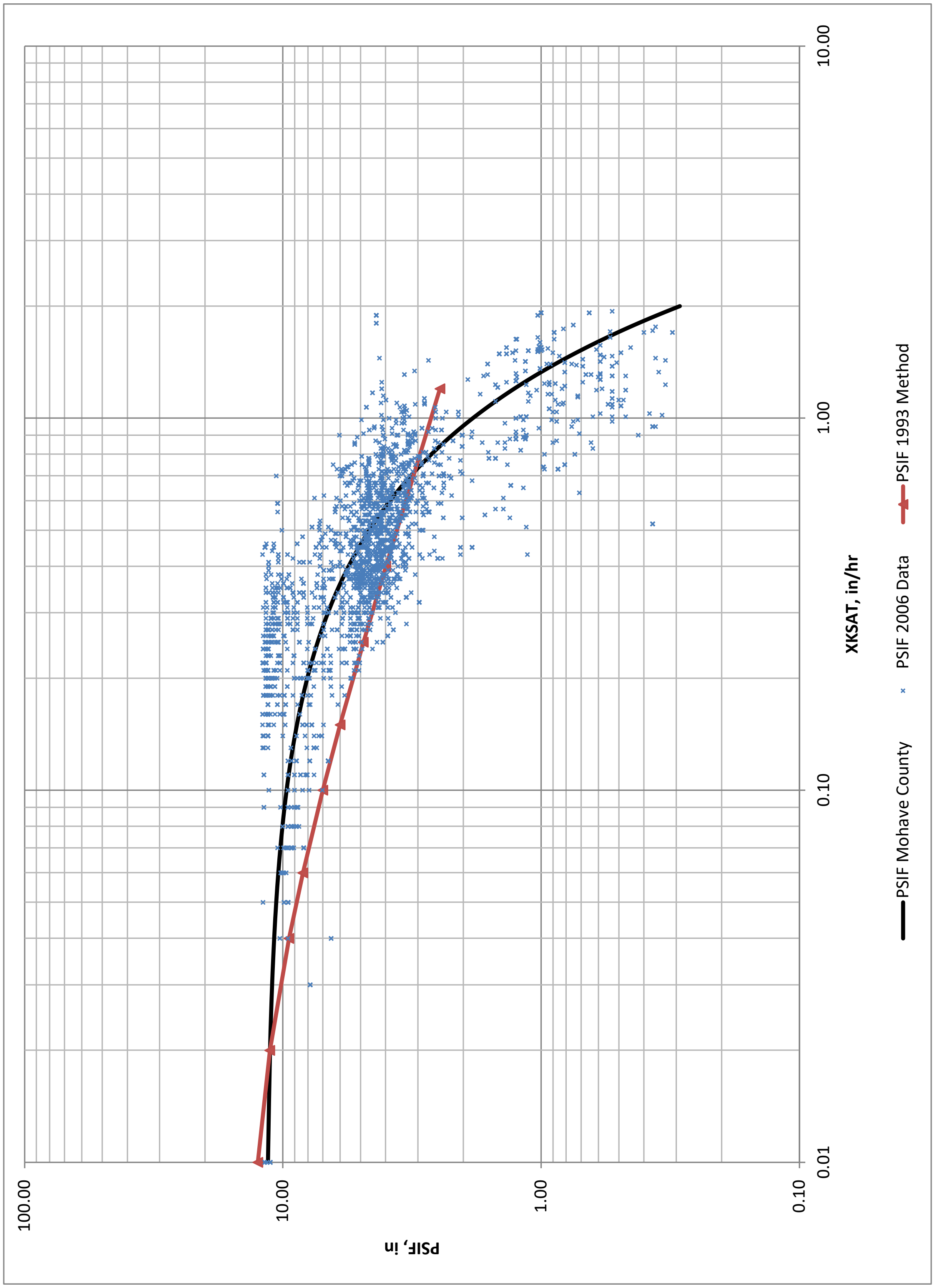
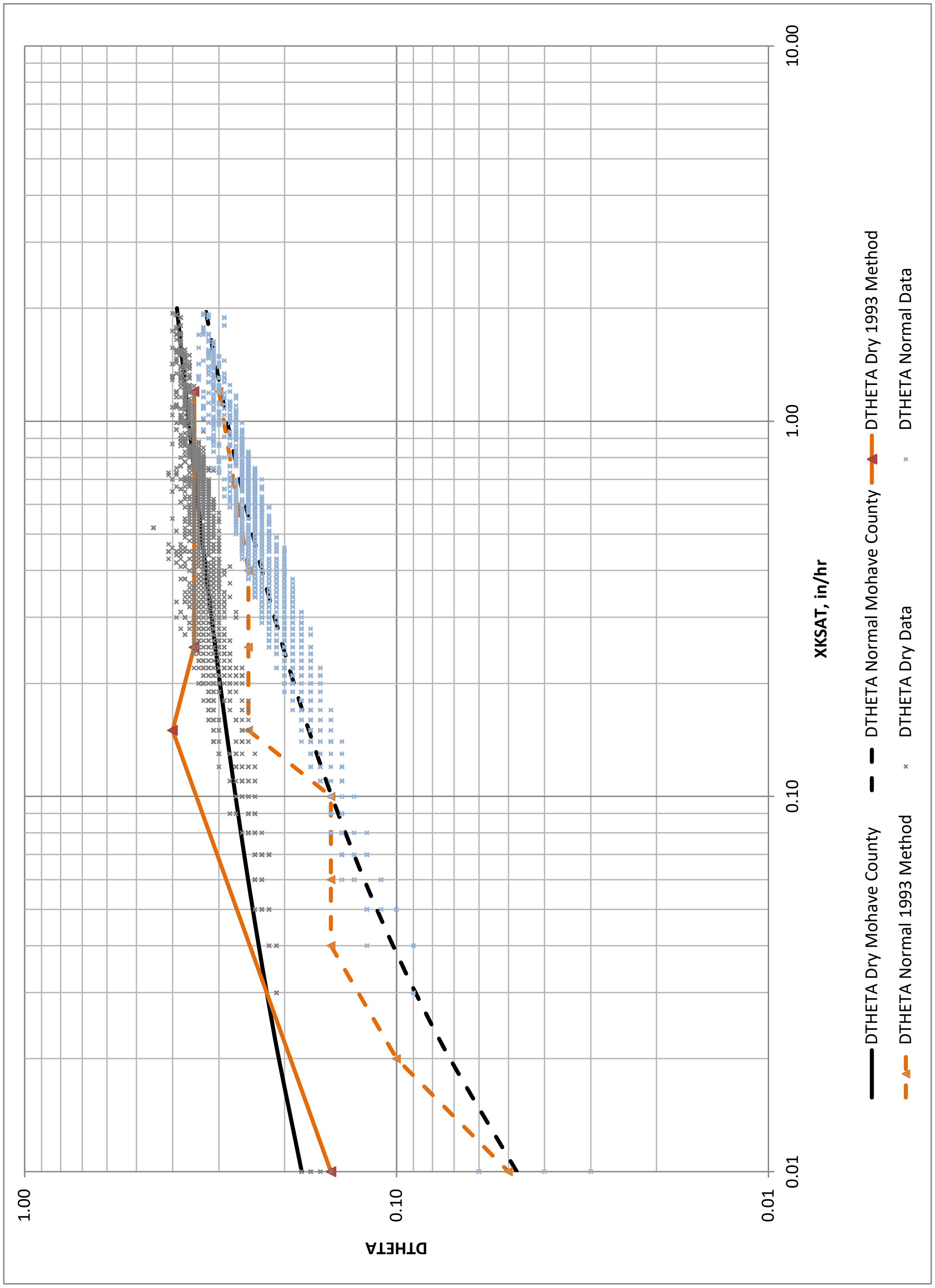


Figure D.2 DTHETA as a function of XKSAT



D.3 XKSAT VALUES BY NRCS SOIL SURVEY

D.3.1 AZ623

Table D.7 AZ623 Shivwits Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1	Akinville-Mokaac association 2 to 20 percent slopes	0.45	0.22	0
2	Albers silty clay 0 to 1 percent slopes	0.02	0.01	0
3	Arada family loamy fine sand 1 to 10 percent slopes	1.63	1.01	0
4	Arizo gravelly sandy loam 1 to 5 percent slopes nonflooded	0.61	0.32	0
5	Arizo very gravelly sandy loam 1 to 5 percent slopes flooded	0.52	0.27	0
6	Badland	0.31	0.16	0
7	Bard family-Tonopah-Arada family association 1 to 10 percent slopes	1.22	0.73	0
8	Barx fine sandy loam 1 to 5 percent slopes	0.07	0.02	0
9	Barx-Strych complex 1 to 10 percent slopes	0.11	0.04	0
10	Berzatic family-Rock outcrop-Goblin complex 35 to 70 percent slopes	0.23	0.10	30
11	Bisoodi-Anasazi family complex 1 to 8 percent slopes	0.30	0.13	0
12	Blind family-Shelley complex 5 to 15 percent slopes moist	0.36	0.17	0
13	Blind family-Shelley complex 5 to 15 percent slopes stony	0.23	0.10	0
14	Boquillas family-Showlow complex 25 to 50 percent slopes	0.02	0.01	0
15	Carrizo complex 1 to 5 percent slopes	0.96	0.57	0
16	Cave-Harrisburg-Grapevine complex 1 to 15 percent slopes	0.60	0.32	0
17	Chic-Teesto-Rock outcrop complex 1 to 30 percent slopes	0.15	0.05	15
18	Childers-Rizno association 4 to 15 percent slopes	0.30	0.14	0
19	Dera very gravelly fine sandy loam 1 to 10 percent slopes	0.28	0.12	0
20	Dermala family-Guy family-Rock outcrop complex 10 to 40 percent slopes	0.06	0.01	20

Table D.7 AZ623 Shivwits Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
21	Disterheff-Natank-Yumtheska complex 2 to 15 percent slopes	0.04	0.02	0
22	Dutchman-McCullan complex 1 to 10 percent slopes	0.38	0.18	0
23	Goblin gravelly fine sandy loam 15 to 50 percent slopes	0.55	0.29	0
24	Goblin-Gyppocket complex 2 to 10 percent slopes	0.36	0.17	0
25	Goesling loam 1 to 5 percent slopes	0.41	0.21	0
26	Grapevine-Hobcan complex 1 to 5 percent slopes	0.61	0.32	0
27	Grapevine-Shelley complex 1 to 5 percent slopes	0.54	0.28	0
28	Gypill-Badland association 10 to 70 percent slopes	0.39	0.20	0
29	Gypill fine sandy loam 15 to 40 percent slopes	0.50	0.24	0
30	Gypill-Hobog complex 6 to 35 percent slopes	0.45	0.22	0
31	Gypill very cobbly sandy loam 15 to 40 percent slopes	0.46	0.25	0
32	Gypsiorthids-Gypsiorthids shallow complex 1 to 50 percent slopes	0.22	0.10	0
33	Havasupai very gravelly loam 1 to 5 percent slopes	0.20	0.08	0
34	Hindu-Rock outcrop-Gypill complex 35 to 70 percent slopes	0.22	0.09	30
35	Hobcan fine sandy loam 1 to 5 percent slopes	0.58	0.30	0
36	Hobog-Grapevine complex 2 to 35 percent slopes	0.43	0.23	0
37	Hobog-Grapevine complex 2 to 35 percent slopes moist	0.43	0.23	0
38	Hobog-Tidwell family complex 8 to 35 percent slopes	0.32	0.16	0
39	Hobog very gravelly sandy loam 5 to 30 percent slopes	0.35	0.18	0
40	Ivanpatch fine sandy loam 1 to 5 percent slopes	0.38	0.18	0
41	Ives loam 1 to 3 percent slopes	0.24	0.09	0

Table D.7 AZ623 Shivwits Area Soil Map Unit Composite XKSAT and RTIMP Values				
		XKSAT, in/hr		Natural
SMU	Soil Map Unit Name	DF = 1.0	DF = 1.1	RTIMP, %
(1)	(2)	(3)	(4)	(5)
42	Katzine-Rock outcrop-Yumtheska complex 35 to 70 percent slopes	0.26	0.12	25
43	Meadview-Cave complex 2 to 30 percent slopes stony	0.39	0.19	0
44	Meadview very gravelly sandy loam 2 to 18 percent slopes	0.53	0.28	0
45	Mellenthin-Rock outcrop-Torriorthents complex 10 to 70 percent slopes	0.35	0.17	20
46	Mellenthin-Strych complex 4 to 25 percent slopes cool	0.21	0.09	0
47	Mellenthin-Strych complex 4 to 25 percent slopes warm	0.21	0.09	0
48	Mellenthin-Tanbark complex 5 to 50 percent slopes cool	0.31	0.14	0
49	Mellenthin-Tanbark complex 5 to 50 percent slopes dry	0.32	0.14	0
50	Mellenthin-Tanbark complex 5 to 50 percent slopes warm	0.31	0.14	0
51	Meriwhitica-Rock outcrop-Strych complex 35 to 70 percent slopes	0.23	0.10	30
52	Meriwhitica-Rock outcrop-Strych complex 35 to 70 percent slopes warm	0.23	0.10	30
53	Mespun complex 2 to 10 percent slopes	1.76	1.43	0
54	Moenkopie-Goblin complex 5 to 50 percent slopes	0.41	0.19	0
55	Moenkopie-Pennell-Rock outcrop complex 10 to 50 percent slopes	0.27	0.11	20
56	Nikey family-Ruesh family-Rock outcrop complex 10 to 40 percent slopes	0.28	0.12	25
57	Nipton-Rock outcrop-Nickel family complex 10 to 50 percent slopes	0.34	0.16	20
58	Nutter-Gyppocket complex 2 to 20 percent slopes	0.30	0.13	0
59	Padilla silt loam 1 to 5 percent slopes	0.02	0.01	0
60	Pocum-Childers-Ubank complex 1 to 10 percent slopes	0.29	0.13	0
61	Pocum-Spenlo complex 1 to 10 percent slopes	0.20	0.08	0

Table D.7 AZ623 Shivwits Area Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
62	Pompeii family-Huevi complex 2 to 15 percent slopes	0.09	0.04	0
63	Radnik loam 1 to 5 percent slopes	0.37	0.17	0
64	Riverwash-Torrifluvents complex 1 to 3 percent slopes	2.00	1.56	0
65	Rizno-Bond-Rock outcrop complex 4 to 25 percent slopes	0.26	0.12	15
66	Robroost fine sandy loam 1 to 3 percent slopes	0.28	0.12	0
67	Ruesh very gravelly fine sandy loam 3 to 20 percent slopes	0.37	0.16	0
68	Sedillo very cobbly loam 1 to 8 percent slopes	0.04	0.01	0
69	Showlow-Thunderbird complex 2 to 25 percent slopes	0.03	0.01	0
70	Showlow very cobbly clay loam 1 to 15 percent slopes	0.06	0.02	0
71	Sponiker loam 1 to 10 percent slopes	0.12	0.04	0
72	Springerville-Delenbaw complex 3 to 25 percent slopes	0.05	0.01	0
73	Strych very gravelly loam 2 to 10 percent slopes	0.20	0.08	0
74	Tanbark family-Strych family-Rock outcrop complex 10 to 40 percent slopes	0.31	0.15	25
75	Tanbark loam 15 to 75 percent slopes	0.52	0.25	0
76	Tassi-Rizno complex 5 to 35 percent slopes	0.29	0.13	0
77	Tonopah gravelly loamy fine sand 1 to 10 percent slopes	1.78	1.12	0
78	Torriorthents-Calciorthids-Rock outcrop complex 10 to 40 percent slopes	0.96	0.62	15
79	Tours silt loam 1 to 3 percent slopes	0.07	0.01	0
80	Tsezhin family-Ashfork family-Rock outcrop complex 10 to 70 percent slopes	0.07	0.02	20
81	Tsezhin very cobbly sandy loam 5 to 15 percent slopes	0.04	0.01	0
82	Twist sandy loam 2 to 10 percent slopes	0.09	0.02	0
83	Twist very cobbly loam 1 to 8 percent slopes	0.05	0.01	0

Table D.7 AZ623 Shivwits Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
84	Virgin Peak-Rock outcrop complex 10 to 70 percent slopes	0.27	0.13	30
85	Whiskey silt loam 1 to 4 percent slopes MLRA 35	0.23	0.10	0
86	Winkel-Rock outcrop complex 2 to 35 percent slopes	0.16	0.06	15
87	Winkel-Rock outcrop complex 2 to 35 percent slopes moist	0.16	0.06	15
88	Winkel very gravelly loam 2 to 25 percent slopes	0.16	0.06	0
89	Winkel very gravelly loam 2 to 25 percent slopes moist	0.16	0.06	0
90	Wutoma-Lozinta complex 15 to 50 percent slopes	0.21	0.09	0
91	Yellowhorse family silty clay o to 3 percent slopes	0.05	0.02	0
92	Yellowhorse-Luzena family complex 1 to 10 percent slopes	0.04	0.01	0
93	Yumtheska-Katzine-Rock outcrop complex 2 to 30 percent slopes	0.30	0.15	20
94	Yumtheska-Katzine-Rock outcrop complex 5 to 50 percent slopes moist	0.29	0.14	15
95	Yumtheska-Natank complex 10 to 45 percent slopes	0.19	0.10	0
96	Yurm family-Meadview association 15 to 40 percent slopes	0.27	0.12	0
97	Yurm family-Meadview association 15 to 40 percent slopes moist	0.27	0.12	0
98	Yurm family very gravelly loam 15 to 35 percent slopes	0.23	0.10	0
99	Yurm family very gravelly loam 15 to 35 percent slopes moist	0.23	0.10	0

Page Intentionally Left Blank

D.3.2 AZ625

Table D.8 AZ625 Mohave County Area, Northeastern Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1	Badland	0.31	0.16	0
2	Barx fine sandy loam 1 to 5 percent slopes	0.19	0.07	0
3	Barx loam 1 to 4 percent slopes	0.22	0.08	0
4	Begay fine sandy loam 1 to 3 percent slopes	0.81	0.47	0
5	Begay fine sandy loam 3 to 12 percent slopes	0.81	0.47	0
6	Bidonia-Bond-Rock outcrop complex 1 to 25 percent slopes	0.04	0.02	15
7	Bond-Bidonia complex 1 to 7 percent slopes	0.08	0.02	0
8	Brinkerhoff-Grieta complex 0 to 5 percent slopes	0.46	0.22	0
9	Campanile clay 1 to 6 percent slopes	0.02	0.01	0
10	Clayhole loam 1 to 3 percent slopes	0.15	0.05	0
11	Curhollow-Prieta complex 4 to 20 percent slopes	0.05	0.02	0
12	Godding gravelly loam 3 to 40 percent slopes	0.10	0.04	0
13	Grieta fine sandy loam 1 to 5 percent slopes	0.12	0.04	0
14	Grieta loam 1 to 5 percent slopes	0.12	0.04	0
15	Gypsiorthids-Gypsiorthids shallow complex 1 to 50 percent slopes	0.22	0.10	0
16	Hatknoll-Kinan complex 1 to 10 percent slopes	0.09	0.03	0
17	Havasupai-Mellenthin complex 2 to 12 percent slopes	0.13	0.05	0
18	Jocity loamy fine sand saline-sodic 1 to 3 percent slopes	0.10	0.03	0
19	Jocity-Clayhole complex 1 to 4 percent slopes	0.05	0.01	0
20	Jocity silty clay loam 1 to 4 percent slopes	0.02	0.01	0
21	Jocity silty clay loam 1 to 2 percent slopes flooded	0.05	0.01	0
22	Kinan gravelly loam 1 to 15 percent slopes	0.26	0.11	0
23	Kinan-Hatknoll-Grieta complex 1 to 5 percent slopes	0.15	0.05	0
24	Kinan-Pennell complex 1 to 20 percent slopes	0.25	0.11	0

Table D.8 AZ625 Mohave County Area, Northeastern Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
25	Klondike sandy clay loam 2 to 15 percent slopes MLRA 35	0.11	0.04	0
26	Lava flows	0.01	0.01	100
27	Lozinta extremely gravelly loam 1 to 15 percent slopes	0.14	0.06	0
28	Lozinta extremely gravelly loam 15 to 45 percent slopes	0.14	0.06	0
29	Manikan silty clay loam 1 to 4 percent slopes	0.07	0.02	0
30	Mellenthin-Anasazi complex 1 to 15 percent slopes	0.48	0.25	0
31	Mellenthin-Barx complex 1 to 15 percent slopes	0.23	0.10	0
32	Mellenthin-Progresso complex 1 to 7 percent slopes	0.18	0.07	0
33	Mellenthin very gravelly loam 1 to 25 percent slopes	0.19	0.08	0
34	Mellenthin very gravelly loam 30 to 50 percent slopes	0.17	0.08	0
35	Mellenthin very gravelly loam cool 1 to 25 percent slopes	0.17	0.08	0
36	Mellenthin very gravelly loam warm 1 to 25 percent slopes	0.17	0.08	0
37	Mido fine sand 1 to 10 percent slopes	2.00	1.36	0
38	Mido loamy fine sand 1 to 4 percent slopes gullied	1.52	0.95	0
39	Milok gravelly loam 1 to 15 percent slopes	0.26	0.12	0
40	Moab loam 1 to 5 percent slopes	0.16	0.07	0
41	Moab-Mellenthin complex 1 to 20 percent slopes	0.16	0.07	0
42	Monue fine sandy loam 1 to 5 percent slopes	0.60	0.31	0
43	Padilla-Penistaja-Campanile complex 1 to 6 percent slopes	0.04	0.02	0
44	Palma loamy fine sand 1 to 5 percent slopes	1.44	0.88	0
45	Penistaja fine sandy loam 1 to 5 percent slopes	0.16	0.05	0
46	Pennell-Bacobi complex 1 to 7 percent slopes	0.35	0.16	0
47	Pennell gravelly loam 1 to 12 percent slopes	0.24	0.10	0
48	Poley cobbly silty clay loam 1 to 5 percent slopes	0.04	0.01	0

Table D.8 AZ625 Mohave County Area, Northeastern Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
49	Poley-Moab complex 1 to 10 percent slopes	0.08	0.03	0
50	Radnik fine sandy loam 1 to 5 percent slopes	0.76	0.43	0
51	Riverwash	2.00	1.56	0
52	Royosa fine sand 2 to 10 percent slopes	1.43	0.88	0
53	Royosa-Tonalea complex 1 to 15 percent slopes	1.91	1.38	0
54	Saido-Brinkerhoff complex 1 to 5 percent slopes	0.13	0.04	0
55	Sheppard fine sand 1 to 7 percent slopes	1.55	0.95	0
56	Sheppard loamy fine sand 1 to 4 percent slopes gullied	1.55	0.95	0
57	Showlow-Section complex 1 to 15 percent slopes	0.11	0.04	0
58	Showlow-Thimble complex 1 to 15 percent slopes	0.03	0.02	0
59	Showlow very cobbly clay loam 1 to 15 percent slopes	0.06	0.02	0
60	Showlow very cobbly silty clay loam 15 to 35 percent slopes	0.06	0.02	0
61	Sponiker gravelly loam 1 to 15 percent slopes	0.11	0.04	0
62	Sponiker gravelly loam 15 to 40 percent slopes	0.11	0.04	0
63	Torriorthents-Rock outcrop complex 30 to 70 percent slopes	0.96	0.62	45
64	Torriorthents-Rock outcrop complex dry 30 to 70 percent slopes	0.96	0.62	45
65	Torriorthents-Rock outcrop complex warm 30 to 70 percent slopes	0.96	0.62	45
66	Whiskey silt loam 1 to 4 percent slopes MLRA 35	0.23	0.10	0
67	Wukoki-Lomaki complex 15 to 50 percent slopes	0.11	0.04	0
68	Wutoma-Lozinta complex 1 to 15 percent slopes	0.15	0.06	0
69	Wutoma-Lozinta complex 15 to 50 percent slopes	0.15	0.07	0
70	Wutoma-Rock outcrop complex 1 to 15 percent slopes	0.22	0.09	30

Table D.8 AZ625 Mohave County Area, Northeastern Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
71	Yumtheska-Goesling complex 1 to 15 percent slopes	0.24	0.11	0
72	Yumtheska very gravelly loam 4 to 20 percent slopes	0.20	0.09	0
73	Yumtheska very gravelly loam 30 to 50 percent slopes	0.20	0.09	0

D.3.3 AZ627

Table D.9 AZ627 Mohave County Southern Part Soil Map Unit Composite XKSAT and RTIMP Values				
		XKSAT, in/hr		
SMU	Soil Map Unit Name	DF = 1.0	DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
1	Akela-Rock outcrop-Rubble land complex 40 to 70 percent slopes	0.21	0.10	40
2	Akela-Rock outcrop-Rubble land complex dry 40 to 70 percent slopes	0.21	0.10	40
3	Alko family cobbly loam 2 to 15 percent slopes	0.28	0.13	0
4	Alko family cobbly loam dry 2 to 15 percent slopes	0.28	0.13	0
5	Amole sandy loam 1 to 3 percent slopes	0.61	0.32	0
6	Amole sandy loam dry 1 to 3 percent slopes	0.60	0.32	0
7	Anthony-Dudleyville complex 1 to 3 percent slopes	0.68	0.38	0
8	Aquarius-Akela-Rock outcrop complex 1 to 25 percent slopes	0.12	0.05	20
9	Arizo-Franconia-Riverwash complex 1 to 3 percent slopes	0.77	0.45	0
10	Arizo-Franconia-Riverwash complex dry 1 to 3 percent slopes	0.79	0.46	0
11	Bartmus very gravelly sandy loam 2 to 15 percent slopes	0.13	0.05	0
12	Bonita family very cobbly silty clay loam 2 to 10 percent slopes	0.02	0.01	0
13	Bonita family-Gonzales complex 10 to 35 percent slopes	0.02	0.01	0
14	Brazito family sand 0 to 3 percent slopes	2.00	1.45	0
15	Bucklebar sandy loam 1 to 3 percent slopes	0.19	0.07	0
16	Cacique family extremely gravelly loam 1 to 7 percent slopes	0.09	0.03	0
17	Castaneda extremely gravelly loam 1 to 7 percent slopes	0.04	0.01	0
18	Castaneda extremely gravelly loam dry 1 to 7 percent slopes	0.04	0.01	0
19	Carrizo family very gravelly loamy sand 1 to 3 percent slopes	0.88	0.53	0
20	Carrizo family-Riverwash complex 1 to 3 percent slopes	1.07	0.68	0
21	Carrizo-Riverwash complex 3 to 8 percent slopes MLRA 30	0.91	0.55	0

Table D.9 AZ627 Mohave County Southern Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
22	Carrizo-Riverwash complex 1 to 3 percent slopes	1.09	0.69	0
23	Cave gravelly sandy loam 10 to 35 percent slopes	0.52	0.27	0
24	Cave gravelly sandy loam dry 10 to 35 percent slopes	0.52	0.27	0
25	Cellar-Rock outcrop complex 20 to 60 percent slopes	0.39	0.20	25
26	Cellar-Rock outcrop complex dry 20 to 60 percent slopes	0.39	0.20	25
27	Cellar-Topock-Rock outcrop complex 5 to 35 percent slopes	0.09	0.06	20
28	Cherioni very cobbly loam 2 to 15 percent slopes	0.04	0.01	0
29	Chuckawalla-Riverbend complex 2 to 15 percent slopes	0.13	0.05	0
30	Chuckawalla-Riverbend families complex 2 to 15 percent slopes	0.16	0.06	0
31	Cipriano very stony loam 2 to 10 percent slopes	0.23	0.10	0
32	Cline very stony loam 2 to 15 percent slopes	0.08	0.03	0
33	Cline very stony loam dry 2 to 15 percent slopes	0.08	0.03	0
34	Continental-Tres Hermanos complex 2 to 15 percent slopes	0.08	0.02	0
35	Continental-Tres Hermanos complex dry 2 to 15 percent slopes	0.08	0.02	0
36	Continental-Rillino complex 2 to 15 percent slopes	0.10	0.03	0
37	Continental-Rillino complex dry 2 to 15 percent slopes	0.10	0.03	0
38	Coolidge-Denure complex 1 to 7 percent slopes	0.79	0.45	0
39	Coolidge-Denure families complex 1 to 7 percent slopes	0.51	0.26	0
40	Courthouse family-Rock outcrop-Rubble land complex 40 to 70 percent slopes	0.26	0.12	40
41	Courthouse family-Rock outcrop-Wagonbow complex 15 to 70 percent slopes	0.15	0.05	30

Table D.9 AZ627 Mohave County Southern Part Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
42	Far-Rock outcrop complex 10 to 45 percent slopes	0.37	0.20	20
43	Dutchflat sandy loam 0 to 2 percent slopes	0.19	0.07	0
44	Dutchflat fine sandy loam dry 1 to 3 percent slopes	0.09	0.03	0
45	Gadsden silty clay 0 to 1 percent slopes	0.02	0.01	0
46	Gila-Glendale complex 1 to 3 percent slopes	0.12	0.03	0
47	Gila-Glendale complex dry 1 to 3 percent slopes	0.12	0.03	0
48	Goldroad-Rock outcrop complex 20 to 60 percent slopes	0.38	0.20	20
49	Gonzales-Rock outcrop complex 15 to 35 percent slopes	0.02	0.01	25
50	Goodsprings family gravelly sandy loam 1 to 15 percent slopes	0.36	0.16	0
51	Goodsprings family gravelly sandy loam dry 1 to 15 percent slopes	0.36	0.16	0
52	Goodsprings family gravelly sandy loam 10 to 35 percent slopes	0.36	0.16	0
53	Goodsprings family gravelly sandy loam dry 10 to 35 percent slopes	0.36	0.16	0
54	Graham-Arivaca complex 2 to 15 percent slopes	0.06	0.02	0
55	Graham-Rock outcrop complex 10 to 40 percent slopes	0.09	0.03	20
56	Gunsight very gravelly loam 2 to 15 percent slopes	0.17	0.07	0
57	Gunsight very gravelly sandy loam 10 to 40 percent slopes	0.38	0.20	0
58	Hassell family-Lampshire-Rock outcrop complex 10 to 30 percent slopes	0.05	0.02	20
59	Holtville silty clay 0 to 1 percent slopes	0.02	0.01	0
60	Huevi very gravelly loam 2 to 15 percent slopes	0.23	0.10	0
61	Huevi very gravelly loam 10 to 40 percent slopes	0.24	0.11	0
62	Akela-Rock outcrop complex 20 to 60 percent slopes	0.38	0.20	20
63	Hyder-Rock outcrop-Rubble land complex 40 to 70 percent slopes	0.21	0.10	40

Table D.9 AZ627 Mohave County Southern Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
64	Indio silt loam 0 to 1 percent slopes	0.12	0.03	0
65	Ireteba family-Arizo complex 1 to 3 percent slopes	0.55	0.29	0
66	Kinley gravelly loamy sand 15 to 35 percent slopes	0.67	0.36	0
67	Kinley-Poachie complex 2 to 15 percent slopes	0.20	0.07	0
68	Kofa silty clay 0 to 1 percent slopes	0.04	0.01	0
69	Dudleyville-Vinton-Riverwash complex 1 to 3 percent slopes	1.08	0.66	0
70	Dudleyville-Vinton-Riverwash complex dry 1 to 3 percent slopes	1.08	0.66	0
71	Lagunita sand 0 to 1 percent slopes	2.00	1.37	0
72	Lagunita-Ripley complex 0 to 3 percent slopes	0.83	0.45	0
73	Lampshire-Rock outcrop complex 20 to 60 percent slopes	0.51	0.29	20
74	Lampshire-Rock outcrop complex cool 30 to 70 percent slopes	0.32	0.16	20
75	Lampshire-Rock outcrop complex 15 to 60 percent slopes stony	0.30	0.15	40
76	Lostman gravelly sandy loam moist 1 to 5 percent slopes	0.45	0.23	0
77	Lostman sandy loam dry 1 to 3 percent slopes	0.63	0.34	0
78	Lostman-Kinley complex 1 to 7 percent slopes	0.58	0.31	0
79	Marshes	0.01	0.01	100
80	Meloland very fine sandy loam 0 to 1 percent slopes	0.54	0.27	0
81	Mohon-Kinley complex 2 to 15 percent slopes	0.08	0.04	0
82	Mohon-Poachie complex 2 to 15 percent slopes	0.06	0.03	0
83	Mohon-Poachie complex dry 2 to 15 percent slopes	0.06	0.03	0
84	Nickel-Topawa-Eba families complex 10 to 50 percent slopes	0.04	0.02	0
85	Orwash family sandy loam 1 to 3 percent slopes	0.61	0.32	0

Table D.9 AZ627 Mohave County Southern Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
86	Orwash family sandy loam dry 1 to 3 percent slopes	0.61	0.32	0
87	Penthouse-Gonzales complex 5 to 35 percent slopes	0.06	0.02	0
88	Poachie very gravelly loam 1 to 4 percent slopes	0.16	0.06	0
89	Poachie very gravelly loam dry 1 to 4 percent slopes	0.16	0.06	0
90	Quilotosa-Rock outcrop complex 20 to 60 percent slopes	0.38	0.20	20
91	Razorback extremely gravelly sandy loam 15 to 35 percent slopes	0.38	0.20	0
92	Razorback-Rock outcrop complex 1 to 25 percent slopes	0.21	0.10	20
93	Razorback-Rock outcrop complex 15 to 70 percent slopes	0.21	0.10	20
94	Razorback-Rock outcrop complex dry 15 to 70 percent slopes	0.21	0.10	20
95	Razorback-Rock outcrop-Rubble land complex 40 to 70 percent slopes	0.21	0.10	40
96	Razorback-Rock outcrop-Rubble land complex dry 40 to 70 percent slopes	0.21	0.10	40
97	Rillino gravelly loamy sand 15 to 35 percent slopes	0.15	0.06	0
98	Rillino-Tres Hermanos complex 2 to 15 percent slopes	0.10	0.03	0
99	Ripley silt loam 0 to 1 percent slopes	0.13	0.04	0
100	Riverbend family very cobbly sandy loam 2 to 15 percent slopes	0.42	0.22	0
101	Riverbend very cobbly sandy loam 2 to 15 percent slopes	0.38	0.19	0
102	Riverwash-Fluvaquents association 0 to 3 percent slopes	2.00	1.56	0
103	Rock outcrop-Hyder complex 35 to 65 percent slopes	0.21	0.10	45
104	Rock outcrop-Razorback complex 20 to 70 percent slopes	0.21	0.10	65
105	Rock outcrop-Sunrock complex 35 to 65 percent slopes	0.37	0.19	45

Table D.9 AZ627 Mohave County Southern Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
106	Romero-Chiricahua-Rock outcrop complex 5 to 35 percent slopes	0.03	0.02	20
107	Romero-Lampshire-Rock outcrop complex 35 to 70 percent slopes	0.13	0.05	15
108	Rositas family superstition and torriorthents soils 1 to 60 percent slopes	1.55	1.21	0
109	Rositas superstition family and torriorthents soils 1 to 60 percent slopes	1.68	1.15	0
110	Stagecoach very gravelly loam 2 to 15 percent slopes	0.24	0.11	0
111	Stagecoach very gravelly loam 10 to 40 percent slopes	0.24	0.11	0
112	Stagecoach very gravelly sandy loam 5 to 35 percent slopes	0.30	0.14	0
113	Stagecoach very gravelly sandy loam dry 5 to 35 percent slopes	0.30	0.14	0
114	Stagecoach-Topawa family-Eba complex 10 to 50 percent slopes	0.07	0.04	0
115	Stagecoach-Topawa family-Eba complex dry 10 to 50 percent slopes	0.07	0.04	0
116	Sunrock extremely gravelly sandy loam 15 to 35 percent slopes	0.35	0.18	0
117	Sunrock-Rock outcrop complex 30 to 65 percent slopes	0.35	0.18	20
118	Tombstone-Caralampi-Eloma complex 10 to 50 percent slopes	0.09	0.04	0
119	Torriorthents 35 to 65 percent slopes	0.96	0.62	0
120	Torriorthents dry 35 to 65 percent slopes	0.96	0.62	0
121	Tumarion very cobbly loam 2 to 15 percent slopes	0.08	0.03	0
122	Tumarion very cobbly loam dry 2 to 15 percent slopes	0.10	0.03	0
123	Tyro extremely stony sandy loam 3 to 35 percent slopes	0.36	0.19	0
124	Tyro very stony loam 2 to 10 percent slopes	0.21	0.10	0
125	Vekol family gravelly loamy sand 2 to 7 percent slopes	0.50	0.26	0
126	Vekol family gravelly loamy sand dry 2 to 7 percent slopes	0.50	0.26	0
127	Water	0.01	0.01	100

Table D.9 AZ627 Mohave County Southern Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
128	Whitehills very gravelly loam 1 to 5 percent slopes	0.15	0.06	0
129	Whitehills very gravelly loam dry 2 to 15 percent slopes	0.15	0.06	0
130	White House family very gravelly loamy sand 2 to 15 percent slopes	0.08	0.03	0
131	White House gravelly loamy sand 2 to 15 percent slopes	0.01	0.01	0
132	Wikieup-Mutang-Rock outcrop complex 5 to 35 percent slopes	0.12	0.06	20
133	Mutang-Wikieup-Rock outcrop complex 3 to 30 percent slopes	0.05	0.03	15
134	Wikieup-Rock outcrop complex dry 20 to 60 percent slopes	0.41	0.21	25
135	Yahana family silty clay loam 1 to 3 percent slopes	0.04	0.01	0
136	Tumarion-Nickel family complex 8 to 35 percent slopes	0.21	0.09	0
137	Valena-Rock outcrop-Carri family complex 1 to 25 percent slopes	0.39	0.18	20
138	Nodman-Rock outcrop complex 15 to 65 percent slopes	0.06	0.02	20
139	Nodman-Romero family complex 15 to 65 percent slopes	0.17	0.07	0

Page Intentionally Left Blank

D.3.4 AZ629

Table D.10 AZ629 Coconino County Area North Kaibab Part Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1	Aneth fine sand 2 to 16 percent slopes	1.31	0.78	0
2	Arches-Pensom complex 4 to 12 percent slopes	2.00	1.61	0
3	Arches-Pensom complex cool 4 to 12 percent slopes	2.00	1.52	0
4	Barx gravelly loam 1 to 6 percent slopes	0.11	0.04	0
5	Barx-Pensom complex 1 to 6 percent slopes	0.15	0.05	0
6	Bidonia-Rock outcrop complex 1 to 15 percent slopes	0.01	0.01	15
7	Bison-Curob complex 2 to 6 percent slopes	0.19	0.08	0
8	Clayhole silty clay loam 1 to 5 percent slopes	0.06	0.01	0
9	Clayhole-Torriorthents complex 2 to 25 percent slopes	0.20	0.08	0
10	Curhollow-Mellenthin complex 2 to 12 percent slopes	0.17	0.08	0
11	Curob loamy sand 2 to 10 percent slopes	1.56	0.98	0
12	Curob very gravelly loam 2 to 12 percent slopes	0.15	0.06	0
13	Disterheff very gravelly loam 2 to 15 percent slopes	0.09	0.03	0
14	Disterheff-Houserock complex 3 to 15 percent slopes	0.07	0.02	0
15	Doak fine sandy loam 1 to 6 percent slopes	0.08	0.02	0
16	Glenyon silty clay loam 0 to 2 percent slopes	0.04	0.01	0
17	Houserock-Disterheff complex 3 to 15 percent slopes	0.05	0.01	0
18	Jocity clay loam 1 to 3 percent slopes	0.05	0.01	0
19	Jocity silty clay loam 1 to 3 percent slopes	0.05	0.01	0
20	Keeseha loam 1 to 6 percent slopes	0.02	0.01	0
21	Kinan-Pennell complex 4 to 15 percent slopes	0.41	0.20	0
22	Kinan-Pennell complex dry 4 to 15 percent slopes	0.41	0.20	0
23	Klondike sandy clay loam 2 to 15 percent slopes MLRA 35	0.11	0.04	0
24	Manikan silty clay loam 1 to 3 percent slopes	0.07	0.02	0
25	Mellenthin very gravelly loam 1 to 25 percent slopes	0.19	0.08	0

Table D.10 AZ629 Coconino County Area North Kaibab Part Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
26	Mellenthin very gravelly loam 30 to 60 percent slopes	0.17	0.08	0
27	Monierco clay loam 2 to 15 percent slopes	0.04	0.01	0
28	Monue sandy loam 1 to 6 percent slopes	0.61	0.32	0
29	Monue-Seeg complex 1 to 6 percent slopes	0.55	0.28	0
30	Needle-Rock outcrop complex 4 to 15 percent slopes	1.62	1.02	15
31	Needle-Sheppard complex 2 to 12 percent slopes	1.71	1.08	0
32	Pagina loamy sand 1 to 3 percent slopes	1.33	0.80	0
33	Pagina-Wahweap complex 3 to 16 percent slopes	1.30	0.78	0
34	Pennell cobbly loam 3 to 10 percent slopes	0.20	0.08	0
35	Pennell gravelly sandy loam 20 to 45 percent slopes	0.38	0.18	0
36	Pennell sandy loam 20 to 45 percent slopes	0.60	0.31	0
37	Pensom fine sand 2 to 16 percent slopes	2.00	1.35	0
38	Pensom-Arches complex 4 to 12 percent slopes	1.54	0.95	0
39	Pensom-Arches complex moist 4 to 16 percent slopes	1.54	0.95	0
40	Pits borrow	0.02	0.01	0
41	Rock outcrop	0.01	0.01	85
42	Rock outcrop-Needle complex 4 to 50 percent slopes	1.62	1.02	55
43	Rock outcrop-Torriorthents complex warm 25 to 65 percent slopes	0.96	0.62	65
44	Sheppard loamy fine sand 1 to 5 percent slopes	2.00	1.30	0
45	Sheppard loamy fine sand 5 to 15 percent slopes	2.00	1.30	0
46	Strych loam 1 to 4 percent slopes	0.17	0.08	0
47	Torriorthents 3 to 50 percent slopes	0.96	0.62	0
48	Torriorthents-Rock outcrop complex 25 to 65 percent slopes	0.96	0.62	30
49	Wahweap loamy sand 0 to 5 percent slopes	1.22	0.73	0
50	Wahweap-Rock outcrop complex 1 to 15 percent slopes	0.54	0.28	35
51	Yumtheska very gravelly loam 4 to 30 percent slopes	0.20	0.09	0

Table D.10 AZ629 Coconino County Area North Kaibab Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
52	Yumtheska-Houserock association 4 to 20 percent slopes	0.11	0.04	0
1	Aneth fine sand 2 to 16 percent slopes	1.31	0.78	0

Page Intentionally Left Blank

D.3.5 AZ631

Table D.11 AZ631 Coconino County Central Part Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1	Ashfork gravelly clay loam 1 to 15 percent slopes	0.05	0.01	0
2	Aut gravelly loam 0 to 8 percent slopes	0.20	0.08	0
3	Aut-Cross association moderately sloping	0.13	0.04	0
4	Aut-Lynx association gently sloping	0.15	0.06	0
5	Badland-Torriorthents complex moderately steep	0.44	0.24	0
6	Boquillas-Seligman complex 1 to 15 percent slopes	0.03	0.01	0
7	Clovis loamy sand 1 to 8 percent slopes	0.10	0.03	0
8	Cross-Apache complex 2 to 15 percent slopes	0.04	0.01	0
9	Daze-Deama association moderately steep	0.25	0.11	0
10	Deama gravelly loam 2 to 15 percent slopes	0.18	0.07	0
11	Deama stony loam 1 to 15 percent slopes	0.14	0.06	0
12	Deama-Rock outcrop complex 8 to 30 percent slopes	0.15	0.06	30
13	Deama-Toqui complex 0 to 8 percent slopes	0.06	0.03	0
14	Deama-Tovar association steep	0.09	0.03	0
15	Disterheff very gravelly sandy clay loam 1 to 15 percent slopes	0.02	0.01	0
16	Disterheff-Kopie association moderately sloping	0.06	0.02	0
17	Epikom very cindery loamy sand 0 to 5 percent slopes	0.83	0.49	0
18	Epikom complex 0 to 15 percent slopes	0.21	0.08	0
19	Epikom-Rock outcrop complex 8 to 60 percent slopes	0.20	0.08	20
20	Faraway-Rock outcrop complex 20 to 80 percent slopes	0.26	0.13	30
21	Keeseha-Poley gravelly sandy loams 0 to 8 percent slopes	0.03	0.01	0
22	Kopie-Servilleta association moderately sloping	0.10	0.04	0
23	Lava flows	0.01	0.01	100
24	Lomaki-Nalaki very cindery loams 0 to 8 percent slopes	0.09	0.03	0

Table D.11 AZ631 Coconino County Central Part Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
25	Mespun-Palma complex 1 to 8 percent slopes	0.99	0.56	0
26	Navajo clay 0 to 5 percent slopes	0.02	0.01	0
27	Palma sandy loam 0 to 5 percent slopes	0.51	0.25	0
28	Pastura gravelly loam 0 to 8 percent slopes	0.14	0.05	0
29	Paymaster-Lynx association gently sloping	0.21	0.09	0
30	Poley sandy loam 0 to 5 percent slopes	0.08	0.02	0
31	Poley gravelly loam 0 to 8 percent slopes	0.08	0.02	0
32	Poley-Lynx association gently sloping	0.09	0.02	0
33	Poley-Tusayan association gently sloping	0.08	0.02	0
34	Purgatory gravelly fine sandy loam 0 to 8 percent slopes	0.50	0.26	0
35	Quivera very gravelly loam 0 to 8 percent slopes	0.03	0.01	0
36	Riverwash	2.00	1.56	0
37	Rune silty clay loam 0 to 8 percent slopes	0.05	0.02	0
38	Rune-Disterheff association gently sloping	0.04	0.01	0
39	Servilleta fine sandy loam 1 to 8 percent slopes	0.03	0.01	0
40	Servilleta-Tusayan complex 1 to 8 percent slopes	0.04	0.01	0
41	Showlow gravelly fine sandy loam 0 to 8 percent slopes	0.03	0.01	0
42	Showlow gravelly fine sandy loam 8 to 30 percent slopes	0.03	0.01	0
43	Springerville cobbly clay 0 to 8 percent slopes	0.02	0.01	0
44	Springerville very stony clay 0 to 8 percent slopes	0.01	0.01	0
45	Tajo-Springerville complex 0 to 15 percent slopes	0.05	0.02	0
46	Tenorio very gravelly sandy loam 0 to 8 percent slopes	0.07	0.02	0
47	Thunderbird-Cabezon complex 2 to 30 percent slopes	0.02	0.01	0
48	Thunderbird-Rock outcrop complex 30 to 60 percent slopes	0.03	0.01	30
49	Thunderbird-Springerville association strongly sloping	0.03	0.01	0
50	Torrifluvents saline	2.00	1.56	0

Table D.11 AZ631 Coconino County Central Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
51	Tours silty clay loam 0 to 8 percent slopes	0.05	0.01	0
52	Tours-Ives association gently sloping	0.61	0.32	0
53	Tovar complex 2 to 25 percent slopes	0.07	0.02	0
54	Tovar complex 25 to 60 percent slopes	0.07	0.02	0
55	Tusayan-Lynx association gently sloping	0.14	0.05	0
56	Tuweep very gravelly loam 0 to 15 percent slopes	0.07	0.02	0
57	Valle gravelly silt loam 0 to 8 percent slopes	0.08	0.03	0
58	Wilaha cindery loam 2 to 30 percent slopes	0.08	0.03	0
59	Wilaha-Wukoki association steep	0.10	0.04	0
60	Winona gravelly loam 0 to 8 percent slopes	0.11	0.04	0
61	Winona stony loam 0 to 8 percent slopes	0.11	0.04	0
62	Winona-Boysag gravelly loams 0 to 8 percent slopes	0.07	0.02	0
63	Winona-Epikom association gently sloping	0.14	0.05	0
64	Winona-Rock outcrop complex 15 to 30 percent slopes	0.11	0.04	30
65	Winona-Rock outcrop complex 30 to 70 percent slopes	0.11	0.04	30
66	Winona-Tusayan association gently sloping	0.11	0.04	0
67	Wukoki-Rock outcrop complex 5 to 25 percent slopes	0.12	0.05	25
68	Wukoki-Wupatki very cindery loams 15 to 60 percent slopes	0.12	0.05	0
69	Wupatki-Wukoki very cindery loams 0 to 15 percent slopes	0.12	0.05	0
70	Ziegler gravelly loam 0 to 8 percent slopes	0.02	0.01	0
71	Ziegler-Cross association moderately sloping	0.02	0.01	0
72	Ziegler-Wilaha association strongly sloping	0.03	0.01	0
73	Water	0.01	0.01	100
100	Bighawk gravelly sandy loam 1 to 5 percent slopes	1.64	1.05	0
101	Bighawk family gravelly sand 2 to 11 percent slopes	0.17	0.07	0
102	Chedeski very gravelly sandy loam 0 to 6 percent slopes	0.11	0.03	0
103	Flaco extremely gravelly coarse sand 1 to 3 percent slopes	0.04	0.01	0
104	Flaco-Lava flows complex 1 to 18 percent slopes	0.24	0.10	10

Table D.11 AZ631 Coconino County Central Part Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
105	Flaco-Pocum complex 1 to 3 percent slopes	0.05	0.02	0
106	Gish very gravelly coarse sand 0 to 0.4 percent slopes	0.03	0.01	0
107	Ives-Riverwash complex 1 to 5 percent slopes rarely flooded	0.30	0.06	0
108	Meriwhitica-Rock outcrop complex 7 to 68 percent slopes	0.55	0.29	25
109	Miburn coarse sand 1 to 10 percent slopes	2.00	1.69	0
110	Miburn-Cambidic Haplodurids complex 1 to 8 percent slopes	2.00	1.92	0
111	Miburn-Heiser-Lava flows complex 4 to 45 percent slopes	2.00	1.35	10
112	Moenkopie-Typic Haplocambids complex 1 to 6 percent slopes	0.24	0.10	0
113	Moenkopie-Rock outcrop complex 1 to 14 percent slopes	1.50	0.92	20
114	Nalakihu loamy sand 0 to 4 percent slopes	0.39	0.18	0
115	Peshlaki-Rock outcrop complex 1 to 11 percent slopes	1.02	0.62	10
116	Rock outcrop-Typic Torriorthents-Heiser association 3 to 40 percent slopes	0.22	0.09	35
117	Sandy Typic Torriorthents 1 to 15 percent slopes	0.27	0.12	0
118	Shinume channery sandy clay loam 2 to 30 percent slopes	0.12	0.04	0
119	Trachute-Lava flows complex 0 to 5 percent slopes very rarely flooded	0.57	0.29	10
120	Tsosie very gravelly coarse sand 1 to 5 percent slopes	0.13	0.04	0
121	Vitrandic Torriorthents 10 to 63 percent slopes	1.76	1.11	0

D.3.6 AZ637

Table D.12 AZ637 Yavapai County Western Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
AaB	Abra gravelly sandy loam 0 to 8 percent slopes	0.16	0.06	0
AbB	Abra-Lonti loams 0 to 5 percent slopes	0.09	0.03	0
AeB	Abra-Poley loams 0 to 5 percent slopes	0.09	0.04	0
AlC	Abra-Balon association rolling	0.11	0.04	0
AlD	Abra-Balon association hilly	0.12	0.04	0
AmC	Abra-Lynx association rolling	0.19	0.07	0
AnC	Abra-Wineg association rolling	0.15	0.06	0
AoC	Anthony gravelly loamy sand 8 to 15 percent slopes	0.33	0.15	0
ApB	Anthony gravelly sandy loam 0 to 8 percent slopes	0.33	0.15	0
ArA	Anthony-Mohave sandy loams 1 to 3 percent slopes	0.41	0.20	0
As	Apache gravelly loam	0.13	0.05	0
At	Apache very stony loam	0.13	0.05	0
AuC	Arp gravelly clay loam 0 to 20 percent slopes	0.02	0.01	0
AvD	Arp cobbly clay loam 10 to 25 percent slopes	0.02	0.01	0
AwE	Arp very rocky clay loam 20 to 40 percent slopes	0.02	0.01	20
AxD	Arp-Moano complex 0 to 30 percent slopes	0.05	0.02	0
AyC	Arp-Lynx association rolling	0.05	0.02	0
Ba	Badland	0.31	0.16	0
BdC	Balon sandy loam 0 to 15 percent slopes	0.07	0.02	0
BgD	Balon gravelly sandy clay loam 5 to 30 percent slopes	0.07	0.02	0
BlC	Balon-Lynx association rolling	0.08	0.02	0
BmF	Barkerville cobbly sandy loam 20 to 60 percent slopes	0.60	0.33	0
BnD	Barkerville very stony sandy loam 5 to 25 percent slopes	0.28	0.14	0
BoF	Barkerville extremely rocky sandy loam 20 to 60 percent slopes	0.60	0.33	20
BrD	Bridge gravelly loam 0 to 25 percent slopes	0.08	0.02	0
BsC	Brolliar very stony silt loam 0 to 15 percent slopes	0.33	0.19	0
BsD	Brolliar very stony silt loam 15 to 30 percent slopes	0.33	0.19	0

Table D.12 AZ637 Yavapai County Western Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
CaD	Cabezon-Springerville complex 5 to 25 percent slopes	0.02	0.01	0
CbC	Cabezon-Springerville cobbly complex 5 to 15 percent slopes	0.02	0.01	0
CdC	Cabezon-Thunderbird complex 5 to 15 percent slopes	0.02	0.01	0
CeE	Cabezon soils 8 to 45 percent slopes	0.02	0.01	0
CgC	Cave gravelly sandy loam 2 to 15 percent slopes	0.59	0.32	0
ClD	Cave-Continental gravelly sandy loams 2 to 30 percent slopes	0.16	0.08	0
CmD	Cellar very gravelly sandy loam 8 to 30 percent slopes	0.12	0.04	0
CnC	Cellar very rocky sandy loam 2 to 15 percent slopes	0.12	0.04	20
CnF	Cellar very rocky sandy loam 15 to 60 percent slopes	0.12	0.04	20
CoD	Cellar-Chiricahua complex 8 to 30 percent slopes	0.07	0.03	0
CrF	Cellar soils 20 to 60 percent slopes	0.12	0.04	0
CsC	Continental gravelly sandy loam 2 to 15 percent slopes	0.02	0.01	0
CtD	Continental-Cave gravelly sandy loams 8 to 30 percent slopes	0.07	0.04	0
CuC	Continental-Whitlock gravelly sandy loams 2 to 15 percent slopes	0.08	0.04	0
CvB	Continental-Loamy alluvial land association sloping	0.05	0.03	0
CwD	Continental soils 3 to 30 percent slopes	0.02	0.01	0
Cx	Cordes sandy loam	0.61	0.35	0
Cy	Cordes fine sandy loam red variant	0.63	0.36	0
CzC	Cross Cabezon and Apache soils 2 to 15 percent slopes	0.04	0.02	0
DaF	Dandrea gravelly loam 20 to 60 percent slopes	0.21	0.09	0
DgC	Dye gravelly loam 2 to 15 percent slopes	0.03	0.01	0
DrC	Dye very rocky loam 2 to 15 percent slopes	0.03	0.01	20
FaC	Faraway very rocky loam 0 to 15 percent slopes	0.17	0.07	25

Table D.12 AZ637 Yavapai County Western Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
FlE	Faraway-Luzena complex 20 to 40 percent slopes	0.10	0.05	0
FlF	Faraway-Luzena complex 40-60 percent slopes	0.10	0.05	0
GdD	Gaddes gravelly sandy loam 3 to 25 percent slopes	0.09	0.03	0
Go	Gila soils	0.23	0.09	0
GrB	Graham-Rimrock complex 0 to 8 percent slopes	0.02	0.01	0
GsE	Graham soils 8 to 45 percent slopes	0.03	0.01	0
HgB	Hogg gravelly loam 0 to 8 percent slopes	0.03	0.01	0
HgD	Hogg gravelly loam 8 to 30 percent slopes	0.03	0.01	0
HmE	House Mountain soils 15-40 percent slopes	0.11	0.04	0
JaC	Jacks very rocky loam 3 to 15 percent slopes	0.02	0.01	20
JaD	Jacks very rocky loam 15 to 30 percent slopes	0.02	0.01	20
La	Latene gravelly sandy loam	0.16	0.06	0
Lc	Latene-Mohave complex	0.27	0.12	0
Le	Lehmans gravelly clay loam 8 to 45 percent slopes	0.01	0.01	0
Lh	Lehmans extremely rocky clay loam 8 to 60 percent slopes	0.01	0.01	40
LkD	Lonti gravelly sandy loam 15 to 30 percent slopes	0.03	0.01	0
LlC	Lonti gravelly sandy loam high rainfall 0 to 15 percent slopes	0.03	0.01	0
LlD	Lonti gravelly sandy loam high rainfall 15 to 30 percent slopes	0.03	0.01	0
LmB	Lonti gravelly loam 0 to 8 percent slopes	0.03	0.01	0
LnC	Lonti cobbly loam 0 to 15 percent slopes	0.03	0.01	0
LnF	Lonti cobbly loam 30 to 60 percent slopes	0.03	0.01	0
LoD	Lonti complex 2 to 30 percent slopes	0.03	0.01	0
LpB	Lonti-Abra gravelly sandy loams 0 to 8 percent slopes	0.06	0.02	0
LrD	Lonti-Abra complex 8 to 30 percent slopes	0.06	0.02	0
LsC	Lonti-Pastura complex 0 to 20 percent slopes	0.05	0.02	0
LtB	Lonti-Cordes association undulating	0.10	0.04	0
LuC	Lonti-Wineg complex 3 to 15 percent slopes	0.06	0.02	0
LvE	Lonti-Rock land association hilly	0.03	0.01	35

Table D.12 AZ637 Yavapai County Western Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
LwD	Luzena cobbly loam 0 to 30 percent slopes	0.02	0.01	0
LxD	Luzena very rocky loam 10 to 30 percent slopes	0.02	0.01	25
Ly	Lynx soils	0.14	0.05	0
Ly2	Lynx soils eroded	0.08	0.02	0
Lz	Lynx soils wet variant	0.15	0.05	0
MbC	Mirabal gravelly sandy loam 8 to 20 percent slopes	0.50	0.26	0
MbF	Mirabal gravelly sandy loam 20 to 60 percent slopes	0.50	0.26	0
MdF	Mirabal-Dandrea complex 20 to 60 percent slopes	0.30	0.14	0
MgD	Moano gravelly loam 0 to 30 percent slopes	0.18	0.08	0
MkF	Moano very rocky loam 15 to 60 percent slopes	0.18	0.08	20
MoD	Moano extremely rocky loam 15 to 30 percent slopes	0.18	0.08	30
MrC	Moano-Lynx association rolling	0.20	0.09	0
MsB	Moenkopie association undulating	0.64	0.35	0
Mt	Mohave sandy loam	0.60	0.32	0
PaB	Palma sandy loam 1 to 8 percent slopes	0.48	0.23	0
PcE	Palos Verdes gravelly sandy loam 8 to 40 percent slopes	0.05	0.01	0
Pd	Partri loam	0.03	0.01	0
Pe	Partri gravelly clay loam	0.03	0.01	0
Pf	Partri-Abra loams	0.06	0.02	0
PgB	Pastura gravelly loam 0 to 8 percent slopes	0.13	0.05	0
PhD	Pastura complex 1 to 30 percent slopes	0.13	0.05	0
PlB	Pastura-Poley complex 2 to 8 percent slopes	0.06	0.03	0
PmB	Pastura-Lynx association undulating	0.16	0.06	0
PnB	Pastura-Rune association undulating	0.18	0.08	0
Po	Poley gravelly sandy loam	0.02	0.01	0
Pp	Poley-Partri loams	0.02	0.01	0
PrC	Purner gravelly loam 2 to 15 percent slopes	0.19	0.08	0
PsC	Purner very stony loam 2 to 15 percent slopes	0.16	0.07	0
PsD	Purner very stony loam 15 to 20 percent slopes	0.16	0.07	0
PuC	Purner-Boysag complex 2 to 15 percent slopes	0.09	0.03	0

Table D.12 AZ637 Yavapai County Western Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
PvD	Purner and Dye soils 2 to 30 percent slopes	0.09	0.04	0
PwD	Purner and Moenkopie soils 8 to 30 percent slopes	0.25	0.12	0
ReD	Retriever gravelly loam 2 to 30 percent slopes	0.14	0.05	0
Rk	Rimrock cobbly clay	0.01	0.01	0
Rm	Rimrock-Cave complex	0.04	0.03	0
Rn	Rimrock-Graham complex 3 to 15 percent slopes	0.01	0.01	0
Ro	Rock land	0.01	0.01	90
Rr	Rock land low rainfall	0.01	0.01	90
Rs	Rough broken land	0.01	0.01	95
Rt	Rune loam	0.35	0.18	0
Sa	Sandy and Gravelly alluvial land	0.96	0.62	0
ShB	Showlow gravelly sandy loam 0 to 8 percent slopes	0.12	0.04	0
SlB	Springerville cobbly clay 0 to 8 percent slopes	0.02	0.01	0
SmB	Springerville very stony clay 0 to 8 percent slopes	0.01	0.01	0
SnD	Springerville-Cabezon complex 3 to 30 percent slopes	0.02	0.01	0
SpB	Springerville-Pastura complex 1 to 5 percent slopes	0.04	0.02	0
StB	Springerville-Thunderbird complex 0 to 8 percent slopes	0.02	0.01	0
SuB	Springerville-Lonti association undulating	0.02	0.01	0
TaB	Tajo gravelly loam 0 to 8 percent slopes	0.08	0.02	0
TcC	Tajo-Springerville complex 0 to 15 percent slopes	0.05	0.02	0
TdC	Thunderbird cobbly clay loam 0 to 15 percent slopes	0.02	0.01	0
TdE	Thunderbird cobbly clay loam 15 to 40 percent slopes	0.02	0.01	0
ThC	Thunderbird-Cabezon complex 0 to 15 percent slopes	0.02	0.01	0
TlB	Tortugas gravelly loam 2 to 8 percent slopes	0.21	0.09	0
TmD	Tortugas very rocky loam 8 to 30 percent slopes	0.15	0.07	20

Table D.12 AZ637 Yavapai County Western Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
TnF	Tortugas extremely rocky loam 15 to 60 percent slopes	0.23	0.11	30
To	Tours loam	0.08	0.02	0
TwC	Tres Hermanos-Whitlock gravelly sandy loams 0 to 15 percent slopes	0.25	0.09	0
Vm	Vekol-Mohave complex	0.10	0.04	0
VnD	Venezia cobbly loam 0 to 30 percent slopes	0.32	0.16	0
VrF	Venezia very stony loam 30 to 60 percent slopes	0.28	0.14	0
VsC	Venezia-Springerville complex 0 to 20 percent slopes	0.11	0.06	0
VtC	Venezia-Thunderbird complex 5 to 15 percent slopes	0.12	0.06	0
VtE	Venezia-Thunderbird complex 15 to 40 percent slopes	0.12	0.06	0
W	Water	0.01	0.01	100
WcC	Waldroup-Cabezon association hilly	0.01	0.01	0
WgC	Whitlock gravelly sandy loam 0 to 15 percent slopes	0.52	0.27	0
WhC	Whitlock-Anthony gravelly sandy loams 0 to 15 percent slopes	0.45	0.22	0
WlF	Wilcoxson gravelly loam 30 to 60 percent slopes	0.03	0.01	0
Wm	Wineg sandy loam	0.14	0.06	0
Wn	Wineg-Abra complex	0.15	0.06	0
Wo	Wineg-Lynx association	0.17	0.07	0
Wp	Wineg and Poley soils	0.05	0.02	0

D.3.7 AZ657

Table D.13 AZ657 Kofa Area, Arizona, Parts Of La Paz And Yuma Counties

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
200	Gunsight family-Pinamt complex 1 to 15 percent slopes	0.11	0.04	0
205	Denure-Pahaka-Growler complex 0 to 3 percent slopes	0.70	0.37	0
206	Denure sandy loam 0 to 1 percent slopes	0.95	0.54	0
207	Denure fine sandy loam 0 to 1 percent slopes	0.83	0.46	0
208	Pahaka fine sandy loam 0 to 1 percent slopes	0.75	0.41	0
209	Pahaka sandy loam 0 to 1 percent slopes	1.00	0.57	0
210	Brios-Riverwash complex 0 to 1 percent slopes	1.59	1.06	0
215	Denure complex 1 to 5 percent slopes	0.66	0.35	0
220	Momoli-Carrizo family complex 1 to 5 percent slopes	0.57	0.31	0
225	Growler sandy loam 1 to 5 percent slopes	0.67	0.35	0
230	Casa Grande family-Rositas family complex 0 to 8 percent slopes	0.42	0.18	0
235	Superstition-Rositas family complex dry 0 to 3 percent slopes	1.97	1.25	0
240	Beeline-Laposa complex 2 to 45 percent slopes	0.57	0.30	0
245	Hyder-Rock outcrop complex 5 to 45 percent slopes	0.07	0.02	35
250	Brios coarse sand 3 to 35 percent slopes	1.55	0.96	0
255	Glendale-Gila complex 0 to 1 percent slopes	0.17	0.05	0
257	Glendale silty clay loam 0 to 1 percent slopes	0.06	0.01	0
258	Gila very fine sandy loam 0 to 1 percent slopes	0.79	0.43	0
265	Hickiwan-Gunsight complex 3 to 30 percent slopes	0.46	0.24	0

Table D.13 AZ657 Kofa Area, Arizona, Parts Of La Paz And Yuma Counties

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
270	Pajarito sandy loam 0 to 1 percent slopes	0.93	0.53	0
271	Whitlock family sandy loam 0 to 1 percent slopes	0.49	0.24	0
272	Sahuarita sandy loam 0 to 1 percent slopes	0.88	0.50	0
275	Pajarito-Whitlock-Sahuarita complex 0 to 1 percent slopes	0.67	0.35	0
280	Delnorte-Whitlock complex 2 to 10 percent slopes	0.24	0.10	0
285	Mohave sandy loam 0 to 1 percent slopes	0.07	0.02	0
290	Dixaleta-Rock outcrop complex 3 to 30 percent slopes	0.09	0.03	15
295	Yturbide sand 0 to 1 percent slopes	2.00	1.83	0
296	Brazito sandy loam 0 to 1 percent slopes	0.78	0.42	0
300	Stagecoach-Pinaleno family complex 3 to 15 percent slopes	0.40	0.20	0
305	Mohave sandy loam 0 to 3 percent slopes	0.07	0.02	0
310	Glenbar silt loam 0 to 1 percent slopes	0.07	0.02	0
311	Gadsden silty clay loam 0 to 1 percent slopes	0.04	0.01	0
312	Gadsden-Glenbar complex 0 to 2 percent slopes	0.03	0.01	0
315	Contine sandy loam 0 to 1 percent slopes	0.70	0.37	0
316	Mohall sandy loam 0 to 1 percent slopes	0.54	0.27	0
317	Mohall loam 0 to 1 percent slopes	0.23	0.09	0
318	Glenbar silt loam loamy substratum 0 to 1 percent slopes	0.11	0.03	0
320	Hantz silty clay loam 0 to 1 percent slopes	0.03	0.01	0
321	Hantz silty clay loam 0 to 2 percent slopes	0.05	0.01	0
325	Dateland-Denure complex 0 to 2 percent slopes	0.71	0.38	0

Table D.13 AZ657 Kofa Area, Arizona, Parts Of La Paz And Yuma Counties Soil Map Unit Composite XKSAT and RTIMP Values				
		XKSAT, in/hr		
SMU	Soil Map Unit Name	DF = 1.0	DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
330	Gunsight family-Rillito complex 1 to 10 percent slopes	0.45	0.23	0
331	Rillito sandy loam 0 to 1 percent slopes	0.61	0.32	0
332	Gunsight family gravelly sandy loam 0 to 1 percent slopes	0.58	0.30	0
335	Dateland loam 0 to 1 percent slopes	0.39	0.18	0
336	Dateland fine sandy loam 0 to 1 percent slopes	0.83	0.45	0
340	Mohall-Contine complex 1 to 5 percent slopes	0.09	0.06	0
345	Gilman silt loam 0 to 1 percent slopes	0.24	0.09	0
350	Gunsight family-Cristobal complex dry 1 to 10 percent slopes	0.22	0.09	0
355	Wintersburg-Laveen complex 0 to 3 percent slopes	0.44	0.20	0
360	Schenco-Chuichu-Rock outcrop complex 3 to 45 percent slopes	0.15	0.06	20
370	Superstition-Rillito complex dry 2 to 10 percent slopes	0.69	0.35	0
375	Riverbend family-Superstition complex dry 1 to 30 percent slopes	0.68	0.40	0
385	Carrizo family very gravelly sandy loam dry 0 to 3 percent slopes	0.45	0.23	0
390	Carrizo family-Riverwash complex dry 0 to 2 percent slopes	1.28	0.82	0
395	Cristobal family-Gunsight family complex dry 1 to 10 percent slopes	0.08	0.03	0
400	Gilman-Carrizo family complex dry 0 to 3 percent slopes	0.62	0.32	0
405	Harqua-Casa Grande family complex dry 0 to 4 percent slopes	0.13	0.04	0
410	Gunsight family very gravelly sandy loam dry 1 to 15 percent slopes	0.37	0.19	0
415	Rock outcrop-Laposa family-Hyder complex dry 3 to 45 percent slopes	0.37	0.19	35
420	Gilman-Yahana complex dry 0 to 2 percent slopes	0.24	0.09	0

Table D.13 AZ657 Kofa Area, Arizona, Parts Of La Paz And Yuma Counties

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
425	Rock outcrop-Schenco complex dry 5 to 50 percent slopes	0.37	0.19	60
430	Water association	0.01	0.01	100
NOTCOM	No Digital Data Available	0.02	0.01	0

D.3.8 AZ697

Table D.14 AZ697 Mohave County Central Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
1	Alko family cobbly loam 0 to 25 percent slopes	0.29	0.13	0
2	Alko family gravelly sandy loam 1 to 15 percent slopes	0.29	0.13	0
3	Appleseed-Huevi association 4 to 30 percent slopes	0.27	0.13	0
4	Aridic Argiustolls-Lithic Haplustolls complex 1 to 40 percent slopes	0.31	0.16	0
5	Arizo-Detrital-Nickel complex 2 to 6 percent slopes	0.53	0.27	0
6	Arizo-Franconia-Riverwash complex 1 to 3 percent slopes	0.79	0.46	0
7	Arizo-Riverwash complex 0 to 1 percent slopes	1.30	0.84	0
8	Arizo-Riverwash complex 1 to 4 percent slopes	1.66	1.11	0
9	Arizo-Riverwash complex dry 0 to 1 percent slopes	1.66	1.11	0
10	Arizo-Riverwash complex moist 1 to 3 percent slopes	1.95	1.34	0
11	Azure-Detrital-Antares complex 5 to 30 percent slopes	0.29	0.14	0
12	Birdsbeak very channery loam 10 to 35 percent slopes	0.02	0.01	0
13	Bluebird-Detrital complex 2 to 15 percent slopes very stony	0.19	0.08	0
14	Bluebird-Lostman complex 1 to 5 percent slopes	0.24	0.10	0
15	Carrizo complex 1 to 5 percent slopes	0.29	0.14	0
16	Carrizo-Riverwash complex 0 to 1 percent slopes	0.78	0.45	0
17	Carrizo-Riverwash complex 3 to 8 percent slopes MLRA 30	0.91	0.55	0
18	Chuckawalla-Riverbend complex 2 to 15 percent slopes	0.13	0.05	0
19	Circular complex 1 to 3 percent slopes	0.47	0.23	0
20	Circular-Dusty complex 0 to 4 percent slopes	0.26	0.10	0

Table D.14 AZ697 Mohave County Central Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
21	Cod gravelly sandy loam 2 to 6 percent slopes	0.41	0.20	0
22	Cordes-Manikan-Riverwash complex 1 to 6 percent slopes	0.54	0.27	0
23	Cupel-Rock outcrop complex 35 to 65 percent slopes	0.14	0.06	20
24	Cyclopic very stony loam 3 to 8 percent slopes	0.01	0.01	0
25	Deluge-Gotchell-Sunstroke complex 3 to 7 percent slopes	0.11	0.04	0
26	Detrital-Bluebird complex 2 to 12 percent slopes	0.18	0.07	0
27	Detrital-Nealy complex 1 to 6 percent slopes	0.29	0.13	0
28	Detrital-Nickel complex dry 1 to 6 percent slopes	0.41	0.21	0
29	Detrital-Nickel family complex 1 to 4 percent slopes	0.51	0.26	0
30	Detrital-Skelon family complex 1 to 5 percent slopes	0.29	0.14	0
31	Dusty-Kurstan family complex 1 to 6 percent slopes	0.15	0.04	0
32	Dutchflat sandy loam 0 to 2 percent slopes	0.19	0.07	0
33	Dye-Tovar-Rock outcrop complex 6 to 25 percent slopes	0.04	0.01	15
34	Faraway-Rock outcrop complex 30 to 70 percent slopes	0.16	0.07	20
35	Fig-Blind-Nodman complex 30 to 70 percent slopes	0.16	0.07	0
36	Filaree gravelly sandy loam 2 to 6 percent slopes	0.90	0.52	0
37	Filaree-Dutchflat complex 2 to 6 percent slopes	0.76	0.42	0
38	Garnet-Dutchflat complex 2 to 6 percent slopes	0.50	0.24	0
39	Goesling family silt loam 3 to 8 percent slopes	0.13	0.05	0
40	Goldroad-Rock outcrop complex 15 to 35 percent slopes	0.33	0.17	10
41	Goldroad-Rock outcrop complex 35 to 65 percent slopes	0.33	0.17	20

Table D.14 AZ697 Mohave County Central Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
42	Gonzales-Rock outcrop complex 15 to 35 percent slopes	0.02	0.01	25
43	Goodsprings family gravelly sandy loam 10 to 35 percent slopes	0.36	0.16	0
44	Gotchell-Sunstroke complex 6 to 35 percent slopes	0.23	0.11	0
45	Graham-Arivaca complex 2 to 15 percent slopes	0.06	0.02	0
46	Graham-Rock outcrop complex 10 to 40 percent slopes	0.09	0.03	20
47	Grandwash extremely flaggy sandy loam 2 to 25 percent slopes	0.01	0.01	0
48	Greyeagle family extremely gravelly coarse sandy loam 15 to 40 percent slopes	0.19	0.08	0
49	Greyeagle family extremely gravelly sandy loam 35 to 60 percent slopes	0.38	0.20	0
50	Greyeagle family-Cyclopic complex 3 to 12 percent slopes	0.16	0.09	0
51	Greyeagle-Skelon families complex 2 to 12 percent slopes	0.23	0.10	0
52	Greyeagle-Skelon families complex moist 4 to 25 percent slopes	0.26	0.12	0
53	Gypsids 3 to 50 percent slopes	0.22	0.10	0
54	Haplogypsids eroded-Haplogypsids complex 35 to 75 percent slopes	0.22	0.10	0
55	Hassell family-Lampshire-Rock outcrop complex 10 to 30 percent slopes	0.05	0.02	20
56	Hindu-Rock outcrop complex 5 to 45 percent slopes	0.12	0.04	20
57	Hooks-Courtland families complex 1 to 5 percent slopes	0.25	0.10	0
58	Hosta family sandy loam 1 to 8 percent slopes	0.18	0.07	0
59	House Mountain family-Calvista family-Rock outcrop complex 10 to 35 percent slopes	0.22	0.09	20
60	Huevi extremely cobbly sandy loam 2 to 6 percent slopes	0.27	0.13	0
61	Huevi very gravelly loam 10 to 40 percent slopes	0.24	0.11	0

Table D.14 AZ697 Mohave County Central Part Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
62	Huevi very gravelly sandy loam 15 to 35 percent slopes	0.33	0.17	0
63	Huevi-Carrizo complex 1 to 25 percent slopes	0.17	0.07	0
64	Huevi-Carrwash complex 2 to 75 percent slopes	0.49	0.26	0
65	Huevi-Sunrock-Rock outcrop complex 20 to 70 percent slopes	0.24	0.11	10
66	Hulda extremely gravelly sandy loam 20 to 65 percent slopes	0.39	0.20	0
67	Hulda-Rock outcrop complex 20 to 65 percent slopes	0.39	0.20	20
68	Hulda-Rock outcrop complex moist 35 to 70 percent slopes	0.31	0.16	35
69	Ireteba family-Arizo complex 1 to 3 percent slopes	0.55	0.29	0
70	Jagerson very gravelly loam 0 to 4 percent slopes	0.21	0.08	0
71	Jagerson-Nealy complex 1 to 3 percent slopes	0.12	0.04	0
72	Kingtut-Promontory complex 3 to 12 percent slopes	0.03	0.02	0
73	Kinley gravelly loamy sand 15 to 35 percent slopes	0.67	0.36	0
74	Kurstan family-Dusty complex 2 to 6 percent slopes	0.33	0.14	0
75	Lampshire-Rock outcrop complex 20 to 60 percent slopes	0.51	0.29	20
76	Lostman gravelly sandy loam moist 1 to 5 percent slopes	0.45	0.23	0
77	Lostman sandy loam 1 to 4 percent slopes	0.69	0.39	0
78	Luzena-Thunderbird complex 3 to 20 percent slopes	0.03	0.01	0
79	Lykorly gravelly loam 1 to 4 percent slopes	0.08	0.02	0
80	Lykorly silt loam moist 1 to 5 percent slopes	0.36	0.18	0
81	Manikan-Nuffel complex 1 to 3 percent slopes	0.18	0.07	0
82	Mathis family-Riverwash complex 1 to 4 percent slopes	0.72	0.44	0

Table D.14 AZ697 Mohave County Central Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
83	Mayswell-Rock outcrop complex 5 to 40 percent slopes	0.02	0.01	15
84	Meadview extremely gravelly sandy loam 5 to 40 percent slopes	0.28	0.13	0
85	Meadview-Yurm family complex 4 to 25 percent slopes	0.28	0.13	0
86	Meriwhitica-Rock outcrop complex 5 to 35 percent slopes	0.49	0.27	15
87	Mextank very gravelly sandy loam 2 to 15 percent slopes	0.17	0.07	0
88	Milkweed-Quartermaster-Buckndoe complex 2 to 20 percent slopes	0.16	0.07	0
89	Milok-Pastern complex 4 to 12 percent slopes	0.35	0.16	0
90	Mutang-Dutchflat complex 0 to 3 percent slopes	0.06	0.02	0
91	Mutang-Wikieup-Rock outcrop complex 3 to 30 percent slopes	0.04	0.02	15
92	Nealy-Shamock family complex 2 to 8 percent slopes	0.20	0.07	0
93	Nealy-Skelon family-Detrital complex 3 to 10 percent slopes	0.38	0.18	0
94	Nickel family-Bluebird complex 15 to 45 percent slopes	0.13	0.06	0
95	Nickel-Skelon family-Detrital complex 3 to 10 percent slopes	0.36	0.18	0
96	Nickel-Topawa-Eba families complex 10 to 50 percent slopes	0.04	0.02	0
97	Nodman-Antares complex 3 to 15 percent slopes	0.12	0.04	0
98	Nodman-Courtland family complex 2 to 20 percent slopes	0.15	0.06	0
99	Nodman-Rock outcrop complex 15 to 65 percent slopes	0.06	0.02	20
100	Nodman-Romero family complex 15 to 65 percent slopes	0.17	0.07	0
101	Nolam family-Ustalfic Petrocalcids-Caralampi family complex 1 to 15 percent slopes	0.04	0.01	0
102	Ohaco family-Bluebird complex 2 to 8 percent slopes	0.04	0.02	0

Table D.14 AZ697 Mohave County Central Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
103	Orejano gravelly sandy loam 4 to 35 percent slopes	0.05	0.01	0
104	Pantak family-Taine-Terino family complex 15 to 65 percent slopes	0.04	0.01	0
105	Pastern-Strych complex 4 to 20 percent slopes	0.17	0.07	0
106	Peachsprings-Havasupai complex 2 to 35 percent slopes	0.35	0.17	0
107	Pearce extremely stony loam 4 to 15 percent slopes	0.14	0.06	0
108	Pearce-Detrital-Rock outcrop complex 20 to 75 percent slopes	0.18	0.07	10
109	Pearce-Rock outcrop complex 5 to 65 percent slopes	0.14	0.05	15
110	Pedregosa-Tombstone families complex 1 to 15 percent slopes	0.29	0.14	0
111	Pidineen-Tricon families complex 2 to 10 percent slopes	0.24	0.11	0
112	Pits-Dumps complex	0.02	0.01	0
113	Playa	0.12	0.05	0
114	Prieta-Rock outcrop complex 2 to 35 percent slopes	0.01	0.01	15
115	Quagwa silt loam 1 to 3 percent slopes	0.23	0.09	0
116	Razorback extremely gravelly sandy loam 15 to 35 percent slopes	0.38	0.20	0
117	Razorback-Rock outcrop complex 15 to 70 percent slopes	0.21	0.10	20
118	Razorback-Rock outcrop complex 20 to 70 percent slopes	0.16	0.06	30
119	Rift silt loam 0 to 1 percent slopes frequently flooded	0.07	0.02	0
120	Rift silty clay loam 0 to 1 percent slopes	0.05	0.01	0
121	Rillino family-Shamock family-Dutchflat complex 1 to 4 percent slopes	0.47	0.23	0
122	Rock outcrop-Appleseed complex 35 to 75 percent slopes	0.38	0.20	50
123	Rock outcrop-Pearce complex 35 to 75 percent slopes	0.26	0.12	55
124	Rock outcrop-Razorback complex 20 to 70 percent slopes	0.21	0.10	65

Table D.14 AZ697 Mohave County Central Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
125	Rock outcrop-Torriorthents complex 35 to 75 percent slopes	0.96	0.62	50
126	Rock outcrop-Torriorthents cool complex 35 to 75 percent slopes	0.96	0.62	50
127	Rock outcrop-Valena-Kopie family complex 5 to 35 percent slopes	0.45	0.22	50
128	Rolie-Dean complex 2 to 20 percent slopes	0.12	0.04	0
129	Romero-Chiricahua-Rock outcrop complex 5 to 35 percent slopes	0.03	0.02	20
130	Romero-Lampshire-Rock outcrop complex 35 to 70 percent slopes	0.13	0.05	15
131	Rositas sand 4 to 30 percent slopes	2.00	1.79	0
132	Shortbread loamy sand 1 to 4 percent slopes	1.42	0.88	0
133	Shortbread-Kurstan family-Dusty complex 0 to 7 percent slopes	0.58	0.30	0
134	Skelon family-Greyeagle family-Detrital complex 3 to 30 percent slopes	0.38	0.19	0
135	Skelon-Pinaleno families complex 1 to 4 percent slopes	0.27	0.13	0
136	Storybook very gravelly loam 1 to 3 percent slopes	0.31	0.15	0
137	Stronghold-McAllister families complex 2 to 15 percent slopes	0.16	0.06	0
138	Sunrock extremely gravelly sandy loam 15 to 35 percent slopes	0.35	0.18	0
139	Sunrock-Rock outcrop complex 30 to 65 percent slopes	0.37	0.19	20
140	Superstition family-Carrwash complex 35 to 75 percent slopes	0.93	0.56	0
141	Taine extremely cobbly loam 12 to 35 percent slopes	0.02	0.01	0
142	Thimble-Rock outcrop complex 35 to 65 percent slopes	0.02	0.01	10
143	Tombstone-Caralampi-Nolam families complex 2 to 30 percent slopes	0.16	0.06	0
144	Torriorthents 25 to 75 percent slopes	0.96	0.62	0
145	Torriorthents gypsic-Haplocambids gypsic complex 3 to 15 percent slopes	0.52	0.29	0
146	Torriorthents-Rock outcrop complex 25 to 75 percent slopes	0.96	0.62	15

Table D.14 AZ697 Mohave County Central Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
147	Tovar-Grandwash complex 6 to 25 percent slopes	0.03	0.01	0
148	Truxton complex 1 to 3 percent slopes	0.18	0.07	0
149	Tumarion very cobbly loam 2 to 15 percent slopes	0.08	0.03	0
150	Tumarion-Nickel family complex 8 to 35 percent slopes	0.21	0.09	0
151	Tumarion-Nickel family complex moist 5 to 40 percent slopes	0.21	0.09	0
152	Tyro extremely stony sandy loam 3 to 35 percent slopes	0.33	0.17	0
153	Tyro very gravelly sandy loam 3 to 30 percent slopes	0.35	0.18	0
154	Tyro-Sunrock complex 3 to 15 percent slopes	0.31	0.15	0
155	Urban land-Calvista family complex 2 to 10 percent slopes	0.52	0.28	0
156	Ustorthents-Rock outcrop complex 35 to 90 percent slopes	2.00	1.56	30
157	Valena-Carri complex 3 to 15 percent slopes	0.37	0.17	0
158	Valena-Rock outcrop-Carri family complex 1 to 25 percent slopes	0.39	0.18	20
159	Vekol family gravelly loamy sand 2 to 7 percent slopes	0.50	0.26	0
160	Vekol family loam 1 to 3 percent slopes	0.02	0.01	0
161	Vekol family-Whitehills complex 2 to 7 percent slopes	0.05	0.02	0
162	Vock-Elements-Rock outcrop complex 30 to 65 percent slopes	0.46	0.24	10
163	Vock-Elements-Rock outcrop complex cool 30 to 65 percent slopes	0.41	0.22	10
164	Water	0.01	0.01	100
165	White House gravelly loamy sand 2 to 15 percent slopes	0.01	0.01	0
166	White House family very gravelly loamy sand 2 to 15 percent slopes	0.08	0.03	0
167	Whitehills very gravelly loam 1 to 5 percent slopes	0.15	0.06	0
168	Wodomont-Kydestea complex 5 to 40 percent slopes	0.19	0.08	0

Table D.14 AZ697 Mohave County Central Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
169	Wodomont-Metuck-Rock outcrop complex 25 to 45 percent slopes	0.39	0.21	15
170	Wodomont-Rock outcrop complex 5 to 40 percent slopes	0.15	0.06	20
171	Yahana family silty clay loam 1 to 3 percent slopes	0.04	0.01	0
172	Zibate family extremely gravelly sandy loam 5 to 35 percent slopes	0.03	0.01	0
173	Zibate family very stony loam 12 to 30 percent slopes	0.06	0.02	0
174	Zibate family-Dutchflat-Tumarion complex 4 to 30 percent slopes	0.08	0.04	0

Page Intentionally Left Blank

D.3.9 AZ699

Table D.15 AZ699 Hualapai-Havasupai Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1	Albers silty clay loam 0 to 3 percent slopes	0.02	0.01	0
2	Arizo-Lostman complex 1 to 5 percent slopes	0.63	0.35	0
3	Arizo-Riverwash complex 1 to 3 percent slopes	1.84	1.39	0
4	Barx fine sandy loam 1 to 6 percent slopes	0.12	0.04	0
5	Bleumont-Frazwell association 2 to 20 percent slopes	0.02	0.02	0
6	Cowan family-Tobler complex 0 to 3 percent slopes	1.03	0.60	0
7	Curhollow-Puertecito complex 1 to 12 percent slopes	0.07	0.02	0
8	Curhollow-Rolie-Meriwhitica association 1 to 35 percent slopes	0.10	0.03	0
9	Curhollow-Tenderfoot complex 1 to 8 percent slopes	0.07	0.02	0
10	Deama-Rock outcrop complex 25 to 55 percent slopes	0.12	0.05	20
11	Disterheff gravelly fine sandy loam cool 1 to 8 percent slopes	0.02	0.01	0
12	Disterheff gravelly loam 1 to 4 percent slopes	0.02	0.01	0
13	Frazwell-Jacques complex 1 to 3 percent slopes	0.05	0.01	0
14	Grandwash extremely flaggy sandy loam 2 to 25 percent slopes	0.01	0.01	0
15	Havasupai very gravelly loam 1 to 8 percent slopes	0.13	0.04	0
16	Hermshale extremely flaggy fine sandy loam 15 to 35 percent slopes	0.15	0.06	0
17	Hidvalle very fine sandy loam 1 to 6 percent slopes	0.45	0.23	0
18	Hindu-Rock outcrop complex 5 to 45 percent slopes	0.12	0.04	20
19	Lostman family-Harrisburg complex 1 to 5 percent slopes	0.39	0.19	0
20	Luzena-Thunderbird complex 3 to 20 percent slopes	0.04	0.01	0

Table D.15 AZ699 Hualapai-Havasupai Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
21	Lykorly gravelly loam 1 to 4 percent slopes	0.10	0.03	0
22	Lykorly silt loam moist 1 to 5 percent slopes	0.11	0.04	0
23	Metuck-Rock outcrop complex 15 to 60 percent slopes	0.25	0.12	30
24	Mextank-Lykorly-Disterheff complex 2 to 20 percent slopes	0.15	0.06	0
25	Milkweed-Quartermaster-Buckndoe complex 2 to 20 percent slopes	0.16	0.07	0
26	Milok-Pastern complex 4 to 12 percent slopes	0.34	0.16	0
27	Natank-Disterheff-Yumtheska complex 2 to 35 percent slopes	0.03	0.01	0
28	Nickel family extremely gravelly sandy loam 2 to 35 percent slopes	0.28	0.13	0
29	Peachsprings-Havasupai complex 2 to 35 percent slopes	0.35	0.17	0
30	Pinntank fine sandy loam 1 to 8 percent slopes	0.46	0.24	0
31	Pinntank-Pocomate-Retsover complex 1 to 30 percent slopes	0.07	0.03	0
32	Plaintank-Barx complex 1 to 5 percent slopes	0.11	0.04	0
33	Pocomate-Rock outcrop complex 15 to 55 percent slopes	0.07	0.03	35
34	Poley loam 1 to 5 percent slopes	0.05	0.01	0
35	Poley-Rolie complex 1 to 8 percent slopes	0.07	0.02	0
36	Prieta-Rock outcrop complex 2 to 35 percent slopes	0.03	0.01	15
37	Quagwa silt loam 1 to 3 percent slopes	0.23	0.09	0
38	Rizno-Rock outcrop complex 2 to 15 percent slopes	0.66	0.35	25
39	Rock outcrop-Torriorthents complex 35 to 120 percent slopes	0.96	0.62	60
40	Rolie-Dean complex 2 to 20 percent slopes	0.11	0.04	0
41	Saemo extremely gravelly sandy loam 2 to 45 percent slopes	0.09	0.03	0
42	Sazi family very gravelly fine sandy loam 1 to 5 percent slopes	0.40	0.21	0
43	Splanod-Rock outcrop complex 2 to 15 percent slopes	0.12	0.04	40

Table D.15 AZ699 Hualapai-Havasupai Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
44	Sponiker loam 1 to 4 percent slopes	0.11	0.04	0
45	Theecan-Pinespring association 2 to 35 percent slopes	0.03	0.01	0
46	Topocoba-Wodomont association 2 to 15 percent slopes	0.10	0.04	0
47	Toqui-Tovar-Rock outcrop complex 1 to 15 percent slopes	0.02	0.01	20
48	Toqui-Yumtheska complex 2 to 30 percent slopes	0.05	0.02	0
49	Tovar extremely flaggy fine sandy loam 2 to 25 percent slopes	0.03	0.01	0
50	Tovar very fine sandy loam 1 to 10 percent slopes	0.20	0.08	0
51	Turkeytrack gravelly loam 1 to 6 percent slopes	0.17	0.07	0
52	Ustorthents-Rock outcrop complex 35 to 90 percent slopes	2.00	1.56	30
53	Winona-Curhollow complex 1 to 12 percent slopes	0.07	0.02	0
54	Winona-Rock outcrop complex 15 to 55 percent slopes	0.08	0.02	30
55	Winona-Rock outcrop-Tusayan complex 15 to 55 percent slopes	0.11	0.04	25
56	Wodomont-Coconino complex 2 to 15 percent slopes	0.19	0.08	0
57	Wodomont-Rock outcrop complex 5 to 40 percent slopes	0.12	0.05	20
58	Wukoki-Lomaki complex 15 to 50 percent slopes	0.08	0.02	0
59	Wyva family-Rock outcrop complex 5 to 35 percent slopes	0.04	0.01	25
60	Water	0.01	0.01	100

Page Intentionally Left Blank

D.3.10 AZ701

Table D.16 AZ701 Grand Canyon Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
1	Albers clay loam 0 to 1 percent slopes	0.10	0.04	0
2	Argic Petrocalcids 8 to 15 percent slopes	0.31	0.16	0
3	Argic Petrocalcids warm 2 to 30 percent slopes	0.31	0.16	0
4	Aridic Haplustalfs-Lithic Haplustalfs complex 2 to 30 percent slopes	0.18	0.09	0
5	Aridic Haplustepts 0 to 8 percent slopes	0.22	0.10	0
6	Aridic Lithic Ustorthents-Rock outcrop complex supai group cool 15 to 55 percent slopes	2.00	1.56	30
7	Arizo very gravelly sandy loam 1 to 5 percent slopes	0.43	0.22	0
8	Bilburc very gravelly loam 2 to 6 percent slopes	0.03	0.01	0
9	Binsin-Bilburc-Yumtheska complex 2 to 15 percent slopes	0.11	0.04	0
10	Bluepoint-Rock outcrop complex 5 to 15 percent slopes	2.00	1.80	25
11	Bobzbulz extremely gravelly sandy loam 2 to 10 percent slopes	0.11	0.04	0
12	Bobzbulz extremely gravelly sandy loam 30 to 55 percent slopes	0.18	0.07	0
13	Bobzbulz-Snapcan association	0.15	0.06	0
14	Calcic Petrocalcids 2 to 15 percent slopes	0.96	0.62	0
15	Calcic Petrocalcids-Calcic Petrocalcids moderately steep-Rock outcrop complex hermit formation 2 to 50 percent slopes	0.96	0.62	30
16	Calcic Petrocalcids-Rock outcrop complex 15 to 55 percent slopes	0.96	0.62	20
17	Calcic Petrocalcids-Typic Haplocambids complex 15 to 30 percent slopes	0.96	0.62	0
18	Carrizo complex 1 to 5 percent slopes	1.09	0.67	0
19	Carrizo-Carrizo-Riverbend association	1.73	1.16	0
20	Childers-Lava flows association 4 to 15 percent slopes	0.13	0.05	35
21	Chilton-Teesto-Puertecito families complex 15 to 55 percent slopes	0.27	0.13	0

Table D.16 AZ701 Grand Canyon Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
22	Chunkmonk-Wodomont-Houserock families complex 15 to 40 percent slopes	0.12	0.06	0
23	Chunkmonk-Wodomont-Toqui families complex 2 to 15 percent slopes	0.11	0.04	0
24	Cliffdown moderately steep-Cliffdown families complex 15 to 40 percent slopes	0.19	0.08	0
25	Cliffdown-Izo families complex 2 to 8 percent slopes	0.41	0.21	0
26	Curhollow-Lapoint-Mellenthin families complex 2 to 15 percent slopes	0.11	0.04	0
27	Curhollow-Mellenthin complex 2 to 25 percent slopes	0.13	0.05	0
28	Curhollow-Meriwhitica complex 2 to 25 percent slopes	0.12	0.04	0
29	Curhollow-Puertecito complex 1 to 12 percent slopes	0.07	0.02	0
30	Curhollow-Puertecito-Mellenthin families complex 2 to 25 percent slopes	0.11	0.04	0
31	Curhollow-Tenderfoot complex 1 to 8 percent slopes	0.08	0.02	0
32	Curob-Whirlo families complex 15 to 30 percent slopes	0.19	0.08	0
33	Deama-Rock outcrop complex 25 to 55 percent slopes	0.12	0.05	20
34	Dera family 15 to 55 percent slopes	0.09	0.03	0
35	Disterheff-Albers association 1 to 3 percent slopes	0.03	0.01	0
36	Disterheff-Yumtheska complex 2 to 6 percent slopes	0.03	0.02	0
37	Elledge family 2 to 15 percent slopes	0.64	0.33	0
38	Elledge family 15 to 40 percent slopes	0.34	0.17	0
39	Firo family-Sandia-Rock outcrop complex 15 to 55 percent slopes	0.49	0.28	15
40	Fluvaquents-Psamments complex 2 to 6 percent slopes	2.00	1.56	0
41	Fluvaquents-Psamments complex warm 2 to 6 percent slopes	2.00	1.56	0
42	Garr-Zibate families complex 2 to 15 percent slopes	0.05	0.01	0

Table D.16 AZ701 Grand Canyon Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
43	Gypill fine sandy loam 15 to 40 percent slopes	0.88	0.49	0
44	Gypill-Meadview complex 2 to 15 percent slopes	0.45	0.22	0
45	Haplocalcids-Rock outcrop complex 1 to 19 percent slopes	0.31	0.16	15
46	Hindu-Rock outcrop complex 5 to 45 percent slopes	0.15	0.05	20
47	Huevi extremely gravelly fine sandy loam 2 to 4 percent slopes	0.39	0.20	0
48	Iceberg-Rock outcrop-Helkitchen association	0.21	0.09	25
49	Kaiparowits gravelly fine sandy loam 15 to 40 percent slopes	0.37	0.19	0
50	Kaiparowits-Plite family complex 2 to 8 percent slopes	0.35	0.16	0
51	Kanabownits fine sandy loam 15 to 40 percent slopes	0.90	0.52	0
52	Kanabownits-Kippers-Kaiparowits complex 2 to 15 percent slopes	0.11	0.05	0
53	Kanabownits-Kippers-Kaiparowits complex cool 2 to 15 percent slopes	0.36	0.19	0
54	Kanackey family 8 to 15 percent slopes	0.06	0.02	0
55	Kellypoint-Luzena complex 2 to 15 percent slopes	0.02	0.01	0
56	Kellypoint-Rock outcrop complex 15 to 35 percent slopes	0.08	0.03	15
57	Lava flows-Typic Torriorthents complex 30 to 60 percent slopes	0.96	0.62	80
58	Lithic Haplargids shinumo formation 8 to 15 percent slopes	0.31	0.16	0
59	Lithic Haplargids-Rock outcrop complex redwall formation 2 to 30 percent slopes	0.31	0.16	20
60	Lithic Haplargids-Typic Haplargids-Lava flows complex 2 to 35 percent slopes	0.31	0.16	15
61	Lithic Haplocalcids pakoon limestone 2 to 8 percent slopes	0.96	0.62	0
62	Lithic Haplocalcids-Rock outcrop complex esplanade formation 2 to 15 percent slopes	0.96	0.62	30

Table D.16 AZ701 Grand Canyon Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
63	Lithic Haplocambids-Lithic Haplargids complex bright angel and tapeats formations 2 to 15 percent slopes	0.25	0.12	0
64	Lithic Haplustalfs-Lava flows complex 30 to 60 percent slopes	0.09	0.04	45
65	Lithic Haplustolls-Udic Haplustolls-Rock outcrop complex kaibab torroweap and coconino formations 15 to 55 percent slopes	0.31	0.16	20
66	Lithic Torriorthents-Lithic Calciargids complex bright angel and tapeats formations hyperthermic 2 to 55 percent slopes	0.77	0.47	0
67	Lithic Torriorthents-Lithic Calciargids complex bright angel and tapeats formations thermic 2 to 55 percent slopes	0.68	0.41	0
68	Lithic Torriorthents-Rock outcrop complex dox formation 15 to 60 percent slopes	0.96	0.62	45
69	Lithic Torriorthents-Rock outcrop complex esplanade formation 2 to 8 percent slopes	0.96	0.62	30
70	Lithic Torriorthents-Rock outcrop complex muav and redwall formations 15 to 70 percent slopes	0.96	0.62	30
71	Lithic Torriorthents-Typic Torriorthents-Rock outcrop complex hermit formation 3 to 85 percent slopes	0.96	0.62	20
72	Lithic Ustic Torriorthents-Rock outcrop complex hermit formation 20 to 50 percent slopes	0.31	0.16	40
73	Lithic Ustic Torriorthents-Rock outcrop complex supai group 15 to 55 percent slopes	0.31	0.16	30
74	Lithic Ustic Torriorthents-Udic Haplustolls-Rock outcrop complex kaibab toroweap and coconino formations 15 to 55 percent slopes	0.31	0.16	15
75	Lostman family-Harrisburg complex 1 to 5 percent slopes	0.40	0.19	0
76	Luzena-Kellypoint complex 2 to 35 percent slopes	0.02	0.01	0

Table D.16 AZ701 Grand Canyon Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
77	Lykorly gravelly loam 1 to 4 percent slopes	0.10	0.03	0
78	Lykorly loam 2 to 4 percent slopes	0.20	0.08	0
79	Meadview-Arizo complex 1 to 5 percent slopes	0.43	0.20	0
80	Meriwhitica-Rock outcrop complex 35 to 70 percent slopes	0.28	0.13	30
81	Meriwhitica-Tassi complex 0 to 33 percent slopes	0.67	0.39	0
82	Metuck family-Rock outcrop complex 8 to 50 percent slopes	0.19	0.08	30
83	Natank-Disterheff-Yumtheska complex 2 to 35 percent slopes	0.03	0.01	0
84	Natank-Yumtheska complex 2 to 8 percent slopes	0.05	0.02	0
85	Nutter-Gyppocket complex 2 to 20 percent slopes	0.27	0.12	0
86	Orrubo very gravelly loam 15 to 35 percent slopes	0.16	0.07	0
87	Orrubo-Meadview-Meadview moderately steep complex 2 to 40 percent slopes	0.24	0.11	0
88	Orthents-Rock outcrop complex 2 to 6 percent slopes	2.00	1.56	20
89	Oxyaquic Torriorthents-Typic Endoaquents association 1 to 4 percent slopes	1.14	0.70	0
90	Phizphre-Rock outcrop complex 8 to 15 percent slopes	0.21	0.09	15
91	Pinntank-Retsover complex 2 to 8 percent slopes	0.04	0.02	0
92	Plite-Canburn families complex 2 to 8 percent slopes	0.71	0.43	0
93	Pocomate-Pinntank complex 15 to 30 percent slopes	0.13	0.04	0
94	Pocomate-Pinntank-Toqui complex 15 to 25 percent slopes	0.07	0.02	0
95	Pocomate-Pinntank-Ustifluvents complex 2 to 30 percent slopes	0.14	0.05	0
96	Pompeii family-Huevi-Huevi moderately steep complex 2 to 25 percent slopes	0.24	0.11	0
97	Puertecito family 2 to 8 percent slopes	0.08	0.02	0
98	Puertecito family 15 to 35 percent slopes	0.07	0.02	0

Table D.16 AZ701 Grand Canyon Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
99	Puertecito-Meriwhitica-Progresso families complex 2 to 8 percent slopes	0.14	0.06	0
100	Robroost fine sandy loam 1 to 3 percent slopes	0.28	0.11	0
101	Rock outcrop-Akela family complex 15 to 60 percent slopes	0.14	0.05	45
102	Rock outcrop-Cellar family complex 15 to 60 percent slopes	0.75	0.44	75
103	Rock outcrop-Lithic Torriorthents complex 15 to 60 percent slopes	0.96	0.62	70
104	Rock outcrop-Lithic Torriorthents complex cardenas formation 15 to 60 percent slopes	0.96	0.62	70
105	Rock outcrop-Lithic Torriorthents complex hakatai formation 15 to 60 percent slopes	0.96	0.62	80
106	Rock outcrop-Lithic Torriorthents complex kaibab toroweap and coconino formations 15 to 60 percent slopes	0.96	0.62	60
107	Rock outcrop-Lithic Torriorthents complex moenkopi kaibab and toroweap formations 15 to 60 percent slopes	0.96	0.62	70
108	Rock outcrop-Lithic Torriorthents complex nankoweap formation 2 to 8 percent slopes	0.96	0.62	70
109	Rock outcrop-Lithic Torriorthents complex supai group 15 to 60 percent slopes	0.96	0.62	60
110	Rock outcrop-Lithic Torriorthents complex vishnu schist formation 15 to 60 percent slopes	0.96	0.62	60
111	Rock outcrop-Lithic Ustic Torriorthents complex esplanade formation 2 to 8 percent slopes	0.31	0.16	60
112	Rock outcrop-Lithic Ustic Torriorthents-Ustic Haplocalcids complex tonto group and redwall formation 30 to 60 percent slopes	0.47	0.26	45
113	Rock outcrop-Skos-Seis families complex 30 to 60 percent slopes	0.33	0.15	40
114	Rock outcrop-Torriorthents complex kaibab formation 15 to 85 percent slopes	0.96	0.62	70
115	Rock outcrop-Torriorthents-Lithic Torriorthents complex supai group and redwall formation 2 to 60 percent slopes	0.96	0.62	50

Table D.16 AZ701 Grand Canyon Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
116	Rock outcrop-Typic Torriorthents complex hermit formation 15 to 60 percent slopes	0.96	0.62	60
117	Rock outcrop-Typic Torriorthents complex tonto group and redwall formation 30 to 60 percent slopes	0.96	0.62	60
118	Rockyroad very cobbly silty clay loam 2 to 10 percent slopes	0.02	0.01	0
119	Skos family-Rock outcrop complex 15 to 55 percent slopes	0.24	0.10	30
120	Skos family-Sandia-Rock outcrop complex 15 to 55 percent slopes	0.47	0.25	15
121	Tassi gravelly loamy very fine sand 0 to 3 percent slopes	0.90	0.50	0
122	Topocoba family 2 to 8 percent slopes	0.03	0.01	0
123	Topocoba-Wodomont association 2 to 15 percent slopes	0.10	0.04	0
124	Toqui gravelly loam 1 to 8 percent slopes	0.02	0.01	0
125	Toqui-Yumtheska complex 2 to 30 percent slops	0.04	0.02	0
126	Torriorthents-Haplocalcids-Lava flows complex 10 to 40 percent slopes	0.33	0.16	20
127	Torriorthents-Haplogypsids complex muddy creek formation 35 to 75 percent slopes	0.62	0.36	0
128	Torriorthents-Lithic Haplargids-Rock outcrop complex tonto group 15 to 60 percent slopes	0.69	0.42	15
129	Torriorthents-Rock outcrop complex hermit formation 2 to 40 percent slopes	0.96	0.62	30
130	Tovar loam 2 to 8 percent slopes	0.03	0.01	0
131	Tovar-Toqui-Yumtheska complex 2 to 8 percent slopes	0.04	0.01	0
132	Tunitcha-Valto family-Plite family complex 2 to 15 percent slopes	0.63	0.35	0
133	Twist very cobbly loam 1 to 8 percent slopes	0.05	0.01	0
134	Typic Calciargids-Lava flows complex 2 to 30 percent slopes	0.96	0.62	30
135	Typic Haplocalcids 2 to 8 percent slopes	0.96	0.62	0
136	Typic Haplocalcids 15 to 55 percent slopes	0.96	0.62	0

Table D.16 AZ701 Grand Canyon Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
137	Typic Haplocalcids-Typic Calciargids complex 2 to 15 percent slopes	0.96	0.62	0
138	Typic Haplocalcids-Typic Petrocalcids complex 15 to 25 percent slopes	0.61	0.36	0
139	Typic Haplocalcids-Typic Torriorthents complex 2 to 15 percent slopes	0.96	0.62	0
140	Typic Haplogypsids hermit formation 8 to 15 percent slopes	0.96	0.62	0
141	Typic Petrocalcids-Haplogypsids-Rock outcrop complex hermit formation 8 to 45 percent slopes	0.28	0.14	20
142	Typic Petrocalcids-Rock outcrop complex hermit formation 2 to 50 percent slopes	0.31	0.16	30
143	Typic Torrifluvents 0 to 1 percent slopes	2.00	1.56	0
144	Typic Torrifluvents-Typic Torripsamments complex 0 to 6 percent slopes	2.00	1.56	0
145	Typic Torrifluvents-Typic Torripsamments complex cool 0 to 6 percent slopes	2.00	1.56	0
146	Typic Torriorthents soils and badlands chuar group 15 to 65 percent slopes	0.55	0.31	0
147	Typic Torriorthents 2 to 8 percent slopes	0.96	0.62	0
148	Typic Torriorthents-Typic Haplogypsids complex hermit formation 15 to 40 percent slopes	0.96	0.62	0
149	Ustic Haplargids-Lava flows complex 2 to 20 percent slopes	0.31	0.16	30
150	Ustic Haplocalcids-Ustic Petrocalcids complex 2 to 4 percent slopes	0.71	0.43	0
151	Ustic Haplocalcids-Ustic Petrocalcids-Rock outcrop complex hermit formation 8 to 60 percent slopes	0.62	0.36	15
152	Ustic Haplocambids 1 to 2 percent slopes	2.00	1.56	0
153	Ustic Haplocambids 2 to 15 percent slopes	2.00	1.56	0
154	Ustic Torriorthents soils and badlands chuar group 15 to 65 percent slopes	0.31	0.16	0
155	Ustic Torriorthents 0 to 1 percent slopes	0.31	0.16	0
156	Ustic Torriorthents 2 to 4 percent slopes	0.31	0.16	0
157	Ustic Torriorthents 4 to 15 percent slopes	0.31	0.16	0

Table D.16 AZ701 Grand Canyon Area Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
158	Ustic Torriorthents-Lithic Ustic Torriorthents-Lithic Ustic Haplargids complex tonto group and redwall formation 8 to 60 percent slopes	0.31	0.16	0
159	Valleycity-Berzatic-Seeg families complex 8 to 60 percent slopes	0.18	0.06	0
160	Vitrandic Haplocalcids 15 to 40 percent slopes	0.22	0.10	0
161	Vitrandic Haplocambids-Vitrandic Haplocalcids complex 15 to 40 percent slopes	0.22	0.10	0
162	Water	0.01	0.01	100
163	Wauquie-Houserock families complex 2 to 65 percent slopes	0.06	0.03	0
164	Winkel family 15 to 55 percent slopes	0.24	0.10	0
165	Winkel-Rock outcrop complex 2 to 12 percent slopes	0.19	0.08	15
166	Winona-Rock outcrop-Tusayan complex 15 to 55 percent slopes	0.09	0.04	25
167	Wodomont-Topocoba-Plumasano families complex 2 to 15 percent slopes	0.25	0.11	0
168	Wutoma-Lozinta complex 15 to 60 percent slopes	0.65	0.37	0
169	Yellowhorse-Luzena-Sponiker association 2 to 15 percent slopes	0.06	0.02	0
170	Yumtheska-Bilburc association 10 to 45 percent slopes	0.07	0.02	0
171	Yumtheska-Katzine-Rock outcrop complex 2 to 30 percent slopes	0.16	0.07	20
172	Yumtheska-Rock outcrop complex 0 to 2 percent slopes	0.14	0.06	40
173	Yumtheska-Rock outcrop complex 2 to 8 percent slopes	0.18	0.08	15
174	Yumtheska-Rock outcrop complex 15 to 45 percent slopes	0.18	0.09	25
175	Yumtheska-Toqui-Rock outcrop complex 2 to 8 percent slopes	0.08	0.03	15
176	Yumtheska-Toqui-Rock outcrop complex 15 to 40 percent slopes	0.08	0.03	15
177	Zibate family 2 to 8 percent slopes	0.02	0.01	0

Page Intentionally Left Blank

D.3.11 ARIZONA GENERAL SOIL SURVEY

Table D.17 AZ STATSGO Arizona General Soils Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
s1126	Tecopa-Rock outcrop-Lithic Torriorthents (s1126)	0.50	0.26	58
s1129	Rositas-Beeline-Badland (s1129)	0.47	0.25	0
s1131	Rock outcrop (s1131)	0.29	0.13	65
s1140	Rillito-Gunsight (s1140)	0.14	0.05	0
s1422	Uzona-Rock outcrop-Myton family-Claysprings (s1422)	0.02	0.01	10
s274	Carrizo-Brios-Antho (s274)	0.58	0.31	0
s275	Rositas-Ripley-Indio-Gilman (s275)	0.26	0.10	0
s276	Denure-Dateland (s276)	0.48	0.24	0
s277	Glenbar-Gadsden-Brios (s277)	0.05	0.02	0
s278	Sasco-Marana-Denure (s278)	0.14	0.04	0
s279	Yahana-Indio-Gadsden (s279)	0.10	0.03	0
s280	Pahaka-Mohall-Laveen-Denure (s280)	0.31	0.13	0
s281	Momoli-Denure-Carrizo (s281)	0.44	0.23	0
s282	Why-Wellton-Gunsight-Growler-Denure (s282)	0.42	0.21	0
s283	Mohall-Denure-Coolidge (s283)	0.33	0.14	0
s284	Mohall-Contine (s284)	0.07	0.02	0
s285	Yahana-Shontik-Casa Grande (s285)	0.16	0.05	0
s286	Tremant-Pinamt-Ebon (s286)	0.04	0.01	0
s287	Suncity-Cipriano-Carefree (s287)	0.05	0.02	0
s288	Rillito-Gunsight-Denure-Chuckawalla (s288)	0.27	0.13	0
s289	Hyder-Coolidge-Cipriano-Cherioni (s289)	0.23	0.10	9
s290	Ligurta-Gunsight-Cristobal (s290)	0.05	0.01	0
s291	Pinamt-Gunsight-Cavelt (s291)	0.11	0.03	0
s292	Pinamt-Momoli-Cipriano (s292)	0.18	0.07	0
s293	Rock outcrop-Quilotosa-Momoli (s293)	0.38	0.20	34
s294	Rock outcrop-Quilotosa-Hyder-Gachado (s294)	0.21	0.08	15
s295	Schenco-Rock outcrop-Laposa (s295)	0.08	0.03	30
s296	Laveen-Kamato-Casa Grande (s296)	0.07	0.01	0
s297	Toltec-La Palma-Casa Grande (s297)	0.28	0.10	0
s298	Mohall-Dateland-Casa Grande (s298)	0.13	0.04	0
s299	Pahaka-Estrella-Antho (s299)	0.71	0.38	0
s300	Valencia-Estrella-Cuerda (s300)	0.63	0.33	0
s301	Superstition-Rositas (s301)	2.00	1.70	0
s302	Guest-Glendale-Gila (s302)	0.06	0.01	0

Table D.17 AZ STATSGO Arizona General Soils Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
s303	Riveroad-Comoro-Arizo (s303)	0.41	0.18	0
s305	Mohave-Guest-Continental (s305)	0.06	0.02	0
s306	Tres Hermanos-Pajarito-Mohave (s306)	0.20	0.08	0
s307	Sonoita-Hayhook-Continental (s307)	0.45	0.22	0
s308	Sahuarita-Mohave-Cave (s308)	0.17	0.06	0
s309	Cacique-Bucklebar-Alko (s309)	0.15	0.05	0
s310	Stagecoach-Nahda-Delnorte-Agustin (s310)	0.13	0.07	0
s311	Pinaleno-Eba (s311)	0.01	0.01	0
s312	Nickel-Greyeagle-Continental (s312)	0.08	0.03	0
s313	Pinaleno-Palos Verdes-Nickel (s313)	0.08	0.03	0
s314	Tumarion-Rock outcrop-Lehmans-House Mountain-Akela (s314)	0.07	0.03	15
s315	Rock outcrop-Luzena-Faraway (s315)	0.04	0.03	25
s316	Rock outcrop-Lehmans-Gran (s316)	0.01	0.01	30
s317	Rock outcrop-Lajitas-Delthorny-Anklam (s317)	0.20	0.10	25
s318	Torriorthents-Rock outcrop (s318)	0.96	0.62	90
s319	Tovar-Toqui-Deama (s319)	0.06	0.02	0
s320	Santo Tomas-Pima-Comoro (s320)	0.32	0.15	0
s321	Hondale-Gothard-Bluepoint (s321)	0.04	0.02	0
s322	Sontag-Bonita (s322)	0.02	0.01	0
s323	Tubac-Forrest-Enzian-Diaspar (s323)	0.13	0.06	0
s324	Winkel-Harrisburg-Cave (s324)	0.59	0.31	0
s325	White House-Hathaway-Bernardino (s325)	0.04	0.01	0
s326	Tombstone-Stronghold-Jerag (s326)	0.19	0.07	0
s327	Torriorthents-Rock outcrop-Gypill (s327)	0.62	0.36	20
s328	White House-Hathaway-Caralampi-Bernardino (s328)	0.05	0.02	0
s329	Romero-Rock outcrop-Lampshire (s329)	0.19	0.09	31
s330	Zukan-Rock outcrop-Goblin (s330)	0.21	0.08	10
s331	Tanbark-Mellenthin-Calciorthids (s331)	0.16	0.06	0
s332	Thunderbird-Collbran-Boquillas (s332)	0.02	0.01	0
s333	Yumtheska-Natank-Disterheff (s333)	0.03	0.01	0
s334	Sponiker-Rock outcrop-Cross (s334)	0.06	0.03	10
s335	Rock outcrop-Mabray-Lemitar (s335)	0.08	0.02	15
s336	Pennell-Bacobi (s336)	0.40	0.19	0
s337	Tours saline-Sodic-Riverwash-Jocity saline-Sodic-Ives saline-Sodic-Burnswick (s337)	0.19	0.07	1
s338	Marcou-Jocity saline-Sodic-Burnswick (s338)	0.16	0.06	1
s339	Wepo-Polacca-Jocity-Jeddito (s339)	0.13	0.05	2

Table D.17 AZ STATSGO Arizona General Soils Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s340	Sheppard sodic-Sheppard-Joraibi-Jocity (s340)	0.62	0.31	0
s341	Torriorthents-Tewa-Sheppard-Jeddito (s341)	0.50	0.21	6
s342	Rock outcrop-Moenkopie (s342)	0.55	0.28	50
s343	Nakai-Monue-Blackston (s343)	0.85	0.47	0
s344	Purgatory-Epikom-Claysprings-Badland (s344)	0.13	0.05	3
s345	Sheppard-Nakai-Monue (s345)	0.67	0.33	2
s346	Kinan-Hatknoll-Grieta (s346)	0.33	0.15	0
s347	Torriorthents-Sheppard-Pennell-Monue-Jocity-Clayhole (s347)	0.25	0.09	0
s348	Pennell-Pagina-Kinan (s348)	0.47	0.24	0
s349	Mellenthin-Curhollow (s349)	0.19	0.08	0
s350	Yumtheska-Showlow-Lozinta (s350)	0.09	0.04	0
s351	Wayneco-Sazi-Rock outcrop-Rizno-Palma-Mespun (s351)	0.73	0.40	10
s352	Winona-Tenderfoot-Curhollow (s352)	0.08	0.02	0
s353	Rudd-Arches (s353)	0.39	0.18	0
s354	Poley-Palma-Clovis (s354)	0.05	0.02	0
s355	Winona-Tusayan-Boysag (s355)	0.08	0.03	0
s356	Rock outcrop-Needle-Epikom (s356)	0.32	0.13	26
s357	Sheppard-Palma-Hubert-Clovis (s357)	0.29	0.12	0
s358	Strych-Monue-Bison (s358)	0.27	0.12	0
s359	Spenlo-Schmutz-Redbank family-Palma family-Naplene-Lavate-Ildefonso family-Clovis family-Caval (s359)	0.30	0.12	0
s360	Wupatki-Wukoki-Tuweep (s360)	0.08	0.02	0
s361	Stagecoach-Hindu (s361)	0.15	0.06	0
s362	Rock outcrop (s362)	0.25	0.12	83
s363	Sheppard-Grieta (s363)	0.33	0.13	0
s364	Ustic Torriorthents-Penistaja-Mido-Begay (s364)	0.51	0.25	7
s365	Milkweed-Deama-Cabezon (s365)	0.06	0.03	0
s366	Ubank-Cerrillos-Barx (s366)	0.13	0.04	5
s367	Rock outcrop-Mellenthin-Leanto-Kech-Bisoodi (s367)	0.23	0.09	30
s368	Nuffel-Kech-Barx (s368)	0.12	0.03	9
s369	Rock outcrop-Deama (s369)	0.10	0.04	42
s370	Toqui-Topocoba-Deama (s370)	0.04	0.01	0
s371	Ziegler-Wilaha-Showlow (s371)	0.03	0.01	0

Table D.17 AZ STATSGO Arizona General Soils Survey Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s372	Virgin Peak-Rock outcrop-Hualapai (s372)	0.19	0.10	15
s373	Moano-Barkerville (s373)	0.40	0.20	0
s374	Tortugas-Purner-Jacks (s374)	0.15	0.05	0
s375	Thunderbird-Rock outcrop-Luzena (s375)	0.01	0.01	15
s376	Typic Haplustalfs (s376)	0.11	0.04	0
s377	Thunderbird-Springerville-Rudd-Cabezon (s377)	0.02	0.01	0
s378	Whitlock-Continental-Cave (s378)	0.49	0.25	0
s379	Springerville-Cabezon (s379)	0.01	0.01	0
s380	Venezia-Thunderbird-Cabezon (s380)	0.02	0.01	0
s381	Poley-Pastura-Partri-Lynx-Abra (s381)	0.05	0.02	0
s382	Lynx-Lonti-Balon (s382)	0.03	0.01	0
s383	Zyme-Tonalea-Kydestea (s383)	0.13	0.05	7
s384	Torriorthents-Badland (s384)	0.67	0.40	3
s385	Telephone-Rock outcrop-Overgaard-Elledge (s385)	0.59	0.33	10
s386	Spudrock-Elledge-Docdee (s386)	0.23	0.10	0
s387	Gordo-Baldy (s387)	0.99	0.66	0
s388	Sponseller-Ess (s388)	0.07	0.03	0
s389	Thunderbird-Showlow (s389)	0.02	0.01	0
s390	Typic Haplustalfs-Rock outcrop-Aridic Haplustalfs (s390)	0.14	0.05	20
s391	Typic Haplustalfs-Lithic Haplustalfs (s391)	0.27	0.10	0
s392	Sogzie-Sheppard-Rock outcrop-Aneth (s392)	1.34	0.92	10
s393	Shedado-Rock outcrop-Mespun-Begay-Anasazi (s393)	0.81	0.46	15
s394	Ustollic Haplargids-Rock outcrop-Namon (s394)	0.43	0.22	30
s395	Abreu (s395)	0.47	0.25	0
s396	Typic Eutroboralfs (s396)	0.24	0.10	0
s397	Typic Eutroboralfs (s397)	0.24	0.11	0
s398	Sheppard-Rock outcrop-Monue-Moepitz (s398)	1.46	1.02	10
s399	Pinamt-Momoli-Hickiwan-Gunsight-Denure (s399)	0.22	0.10	0
s400	Retriever-Calciorthids (s400)	0.14	0.05	0
s401	Vertic Haplustalfs-Aridic Ustochrepts (s401)	0.04	0.02	0
s402	Rock outcrop-Lama-Fragua (s402)	0.24	0.10	30
s403	Winona-Spudrock-Rock outcrop (s403)	0.28	0.13	10
s404	Winona-Spudrock-Rock outcrop (s404)	0.28	0.13	30

Table D.17 AZ STATSGO Arizona General Soils Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s405	Quintana (s405)	0.09	0.02	0
s406	Typic Paleboralfs-Eutric Glossoboralfs (s406)	0.17	0.07	0
s407	Typic Cryoboralfs-Rock outcrop-Eutric Glossoboralfs (s407)	0.14	0.06	20
s408	Rock outcrop-Eutric Glossoboralfs (s408)	0.14	0.06	30
s409	Typic Haplustalfs-Fluventic Ustochrepts (s409)	0.15	0.06	0
s410	Rock outcrop-Aridic Ustochrepts-Aridic Haplustolls (s410)	0.07	0.02	10
s411	Typic Paleboralfs-Typic Cryoboralfs-Rock outcrop (s411)	0.21	0.09	10
s412	Vertic Haplustalfs-Typic Haplustalfs (s412)	0.03	0.01	7
s413	Typic Haplustalfs (s413)	0.56	0.30	0
s414	Typic Haplustalfs (s414)	0.11	0.04	0
s415	Typic Haplustalfs-Rock outcrop-Eutric Glossoboralfs (s415)	0.12	0.04	20
s416	Silkie-Espiritu (s416)	0.03	0.01	0
s417	Wineg-Quintana-Amos (s417)	0.03	0.01	0
s418	Typic Haplustalfs-Lithic Haplustalfs (s418)	0.10	0.03	0
s419	Mollic Eutroboralfs (s419)	0.11	0.03	0
s420	Rock outcrop-Mollic Cryoboralfs-Eutric Glossoboralfs (s420)	0.19	0.08	30
s421	Mirand-Derecho (s421)	0.04	0.02	0
s422	Silkie-Mirand (s422)	0.02	0.01	0
s423	Vibo-Casto (s423)	0.18	0.07	0
s424	Typic Haplustalfs-Mollic Eutroboralfs (s424)	0.11	0.03	0
s425	Mirand-Maes (s425)	0.05	0.03	0
s426	Eutric Glossoboralfs (s426)	0.11	0.04	0
s427	Heflin-Casto (s427)	0.13	0.05	0
s428	Rillino-Gila-Continental (s428)	0.18	0.07	0
s429	Tombstone-Romero-Rock outcrop (s429)	0.28	0.13	30
s430	Tubac-Pajarito-Hayhook-Glendale-Bucklebar (s430)	0.31	0.14	0
s431	Tres Hermanos-Pinamt-Artesia (s431)	0.07	0.02	0
s432	Eicks-Eba-Cloverdale (s432)	0.02	0.02	0
s433	Limpia-Graham-Bonita-Atascosa (s433)	0.04	0.02	0
s434	Mabray-Chiricahua-Atascosa (s434)	0.06	0.02	0
s435	Rock outcrop-Mokiak-Faraway (s435)	0.29	0.14	20
s436	Rock outcrop-Luzena-Fallsam (s436)	0.04	0.03	40
s437	Tapco-Peloncillo-Artesia (s437)	0.02	0.01	0

Table D.17 AZ STATSGO Arizona General Soils Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s438	Wampoo-Signal-Bonita (s438)	0.02	0.01	0
s439	Selevin-Eloma-Alsco (s439)	0.02	0.01	0
s440	Yumtheska-Virgin Peak-Rock outcrop-Katzine (s440)	0.25	0.11	22
s441	Rock outcrop-Piute-Bluechief (s441)	1.22	0.71	15
s442	Uzona-Shumbegay-Escavada (s442)	0.15	0.08	0
s443	Millett-Farview-Doakum (s443)	0.22	0.07	0
s444	Mido-Blanding-Arches (s444)	0.65	0.32	0
s445	Tunitcha-Klizhin-Akhoni (s445)	0.68	0.39	0
s446	Abreu (s446)	0.24	0.10	0
s447	Altar (s447)	0.14	0.05	0
s448	Altar (s448)	0.14	0.05	0
s449	Rock outcrop-Garr (s449)	0.30	0.15	40
s450	Ustorthents-Rizno-Metuck (s450)	0.72	0.42	0
s451	Vibo-Ustochrepts-Badland (s451)	0.24	0.10	0
s452	Telescope-Royosa-Augustine (s452)	0.29	0.12	0
s453	Badland-Aridic Ustochrepts-Aridic Haplustolls (s453)	0.11	0.03	0
s454	Shoegame-McNeal-Badland (s454)	0.18	0.06	0
s455	Rock outcrop-Lithic Ustorthents family-Hogris (s455)	0.86	0.54	30
s456	Torriorthents-Cellar (s456)	0.26	0.12	0
s457	Spudrock-Rock outcrop-Cellar (s457)	0.46	0.23	30
s458	Yaqui-Werlog (s458)	0.17	0.07	0
s459	Werlog-Santo Tomas-Riverwash (s459)	0.34	0.17	0
s460	Torriorthents (s460)	0.18	0.08	0
s461	Rock outcrop-Moenkopie (s461)	0.46	0.24	30
s462	Typic Ustifluvents-Fluventic Ustochrepts (s462)	0.53	0.27	0
s463	Fluventic Ustochrepts-Aquic Ustifluvents (s463)	0.28	0.11	0
s464	Vessilla-Rock outcrop (s464)	0.39	0.19	35
s465	Teromote-Kopie (s465)	0.11	0.03	0
s466	Quintana-Kopie (s466)	0.12	0.03	0
s467	Typic Ustochrepts-Typic Haplustalfs-Rock outcrop (s467)	0.10	0.03	25
s468	Shoegame-Badland-Aridic Ustochrepts (s468)	0.23	0.11	0
s469	Ransect (s469)	0.06	0.01	0
s470	Typic Ustochrepts-Lithic Ustochrepts (s470)	0.12	0.03	0

Table D.17 AZ STATSGO Arizona General Soils Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s471	Typic Ustochrepts-Typic Haplustalfs-Rock outcrop (s471)	0.10	0.03	30
s472	Typic Dystrochrepts-Spudrock-Rock outcrop (s472)	0.14	0.06	30
s473	Typic Dystrochrepts-Dystric Cryochrepts (s473)	0.04	0.01	0
s474	Typic Dystrochrepts-Rock outcrop-Dystric Cryochrepts (s474)	0.08	0.03	20
s475	Dystric Cryochrepts (s475)	0.42	0.21	0
s476	Sobega-Quintana-Kopie (s476)	0.23	0.09	0
s477	Dystric Cryochrepts (s477)	0.42	0.21	0
s478	Rock outcrop-Lithic Ustochrepts (s478)	0.11	0.03	30
s479	Typic Dystrochrepts-Rock outcrop-Lithic Ustochrepts (s479)	0.11	0.05	30
s480	Quintana (s480)	0.09	0.02	0
s481	Spudrock-Sobega-Rock outcrop (s481)	0.43	0.22	40
s482	Spudrock-Rombo-Rock outcrop (s482)	0.16	0.06	30
s483	Timhus-Quintana-Flugle (s483)	0.10	0.03	0
s484	Riverwash-Prewitt-Lynx (s484)	0.15	0.06	0
s485	Ess-Cundiyo (s485)	0.30	0.14	0
s486	Hereford (s486)	0.11	0.04	0
s487	Vertic Argiborolls (s487)	0.08	0.02	0
s488	Pachic Udic Argiborolls (s488)	0.15	0.06	0
s489	Rock outcrop-Lithic Haplustolls (s489)	0.21	0.10	30
s490	Nakai-Monue-Blackston (s490)	0.85	0.47	0
s491	Ustochreptic Calciorthids (s491)	0.58	0.32	0
s492	Rock outcrop-Bond-Bidonia (s492)	0.16	0.08	15
s493	Winona-Pastura-Cibeque (s493)	0.08	0.02	0
s494	Sponiker-Godding (s494)	0.12	0.05	0
s495	Torriorthents-Calciorthids-Badland (s495)	0.35	0.18	0
s496	Faraway-Barkerville (s496)	0.51	0.28	0
s497	Tours-Showlow-Cibeque (s497)	0.03	0.01	0
s498	Rond-Jacks-Chevelon (s498)	0.04	0.01	0
s499	Tortugas-Roundtop-Rock outcrop (s499)	0.09	0.05	15
s500	Lemitar-Lampshire-Chiricahua (s500)	0.04	0.02	0
s501	Tuloso-Tinaja (s501)	0.20	0.08	0
s502	Riverwash-Prewitt-Pinetop-Lynx (s502)	0.09	0.04	0
s5061	Vertic Haplustalfs-Typic Haplustalfs (s5061)	0.05	0.02	0
s5065	Typic Eutroboralfs-Lithic Haplustalfs (s5065)	0.16	0.05	0

Table D.17 AZ STATSGO Arizona General Soils Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s5068	Typic Haplustalfs-Rock outcrop-Eutric Glossoboralfs (s5068)	0.11	0.04	30
s5085	Typic Ustorthents-Typic Ustochrepts-Typic Udorthents-Rock outcrop (s5085)	0.29	0.11	25
s5087	Typic Ustochrepts-Rock outcrop-Aridic Ustochrepts (s5087)	0.39	0.19	30
s5094	Udic Ustochrepts-Typic Ustochrepts (s5094)	0.30	0.14	0
s5108	Fluventic Haploborolls-Aquic Ustifluvents (s5108)	0.28	0.14	0
s5116	Typic Argiborolls (s5116)	0.18	0.07	0
s5168	Rock outcrop-Flugle-Catman (s5168)	0.08	0.03	13
s5169	Rock outcrop-Nogal (s5169)	0.07	0.03	22
s5170	Teco-Rock outcrop-Montecito-Cabezon-Atarque (s5170)	0.02	0.01	11
s5172	Stout-Kiln-Hesperus (s5172)	0.40	0.19	0
s5173	Telescope-Royosa (s5173)	1.42	1.04	0
s5177	Weska-Travessilla-Rock outcrop-Oelop (s5177)	0.07	0.02	30
s5249	Ojocal-Alicia (s5249)	0.07	0.02	0
s5315	Rock outcrop-Lehmans-Chiricahua-Chamberino (s5315)	0.03	0.01	20
s5325	Rock outcrop-Muzzler-Luzena (s5325)	0.01	0.01	20
s5331	Thunderbird-Rudd-Hubbell-Cabezon (s5331)	0.06	0.03	0
s5333	Mion-Jacee-Goesling-Celacy-Augustine (s5333)	0.08	0.03	3
s5396	Loarc-Guy-Dioxice-Datil (s5396)	0.25	0.11	2
s5397	Manzano-Hickman-Catman (s5397)	0.05	0.02	0
s5573	Water-Virgin River-Toquop-Riverwash-Black Butte-Alluvial land (s5573)	0.30	0.14	10
s5575	Naye-Mormon Mesa (s5575)	0.50	0.26	1
s5576	St. Thomas-Rock outcrop-Kyler (s5576)	0.20	0.09	15
s5577	Cave family-Cave-Ajo (s5577)	0.20	0.08	0
s5578	Harrisburg-Cave-Arizo (s5578)	0.69	0.37	0
s5579	Toquop-Black Butte-Arada (s5579)	0.74	0.38	0
s5580	Tonopah-Colorock-Badland (s5580)	0.28	0.13	1
s5581	Yurm family-Winkel-Torriorthents (s5581)	0.29	0.14	9
s5586	Zeheme-St. Thomas-Rock outcrop (s5586)	0.33	0.16	19
s5587	Zeheme-Virgin Peak-Rock outcrop-Hobog (s5587)	0.25	0.12	14
s5588	Nickel-Bitter Spring-Arizo (s5588)	0.48	0.24	2

Table D.17 AZ STATSGO Arizona General Soils Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s5589	Rositas-Pompeii-Gunsight-Carrizo-Ajo (s5589)	0.26	0.12	0
s5590	Rock outcrop-Hindu-Gypill-Badland (s5590)	0.29	0.13	25
s5592	Rock outcrop-Kanackey-Dedas-Calvista-Breko (s5592)	0.10	0.05	20
s5742	Typic Torriorthents-Gypill-Cave-Badland (s5742)	0.36	0.18	5
s7770	Sheppard-Rock outcrop-Oljeto-Neskahi-Mota (s7770)	0.81	0.46	10
s7771	Rock outcrop-Piute-Moenkopie-Hoskinnini (s7771)	0.39	0.18	20
s7774	Rock outcrop-Lithic Torriorthents-Badland (s7774)	0.28	0.13	50
s8181	Tobler-St. George-Nikey-Junction-Harrisburg (s8181)	0.46	0.22	0
s8182	Winkel-Renbac-Hobog-Bermesa (s8182)	0.42	0.24	0
s8184	Shalet-Badland (s8184)	0.25	0.11	5
s8187	Pastura family-Magotsu-Curhollow (s8187)	0.15	0.06	5
s8196	Rock outcrop-Mespun-Arches (s8196)	1.74	1.14	10
s8197	Yarts-Palma-Neville family-Barx-Atchee (s8197)	0.19	0.08	5
s8198	Skos-Rock outcrop (s8198)	0.07	0.02	20
s8369	Water (s8369)	0.01	0.01	100
s9582	Leanto-Bisoodi-Arntz (s9582)	0.12	0.04	4
s9583	Torriorthents-Marcou-Claysprings-Burnswick-Badland (s9583)	0.25	0.12	6
s9584	Strych-Rock outcrop-Monue (s9584)	0.37	0.17	18
s9585	Vecont-Trix-Mohall-Denure-Dateland-Casa Grande (s9585)	0.22	0.09	0
s9586	Selevin-Kimrose-Keysto-Caralampi (s9586)	0.06	0.03	0

Page Intentionally Left Blank

D.3.12 NV608

Table D.18 NV608 Virgin River Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
100	St. Thomas-Rock outcrop association	0.20	0.08	35
122	Zeheme-St. Thomas-Rock outcrop association	0.29	0.13	17
141	Elbowcanyon-Wechech association	0.42	0.21	0
160	Wechech-Weiser association	0.38	0.19	0
161	Wechech gravelly loam 0 to 2 percent slopes	0.27	0.11	0
314	Weiser-Wechech association	0.40	0.20	0
316	Weiser-Wechech association moist	0.35	0.17	0
Ad	Alluvial land	0.40	0.19	0
Ae	Anthony fine sandy loam	0.40	0.19	0
Af	Anthony fine sandy loam gravelly substratum	0.40	0.19	0
Ah	Anthony fine sandy loam watertable	0.36	0.16	0
AMC	Arada fine sand 2 to 8 percent slopes	1.69	1.16	0
AOB	Arada fine sand gravelly substratum 0 to 4 percent slopes	1.82	1.28	0
ASC	Arada fine sand hardpan variant 2 to 8 percent slopes	2.00	1.82	0
ATA	Arizo fine sand 0 to 2 percent slopes	2.00	2.00	0
AVB	Arizo gravelly fine sand 2 to 4 percent slopes	2.00	1.57	0
AXC	Arizo very gravelly loamy sand 2 to 8 percent slopes	1.96	1.53	0
AYD	Arrolime gravelly silt loam 2 to 15 percent slopes	0.04	0.01	0
BD	Badland	0.31	0.16	0
BFD	Bard gravelly fine sand 4 to 15 percent slopes	0.66	0.35	0
BHC	Bard gravelly fine sandy loam 2 to 8 percent slopes	0.39	0.19	0
BLB	Blacknat-Arada association	1.84	1.52	0
BMD	Bard very gravelly fine sandy loam 2 to 15 percent slopes	0.34	0.16	0
BNB	Bard very stony loam 2 to 4 percent slopes	0.18	0.07	0
BOB	Bard-Rough broken land association gently sloping	0.32	0.15	30
BP	Pits borrow	0.02	0.01	0

Table D.18 NV608 Virgin River Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
BRB	Bard-Tonopah association gently sloping	0.26	0.11	0
BSG	Boxspring-Seralin-Rock outcrop association	0.18	0.08	15
BTC	Bitter Spring-Arizo association moderately sloping	0.41	0.19	0
Bu	Black Butte silt loam	0.07	0.02	0
Bv	Black Butte silt loam watertable	0.07	0.02	0
Bw	Bluepoint loamy fine sand	1.49	0.91	0
By	Bluepoint fine sandy loam strongly saline	0.94	0.54	0
BZF	Boxspring-Zeheme-Rock outcrop complex 15 to 50 to percent slopes MLRA 30	0.24	0.11	15
Ca	Calico fine sandy loam	0.67	0.35	0
CAC	Carrizo association	1.21	0.75	0
Cc	Calico fine sandy loam drained	0.67	0.35	0
Cd	Calico fine sandy loam strongly saline	0.67	0.35	0
CID	Crosgrain-Irongold association	0.22	0.09	0
Cm	Calico clay loam	0.06	0.01	0
Cn	Calico loamy fine sand coarse variant drained	1.50	0.92	0
Co	Calico loamy fine sand coarse variant strongly saline	1.40	0.84	0
CRD	Carrizo-Carrizo-Riverbend association	1.15	0.73	0
CTC	Colorock-Tonopah association moderately sloping	0.17	0.07	0
CYB	Crystal Springs gravelly sandy loam 2 to 4 percent slopes	0.49	0.25	0
Ea	Eastland gravelly sandy loam	0.77	0.42	0
FLC	Flattop gravelly clay loam 2 to 8 percent slopes	0.06	0.01	0
Gd	Gila fine sand	2.00	1.61	0
Ge	Gila loam	0.20	0.07	0
Gf	Gila loam strongly saline	0.27	0.11	0
GHF	Goldroad-Haleburu-Rock outcrop association	0.40	0.20	15
Gm	Gila loam water table	0.31	0.13	0
Gn	Gila loam water table strongly saline	0.31	0.13	0
Go	Glendale fine sand	2.00	1.99	0
GP	Pits gravel	0.02	0.01	0
Gr	Glendale loam	0.30	0.13	0
Gs	Glendale loam strongly saline	0.30	0.13	0
Gv	Grapevine loam	0.36	0.16	0

Table D.18 NV608 Virgin River Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
HEE	Heleweiser association	0.40	0.20	0
HHD	Huevi-Hiller association	0.34	0.17	1
HUF	Huevi-Badland association	0.34	0.17	0
HYB	Hypoint-Bluepoint-Arizo association	0.89	0.50	0
Ir	Ireteba loam	0.32	0.14	0
It	Ireteba loam overflow	0.32	0.14	0
IUC	Irongold-Wechech association	0.27	0.12	0
IWD	Irongold-Weiser association	0.21	0.09	0
La	Land loamy fine sand	0.05	0.01	0
Lc	Land silty clay loam	0.05	0.01	0
Ld	Land silty clay loam wet	0.05	0.01	0
MAE	Moapa-Bluepoint-Rock outcrop association	1.82	1.56	20
MBG	Monger-Bard-Typic Torriorthents association	0.33	0.15	0
MMB	Mormon Mesa loamy fine sand 0 to 4 percent slopes	0.57	0.29	0
MOB	Mormon Mesa fine sandy loam 0 to 8 percent slopes	0.60	0.30	0
NBC	Naye-Bitter Spring association	0.41	0.19	0
NIC	Nickel-Bitter Spring association	0.32	0.15	0
Oc	Overton silty clay	0.04	0.01	0
Oe	Overton silty clay slightly saline	0.05	0.01	0
On	Overton silty clay strongly saline	0.05	0.01	0
Or	Overton clay overwash saline	0.02	0.01	0
Os	Overton silt loam loamy variant slightly saline	0.44	0.24	0
Ot	Overton silt loam loamy variant strongly saline	0.44	0.24	0
Ox	Oxyaquic Torriorthents-Toquop complex 0 to 8 percent slopes	0.22	0.08	0
PL	Playas	0.03	0.01	0
PME	Pulsipher-Rock outcrop complex 15 to 30 percent slopes	0.25	0.10	20
PPE	Pulsipher association hilly	0.08	0.04	0
PRE	Pulsipher gravelly clay loam fine variant 15 to 30 percent slopes	0.01	0.01	0
RBG	Rock outcrop-Moapa-Bluepoint association	1.80	1.58	45
Re	Riverwash	0.26	0.12	0
RHF	Rock outcrop-Redneedle-Heleweiser association	0.53	0.28	35

Table D.18 NV608 Virgin River Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
Ri	Riverwash-Water complex 0 to 2 percent slopes	0.24	0.11	30
RME	Rock land-Moapa association hilly	2.00	1.80	60
RTF	Rock land-St. Thomas association very steep	0.20	0.09	60
SAE	Sandpan-Rositas association	1.23	0.92	0
SEG	Seralin extremely gravelly loam 30 to 75 percent slopes	0.17	0.07	4
SP	Spring silty clay loam	0.04	0.01	0
SQE	St. Thomas association	0.20	0.08	5
STE	St.Thomas-Rock outcrop-Zeheme assocation	0.33	0.16	20
STF	St. Thomas-Rock outcrop complex	0.20	0.08	20
SWC	Sweetspring-Carrizo association	0.18	0.07	0
TAC	Teebar-Sandpan association	0.53	0.29	0
Tb	Tobler fine sandy loam	0.55	0.28	0
Tc	Tobler fine sandy loam strongly saline	0.55	0.28	0
Td	Tobler silt loam wet	0.22	0.08	0
Te	Tobler clay strongly saline	0.02	0.01	0
TGC	Tonopah-Arizo association	0.56	0.30	0
THB	Tonopah gravelly sandy loam 0 to 4 percent slopes	0.61	0.32	0
TMD	Tonopah very gravelly sandy loam 4 to 15 percent slopes	0.47	0.24	0
TnA	Toquop fine sand 0 to 2 percent slopes	2.00	1.38	0
TnB	Toquop fine sand 2 to 8 percent slopes	2.00	1.38	0
TqA	Toquop complex 0 to 2 percent slope	0.46	0.19	0
TsA	Toquop fine sand watertable 0 to 2 percent slopes	2.00	1.27	0
TtA	Toquop fine sandy loam 0 to 2 percent slopes	0.84	0.46	0
TuA	Toquop fine sandy loam watertable 0 to 2 percent slopes	0.91	0.51	0
TvA	Toquop silty clay loam strongly saline 0 to 2 percent slopes	0.07	0.01	0
Ty	Typic Torriorthents-Badland association	0.40	0.20	0
UNB	Underton extremely gravelly fine sandy loam 2 to 8 percent slopes	0.23	0.10	0
UPE	Upperline very gravelly sandy loam 8 to 30 percent slopes	0.52	0.27	0

Table D.18 NV608 Virgin River Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
USE	Upperline-St. Thomas-Upperline association	0.40	0.20	0
UWD	Upperline-Weiser-Whitebasin association	0.49	0.25	0
Vd	Vinton fine sandy loam	0.50	0.25	0
VFG	Virgin Peak-Rock outcrop association	0.30	0.15	15
Vg	Virgin River silty clay	0.02	0.01	0
Vn	Virgin River silty clay strongly saline	0.02	0.01	0
Vr	Virgin River silty clay loam wet variant	0.04	0.01	0
W	Water	0.01	0.01	100
WAC	Wechech association	0.41	0.21	0
WBE	Wechech very gravelly fine sandy loam 8 to 30 percent slopes	0.34	0.17	0
WCE	Wechech-Ifteen association	0.83	0.49	0
WDC	Wechech-Weiser association	0.39	0.20	0
WEE	Weiser cobbly sandy loam 15 to 30 percent slopes	0.37	0.19	0
WFC	Weiser-Arizo association	0.53	0.28	0
WGC	Weiser-Oldspan-Wechech association	0.33	0.16	0
WHE	Whitebasin-Upperline-Hardbasin association	0.66	0.35	0
ZAG	Zeheme-Rock outcrop association	0.33	0.16	20

Page Intentionally Left Blank

D.3.13 NV713

Table D.19 NV713 Meadow Valley Area Nevada, Part of Lincoln County

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1004	Armespan association	0.20	0.08	1004
1010	Linco-Acana-Patter association	0.26	0.11	1010
1025	Aned-Newvil-Decan association	0.08	0.03	1025
1037	Badland	0.31	0.16	1037
1038	Linco loamy fine sand hummocky 2 to 8 percent slopes	0.32	0.14	1038
1039	Ursine association	0.37	0.19	1039
1040	Chuckmill-Qwynn association	0.12	0.04	1040
1051	Xeric Torriorthents-Acana-Holsine association	0.23	0.09	1051
1064	Basket-Xeric Torriorthents-Decathon association	0.05	0.01	1064
1090	Kyler-Eaglepass-Rock outcrop association	0.24	0.11	1090
1091	Kyler-Eaglepass-Rock outcrop association warm	0.25	0.11	1091
1100	Linoyer-Heist association	0.59	0.31	1100
1103	Fifteenmile-Sevenmile complex 0 to 2 percent slopes	0.15	0.05	1103
1107	Armespan-Fifteenmile association	0.16	0.06	1107
1108	Baberwit-Holsine associaton	0.20	0.08	1108
1113	Farepeak-Slockey-Schoolmarm association	0.07	0.02	1113
1114	Slockey-Schoolmarm-Rock outcrop association	0.09	0.03	1114
1116	Springmeadow sandy loam drained 0 to 2 percent slopes	0.43	0.21	1116
1121	Fanu loam 0 to 2 percent slopes	0.50	0.26	1121
1134	Lojet-Chuckmill-Sevenmile association	0.10	0.03	1134
1135	Springmeadow complex 0 to 2 percent slopes	0.07	0.02	1135
1138	Littleailie-Lien-Sevenmile association	0.24	0.11	1138
1140	Minu-Lojet-Acana association	0.10	0.02	1140
1142	Acana-Lojet association	0.17	0.05	1142
1173	Cedaran-Rock outcrop complex 2 to 15 percent slopes	0.03	0.01	1173
1182	Decan-Acoma-Uana association	0.03	0.01	1182
1184	Decan-Acoma-Uana association moist	0.03	0.01	1184
1186	Decan association	0.03	0.01	1186
1201	Decan-Uana association	0.03	0.01	1201

Table D.19 NV713 Meadow Valley Area Nevada, Part of Lincoln County

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1234	Decathon-Basket association	0.03	0.01	1234
1250	Patter-Heist association	0.39	0.19	1250
1264	Chiefpan-Linco association	0.07	0.03	1264
1266	Indicove association	0.06	0.02	1266
1290	Ravendog-Fanu-Fifteenmile association	0.34	0.15	1290
1291	Ravendog-Fanu-Fifteenmile association cool	0.35	0.15	1291
1301	Geer fine sandy loam gravel substratum 0 to 2 percent slopes	0.71	0.39	1301
1302	Flatnosewash silt loam 0 to 2 percent slopes	0.10	0.03	1302
1311	Geer silt loam 0 to 2 percent slopes	0.29	0.12	1311
1331	Geer silt loams 0 to 2 percent slopes	0.32	0.14	1331
1361	Hamtah-Starflyer-Rock outcrop association	0.10	0.03	1361
1362	Deerlodge-Fanu-Newvil association	0.14	0.05	1362
1364	Bamos-Pass Canyon-Rock outcrop association	0.07	0.02	1364
1372	Hamtah-Schoolmarm-Rock outcrop association	0.09	0.03	1372
1374	Denpark-Hamtah-Rock outcrop association	0.15	0.06	1374
1378	Oxvalley-Denpark-Hamtah assocation	0.21	0.10	1378
1390	Heist gravelly ashy sandy loam 0 to 4 percent slopes	0.55	0.28	1390
1401	Heist gravelly ashy sandy loam sand substratum 0 to 8 percent slopes	0.59	0.31	1401
1432	Pagecreek ashy sandy loam 4 to 8 percent slopes	0.06	0.01	1432
1442	Homestake association	0.02	0.01	1442
1444	Homestake-Basket association	0.03	0.01	1444
1460	Wakansapa-Turba-Cedaran association	0.07	0.02	1460
1464	Wakansapa-Rock outcrop-Turba association	0.06	0.02	1464
1472	Zoate-Rock outcrop-Anaud association	0.06	0.02	1472
1492	Eaglepass-Rock outcrop complex 15 to 75 percent slopes	0.19	0.08	1492
1510	Ursine-Jarab-Pamsdel association	0.26	0.12	1510
1514	Jarab-Blackcan association	0.12	0.05	1514
1529	Linco-Acana association	0.28	0.12	1529
1532	Harvan-Linco-Xeric Torriorthents association	0.16	0.06	1532
1534	Minu-Acana-Xeric Torriorthents association	0.13	0.03	1534
1539	Xeric Torriorthents-Linco association	0.20	0.08	1539

Table D.19 NV713 Meadow Valley Area Nevada, Part of Lincoln County

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1542	Linco-Xeric Torriorthents-Armespan association	0.24	0.10	1542
1544	Xeric Torriorthents-Acana association	0.21	0.08	1544
1549	Linco-Patter-Baberwit association	0.23	0.09	1549
1581	Ursine-Holsine association	0.39	0.20	1581
1620	Nevu gravelly ashy sandy loam 4 to 15 percent slopes	0.06	0.02	1620
1630	Pahranagat silt loam drained strongly saline 0 to 2 percent slopes	0.13	0.05	1630
1640	Pahranagat silt loam strongly saline 0 to 2 percent slopes	0.13	0.05	1640
1650	Pahranagat silt loam 0 to 2 percent slopes	0.14	0.05	1650
1660	Pahranagat silt loam drained 0 to 2 percent slopes	0.13	0.05	1660
1692	Fifteenmile association	0.06	0.01	1692
1694	Fifteenmile-Heist-Patter association	0.14	0.04	1694
1696	Medburn-Heist-Patter association	0.45	0.21	1696
1698	Chuffa-Fifteenmile silt loams 0 to 4 percent slopes	0.10	0.03	1698
1704	Chiefrange-Checkett association	0.03	0.01	1704
1706	Checkett extremely gravelly loam 15 to 50 percent slopes	0.05	0.01	1706
1736	Chubard-Rock outcrop-Richinde association	0.10	0.03	1736
1745	Roval-Minu association	0.06	0.01	1745
1770	Veet-Mosida association	0.40	0.20	1770
1771	Veet-Heist association	0.38	0.18	1771
1772	Heist-Veet-Holsine association	0.45	0.22	1772
1773	Holsine-Veet-Heist association	0.45	0.23	1773
1776	Veet association	0.36	0.17	1776
1801	Seval-Roval association	0.07	0.02	1801
1825	Acti-Cedaran-Turba association	0.04	0.02	1825
1828	Cedaran-Wakansapa-Turba association	0.04	0.02	1828
1829	Wakansapa-Cedaran association	0.03	0.01	1829
1840	Slickens	0.13	0.03	1840
1860	Satt-Swisbob association	0.05	0.01	1860
1862	Homestake-Swisbob association	0.03	0.01	1862
1886	Schoolmarm-Starflyer-Rock outcrop association	0.07	0.02	1886
1898	Quazo-Motoqua very gravelly sandy loams 30 to 70 percent slopes	0.09	0.03	1898

Table D.19 NV713 Meadow Valley Area Nevada, Part of Lincoln County

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1922	Quazo-Motoqua-Rock outcrop association	0.09	0.03	1922
1924	Wakansapa-Rock outcrop association	0.05	0.01	1924
1962	Eastmore-Holsine-Xeric Torriorthents association	0.30	0.14	1962
1965	Eastmore-Armespan association	0.41	0.22	1965
1972	Radol-Rock outcrop-Monarch association	0.17	0.07	1972
1994	Rock outcrop-Gabbvally-Tejabe association	0.19	0.08	1994
1998	Gabbvally-Stewval-Rock outcrop association	0.12	0.04	1998
2010	Stewval-Gabbvally association	0.09	0.03	2010
2011	Stewval-Lomoine-Rock outcrop association	0.14	0.06	2011
2042	Denpark-Notellumcreek-Rock outcrop association	0.16	0.06	2042
2044	Nevtah-Denpark-Antennapeak association	0.19	0.08	2044
2046	Antennapeak-Nevtah-Wiltop association	0.20	0.08	2046
2048	Denpark-Greengrove association	0.28	0.13	2048
2050	Denpark-Notellumcreek association	0.15	0.06	2050
2052	Wiltop-Denpark association	0.18	0.08	2052
2054	Notellumcreek-Rock outcrop association	0.07	0.02	2054
2062	Winz gravely ashy loam 30 to 50 percent slopes	0.22	0.09	2062
2118	Lojet-Armespan-Xeric Torriorthents association	0.12	0.03	2118
2121	Lojet-Acana-Linco association	0.15	0.04	2121
2129	Stewval-Gabbvally-Rock outcrop association	0.07	0.03	2129
2130	Richinde-Rock outcrop association	0.08	0.03	2130
2132	Chubard-Richinde-Zoate association	0.07	0.02	2132
2278	Schoolmarm-Rock outcrop association	0.06	0.02	2278
2296	Chubard association	0.11	0.04	2296
2299	Chubard-Rock outcrop association	0.11	0.04	2299
2322	Blackcan-Linco-Xeric Torriorthents association	0.24	0.10	2322
2324	Blackcan association	0.26	0.12	2324
3674	Kyler-Rock outcrop complex 8 to 50 percent slopes	0.24	0.11	3674
3870	Newvil-Chuckmill-Sevenmile association	0.16	0.06	3870
3872	Newvil-Okayview association	0.19	0.07	3872
3880	Nevu-Okayview-Sevenmile association	0.16	0.06	3880
3888	Anaud-Starflyer association	0.15	0.06	3888
3890	Anaud very gravelly ashy loam 2 to 15 percent slopes	0.22	0.10	3890

Table D.19 NV713 Meadow Valley Area Nevada, Part of Lincoln County

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
3892	Slockey-Hamtah-Schoolmarm association	0.10	0.03	3892
3896	Hamtah-Slockey-Farepeak association	0.15	0.06	3896
4020	Schoolmarm-Farepeak-Rock outcrop association	0.06	0.02	4020
4024	Schoolmarm-Slockey association	0.07	0.02	4024
4026	Schoolmarm-Hamtah-Rock outcrop association	0.08	0.03	4026
4027	Slockey-Chubard-Anaud association	0.10	0.03	4027
4029	Slockey-Hamtah-Schoolmarm extremely gravelly association	0.08	0.02	4029
4032	Slockey-Starflyer-Rock outcrop association	0.08	0.02	4032
4036	Starflyer-Rock outcrop-Schoolmarm association	0.07	0.02	4036
9999	Water	0.01	0.01	9999

Page Intentionally Left Blank

D.3.14 NV754

Table D.20 NV754 Lincoln County Nevada South Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1000	Weiser-Wechech-Arizo association	0.38	0.19	0
1001	Weiser-Wechech association	0.28	0.14	0
1004	Armespan association	0.20	0.08	0
1010	Wechech-Weiser association	0.37	0.18	0
1016	Wechech association	0.39	0.20	0
1017	Wechech-Bard-Arizo association	0.42	0.22	0
1020	Kurstan-Wechech association	0.45	0.23	0
1021	Kurstan-Knob Hill association	0.61	0.32	0
1030	Arizo-Bluepoint association	1.08	0.64	0
1031	Arizo association	1.13	0.69	0
1040	Akela-Rock outcrop association	0.48	0.26	20
1041	Akela-Rochpah-Rock outcrop association	0.50	0.27	10
1052	Knob Hill-Arizo association	0.68	0.38	0
1060	St. Thomas-Chinkle-Rock outcrop association	0.34	0.17	20
1061	St. Thomas-Zeheme-Rock outcrop association	0.35	0.17	20
1062	Zeheme-Chinkle-Shankba association	0.29	0.13	8
1063	Zeheme-Kanesprings-Rock outcrop association	0.19	0.07	15
1064	Zeheme-Kanackey-Rock outcrop association	0.11	0.07	20
1065	Zeheme-Rock outcrop association	0.34	0.16	35
1066	Zeheme-Boxspring-Rock outcrop association	0.23	0.10	20
1070	Bellehelen-Brier association	0.08	0.03	7
1080	Kaspal-Canoto association	0.10	0.03	0
1090	Logring-Rock outcrop association	0.20	0.08	20
1091	Logring-Eaglepass-Rock outcrop complex	0.18	0.07	15
1100	Geta-Arizo association	0.70	0.38	0
1101	Geta gravelly sandy loam 2 to 4 percent slopes	0.57	0.30	0
1102	Geta-Bluepoint-Arizo association	1.00	0.58	0
1110	Kanesprings-Kanackey-Rock outcrop association	0.06	0.02	15
1111	Nuhelen-Farepeak association	0.10	0.04	6
1113	Kanesprings-Gabbvally association	0.08	0.02	0
1133	Lojet-Qwynn-Littleailie association	0.18	0.05	0
1160	Silent-Koyen association	0.17	0.04	0

Table D.20 NV754 Lincoln County Nevada South Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1170	Alko-Arizo association	0.48	0.25	0
1172	Alko-Geta assocation	0.49	0.25	0
1180	Acoma-Decan-Cath association	0.04	0.02	0
1182	Decan-Acoma-Uana association	0.03	0.01	2
1190	Minu-Shroe-Acoma association	0.04	0.01	0
1210	Brier-Acoma-Bellehelen association	0.08	0.03	5
1211	Brier-Rock outcrop association	0.11	0.04	30
1220	Lien-Devildog association	0.32	0.16	0
1230	Pahranagat association	0.12	0.05	0
1250	Patter-Heist association	0.43	0.20	0
1260	Hollace-Gabbvally association	0.06	0.01	3
1261	Hollace-Rochpah-Wyva association	0.10	0.03	10
1262	Hollace-Winklo-Wyva association	0.06	0.01	3
1266	Indicove association	0.06	0.02	0
1270	Laross-Rock outcrop association	0.50	0.29	20
1300	Mormount-Arizo association	0.31	0.14	0
1302	Mormount very gravelly sandy loam 2 to 8 percent slopes	0.26	0.11	0
1303	Mormount-Canoto association	0.29	0.13	0
1340	Aymate-Canoto association	0.47	0.24	0
1341	Aymate sandy loam 0 to 2 percent slopes	0.59	0.30	0
1342	Aymate-Mormount-Arizo association	0.45	0.22	0
1350	Bard gravelly fine sandy loam 2 to 8 percent slopes	0.38	0.18	0
1360	Canoto-Arizo association	0.53	0.28	0
1370	Mormon Mesa association	0.58	0.30	0
1371	Mormon Mesa-Naye-Dalian association	0.44	0.22	0
1372	Mormon Mesa-Tonopah-Arada association	0.60	0.32	0
1380	Bracken gravelly fine sandy loam 2 to 8 percent slopes	0.73	0.40	0
1390	Shankba-Chinkle-Kanackey association	0.17	0.09	2
1400	Irongold-Canoto association	0.37	0.17	0
1401	Irongold-Arizo association	0.41	0.20	0
1403	Irongold-Wechech association	0.35	0.17	0
1404	Irongold-Mormount-Canoto association	0.30	0.13	0
1405	Irongold-Zeheme association	0.31	0.14	0
1406	Irongold very gravelly sandy loam 4 to 30 percent slopes	0.30	0.14	0
1420	Kanackey-Rock outcrop association	0.02	0.02	15
1430	Typic Torriorthents-Badlands association	0.20	0.07	0

Table D.20 NV754 Lincoln County Nevada South Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1460	Pintwater-Rochpah association	0.37	0.18	3
1470	Tybo-Keefa-Koyen association	0.53	0.27	0
1471	Tybo-Koyen association	0.53	0.27	0
1472	Tybo-Geer association	0.54	0.28	0
1473	Tybo-Leo association	0.51	0.26	0
1474	Tybo-Delamar association	0.34	0.15	0
1475	Treadwell-Veet association	0.29	0.14	6
1490	Keefa-Penoyer association	0.37	0.15	0
1491	Keefa warm-Penoyer association	0.35	0.14	0
1510	Koyen gravelly sandy loam 2 to 4 percent slopes	0.64	0.35	0
1512	Koyen-Penoyer association	0.28	0.10	0
1520	Geer-Penoyer association	0.31	0.11	0
1529	Linco-Acana association	0.28	0.12	0
1530	Delamar-Leo association	0.17	0.06	0
1531	Delamar-Veet association	0.10	0.03	0
1533	Delamar-Tybo-Koyen association	0.22	0.09	0
1534	Delamar-Koyen association	0.14	0.05	0
1535	Delamar gravelly sandy loam 2 to 8 percent slopes	0.10	0.03	0
1539	Xeric Torriorthents-Linco association	0.20	0.08	0
1541	Oleman-Irongold association	0.10	0.03	0
1542	Oleman gravelly sandy loam 4 to 15 percent slopes	0.06	0.02	0
1550	Pahroc-Leo association	0.26	0.11	0
1551	Pahroc very gravelly very fine sandy loam 4 to 15 percent slopes	0.27	0.13	0
1570	Kyler-Eaglepass-Rock outcrop association warm	0.25	0.11	20
1571	Kyler-Logring-Rock outcrop association warm	0.22	0.10	25
1590	Winklo-Wyva assocation	0.05	0.01	5
1591	Winklo-Rochpah-Rock outcrop association	0.09	0.03	15
1650	Handpah-Veet association	0.11	0.04	0
1660	Dewrust-Veet association	0.09	0.03	0
1680	Rochpah-Hollace-Gabbvally association	0.18	0.07	0
1681	Rochpah-Veet association	0.34	0.17	0
1683	Rochpah-Rock outcrop-Leo association	0.45	0.24	30
1690	Jolan-Geer association	0.46	0.22	0
1700	Sierocliff-Veet association	0.16	0.06	0

Table D.20 NV754 Lincoln County Nevada South Part

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1704	Chiefrange-Checkett association	0.03	0.01	6
1710	Cliffdown gravelly sandy loam 2 to 8 percent slopes MLRA 29	0.48	0.24	0
1730	Cath-Veet association	0.12	0.04	0
1734	Qwynn-Devildog association	0.45	0.23	0
1741	Slaw silt loam 0 to 2 percent slopes	0.09	0.02	0
1750	Chanybuck-Brier-Rock outcrop association	0.30	0.16	15
1761	Wyva-Rock outcrop association	0.06	0.01	20
1762	Wyva-Slidymtn association	0.06	0.01	0
1770	Veet-Mosida association	0.34	0.17	0
1776	Veet association	0.36	0.17	0
1810	Boxspring-Rock outcrop association	0.14	0.06	20
1811	Boxspring-Theriot-Rock outcrop association MLRA 29	0.20	0.09	15
1821	Turba-Acti association	0.24	0.13	3
1825	Acti-Cedaran-Turba association	0.04	0.02	4
1828	Cedaran-Wakansapa-Turba association	0.04	0.02	7
1829	Wakansapa-Cedaran association	0.03	0.01	8
1830	Zaqua-Winklo association	0.04	0.01	6
1831	Zaqua-Boxspring association	0.05	0.02	5
1832	Zaqua-Winklo-Kanesprings association	0.05	0.01	5
1833	Zaqua-Rock outcrop association	0.05	0.01	30
1850	Rapado-Oleman association	0.06	0.02	0
1851	Rapado-Veet association	0.07	0.02	0
1870	Faleria-Laross association	0.61	0.37	2
1880	Tejabe-Pintwater-Rock outcrop association	0.24	0.11	15
1881	Richinde-Pintwater-Rock outcrop association	0.09	0.02	15
1885	Richinde-Chubard-Richinde very stony association	0.08	0.02	2
1890	Welring-Rock outcrop association	0.16	0.06	20
1898	Quazo-Motoqua very gravelly sandy loams 30 to 70 percent slopes	0.09	0.03	10
1900	Glendale-Bluepoint association	0.17	0.06	0
1910	Land silt loam 0 to 2 percent slopes	0.06	0.01	0
1920	Motoqua-Rock outcrop association	0.07	0.02	15
1921	Motoqua-Thunderbird association	0.06	0.02	5
1940	Chubard stony-Rock outcrop association	0.11	0.04	20
1941	Slidymtn-Capsus-Wyva association	0.05	0.02	0
1942	Richinde-Chubard association	0.08	0.02	2

Table D.20 NV754 Lincoln County Nevada South Part Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1945	Cabinpine association	1.65	1.10	0
1950	Ursine-Lomoine association	0.22	0.10	8
1951	Ursine association	0.18	0.08	0
1955	Treadwell-Chuckridge-Handpah association	0.16	0.06	0
1960	Crystal Springs gravelly sandy loam 2 to 8 percent slopes	0.44	0.22	0
1980	Longjim-Arizo association	0.33	0.15	0
1990	Gabbvally-Rock outcrop association	0.14	0.05	15
1991	Gabbvally-Hollace association	0.09	0.02	0
1992	Gabbvally-Brier-Rock outcrop association	0.12	0.04	10
1993	Richinde-Rock outcrop association	0.08	0.03	15
1994	Rock outcrop-Gabbvally-Tejabe association	0.19	0.08	45
1998	Gabbvally-Stewval-Rock outcrop association	0.12	0.04	15
2000	Playas	0.12	0.05	0
2010	Stewval-Gabbvally association	0.09	0.03	6
2011	Stewval-Lomoine-Rock outcrop association	0.14	0.06	10
2123	Littleailie-Lojet association	0.17	0.06	0
2129	Stewval-Gabbvally-Rock outcrop association	0.07	0.03	15
2290	Richinde-Chubard-Rock outcrop association	0.08	0.02	20
2292	Chubard-Richinde association	0.09	0.02	4
2297	Chubard-Richinde-Rock outcrop association steep	0.10	0.03	15
2298	Chubard-Richinde association steep	0.10	0.03	6
2320	Blackcan association	0.28	0.13	0
3192	Saltydog-Ambush-Panacker association	0.17	0.06	0
3193	Ewelac-Playas association	0.08	0.02	0
3194	Ambush-Panacker-Playas association	0.31	0.14	0

Page Intentionally Left Blank

D.3.15 NV755

Table D.21 NV755 Clark County Area Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
100	Newera association	0.09	0.03	3
101	Glencarb very fine sandy loam saline	0.05	0.01	0
105	Galehills extremely gravelly fine sandy loam 15 to 50 percent slopes	0.47	0.25	3
106	Galehills-Zeheme association	0.44	0.23	5
107	Galehills-Calwash association	0.24	0.09	0
110	Tenwell-Crosgrain association	0.24	0.10	0
111	Tenwell-Shamock association	0.46	0.23	0
112	Arizo very gravelly loamy sand flooded 0 to 4 percent slopes	0.92	0.54	0
113	Arizo very gravelly fine sandy loam gypsiferous substratum 2 to 8 percent slopes	0.49	0.26	0
115	Whitebasin-Upperline-Hardbasin association	0.66	0.35	0
120	Crosgrain-Tenwell association	0.22	0.09	0
121	Sweetspring-Carrizo association	0.18	0.07	0
125	Bobzbulz-Snapcan association	0.17	0.07	0
134	Newera-Nipton association	0.11	0.04	2
135	Nippeno-Mountmcull-Newera association	0.11	0.03	3
140	Haleburu extremely gravelly sandy loam 4 to 15 percent slopes	0.35	0.17	6
141	Nipton-Haleburu-Rock outcrop association	0.36	0.18	20
143	Haleburu association	0.31	0.15	2
144	Haleburu extremely cobbly-Hiddensun association	0.38	0.19	4
146	Haleburu-Nipton association	0.34	0.17	0
147	Haleburu-Nipton association dry	0.35	0.18	0
148	Haleburu-Seanna association	0.37	0.18	0
150	Hypoint gravelly sandy loam 0 to 4 percent slopes	0.98	0.58	0
151	Bluepoint-Arizo association	1.12	0.68	0
155	Bitterridge-Helkitchen association	0.12	0.04	0
160	Lanip-Kidwell association	0.30	0.13	0
165	Upperline-Weiser-Whitebasin association	0.49	0.25	0
167	Upperline-St. Thomas-Upperline association	0.40	0.20	0

Table D.21 NV755 Clark County Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
168	Upperline very gravelly sandy loam 8 to 30 percent slopes	0.52	0.27	0
170	Tenwell-Lanip association	0.32	0.14	0
175	St. Thomas-Rock outcrop complex	0.20	0.08	20
176	St. Thomas association	0.20	0.08	5
177	St. Thomas-Upperline-Whitebasin complex	0.39	0.18	0
178	St. Thomas-Iceberg-Rock outcrop association	0.30	0.14	25
180	Kidwell-Tenwell association	0.39	0.19	0
185	Lastchance-Commski association	0.22	0.10	0
186	Lastchance-Ferrogold-Commski association	0.21	0.09	0
190	Filaree-Lanip-Nickel association	0.40	0.19	0
191	Bluepoint-Grapevine association	1.18	0.69	0
192	Bluepoint association	1.48	0.90	0
195	Cruzspring-Schader-Rock outcrop association	0.15	0.05	15
200	Commski-Weiser-Threelakes association	0.28	0.14	0
201	Commski extremely gravely loam 8 to 30 percent slopes	0.16	0.07	0
202	Commski-Lastchance association	0.30	0.15	0
203	Commski-Oldspan-Lastchance association	0.34	0.16	0
205	Callville-Badland-Guardian association	0.51	0.27	0
207	Callville association	0.55	0.29	0
210	Nickel-Arizo association	0.60	0.32	0
211	Nickel-Crosgrain association	0.29	0.14	0
220	Haymont-Bluepoint association	0.28	0.11	0
221	Haymont association	0.13	0.03	0
225	Baseline-Callville-Badland association	0.42	0.22	0
226	Baseline extremely gravelly fine sandy loam 2 to 8 percent slopes	0.39	0.20	0
227	Baseline-Gypwash association	0.39	0.20	0
228	Baseline-Guardian association	0.48	0.25	0
230	Wechech-Weiser association	0.39	0.20	0
231	Wechech very gravelly fine sandy loam 2 to 8 percent slopes	0.43	0.22	0
232	Wechech-Upperline association	0.48	0.25	0
233	Wechech-Ifteen association	0.83	0.49	0
234	Wechech very gravelly fine sandy loam 8 to 30 percent slopes	0.34	0.17	0
235	Gypwash-Callville-Carrizo association	0.47	0.25	0

Table D.21 NV755 Clark County Area Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
237	Wechech association	0.41	0.21	0
240	Crosgrain-Irongold-Nickel association	0.20	0.09	0
241	Crosgrain-Typic Torriorthents-Nickel association	0.23	0.10	4
250	Mormon Mesa-Naye association	0.51	0.27	0
255	Tumarion-Nipton association	0.23	0.10	10
260	Naye-Bitter Spring association	0.41	0.19	0
261	Vace-Jean association	0.71	0.38	0
265	Azureridge very gravelly sandy loam 15 to 50 percent slopes	0.46	0.24	0
270	Bard-Nickel-Limewash association	0.57	0.30	8
271	Moapa-Bluepoint association	1.52	1.18	5
272	Moapa-Bluepoint-Rock outcrop association	1.82	1.56	20
285	Heleweiser-Carrizo-Teebar association	0.43	0.22	0
286	Heleweiser-Carrizo association	0.53	0.28	0
287	Heleweiser association	0.40	0.20	0
288	Heleweiser-Teebar association	0.46	0.24	0
289	Heleweiser-Upperline-Nickel association	0.48	0.25	1
290	Rock outcrop-Moapa-Bluepoint association	1.80	1.58	45
291	Rock outcrop-Highland association	0.10	0.03	50
292	Rock outcrop-Nupper association	0.30	0.14	65
294	Rock outcrop sandstone	0.25	0.11	90
298	Rock outcrop-Redneedle-Heleweiser association	0.53	0.28	35
310	Weiser-Arizo association	0.53	0.28	0
311	Weiser-Threelakes association	0.42	0.21	0
313	Weiser-Oldspan-Wechech association	0.33	0.16	0
314	Weiser-Wechech association	0.40	0.20	0
315	Weiser Association	0.33	0.15	0
320	Boxspring-Zeheme-Rock outcrop complex 15 to 50 to percent slopes MLRA 30	0.24	0.11	15
321	Boxspring-Seralin-Rock outcrop association	0.18	0.08	15
322	Boxspring-Potosi-Rock outcrop association	0.18	0.08	10
323	Boxspring-Scrapy-Rock outcrop association	0.26	0.12	15
325	Sandpan-Rositas association	1.23	0.92	0
330	Ramshead-St. Thomas-Rock outcrop association	0.22	0.09	15
335	Teebar very cobbly fine sandy loam 0 to 4 percent slopes	0.40	0.21	7
336	Teebar-Sandpan association	0.53	0.29	0

Table D.21 NV755 Clark County Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
340	Zeheme-Rock outcrop association	0.33	0.16	20
341	Zeheme extremely gravelly fine sandy loam 8 to 30 percent slopes	0.33	0.16	4
342	Zeheme-Potosi-Rock outcrop association	0.28	0.13	15
343	Zeheme-Rock outcrop-Boxspring association	0.30	0.15	20
351	Seralin extremely gravelly loam 30 to 75 percent slopes	0.17	0.07	4
352	Seralin-Traley-Rock outcrop association	0.21	0.09	15
355	Seralin-Devilsthumb-Ednagrey association	0.19	0.08	3
360	Bracken-Arizo-Badland association	0.64	0.37	0
365	Callville-Gypwash-Badland association	0.34	0.17	0
375	Iceberg-Rock outcrop-Helkitchen association	0.20	0.08	25
376	Iceberg-St. Thomas-Rock outcrop association	0.26	0.11	20
380	Tonopah-Arizo association	0.56	0.30	0
390	Tipnat-Hypoint-Grapevine association	0.41	0.19	0
391	Tipnat-Bluepoint-Hypoint association	0.35	0.15	0
400	Arizo-Cafetal association	0.24	0.10	0
405	Oxyaquic Torrifluvents-Gypwash association	0.51	0.26	8
411	Bludiamond-Diamondhil association	0.25	0.11	0
415	Valatier-Goldbutte association	0.16	0.06	2
421	Moentria extremely gravelly loam 15 to 50 percent slopes	0.18	0.07	5
422	Moentria-Purob Association	0.19	0.07	2
430	Bluepoint-Tipnat-Grapevine association	0.61	0.30	0
431	Hypoint-Vegastorm association	1.11	0.65	0
441	Corbilt gravelly loamy fine sand 0 to 4 percent slopes	0.73	0.40	0
450	Arizo association	0.75	0.43	0
451	Arizo-Peskah-Crosgrain association	0.24	0.10	0
454	Arizo-Riverwash association	0.78	0.52	0
455	Arizo-Tenwell association	0.33	0.15	0
460	Pahrump-Wodavar-Vegastorm association	0.23	0.10	0
461	Pahrump-Bluepoint association	0.14	0.05	0
470	Filaree-Seanna association	0.45	0.23	0
475	Guardian-Sunrock-Badland association	0.53	0.28	1
477	Guardian-Baseline-Guardian association	0.59	0.31	0

Table D.21 NV755 Clark County Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
478	Guardian-Baseline association	0.51	0.26	0
480	Vace-Arizo association	0.35	0.16	0
481	Vace-Wechech association	0.31	0.14	0
490	Ifteen extremely gravelly very fine sandy loam 2 to 8 percent slopes	0.49	0.26	0
500	Playas	0.01	0.01	0
501	Dams concrete	0.02	0.01	0
504	Pits quarry	0.02	0.01	0
505	Pits gravel	2.00	2.00	0
506	Pits-Dumps assocation	0.02	0.01	0
508	Landfill	0.02	0.01	0
510	Railroad association	0.38	0.19	2
520	Nolena-Rock outcrop association	0.25	0.11	35
521	Nolena-Nipton association	0.33	0.16	3
522	Nolena-Meadview association	0.36	0.18	1
523	Nolena association	0.35	0.18	0
530	Seanna-Botleg association	0.18	0.07	7
531	Seanna-Rock outcrop association	0.34	0.16	25
532	Seanna-Goldroad-Rock outcrop association	0.34	0.17	15
535	Blackmesa-Sunrock association	0.56	0.29	3
540	Sunrock-Rock outcrop association	0.40	0.20	25
541	Sunrock-Haleburu-Rock outcrop association	0.38	0.19	20
542	Sunrock-Callville-Badland association	0.43	0.22	1
550	Cheme-Riverbend-Carrizo association	0.30	0.13	0
551	Cheme-Carrizo-Huevi association	0.41	0.20	0
552	Cheme-Huevi association	0.26	0.12	1
560	Rositas-Riverbend association	1.75	1.49	5
565	Govwash-Guardian-Badland association	0.34	0.16	0
570	Carrizo association	1.21	0.75	0
571	Carrizo-Carrizo-Riverbend association	1.15	0.73	0
572	Carrizo very cobbly coarse sand 2 to 8 percent slopes	1.28	0.81	0
573	Carrizo-Riverbend association	0.75	0.43	0
574	Carrizo-Sunrock association	0.76	0.43	0
575	Carrizo complex 1 to 5 percent slopes	1.08	0.67	0
581	Threelakes-Weiser association	0.43	0.22	0
590	Riverbend-Carrizo association	0.77	0.45	0
591	Riverbend-Carrwash association	0.63	0.36	0
592	Riverbend-Carrizo frequently flooded association	0.55	0.31	0

Table D.21 NV755 Clark County Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
593	Riverbend-Cheme-Carrizo association	0.44	0.22	0
600	Huevi-Cheme association	0.29	0.14	0
601	Huevi association	0.35	0.18	0
603	Huevi extremely gravelly sandy loam 8 to 30 percent slopes	0.34	0.17	1
604	Huevi-Hiller association	0.31	0.15	1
605	Huevi-Badland association	0.34	0.17	0
606	Huevi-Huevi-Cheme association	0.30	0.14	2
610	Goldroad-Rock outcrop association	0.40	0.20	25
612	Goldroad-Seanna-Rock outcrop association	0.37	0.19	15
613	Goldroad-Haleburu-Rock outcrop association	0.40	0.20	15
620	Arizo-Lanip association	0.43	0.21	0
621	Orwash gravelly loamy coarse sand 2 to 4 percent slopes	1.01	0.59	0
622	Orwash-Arizo-Lanip association	0.53	0.27	0
630	Tenwell very gravelly sandy loam 2 to 4 percent slopes	0.37	0.18	0
635	Aguachiquita-Azureridge association	0.43	0.23	0
640	Cetrepas-Nolena-Rock outcrop association	0.21	0.09	15
645	Goldbutte-Nolena association	0.35	0.17	2
646	Goldbutte-Jumbopeak-Rock outcrop association	0.49	0.26	20
650	Peskah-Crosgrain association	0.14	0.05	0
651	Peskah-Arizo association	0.21	0.08	0
660	Crosgrain extremely gravelly loam 4 to 15 percent slopes	0.16	0.06	0
661	Crosgrain very stony loam 8 to 30 percent slopes	0.17	0.07	0
662	Crosgrain-Arizo association	0.22	0.10	0
663	Crosgrain-Kidwell-Arizo association	0.30	0.14	0
665	Crosgrain-Vace association	0.22	0.09	0
670	Nipton-Highland-Rock outcrop association	0.22	0.09	15
673	Nolena-Newera association	0.16	0.06	3
674	Nipton-Rubble land-Railroad association	0.36	0.18	27
680	Lanfair-Hoppswell association	0.32	0.15	0
690	Hoppswell-Ustidur association	0.16	0.06	0
691	Hoppswell-Jetmine association	0.20	0.08	0
700	Mountmcull-Nippeno association	0.16	0.06	4
701	Nippeno-Nipton association	0.12	0.04	4

Table D.21 NV755 Clark County Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
705	Charkiln-Woodspring-Buckspring association	0.30	0.15	0
710	Arizo-Lanfair-Riverwash association	0.55	0.32	0
715	Troughspring-Charkiln-Buckspring association	0.26	0.13	2
716	Troughspring very gravelly loam 4 to 15 percent slopes	0.31	0.17	0
721	Corncreek-Badland-Pahrump association	0.22	0.09	0
723	Corncreek-Haymont association	0.22	0.08	0
725	Mackscanyon-Purob association	0.16	0.06	0
731	Purob-Irongold association	0.15	0.06	0
732	Purob extremely gravelly loam 8 to 30 percent slopes	0.13	0.05	1
733	Purob extremely gravelly loam 2 to 8 percent slopes	0.12	0.04	2
734	Purob-Niavi association	0.16	0.06	0
740	Varwash association	0.27	0.13	0
741	Varwash-Carrizo association	0.33	0.16	0
750	Haleburu-Crosgrain-Rock outcrop association	0.30	0.14	11
751	Nipton-Nolena association	0.28	0.13	3
752	Nipton-Newera association	0.19	0.08	0
753	Nipton-Hiddensun-Haleburu association	0.38	0.19	2
754	Haleburu-Hiddensun association	0.39	0.20	3
760	Searchlight extremely gravelly sandy loam 2 to 4 percent slopes	0.54	0.29	0
772	Lamadre-Robbersfire association	0.21	0.10	3
775	Ladyofsnow-Robbersfire-Maryjane association	0.19	0.08	2
780	Prisonear fine sand 2 to 8 percent slopes	1.58	1.07	0
781	Prisonear-Bluepoint association	1.70	1.17	0
790	McClanahan-Beerbo association	0.08	0.03	6
801	Nippeno-Newera association	0.07	0.02	2
805	Buckspring-Fletcherpeak-Seralin association	0.20	0.09	3
806	Buckspring-Scrapy association	0.32	0.16	2
810	Straycow-Newera-Rubble land association	0.06	0.02	14
815	Wheelerwell-Wheelerpass association	0.08	0.03	5
820	Newera-Rock outcrop association	0.08	0.02	15

Table D.21 NV755 Clark County Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
821	Helkitchen-St. Thomas complex 15 to 50 percent slopes	0.23	0.10	4
830	Puelzmine extremely gravelly fine sandy loam 4 to 15 percent slopes	0.18	0.08	4
833	Virgin Peak-Rock outcrop association	0.30	0.15	15
840	Potosi-Zeheme-Rock outcrop association	0.25	0.12	10
845	Leecanyon-Goodwater association	0.31	0.15	0
850	Birdspring association	0.35	0.17	6
851	Birdspring-Zeheme-Rock outcrop association	0.23	0.10	15
852	Birdspring-Rock outcrop association	0.45	0.24	20
853	Birdspring-St. Thomas-Rock outcrop association	0.30	0.14	15
854	Birdspring-Birdspring warm-Rock outcrop association	0.42	0.22	20
860	Straycow-Highland association	0.05	0.02	3
865	Mackscanyon very gravelly silt loam 15 to 50 percent slopes	0.19	0.08	0
866	Goodwater-Doespring association 15 to 50 percent slopes	0.35	0.18	0
867	Goodwater very gravelly sandy loam 15 to 50 percent slopes	0.34	0.17	0
868	Mackscanyon-Goodwater association	0.21	0.09	0
870	Irongold extremely gravelly loam 2 to 8 percent slopes	0.19	0.08	0
871	Irongold-Weiser association	0.21	0.09	0
872	Irongold-Wechech association	0.27	0.12	0
875	Kylecanyon-Goodwater association	0.31	0.15	0
880	Nonamewash-Rositas association	1.48	1.02	0
885	Luckystrike gravelly loam 8 to 30 percent slopes	0.14	0.06	2
890	Ripley-Holtville complex	0.06	0.02	0
900	Urban land-Riverbend-Huevi association	0.72	0.43	0
905	Mountmummy-Thesisters-Maryjane association	0.21	0.10	3
910	Carrwash-Riverbend association	0.62	0.35	0
911	Carrwash association	0.64	0.36	0
915	Maryjane-Robbersfire-Kitgram complex 30 to 75 percent slopes	0.16	0.07	1

Table D.21 NV755 Clark County Area

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
916	Maryjane extremely gravelly loam 8 to 30 percent slopes	0.13	0.05	0
920	Tanazza-Wechech-Wodavar association	0.21	0.07	0
925	Lastone association	0.20	0.09	1
930	Cololag-Badland association	0.33	0.17	0
940	Mesabase-Azsand association	0.80	0.49	3
941	Mesabase extremely gravelly sandy loam 2 to 8 percent slopes	0.52	0.28	0
950	Drygyp association	1.49	1.08	0
951	Drygyp-Guardian-Baseline association	0.53	0.28	0
952	Drygyp fine sandy loam 2 to 4 percent slopes	0.68	0.36	0
955	Drygyp-Bluegyp association	0.46	0.24	0
965	Azsand-Mesabase-Rositas association	1.06	0.70	0
970	Rubble land-Charpeak-Rock outcrop complex	0.38	0.20	60
980	Orrubo very gravelly loam 15 to 35 percent slopes	0.18	0.08	0
981	Torriorthents-Haplocalcids-Lava flows complex 10 to 40 percent slopes	0.26	0.12	20
982	Winkel-Rock outcrop complex 2 to 12 percent slopes	0.19	0.08	15
998	Miscellaneous water	0.01	0.01	100
999	Water	0.01	0.01	100

Page Intentionally Left Blank

D.3.16 UT634

Table D.22 UT634 Iron-Washington Area Utah Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
300	Abela cobbly loam 2 to 8 percent slopes	0.25	0.12	0
301	Abela very gravelly sandy loam 8 to 25 percent slopes	0.41	0.22	0
302	Acord extremely cobbly loam 15 to 40 percent slopes	0.14	0.06	0
303	Annabella very gravelly coarse sandy loam 2 to 8 percent slopes	0.56	0.32	0
304	Annabella very gravelly loam 2 to 15 percent slopes	0.12	0.05	0
305	Antelope Springs loam 0 to 2 percent slopes	0.19	0.07	0
306	Antelope Springs silt loam reclaimed 0 to 2 percent slopes	0.18	0.07	0
307	Ashdown clay loam 0 to 2 percent slopes	0.09	0.03	0
308	Ashdown fine sandy loam 0 to 5 percent slopes	0.46	0.23	0
309	Ashdown loam 2 to 5 percent slopes	0.18	0.07	0
310	Ashdown loam gypsiferous substratum 2 to 5 percent slopes	0.18	0.07	0
311	Ashdown silty clay loam 0 to 1 percent slopes	0.09	0.03	0
312	Baboon very cobbly loam 15 to 50 percent slopes	0.15	0.07	0
313	Badland	0.31	0.16	15
314	Badland-Moondog-Rock outcrop complex 30 to 70 percent slopes	0.12	0.04	15
315	Baird Hollow-Mord complex 15 to 40 percent slopes	0.35	0.20	0
316	Bamos extremely cobbly loam 15 to 40 percent slopes	0.06	0.02	0
317	Bamos extremely gravelly loam 2 to 15 percent slopes	0.07	0.02	0

Table D.22 UT634 Iron-Washington Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
318	Bamos-Lucero complex 2 to 25 percent slopes	0.13	0.05	0
319	Bamos-Rock outcrop complex 2 to 25 percent slopes	0.08	0.03	25
320	Bandag loam 0 to 2 percent slopes	0.19	0.08	0
321	Bannion gravelly loam 2 to 5 percent slopes	0.15	0.06	0
322	Behanin-Ess complex 25 to 60 percent slopes	0.39	0.23	0
323	Berent loamy fine sand 0 to 10 percent slopes	2.00	1.57	0
324	Beron-Plegomir gravelly sandy loams 2 to 8 percent slopes	0.33	0.15	0
325	Beryl sandy loam 2 to 5 percent slopes	0.51	0.26	0
326	Bess fine sandy loam 2 to 15 percent slopes	0.72	0.42	0
327	Biblesprings fine sandy loam 0 to 2 percent slopes	0.79	0.45	0
328	Biblesprings loam 0 to 2 percent slopes	0.25	0.10	0
329	Biblesprings-Bannion complex 2 to 5 percent slopes	0.67	0.37	0
330	Biblesprings-Blown out land complex 0 to 5 percent slopes	0.39	0.24	0
331	Birdow loam 0 to 5 percent slopes	0.30	0.16	0
332	Blown out land	0.02	0.01	0
333	Braffits loam 0 to 2 percent slopes	0.19	0.08	0
334	Bullion silt loam 0 to 2 percent slopes	0.13	0.04	0
335	Bullion silt loam 0 to 5 percent slopes	0.28	0.12	0
336	Bullion-Antelope Springs complex 0 to 2 percent slopes	0.15	0.05	0
337	Bullion-Berent complex 0 to 10 percent slopes	0.34	0.15	0
338	Bullion-Biblesprings complex 0 to 2 percent slopes	0.16	0.06	0

Table D.22 UT634 Iron-Washington Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
339	Bullion-Taylorsflat complex 0 to 5 percent slopes	0.30	0.12	0
340	Bushvalley very stony loam 15 to 40 percent slopes	0.22	0.12	0
341	Calcross loam 0 to 2 percent slopes	0.18	0.07	0
342	Calcross loam 2 to 5 percent slopes	0.18	0.07	0
343	Calcross silty clay loam 0 to 1 percent slopes	0.09	0.03	0
344	Canburn silty clay loam 0 to 5 percent slopes	0.15	0.06	0
345	Cathedral-Posant-Rock outcrop complex 25 to 60 percent slopes	0.41	0.24	15
346	Checkett gravelly loam 5 to 40 percent slopes	0.15	0.06	0
347	Checkett-Rock outcrop complex 5 to 40 percent slopes	0.15	0.06	25
348	Checkett-Rock outcrop complex 8 to 25 percent slopes	0.17	0.06	15
349	Chuska-Checkett gravelly loams 8 to 25 percent slopes	0.16	0.06	0
350	Cinder land	2.00	1.56	0
351	Cranbay-Winnemucca complex 10 to 60 percent slopes	0.27	0.14	0
352	Crestline gravelly sandy loam 0 to 5 percent slopes	0.76	0.43	0
353	Crestline sandy loam 0 to 2 percent slopes	0.87	0.51	0
354	Crestline-Sevy sandy loams 0 to 2 percent slopes	0.73	0.41	0
355	Dalcan cobbly loam 2 to 25 percent slopes	0.22	0.10	0
356	Dalcan cobbly loam 15 to 40 percent slopes	0.11	0.04	0
357	Decca sandy loam 0 to 5 percent slopes	0.52	0.27	0
358	Deerlodge gravelly loam 2 to 8 percent slopes	0.16	0.06	0

Table D.22 UT634 Iron-Washington Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
359	Deerlodge gravelly loam 2 to 15 percent slopes	0.15	0.06	0
360	Deerlodge gravelly loam 5 to 15 percent slopes	0.15	0.06	0
361	Deerlodge-Bannion complex 2 to 5 percent slopes	0.28	0.12	0
362	Deerlodge-Checkett gravelly loams 2 to 8 percent slopes	0.16	0.06	0
363	Deerlodge-Monox gravelly sandy loams 2 to 8 percent slopes	0.31	0.14	0
364	Denmark gravelly loam 2 to 15 percent slopes	0.25	0.12	0
365	Denmark loam 2 to 15 percent slopes	0.23	0.10	0
366	Denmark-Saxby complex 2 to 15 percent slopes	0.21	0.10	0
367	Dennot very gravelly loam 2 to 10 percent slopes	0.15	0.06	0
368	Detra complex 2 to 15 percent slopes	0.38	0.20	0
369	Detra fine sandy loam 15 to 40 percent slopes	0.82	0.51	0
370	Dixie gravelly loam 2 to 8 percent slopes	0.16	0.06	0
371	Dixie-Checkett complex 5 to 40 percent slopes	0.14	0.05	0
372	Doyce loam 2 to 15 percent slopes	0.11	0.04	0
373	Dune land	2.00	1.56	0
374	Elenore gravelly loam 2 to 8 percent slopes	0.20	0.09	0
375	Escalante sandy loam 0 to 5 percent slopes	0.82	0.48	0
376	Escalante sandy loam 1 to 5 percent slopes	0.85	0.49	0
377	Faim clay loam 4 to 25 percent slopes	0.23	0.11	0
378	Faim clay loam 4 to 40 percent slopes	0.23	0.11	0
379	Festus gravelly sandy loam 2 to 8 percent slopes	0.48	0.25	0

Table D.22 UT634 Iron-Washington Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
380	Fughes-Sheckle loams 4 to 25 percent slopes	0.47	0.27	0
381	Garbo gravelly sandy loam 2 to 5 percent slopes	0.63	0.35	0
382	Garbo-Biblesprings complex 2 to 5 percent slopes	0.67	0.37	0
383	Garbo-Deerlodge complex 2 to 8 percent slopes	0.26	0.11	0
384	Garbo-Sevy complex 2 to 5 percent slopes	0.30	0.13	0
385	Gomine-Vennob-Rock outcrop complex 15 to 40 percent slopes	0.07	0.03	15
386	Gordonpoint loam 1 to 10 percent slopes	0.36	0.19	0
387	Hatu silty clay 0 to 2 percent slopes	0.06	0.02	0
388	Hiko Peak gravelly loam 2 to 25 percent slopes	0.19	0.08	0
389	Hiko Peak gravelly sandy loam 2 to 15 percent slopes	0.59	0.33	0
390	Hoye sandy loam 2 to 5 percent slopes	0.12	0.04	0
391	Ikit-Rock outcrop-Lorhunt complex 25 to 60 percent slopes	0.15	0.06	35
392	Ironco-Quilt complex 25 to 60 percent slopes	0.14	0.06	0
393	Jigsaw silty clay loam 0 to 2 percent slopes	0.09	0.03	0
394	Junkett cobbly sandy loam 2 to 8 percent slopes	0.49	0.27	0
395	Kanarra extremely cobbly clay loam 8 to 25 percent slopes	0.06	0.02	0
396	Kanarra sandy clay loam 2 to 8 percent slopes	0.22	0.09	0
397	Kolob-Detra association 2 to 40 percent slopes	0.35	0.19	0
398	Komo gravelly loam 2 to 15 percent slopes	0.15	0.06	0
399	Krueger loam 2 to 5 percent slopes	0.40	0.22	0
400	Kunz-Detra complex 2 to 40 percent slopes	0.38	0.20	0

Table D.22 UT634 Iron-Washington Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
401	Kunz-Ramps complex 8 to 25 percent slopes	0.89	0.56	0
402	Lagnaf-Rypod complex 15 to 40 percent slopes	0.19	0.08	0
403	Lava flows	0.01	0.01	85
404	Lavate very cobbly sandy loam 8 to 25 percent slopes	0.43	0.23	0
405	Lodar-Rock outcrop complex 15 to 50 percent slopes	0.17	0.08	25
406	Lucero gravelly sandy loam 2 to 8 percent slopes	0.70	0.40	0
407	Lucero-Checkett complex 15 to 40 percent slopes	0.13	0.05	0
408	Magna silty clay loam 0 to 2 percent slopes	0.09	0.03	0
409	Manderfield gravelly sandy loam 2 to 8 percent slopes	0.70	0.40	0
410	Manselo loam 0 to 2 percent slopes	0.45	0.22	0
411	Manselo loam 0 to 3 percent slopes	0.24	0.11	0
412	Manselo-Antelope Springs silt loams 0 to 2 percent slopes	0.16	0.06	0
413	Manselo-Ashdown complex 0 to 5 percent slopes	0.36	0.16	0
414	Manselo-Berent complex 0 to 10 percent slopes	0.99	0.63	0
415	Manselo-Biblesprings complex 0 to 5 percent slopes	0.43	0.20	0
416	Manselo-Sevy loams 0 to 8 percent slopes	0.20	0.07	0
417	Medburn sandy loam 0 to 2 percent slopes	0.57	0.30	0
418	Medburn sandy loam 2 to 5 percent slopes	0.90	0.52	0
419	Medburn sandy loam saline-alkali 0 to 2 percent slopes	0.91	0.53	0
420	Melling very gravelly loam 8 to 25 percent slopes	0.24	0.12	0

Table D.22 UT634 Iron-Washington Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
421	Minu gravelly sandy loam 2 to 8 percent slopes	0.48	0.25	0
422	Monox gravelly sandy loam 2 to 8 percent slopes	0.19	0.07	0
423	Monroe loam 0 to 2 percent slopes	0.26	0.11	0
424	Monroe-Wales silt loams 0 to 2 percent slopes	0.18	0.07	0
425	Moondog cobbly loam 15 to 40 percent slopes	0.17	0.06	0
426	Moondog-Lorhunt-Rock outcrop complex 30 to 70 percent slopes	0.08	0.02	15
427	Mord gravelly loam 4 to 25 percent slopes	0.38	0.22	0
428	Mosida fine sandy loam 0 to 2 percent slopes	0.76	0.44	0
429	Motoqua-Rock outcrop complex 15 to 40 percent slopes	0.14	0.06	30
430	Muleypoint very cobbly loam 15 to 40 percent slopes	0.20	0.09	0
431	Musinia silty clay loam 0 to 2 percent slopes	0.13	0.05	0
432	Naplene loam 2 to 5 percent slopes	0.17	0.07	0
433	Ocambee extremely cobbly loam 25 to 40 percent slopes	0.14	0.06	0
434	Ocambee extremely gravelly loam 8 to 25 percent slopes	0.14	0.06	0
435	Onaqui-Tolman-Rock outcrop complex 15 to 50 percent slopes	0.24	0.11	15
436	Orcap very gravelly clay loam 15 to 50 percent slopes	0.12	0.05	0
437	Paragonah silty clay loam 0 to 2 percent slopes	0.06	0.01	0
438	Parowan silt loam 0 to 2 percent slopes	0.07	0.02	0
439	Pass Canyon extremely cobbly loam 15 to 40 percent slopes	0.14	0.06	0

Table D.22 UT634 Iron-Washington Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
440	Pass Canyon-Lucero complex 4 to 40 percent slopes	0.11	0.03	0
441	Pass Canyon-Red Butte-Rock outcrop association 15 to 40 percent slopes	0.16	0.07	20
442	Pass Canyon-Rock outcrop complex 25 to 60 percent slopes	0.16	0.07	25
443	Paunsaugunt extremely stony loam 25 to 60 percent slopes	0.20	0.10	0
444	Paunsaugunt-Kolob gravelly loams 10 to 40 percent slopes	0.13	0.06	0
445	Pavant cobbly loam 2 to 15 percent slopes	0.20	0.09	0
446	Pavant-Abela complex 2 to 25 percent slopes	0.27	0.13	0
447	Pavant-Lucero cobbly loams 2 to 25 percent slopes	0.20	0.09	0
448	Pits-Dumps complex	0.02	0.01	0
449	Playas	0.09	0.02	0
450	Plegomir gravelly sandy loam 2 to 15 percent slopes	0.49	0.26	0
451	Plegomir-Deerlodge gravelly sandy loams 2 to 8 percent slopes	0.27	0.11	0
452	Plegomir-Manselo complex 2 to 15 percent slopes	0.29	0.13	0
453	Plite sandy loam 2 to 8 percent slopes	0.77	0.46	0
454	Pyrat gravelly loam 2 to 15 percent slopes	0.34	0.16	0
455	Quichipa silty clay loam 0 to 2 percent slopes	0.07	0.02	0
456	Radec very cobbly loam 2 to 15 percent slopes	0.03	0.01	0
457	Radec-Bodacious complex 15 to 60 percent slopes	0.18	0.08	0
458	Radec-Checkett association 8 to 25 percent slopes	0.07	0.02	0

Table D.22 UT634 Iron-Washington Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
459	Radec-Rock outcrop complex 8 to 25 percent slopes	0.16	0.07	20
460	Red Butte extremely gravelly loam 15 to 40 percent slopes	0.14	0.06	0
461	Red Butte very gravelly loam 2 to 15 percent slopes	0.17	0.07	0
462	Repmis gravelly loam 2 to 15 percent slopes	0.21	0.09	0
463	Revor gravelly loam 2 to 8 percent slopes	0.21	0.09	0
464	Ripgut gravelly loam 2 to 8 percent slopes	0.17	0.06	0
465	Riverwash	2.00	1.56	0
466	Rob Roy extremely cobbly loam 15 to 50 percent slopes	0.16	0.07	0
467	Rock outcrop	0.31	0.16	85
468	Rustico silty clay loam 0 to 2 percent slopes	0.20	0.10	0
469	Rypod very gravelly loam 15 to 40 percent slopes	0.22	0.11	0
470	Sackett loam 2 to 8 percent slopes	0.18	0.07	0
471	Sanpete extremely cobbly loam 8 to 25 percent slopes	0.13	0.05	0
472	Saxby-Rock outcrop-Checkett complex 15 to 40 percent slopes	0.15	0.07	25
473	Seth loam 2 to 15 percent slopes	0.40	0.23	0
474	Seth stony loam 15 to 40 percent slopes	0.32	0.18	0
475	Sevy loam 2 to 8 percent slopes	0.08	0.02	0
476	Sevy sandy loam 0 to 2 percent slopes	0.57	0.30	0
477	Sevy sandy loam 2 to 8 percent slopes	0.55	0.29	0
478	Sevy-Ardnas complex 0 to 5 percent slopes	0.45	0.22	0
479	Sevy-Taylorsflat complex 2 to 8 percent slopes	0.21	0.07	0
480	Simper gravelly loam 2 to 15 percent slopes	0.21	0.09	0

Table D.22 UT634 Iron-Washington Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
481	Siroco cobbly loam 8 to 25 percent slopes	0.11	0.04	0
482	Skumpah silt loam 0 to 2 percent slopes	0.07	0.02	0
483	Soutin loam 2 to 5 percent slopes	0.17	0.07	0
484	Squawcave silt loam 2 to 15 percent slopes	0.15	0.05	0
485	Streuling-Fontreen very gravelly loams 15 to 50 percent slopes	0.17	0.08	0
486	Studhorse gravelly loam 2 to 8 percent slopes	0.21	0.09	0
487	Studhorse gravelly loam 2 to 15 percent slopes	0.21	0.09	0
488	Syrett-Mudcree complex 25 to 60 percent slopes	0.16	0.07	0
489	Taylorsflat loam 0 to 2 percent slopes	0.24	0.11	0
490	Taylorsflat loam 2 to 5 percent slopes	0.23	0.10	0
491	Taylorsflat loam saline 0 to 5 percent slopes	0.19	0.07	0
492	Taylorsflat-Escalante sandy loams 2 to 5 percent slopes	0.85	0.50	0
493	Tiki-Kinghorn-Rock outcrop complex 15 to 40 percent slopes	0.14	0.06	15
494	Tolman extremely cobbly loam 4 to 25 percent slopes	0.14	0.06	0
495	Tolman-Dalcan-Rock outcrop complex 25 to 60 percent slopes	0.25	0.13	15
496	Tolman-Rock outcrop complex 15 to 40 percent slopes	0.43	0.23	15
497	Tolman-Rock outcrop-Dalcan complex 15 to 50 percent slopes	0.14	0.06	30
498	Tolman-Waltershow-Rock outcrop complex 15 to 40 percent slopes	0.32	0.16	15
499	Tombar cobbly loam 2 to 15 percent slopes	0.21	0.09	0
500	Tombar extremely cobbly loam 15 to 40 percent slopes	0.14	0.06	0
501	Trag stony loam 15 to 60 percent slopes	0.32	0.17	0

Table D.22 UT634 Iron-Washington Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
502	Vennob-Bodacious-Rock outcrop association 15 to 50 percent slopes	0.05	0.02	15
503	Vennob-Rock outcrop complex 15 to 40 percent slopes	0.03	0.01	30
504	Wales loam 0 to 2 percent slopes	0.19	0.07	0
505	Wales loam 2 to 5 percent slopes	0.09	0.03	0
506	Wales loam flooded 0 to 2 percent slopes	0.19	0.07	0
507	Wales sandy loam 0 to 2 percent slopes	0.90	0.52	0
508	Wales silty clay loam 0 to 2 percent slopes	0.09	0.03	0
509	Wales very fine sandy loam 0 to 2 percent slopes	0.84	0.49	0
510	Welring-Menefee-Rock outcrop complex 40 to 80 percent slopes	0.19	0.08	15
511	Wenzel cobbly loam 15 to 40 percent slopes	0.30	0.16	0
512	Whiteman very cobbly very fine sandy loam 1 to 6 percent slopes	0.07	0.02	0
513	Winnemucca loam 2 to 15 percent slopes	0.45	0.27	0
514	Winnemucca-Hoodle association 5 to 30 percent slopes	0.33	0.16	0
515	Woodrow silty clay loam 0 to 2 percent slopes	0.09	0.03	0
516	Woodrow silty clay loam saline 0 to 2 percent slopes	0.07	0.02	0
517	Wye very gravelly loam 15 to 40 percent slopes	0.13	0.05	0
518	Water	0.01	0.01	100
1025	Aned-Newvil-Decan association	0.48	0.25	0
1201	Decan-Uana association	0.08	0.03	0
1290	Ravendog-Fanu-Fifteenmile association	0.33	0.14	0
1362	Deerlodge-Fanu-Newvil association	0.30	0.14	0
1364	Bamos-Pass Canyon-Rock outcrop association	0.06	0.02	15

Table D.22 UT634 Iron-Washington Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1378	Oxvalley-Denpark-Hamtah assocation	0.29	0.14	0
1828	Cedaran-Wakansapa-Turba association	0.17	0.07	0
1829	Wakansapa-Cedaran association	0.08	0.03	0
1886	Schoolmarm-Starflyer-Rock outcrop association	0.65	0.38	20
3892	Slockey-Hamtah-Schoolmarm association	0.21	0.10	0
4026	Schoolmarm-Hamtah-Rock outcrop association	0.31	0.15	15

D.3.17 UT636

Table D.23 UT636 Panguitch Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1	Ahlstrom-Osote complex 1 to 15 percent slopes	0.23	0.11	0
2	Alldown clay loam 1 to 2 percent slopes	0.08	0.02	0
3	Alldown clay loam 2 to 5 percent slopes	0.08	0.02	0
4	Alldown loam alkali 1 to 2 percent slopes	0.21	0.09	0
5	Alldown clay loam moist 2 to 5 percent slopes	0.09	0.03	0
6	Andys loam 2 to 15 percent slopes	0.21	0.09	0
7	Andys very cobbly loam 8 to 25 percent slopes	0.24	0.11	0
8	Badland-Cannonville-Rock outcrop complex 30 to 50 percent slopes	0.10	0.05	15
9	Badland-Rock outcrop-Paunsaugunt complex 2 to 20 percent slopes	0.20	0.09	30
10	Baldfield clay 2 to 4 percent slopes	0.02	0.01	0
11	Baldfield clay 2 to 8 percent slopes eroded	0.02	0.01	0
12	Barx fine sandy loam 2 to 10 percent slopes	0.62	0.34	0
13	Bayfield clay 2 to 8 percent slopes	0.03	0.01	0
14	Befar clay 4 to 8 percent slopes	0.03	0.01	0
15	Behanin loam 30 to 70 percent slopes	0.38	0.19	0
16	Blanchard family sand 30 to 70 percent slopes	1.64	1.53	5
17	Borollic Natrargids 0 to 1 percent slopes	0.06	0.01	0
18	Broncho very gravelly sandy loam 2 to 5 percent slopes	0.32	0.15	0
19	Bruman loam 2 to 5 percent slopes	0.30	0.13	0
20	Bruman gravelly loam 2 to 10 percent slopes	0.25	0.11	0
21	Bruman cobbly loam moist 10 to 30 percent slopes	0.28	0.13	0

Table D.23 UT636 Panguitch Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
22	Bruman cobbly loam moist 30 to 50 percent slopes	0.28	0.13	0
23	Bruman very cobbly loam 5 to 30 percent slopes	0.19	0.08	0
24	Bruman very cobbly loam 30 to 50 percent slopes	0.19	0.08	0
25	Brycan very fine sandy loam 1 to 6 percent slopes	0.97	0.60	0
26	Brycan very fine sandy loam 6 to 15 percent slopes	0.83	0.50	0
27	Bushvalley very stony loam 15 to 40 percent slopes	0.18	0.08	0
28	Callings-Winnemucca association 5 to 15 percent slopes	0.46	0.27	0
29	Cannonville clay 30 to 50 percent slopes	0.02	0.01	0
30	Cannonville very stony clay 30 to 50 percent slopes	0.02	0.01	0
31	Castino-Behanin association 20 to 70 percent slopes	0.36	0.20	5
32	Castino-Tica family complex 20 to 70 percent slopes	0.25	0.12	5
33	Castino-Winnemucca association 5 to 30 percent slopes	0.39	0.22	5
34	Circleville-Rock outcrop complex 25 to 60 percent slopes	0.07	0.02	35
35	Clapper cobbly loam 5 to 30 percent slopes	0.13	0.04	0
36	Clapper cobbly loam 30 to 60 percent slopes	0.13	0.05	0
37	Codley silt loam 1 to 2 percent slopes	0.08	0.02	0
38	Codley silt loam 2 to 5 percent slopes	0.09	0.02	0
39	Comodore-Rock outcrop complex 15 to 40 percent slopes	0.06	0.01	30

Table D.23 UT636 Panguitch Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
40	Crestline fine sandy loam 2 to 4 percent slopes	0.62	0.33	0
41	Dalcan very cobbly loam dry 4 to 25 percent slopes	0.13	0.05	0
42	Descot silt loam dry 1 to 2 percent slopes	0.18	0.06	0
43	Descot silt loam 2 to 5 percent slopes	0.17	0.06	0
44	Dimyaw family gravelly loam 4 to 25 percent slopes eroded	0.12	0.05	0
45	Echard loam 5 to 30 percent slopes	0.33	0.17	0
46	Ess-Callings association 15 to 45 percent slopes	0.57	0.33	0
47	Evanston loam 2 to 8 percent slopes	0.34	0.16	0
48	Evanston very cobbly loam 4 to 25 percent slopes	0.23	0.11	0
49	Frandsen loam dry 1 to 15 percent slopes	0.20	0.08	0
50	Frandsen-Neto association 1 to 8 percent slopes	0.23	0.09	0
51	Frandsen dry-Wiggler complex 15 to 50 percent slopes	0.15	0.06	0
52	Fughes silty clay loam 0 to 4 percent slopes	0.15	0.06	0
53	Gerst family-Rock outcrop complex 20 to 70 percent slopes	0.14	0.04	35
54	Greenhalgh silt loam 1 to 2 percent slopes	0.07	0.02	0
55	Greenhalgh silt loam 2 to 5 percent slopes	0.07	0.02	0
56	Grimm sandy loam 1 to 5 percent slopes	0.61	0.32	0
57	Guben gravelly loam dry 1 to 25 percent slopes	0.31	0.16	0
58	Guben-Showalter complex 2 to 30 percent slopes	0.27	0.13	0
59	Harol very cobbly loam 2 to 15 percent slopes	0.19	0.09	0
60	Harol very cobbly loam 15 to 40 percent slopes	0.18	0.08	0

Table D.23 UT636 Panguitch Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
61	Harol very cobbly loam moist 25 to 50 percent slopes	0.18	0.08	0
62	Hatch-Pahreah complex 5 to 25 percent slopes	0.09	0.03	0
63	Hatch-Swapps complex 5 to 25 percent slopes	0.09	0.03	0
64	Henrieville sandy loam 1 to 2 percent slopes	0.58	0.31	0
65	Henrieville sandy loam 2 to 5 percent slopes	0.58	0.31	0
66	Henrieville sandy loam 5 to 10 percent slopes	0.70	0.38	0
67	Henrieville sandy loam moist 2 to 8 percent slopes	0.49	0.26	0
68	Hernandez family-Clapper complex 2 to 8 percent slopes	0.15	0.05	0
69	Ipson cobbly loam 8 to 25 percent slopes	0.25	0.12	0
70	Ipson very cobbly loam 25 to 60 percent slopes	0.24	0.11	0
71	Ipson very stony loam dry 5 to 25 percent slopes	0.21	0.09	0
72	Jodero loam 1 to 2 percent slopes	0.25	0.12	0
73	Jodero loam moist 2 to 8 percent slopes	0.20	0.09	0
74	Kade silt loam 0 to 2 percent slopes	0.40	0.23	0
75	Lava flows	0.01	0.01	100
76	Lazear-Rock outcrop-Badland complex 8 to 20 percent slopes	0.44	0.23	25
77	Losee gravelly loam 3 to 15 percent slopes	0.36	0.18	0
78	Losee gravelly sandy loam dry 10 to 25 percent slopes	0.63	0.36	0
79	Losee very gravelly loam 30 to 60 percent slopes	0.29	0.13	5
80	Luhon loam 2 to 5 percent slopes	0.14	0.05	0

Table D.23 UT636 Panguitch Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
81	Luhon loam gravelly substratum 1 to 2 percent slopes	0.14	0.05	0
82	Luhon loam gravelly substratum 2 to 5 percent slopes	0.14	0.05	0
83	Luhon loam moist 3 to 15 percent slopes	0.14	0.05	0
84	Luhon very cobbly sandy loam 2 to 15 percent slopes	0.38	0.19	0
85	Mespun loamy fine sand 1 to 3 percent slopes	1.60	1.00	0
86	Mespun loamy fine sand 3 to 8 percent slopes	1.58	0.98	0
87	Mespun loamy fine sand 8 to 15 percent slopes	1.69	1.06	5
88	Mikim sandy loam 2 to 8 percent slopes	0.53	0.26	0
89	Mikim loam dry 1 to 2 percent slopes	0.13	0.04	0
90	Mikim loam 2 to 4 percent slopes	0.15	0.05	0
91	Mikim clay loam dry 1 to 2 percent slopes	0.08	0.03	0
92	Mikim clay loam dry 2 to 5 percent slopes	0.08	0.03	0
93	Mitch silt loam 0 to 3 percent slopes	0.27	0.13	0
94	Mitch-Riverwash association 0 to 3 percent slopes	0.61	0.36	0
95	Mivida fine sandy loam 2 to 10 percent slopes	0.69	0.38	0
96	Neto fine sandy loam 1 to 5 percent slopes	0.73	0.42	0
97	Neto very fine sandy loam wet 0 to 2 percent slopes	0.53	0.29	0
98	Notter loam 1 to 4 percent slopes	0.35	0.17	0
99	Notter loam moist 1 to 8 percent slopes	0.33	0.16	0
100	Notter loam thick surface 4 to 8 percent slopes	0.21	0.09	0
101	Notter gravelly coarse sandy loam 2 to 8 percent slopes	0.77	0.44	0

Table D.23 UT636 Panguitch Area Utah Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
102	Notter gravelly loam 8 to 25 percent slopes	0.30	0.14	0
103	Notter very cobbly loam 4 to 25 percent slopes	0.24	0.11	0
104	Notter variant loam 1 to 4 percent slopes	0.21	0.09	0
105	Pahreah-Sheege complex 1 to 20 percent slopes	0.38	0.21	5
106	Pahreah-Sielo complex 2 to 25 percent slopes	0.28	0.14	0
107	Pahreah-Swapps complex 25 to 65 percent slopes	0.25	0.12	5
108	Panguitch-Mitch association 0 to 5 percent slopes	0.54	0.30	0
109	Panguitch-Riverwash association 5 to 15 percent slopes	0.48	0.27	0
110	Paunsaugunt gravelly loam 2 to 15 percent slopes	0.16	0.06	5
111	Paunsaugunt-Syrett gravelly loams 2 to 20 percent slopes	0.20	0.08	5
112	Playas	0.12	0.05	0
113	Plite sandy loam 2 to 8 percent slopes	0.59	0.32	0
114	Podo loamy sand 1 to 12 percent slopes	1.36	0.83	0
115	Podo-Wiggler complex 10 to 50 percent slopes	0.11	0.04	5
116	Podo-Rock outcrop complex 10 to 40 percent slopes	0.40	0.19	15
117	Quilt very cobbly loam 4 to 25 percent slopes	0.17	0.07	0
118	Quilt very cobbly loam 25 to 40 percent slopes	0.17	0.08	0
119	Redcreek gravelly sandy loam dry 10 to 40 percent slopes	0.32	0.15	0
120	Redcreek cobbly loam 15 to 50 percent slopes	0.13	0.05	0

Table D.23 UT636 Panguitch Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
121	Riverwash	1.62	1.21	0
122	Rock outcrop	0.01	0.01	100
124	Rubble land	0.01	0.01	100
126	Ruko-Podo complex 15 to 60 percent slopes	0.13	0.04	5
127	Schauson loam 2 to 4 percent slopes	0.45	0.25	0
128	Schauson loam 4 to 15 percent slopes	0.50	0.28	0
129	Sevier-Skutum association 5 to 35 percent slopes	0.89	0.56	5
130	Sheege-Swapps complex 30 to 50 percent slopes	0.18	0.08	5
131	Showalter-Guben complex dry 0 to 8 percent slopes	0.22	0.10	0
132	Shupert silty clay loam wet 0 to 1 percent slopes	0.11	0.04	0
133	Sielo very fine sandy loam 2 to 12 percent slopes	0.35	0.16	0
134	Skutum very fine sandy loam 1 to 6 percent slopes	0.73	0.43	0
135	Skutum fine sandy loam 10 to 35 percent slopes	0.84	0.52	5
136	Swapps gravelly loam 5 to 25 percent slopes	0.29	0.14	0
137	Swapps gravelly loam 25 to 65 percent slopes	0.22	0.10	0
138	Syrett gravelly loam 2 to 12 percent slopes	0.31	0.17	5
139	Syrett-Frandsen association 1 to 12 percent slopes	0.21	0.09	0
140	Syrett-Vanet gravelly loams 20 to 40 percent slopes	0.18	0.08	5
141	Tebbs sandy loam 2 to 5 percent slopes	0.73	0.39	0
142	Tebbs loam 1 to 2 percent slopes	0.17	0.06	0
143	Tebbs loam moist 1 to 2 percent slopes	0.15	0.05	0

Table D.23 UT636 Panguitch Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
144	Tolman very cobbly silt loam 8 to 35 percent slopes	0.11	0.03	1
145	Tolman-Rock outcrop complex 25 to 40 percent slopes	0.21	0.09	25
146	Tridell loam 2 to 4 percent slopes	0.35	0.17	0
147	Tridell gravelly loam moist 4 to 25 percent slopes	0.29	0.14	0
148	Tridell cobbly loam 4 to 25 percent slopes	0.35	0.17	0
149	Tridell moist-Rock outcrop complex 25 to 50 percent slopes	0.13	0.05	15
150	Ustic Torrifluvents occasionally flooded 2 to 8 percent slopes	0.68	0.36	0
151	Venture cobbly loam 4 to 30 percent slopes	0.23	0.10	0
152	Venture very cobbly silt loam 4 to 25 percent slopes	0.16	0.07	0
153	Venture cobbly loam dry 8 to 25 percent slopes	0.24	0.11	0
154	Villy family silty clay loam 0 to 2 percent slopes	0.24	0.12	0
155	Waltershow extremely cobbly loam 8 to 40 percent slopes	0.16	0.07	0
156	Waltershow extremely cobbly loam 40 to 60 percent slopes	0.16	0.07	0
157	Waltershow-Venture-Rock outcrop complex 4 to 40 percent slopes	0.17	0.07	15
158	Whiteman very cobbly very fine sandy loam 1 to 6 percent slopes	0.09	0.03	5
159	Whiteman-Skutum association 10 to 70 percent slopes	0.22	0.09	5
160	Widtsoe gravelly sandy loam 8 to 40 percent slopes	0.31	0.15	0
161	Wiggler channery loam 20 to 50 percent slopes	0.15	0.05	0

Table D.23 UT636 Panguitch Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
162	Wiggler-Guben complex 25 to 50 percent slopes	0.19	0.08	3
163	Wiggler-Rock outcrop-Podo complex 50 to 70 percent slopes	0.10	0.03	25
164	Winetti gravelly sandy loam 2 to 7 percent slopes	0.66	0.38	0
165	Winnemucca-Hoodle association 5 to 30 percent slopes	0.35	0.18	0
166	Yarts loam 1 to 2 percent slopes	0.38	0.18	0
167	Yarts sandy loam 2 to 5 percent slopes	0.54	0.28	0
168	Yarts sandy loam 5 to 10 percent slopes	0.54	0.28	0
169	Yenlo loam 2 to 8 percent slopes	0.09	0.02	0
170	Zillion very cobbly loam 5 to 25 percent slopes	0.20	0.09	0
171	Zinzer loam 3 to 15 percent slopes	0.21	0.09	0
172	Zyme very cobbly loam 30 to 60 percent slopes	0.02	0.01	0
173	Zyme-Lazear-Rock outcrop complex 8 to 60 percent slopes	0.07	0.04	15
174	Water	0.01	0.01	100
175	Pits gravel	2.00	1.93	0
176	Pits borrow	0.02	0.01	0
177	Miscellaneous water	0.01	0.01	100

D.3.18 UT641

Table D.24 UT641 Washington County Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
1898	Quazo-Motoqua very gravelly sandy loams 30 to 70 percent slopes	0.11	0.04	0
1922	Quazo-Motoqua-Rock outcrop association	0.12	0.04	20
BA	Badland	0.31	0.16	0
BB	Badland very steep	0.31	0.16	0
BED	Bermesa fine sandy loam 1 to 10 percent slopes	1.04	0.62	0
BF	Bermesa-Rock land association	1.65	1.06	20
BOD	Bond sandy loam 1 to 10 percent slopes	0.10	0.03	0
BP	Borrow pits	0.96	0.62	0
CaD	Caval fine sandy loam 2 to 10 percent slopes	0.81	0.46	0
CEF	Cave very gravelly sandy loam 7 to 30 percent slopes	0.37	0.19	0
CFD	Cave very gravelly sandy loam low rainfall 2 to 7 percent slopes	0.37	0.19	0
CHF	Chilton gravelly loam 5 to 30 percent slopes	0.27	0.12	0
CI	Cinder land	2.00	1.56	0
CoC	Clovis fine sandy loam 1 to 5 percent slopes	0.56	0.29	0
CPD	Clovis-Pastura complex 1 to 10 percent slopes	0.33	0.15	0
CRF	Collbran very cobbly clay loam 2 to 30 percent slopes	0.09	0.03	0
CSE	Curhollow very gravelly fine sandy loam 2 to 10 percent slopes	0.71	0.41	0
CUF	Curhollow-Rock outcrop complex 10 to 30 percent slopes	0.71	0.41	15
DAG	Dagflat-Motoqua complex 30 to 70 percent slopes	0.33	0.17	0
DBD	Dalcan cobbly loam 0 to 15 percent slopes	0.15	0.06	0

Table D.24 UT641 Washington County Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
DKG	Detra-Kolob complex 20 to 50 percent slopes	0.40	0.21	0
DrB	Draper loam 2 to 5 percent slopes	0.27	0.13	0
DU	Dune land	2.00	1.56	0
EA	Eroded land-Shalet complex	0.37	0.17	0
EB	Eroded land-Shalet complex warm	0.56	0.31	0
FA	Fluvaquents and torrifluvents sandy	2.00	1.81	0
GA	Gullied land	0.96	0.62	0
GP	Gravel pits	2.00	1.56	0
Ha	Hantz silty clay loam	0.06	0.01	0
HbC	Harrisburg fine sandy loam 1 to 5 percent slopes	1.17	0.69	0
HD	Harrisburg-Rock land association	1.17	0.69	15
HG	Hobog-Rock land association	0.19	0.08	40
IAF	Isom cobbly sandy loam 3 to 30 percent slopes	0.60	0.33	0
Ib	Ivins loamy fine sand	2.00	1.54	0
Ic	Ivins loamy fine sand hummocky	2.00	1.54	0
JaB	Junction fine sandy loam 1 to 2 percent slopes	1.10	0.65	0
JaC	Junction fine sandy loam 2 to 5 percent slopes	1.10	0.65	0
KAE	Kinesava fine sandy loam 15 to 25 percent slopes	0.87	0.51	0
KBD	Kinesava-Detra fine sandy loams 2 to 15 percent slopes	0.83	0.49	0
KCE	Kinesava complex 2 to 30 percent slopes	0.40	0.21	0
KD	Kolob-Detra association	0.67	0.38	0
KHC	Kolob-Hogg complex 2 to 8 percent slopes	0.60	0.34	0
KLG	Kolob-Paunsaugunt complex 20 to 60 percent slopes	0.40	0.22	0
LA	Lava flows	0.01	0.01	100
Lb	Lavate sandy loam	0.72	0.40	0

Table D.24 UT641 Washington County Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
LcB	Laverkin fine sandy loam 1 to 2 percent slopes	1.14	0.68	0
LcC	Laverkin fine sandy loam 2 to 5 percent slopes	1.13	0.67	0
LdB	Laverkin silty clay loam 1 to 2 percent slopes	0.06	0.01	0
LeA	Leeds silty clay loam 0 to 1 percent slopes	0.09	0.03	0
LeB	Leeds silty clay loam 1 to 2 percent slopes	0.09	0.03	0
LeD	Leeds silty clay loam 5 to 10 percent slopes	0.09	0.03	0
MAE	Magotsu-Pastura complex 2 to 20 percent slopes	0.08	0.02	0
MBG	Mathis-Rock outcrop complex 20 to 50 percent slopes	1.31	0.82	20
MEG	Menefee-Rock outcrop complex 25 to 60 percent slopes	0.09	0.02	25
MFD	Mespun fine sand 0 to 10 percent slopes	2.00	2.00	0
MMG	Motoqua-Mokiak very cobbly sandy loams 30 to 70 percent slopes	0.44	0.24	0
MOG	Motoqua-Rock outcrop complex 30 to 70 precent slopes	0.28	0.14	15
NaC	Naplene silt loam 2 to 6 percent slopes	0.10	0.03	0
NEF	Nehar very stony sandy loam 3 to 30 percent slopes	0.52	0.29	0
NIF	Nehar-Ildefonso complex 3 to 30 percent slopes	0.46	0.25	0
NkC	Nikey sandy loam 1 to 3 percent slopes	0.90	0.52	0
NLE	Nikey sandy loam 3 to 15 percent slopes	0.90	0.52	0
NME	Nikey very stony sandy loam 2 to 15 percent slopes	0.63	0.35	0
NNE	Nikey-Isom complex 3 to 30 percent slopes	0.78	0.45	0
PAC	Palma loamy fine sand 1 to 5 percent slopes	1.70	1.08	0

Table D.24 UT641 Washington County Area Utah Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
PbC	Palma fine sandy loam 1 to 5 percent slopes	1.25	0.75	0
PcC	Pastura loam 2 to 5 percent slopes	0.11	0.04	0
PED	Pastura-Esplin complex 0 to 10 percent slopes	0.14	0.05	0
PFG	Paunsaugunt gravelly silt loam 30 to 50 percent slopes	0.27	0.14	0
PG	Paunsaugunt-Kolob association	0.33	0.18	0
PKE	Paunsaugunt-Rock outcrop complex 2 to 30 percent slopes	0.12	0.05	15
PnC	Pintura loamy fine sand 1 to 5 percent slopes	1.40	0.84	0
PoD	Pintura loamy fine sand hummocky 1 to 10 percent slopes	1.40	0.84	0
PTE	Pintura-Toquerville complex 1 to 20 percent slopes	1.64	1.24	0
QMG	Quazo-Motoqua very gravelly sandy loams 30 to 70 percent slopes	0.20	0.09	0
RaC	Redbank fine sandy loam 1 to 5 percent slopes	0.62	0.33	0
RbA	Redbank silty clay loam 0 to 2 percent slopes	0.06	0.01	0
RE	Renbac-Rock land association	0.01	0.01	25
RI	Riverwash	2.00	1.58	0
RO	Rock land	0.01	0.01	80
RP	Rock land stony	0.01	0.01	100
RR	Rock land-Hobog association	0.04	0.03	40
RT	Rock outcrop	0.01	0.01	100
RU	Rough broken land	0.01	0.01	100
Sa	St. George silt loam	0.16	0.06	0
Sb	St. George silt loam strongly saline	0.27	0.11	0
Sc	St. George silty clay loam	0.11	0.04	0

Table D.24 UT641 Washington County Area Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
Sd	St. George silty clay loam moderately saline	0.11	0.04	0
Se	St. George silty clay loam shallow water table	0.11	0.04	0
SH	Schmutz loam	0.23	0.09	0
SPD	Spenlo very fine sandy loam 2 to 10 percent slopes	1.07	0.64	0
SrC	Springerville clay 0 to 5 percent slopes	0.02	0.01	0
SY	Stony colluvial land	0.40	0.22	0
TAG	Tacan very stony sandy loam 30 to 70 percent slopes	0.75	0.46	0
TBF	Tobish very cobbly clay loam 5 to 30 percent slopes	0.04	0.01	0
Tc	Tobler fine sandy loam	0.61	0.32	0
Td	Tobler silty clay loam	0.06	0.01	0
TG	Tortugas-Rock land association	0.14	0.05	20
VeA	Vekol sandy loam 0 to 2 percent slopes	0.41	0.19	0
VFD	Vekol sandy loam 2 to 10 percent slopes	0.41	0.19	0
VHD	Veyo-Curhollow complex 3 to 10 percent slopes	0.13	0.05	0
VPD	Veyo-Pastura complex 1 to 10 percent slopes	0.06	0.02	0
W	Water	0.01	0.01	100
WAG	Welring-Tortugas very gravelly loams 20 to 70 percent slopes	0.15	0.06	0
WBD	Winkel gravelly fine sandy loam 1 to 8 percent slopes	0.91	0.53	0
WCF	Winkel-Rock outcrop complex 8 to 30 percent slopes	0.91	0.53	25
YAF	Yaki very cobbly loam 3 to 35 percent slopes	0.11	0.04	0
YZE	Yaki-Zukan complex 1 to 35 percent slopes	0.20	0.08	0

D.3.19 UT686

Table D.25 UT686 Grand Staircase-Escalante National Monument Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
5001	Mido loamy fine sand 2 to 15 percent slopes	2.00	1.44	0
5002	Dune land	2.00	2.00	0
5003	Milok cool-Barx dry complex 1 to 5 percent slopes	0.88	0.50	0
5004	Rock outcrop Navajo Sandstone	0.01	0.01	90
5006	Milok fine sandy loam cool 2 to 8 percent slopes	0.77	0.43	0
5007	Rock outcrop Navajo Sandstone-Nalcase complex 2 to 30 percent slopes	2.00	2.00	65
5008	Simel complex 2 to 60 percent slopes	0.06	0.02	0
5009	Wayneco sandy loam dry 2 to 15 percent slopes	1.07	0.64	0
5010	Retsabal-Lemrac complex 2 to 60 percent slopes	0.46	0.21	0
5011	Badland Carmel Formation-Rizno cool-Nonip complex 5 to 25 percent slopes	0.16	0.06	0
5012	Santrick-Nalcase-Bispen complex 2 to 30 percent slopes	1.85	1.42	0
5013	Mido-Yarts complex 2 to 15 percent slopes	1.83	1.57	0
5015	Mespun fine sand 2 to 15 percent slopes	2.00	2.00	0
5017	Skos dry-Mido-Arches dry complex 2 to 15 percent slopes	1.69	1.28	0
5018	Skos channery loam dry 5 to 30 percent slopes	0.09	0.03	0
5019	Skos dry Rock outcrop Carmel Formation-Arches dry complex 15 to 60 percent slopes	0.26	0.13	30
5020	Rock outcrop Navajo Sandstone-Mespun-Nalcase complex 2 to 30 percent slopes	2.00	1.71	40
5021	Milok-Anasazi complex cool 2 to 8 percent slopes	0.77	0.44	0

Table D.25 UT686 Grand Staircase-Escalante National Monument Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
5023	Tsaya channery loam 5 to 25 percent slopes	0.14	0.05	0
5025	Yarts sandy loam 2 to 8 percent slopes	0.53	0.27	0
5026	Rock outcrop Entrada and Carmel Formation	0.01	0.01	95
5027	Badland Tropic Formation Shale-Cannonville-Rock outcrop Dakota Formation complex 30 to 50 percent slopes	0.10	0.05	15
5028	Badland Entrada Formation	0.31	0.16	0
5029	Rock outcrop Straight Cliffs Formation-Atchee family steep-Chilton family complex 50 to 80 percent slopes	0.54	0.30	40
5030	Catahoula-Clapper dry complex 15 to 60 percent slopes	0.29	0.14	0
5031	Moclom-Rock outcrop Morrison Formation complex 2 to 15 percent slopes	2.00	1.80	30
5032	Remorris-Kenzo steep-Rock outcrop Morrison and Entrada Formations complex 30 to 60 percent slopes	0.16	0.07	25
5033	Yarts fine sandy loam 15 to 40 percent slopes eroded	0.81	0.46	0
5034	Nonip very channery loam 5 to 25 percent slopes	0.08	0.03	0
5035	Earlweed-Mido complex 2 to 30 percent slopes	2.00	1.81	0
5037	Barx fine sandy loam 2 to 10 percent slopes	0.64	0.35	0
5038	Mido-Rock outcrop Entrada Formation complex 5 to 40 percent slopes	2.00	2.00	20
5040	Sazi-Milok cool complex 2 to 30 percent slopes	0.71	0.40	0
5041	Seeg warm-Pagina complex 2 to 15 percent slopes	1.16	0.71	0

Table D.25 UT686 Grand Staircase-Escalante National Monument Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
5042	Moenkopie warm-Moepitz-Rock outcrop Carmel Formation complex 10 to 30 percent slopes	1.76	1.16	25
5043	Daklos steep-Rock outcrop Morrison Formation and Romana Mesa Sandstone complex 30 to 70 percent slopes	0.48	0.27	40
5044	Dient very stony loam 15 to 50 percent slopes	0.15	0.06	0
5046	Moffat-Sheppard-Nakai complex 2 to 30 percent slopes	1.16	0.68	0
5047	Moffat-Seeg warm-Mack moist complex 2 to 15 percent slopes	1.32	0.81	0
5049	Moffat-Mack moist complex 1 to 5 percent slopes	1.48	0.92	0
5050	Daklos-Arches dry complex 2 to 15 percent slopes	0.62	0.38	0
5052	Yarts-Suwanee complex 1 to 8 percent slopes	0.33	0.14	0
5053	Milok fine sand 2 to 8 percent slopes	2.00	1.47	0
5055	Mivida-Barx dry complex 1 to 8 percent slopes	0.71	0.39	0
5057	Arches dry-Mident-Yarts complex 2 to 40 percent slopes	1.89	1.54	0
5058	Earlweed-Mivida complex 2 to 20 percent slopes	1.16	0.69	0
5059	Mivida-Yarts moist complex 2 to 8 percent slopes	1.08	0.65	0
5060	Ranion-Suzipon-Rock outcrop Navajo Sandstone complex 2 to 30 percent slopes	1.96	1.46	20
5061	Rock outcrop Navajo Sandstone-Suzipon-Peekaboo complex 2 to 30 percent slopes	1.59	1.00	50
5062	Peekaboo-Spooky-Suzipon complex 2 to 15 percent slopes	1.96	1.42	0

Table D.25 UT686 Grand Staircase-Escalante National Monument Utah Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
5063	Rock outcrop Navajo and Carmel Formations-Moenkopie warm-Needle complex 15 to 35 percent slopes	0.55	0.29	40
5065	Trail-Sheppard complex 2 to 10 percent slopes	1.82	1.38	0
5067	Ranion-Peekaboo complex 2 to 20 percent slopes	1.62	1.08	0
5068	Seeg warm-Moffat-Needle complex 2 to 25 percent slopes	1.97	1.33	0
5069	Rock outcrop Entrada Formation-Nepalto moist complex 2 to 8 percent slopes	1.01	0.60	60
5071	Somorent-Rock outcrop Morrison Formation complex 15 to 40 percent slopes	0.58	0.30	40
5073	Kenzo-Nalcase complex 2 to 15 percent slopes	1.64	1.16	0
5074	Evpark-Vessilla complex 2 to 15 percent slopes	0.89	0.52	0
5075	Shalona sandy loam 2 to 8 percent slopes	0.92	0.56	0
5076	Daklos-Catahoula complex 2 to 30 percent slopes	0.24	0.11	0
5077	Gompers family-Rock outcrop Straight Cliffs Formation-Sheecal family complex 50 to 80 percent slopes	0.27	0.13	30
5078	Arabrab-Vessilla-Colskel complex 2 to 15 percent slopes	0.47	0.23	0
5079	Colskel-Arabrab-Vessilla complex 15 to 50 percent slopes	0.34	0.17	0
5080	Moffat-Moepitz complex 2 to 25 percent slopes	0.61	0.32	0
5081	Badland and Rock outcrop Straight Cliffs and Wahweap Formations-Kydestea family complex 50 to 80 percent slopes	0.25	0.12	30
5082	Colskel-Menefee-Arabrab complex 2 to 15 percent slopes	0.24	0.10	0

Table D.25 UT686 Grand Staircase-Escalante National Monument Utah Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
5083	Colskel-Menefee complex 15 to 50 percent slopes	0.15	0.06	0
5085	Hillburn very channery loam 10 to 70 percent slopes	0.09	0.03	0
5086	Mespun-Bispen-Santrick complex 2 to 15 percent slopes	2.00	2.00	0
5087	Kenzo steep-Rock outcrop (Kayenta Formation) complex 15 to 50 percent slopes	1.01	0.62	25
5088	Calcree-Bowington-Mespun complex 0 to 20 percent slopes	2.00	1.97	0
5089	Bowington-Mespun complex 0 to 15 percent slopes	2.00	2.00	0
5090	Baldfield clay saline 2 to 8 percent slopes	0.02	0.01	0
5091	Brumley fine sandy loam 2 to 8 percent slopes	0.93	0.56	0
5092	Rock outcrop Navajo Formation-Navigon complex 30 to 60 percent slopes	1.55	1.01	50
5093	Robay-Strell complex 5 to 30 percent slopes	1.98	1.52	0
5094	Aridic Ustorthents-Yatne complex 15 to 70 percent slopes	0.15	0.06	0
5095	Daklos-Hideout-Rock outcrop Straight Cliffs Formation complex 2 to 15 percent slopes	0.33	0.17	15
5096	Daklos steep-Rock outcrop Straight Cliffs Formation complex 15 to 50 percent slopes	0.25	0.12	15
5097	Skyvillage-Daklos saline-Rock outcrop Wahweap Formation complex 2 to 15 percent slopes	0.54	0.28	15
5098	Daklos saline-Skyvillage saline-Cannonville complex 15 to 50 percent slopes	0.35	0.20	0
5100	Rock outcrop Wingate Formation-Arches dry complex 2 to 10 percent slopes	0.62	0.33	75

Table D.25 UT686 Grand Staircase-Escalante National Monument Utah Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
5101	Polychrome family-Badland Chinle Formation-Gaddes family complex 15 to 60 percent slopes	0.67	0.38	0
5102	Chinchin-Badland chinle Formation complex 25 to 50 percent slopes	0.20	0.09	0
5103	Barx-Remorris complex 5 to 45 percent slopes	0.50	0.24	0
5104	Rock outcrop Shinarump Conglomerate-Hideout complex 5 to 50 percent slopes	0.63	0.37	75
5105	Atchee-Lazear dry-Rock outcrop Shinarump Conglomerate complex 5 to 60 percent slopes	0.18	0.06	15
5106	Hillburn dry-Badland Moenkopi Formation complex 25 to 60 percent slopes	0.12	0.04	0
5107	Simel-Hillburn dry complex 5 to 45 percent slopes	0.07	0.02	0
5108	Hillburn dry-Rock outcrop Moenkopi Formation complex 10 to 60 percent slopes	0.05	0.01	25
5109	Nonip dry-Rock outcrop Moenkopi Formation complex 15 to 50 percent slopes	0.13	0.05	20
5110	Reef very channery sandy loam 5 to 25 percent slopes	0.17	0.07	0
5111	Nonip extremely channery sandy loam dry 5 to 50 percent slopes	0.06	0.01	0
5112	Barx-Radnik moist-Progresso dry complex 2 to 8 percent slopes	0.81	0.46	0
5114	Meriwhitica moist-Mellenthin complex 5 to 15 percent slopes	0.13	0.05	0
5115	Sanostee warm-Daklos-Hideout complex 2 to 15 percent slopes	0.61	0.33	0
5116	Stent-Minchey complex 2 to 15 percent slopes	0.41	0.20	0

Table D.25 UT686 Grand Staircase-Escalante National Monument Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
5117	Sheppard-Badland Carmel and Entrada Formations complex 5 to 30 percent slopes	0.95	0.56	0
5118	Mido-Kenzo-Rock outcrop Carmel Formation complex 2 to 30 percent slopes	0.83	0.46	15
5120	Pinepoint-Flatnose complex 2 to 8 percent slopes	1.87	1.35	0
5121	Trail-Riverwash complex 0 to 5 percent slopes	1.95	1.34	0
5122	Mido-Mivida complex 2 to 15 percent slopes	1.79	1.53	0
5123	Billings-Jocity saline complex 0 to 8 percent slopes	0.10	0.03	0
5125	Clapper very gravelly loam 2 to 15 percent slopes	0.13	0.05	0
5126	Pinepoint-Parkwash complex 2 to 15 percent slopes	2.00	1.61	0
5127	Skyvillage-Mikim-Badland Kaiparowits Formation complex 2 to 15 percent slopes	0.77	0.41	0
5128	Curecanti-Zibetod families complex 30 to 70 percent slopes	0.23	0.10	0
5129	Skyvillage-Rock outcrop Wahweap Formation complex 2 to 15 percent slopes	1.04	0.60	35
5130	Progresso-Begay dry complex 1 to 8 percent slopes	0.29	0.12	0
5131	Badland Kaiparowits Formation-Lazear steep complex 15 to 60 percent slopes	0.48	0.22	0
5132	Strych-Horsemountain-Barx complex 2 to 15 percent slopes	0.55	0.29	0
5133	Menefee-Badland Kaiparowits Formation complex 5 to 30 percent slopes	0.48	0.24	0
5136	Suzmayne-Colskel-Rock outcrop Straight Cliffs Formation complex 10 to 40 percent slopes	0.15	0.05	15

Table D.25 UT686 Grand Staircase-Escalante National Monument Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
5137	Casmos-Pariette families-Rock outcrop Dakota and Morrison Formation complex 2 to 30 percent slopes	0.28	0.12	15
5138	Nakai-Sheppard complex 2 to 15 percent slopes	2.00	1.98	0
5139	Hetz sandy loam 0 to 3 percent slopes	0.91	0.58	0
5140	Green River-Radnik moist-Suwanee saline complex 0 to 5 percent slopes	0.44	0.21	0
5141	Radnik moist-Suwanee saline-Escavada complex 0 to 8 percent slopes	0.65	0.38	0
5142	Alvey-Atrac complex 1 to 15 percent slopes	0.29	0.13	0
5143	Elias-Mikim complex 1 to 7 percent slopes	0.21	0.09	0
5144	Tsaya-Rock outcrop Straight Cliffs Formation complex 10 to 60 percent slopes	0.08	0.02	25
5146	Moffat-Pagina-Sheppard complex 2 to 20 percent slopes	1.47	0.93	0
5149	Tsaya saline-Rock outcrop Straight Cliffs Formation-Lithic Torriorthents complex 50 to 80 percent slopes	0.07	0.02	30
5150	Chipeta-Hanksville-Badland Tropic Shale complex 2 to 30 percent slopes	0.07	0.02	0
5151	Pinepoint dry-Tenneycanyon-Parkwash complex 2 to 25 percent slopes	1.86	1.42	0
5154	Dient-Crotoncanyon complex 15 to 50 percent slopes	0.11	0.04	0
5155	Sanostee warm-Milok-Lazear warm complex 2 to 15 percent slopes	1.17	0.75	0
5156	Daklos steep-Fourmilebench complex 15 to 50 percent slopes	0.10	0.04	0
5157	Daklos family-Rock outcrop Wahweap Formation complex 50 to 80 percent slopes	0.15	0.06	35

Table D.25 UT686 Grand Staircase-Escalante National Monument Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
5158	Mellenthin moist-Rock outcrop Moenkopi Formation complex 25 to 60 percent slopes	0.16	0.07	40
5159	Mellenthin moist-Bowdish complex 2 to 30 percent slopes	0.15	0.06	0
5160	Timpoweap-Evpark-Atarque complex 2 to 15 percent slopes	0.58	0.31	0
5163	Horsemountain fine sandy loam moist 2 to 8 percent slopes	0.53	0.27	0
5164	Badland Chinle Formation	0.31	0.16	0
5166	Hillburn dry-Sazi moist complex 2 to 30 percent slopes	0.34	0.16	0
5167	Progresso cool-Atchee family complex 2 to 15 percent slopes	0.34	0.16	0
5169	Lazear steep-Simel-Rock outcrop Carmel Formation complex 20 to 60 percent slopes	0.20	0.09	20
5170	Lemrac-Simel-Humbug moist complex 2 to 20 percent slopes	0.22	0.09	0
5171	Kenzo-Retsabal-Progresso cool complex 2 to 30 percent slopes	0.22	0.09	0
5172	Ruinpoint-Barx complex 2 to 8 percent slopes	0.11	0.04	0
5173	Simel-Strych moist-Kenzo complex 2 to 20 percent slopes	0.15	0.05	0
5174	Strych-Sazi moist complex 15 to 50 percent slopes	0.55	0.30	0
5180	Pinepoint-Rock outcrop Navajo Sandstone-Parkwash complex 15 to 50 percent slopes	1.86	1.36	30
5181	Parkelei-Plumasano moist-Pinepoint complex 2 to 15 percent slopes	1.27	0.80	0
5182	Arabrab-Colskel-Rock outcrop Carmel Formation complex 15 to 50 percent slopes	0.73	0.42	20

Table D.25 UT686 Grand Staircase-Escalante National Monument Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
5183	Parkwash-Rock outcrop Navajo Sandstone-Vessilla complex 30 to 65 percent slopes	0.68	0.38	30
5185	Nomrah-Upler complex 2 to 15 percent slopes	0.42	0.22	0
5186	Bodot cool-Sili complex 2 to 8 percent slopes	0.05	0.01	0
5187	Zigzag-Aridic Ustorthents complex 15 to 70 percent slopes	0.11	0.04	0
5188	Frandsen loam 1 to 15 percent slopes	0.28	0.13	0
5189	Widtsoe-Emlin complex 5 to 25 percent slopes	0.37	0.18	0
5190	Podo-Rock outcrop Straight Cliffs and Wahweap Formations complex 15 to 50 percent slopes	0.79	0.44	40
5191	Ruko-Rock outcrop Straight Cliffs and Wahweap Formations-Podo complex 30 to 70 percent slopes	0.12	0.04	30
5192	Gerst family-Cannonville-Rock outcropStraight Cliffs and Dakota Formation complex 20 to 50 percent slopes	0.08	0.03	15
5193	Badland Kaiparowits Formation	1.01	0.58	0
5195	Henrieville sandy loam 2 to 8 percent slopes	1.00	0.61	0
5198	Bigpack clay loam 1 to 8 percent slopes	0.10	0.03	0
5199	Quagmeier-Parkelei complex 2 to 30 percent slopes	0.52	0.29	0
5200	Sojourn family-Retsabal-Colskel complex 10 to 50 percent slopes	0.38	0.20	0
5201	Sojourn family-Aridic Ustorthents complex 15 to 50 percent slopes	1.21	0.75	0
5203	Wiggler-Curecanti family cool complex 25 to 65 percent slopes	0.13	0.05	0

Table D.25 UT686 Grand Staircase-Escalante National Monument Utah

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
5205	Curecanti families cool-Widtsoe complex 2 to 25 percent slopes	0.17	0.07	0
5206	Upler cobbly loam 5 to 50 percent slopes	0.23	0.11	0
5207	Winetti-Riverwash complex 2 to 5 percent slopes	0.48	0.27	0
5210	Elpedro moist-Flatnose complex 2 to 8 percent slopes	0.51	0.27	0
5211	Yarts moist-Sazi moist complex 2 to 8 percent slopes	0.81	0.46	0

Page Intentionally Left Blank

D.3.20 UTAH GENERAL SOIL SURVEY

Table D.26 UT STATSGO Utah General Soil Survey Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s1159	Youngston-Willwood-Tipperary-Clapper-Chroder (s1159)	0.58	0.30	0
s1160	Winona-Travessilla-Schooner-Rock outcrop-Rentsac-Duffymont-Crago (s1160)	0.42	0.21	30
s1161	Zillion-Layoint-Forelle-Emlin-Cathedral (s1161)	0.36	0.18	0
s1185	Rock outcrop-Rentsac-Moyerson-Mikim family-Atchee (s1185)	0.19	0.09	10
s1186	Wallson-Walknolls-Turley-Potts-Penistaja family-Abra (s1186)	0.49	0.24	0
s1199	Ustollic Haplargids-Ustollic Calciorthids-Ustic Torriorthents-Rock outcrop (s1199)	0.53	0.29	30
s1210	Potts-Palma-Kech-Hagerman-Cahona-Begay (s1210)	0.62	0.33	5
s1232	Zyme-Torriorthents-Rock outcrop (s1232)	0.04	0.01	35
s1417	Youngston-Torrifluvents (s1417)	0.19	0.07	0
s1420	Rock outcrop-Redlands-Myton family-Moenkopie-Mack-Farb-Badland (s1420)	0.34	0.16	15
s1422	Uzona-Rock outcrop-Myton family-Clayprings (s1422)	0.04	0.01	10
s1424	Romberg-Rock outcrop-Rizno-Littlenan-Cragola-Bodot (s1424)	0.06	0.02	15
s1435	Rock outcrop-Rizno-Mido-Ignacio-Begay (s1435)	0.24	0.10	25
s1436	Strych-Redbank-Moab-Begay (s1436)	0.61	0.34	0
s1437	Witt-Northdale-Monticello-Chaseville-Bond (s1437)	0.39	0.19	0
s1778	Richville-Leavitt-Dagan-Cokeville-Boundridge variant (s1778)	0.26	0.12	0
s1791	Windernot-Preston-Kidman (s1791)	0.57	0.32	5
s1811	Manila-Lonigan-Copenhagen-Broadhead (s1811)	0.28	0.14	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s1815	Parleys-Logan-Langless-Lagonot-Hans-Fridlo (s1815)	0.29	0.14	0
s1826	Ridgecrest-Hondoho (s1826)	0.32	0.16	0
s1834	Strevell-Stanrod-Mellor-Idahome-Declo-Darkbull (s1834)	0.26	0.11	0
s1836	Declo-Darkbull (s1836)	0.31	0.14	0
s1844	Rock outcrop-Ola-Itca-Birchcreek-Arbone (s1844)	0.38	0.19	16
s1846	Coalbank-Chen-Bluehill (s1846)	0.91	0.55	0
s1975	Wilsongulch-Tomsherry-Cottonthomas-Coalbank-Bluehill (s1975)	0.76	0.44	0
s2168	Nielsen-Dranyon-Dra (s2168)	0.26	0.13	0
s2179	Sprollow-Cooley variant-Bezzant (s2179)	0.28	0.13	0
s2180	Zeale-Geneva-Dateman-Aspen (s2180)	0.38	0.20	0
s342	Rock outcrop-Moenkopie (s342)	0.70	0.38	50
s343	Nakai-Monue-Blackston (s343)	1.28	0.76	0
s351	Wayneco-Sazi-Rock outcrop-Rizno-Palma-Mespun (s351)	0.98	0.58	10
s359	Spenlo-Schmutz-Redbank family-Palma family-Naplene-Lavate-Ildefonso family-Clovis family-Caval (s359)	0.47	0.23	0
s362	Rock outcrop (s362)	0.37	0.16	83
s392	Sogzie-Sheppard-Rock outcrop-Aneth (s392)	1.36	0.93	10
s393	Shedado-Rock outcrop-Mespun-Begay-Anasazi (s393)	1.16	0.71	15
s394	Ustollic Haplargids-Rock outcrop-Namon (s394)	0.56	0.33	30
s398	Sheppard-Rock outcrop-Monue-Moepitz (s398)	1.50	1.06	10
s5228	Tocito-Mesa-Cudei-Badland (s5228)	0.20	0.08	7
s5229	Persayo-Nataani-Littlehat-Awet (s5229)	0.19	0.06	2
s5453	Zadvar-Sanpete-Breko (s5453)	0.41	0.21	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s5484	Paranat-Equis-Duffer (s5484)	0.10	0.04	0
s5563	Segura-Rock outcrop-Itca family-Cropper (s5563)	0.15	0.06	10
s5571	Tarnach-Cliffdown (s5571)	0.15	0.06	0
s5577	Cave family-Cave-Ajo (s5577)	0.21	0.09	0
s5598	Pioche-Motoqua-Gabbvally (s5598)	0.11	0.04	1
s5742	Typic Torriorthents-Gypill-Cave-Badland (s5742)	0.43	0.22	5
s5878	Rock outcrop-Podmor family-Logring-Kyler-Flygare family-Eaglepass (s5878)	0.30	0.15	10
s7755	Waas-Tomasaki-Nortez-Herm-Fivepine-Falcon (s7755)	0.27	0.13	5
s7756	Thedalund family-Shalako-Rock outcrop-Killpack-Hanksville family (s7756)	0.10	0.03	10
s7757	Toddler family-Redbank family-Ravola family-Leeko (s7757)	0.09	0.02	0
s7758	Shalako-Rock outcrop-Reva family-Falcon family-Dast family (s7758)	0.46	0.23	20
s7759	Utso-Tosca-Sula family-Seeprid-Reva family-Razorba family (s7759)	0.53	0.30	5
s7760	Walknolls-Rock outcrop-Potts-Gaynor-Badland (s7760)	0.18	0.08	15
s7761	Uffens-Mikim family-Clapper (s7761)	0.16	0.06	0
s7762	Yamac-Stunner-Poposhia-McFadden-Luhon-Grieves (s7762)	0.24	0.10	0
s7763	Dahlquist variant-Dahlquist-Brownsto variant-Brownsto (s7763)	0.53	0.29	0
s7764	Thermopolis-Sinkson-Rock outcrop-Delphill-Blazon (s7764)	0.16	0.06	10
s7765	Morset-McFadden-Luhon-Fluetsch (s7765)	0.30	0.13	0
s7766	Uinta-Lail-Gelkie-Barrett-Amsden (s7766)	0.34	0.16	3
s7767	Turner-Fluetsch (s7767)	0.45	0.25	0
s7768	Strych-Sandoval-Persayo-Fruita-Barx-Avalon (s7768)	0.20	0.08	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s7769	Witt-Sharps-Ruinpoint-Rizno-Cahona (s7769)	0.18	0.07	0
s7770	Sheppard-Rock outcrop-Oljeto-Neskahi-Mota (s7770)	1.58	1.03	10
s7771	Rock outcrop-Piute-Moenkopie-Hoskinnini (s7771)	0.40	0.19	20
s7772	Whit-Sogzie-Sheppard-Rock outcrop (s7772)	0.49	0.26	10
s7773	Rock outcrop-Piute-Pickrell-Badland (s7773)	1.42	0.91	15
s7774	Rock outcrop-Lithic Torriorthents-Badland (s7774)	0.28	0.13	50
s7775	Skumpah-Playas (s7775)	0.08	0.03	0
s7776	Rock outcrop-Promo-Cliffdown (s7776)	0.29	0.14	15
s7777	Lembos-Kunzler-Kawich-Acana (s7777)	0.38	0.19	0
s7778	Tosser-Sitar-Hiko Peak-Bezzant (s7778)	0.29	0.13	0
s7779	Kapod-Fontreen-Donnardo-Collard (s7779)	0.26	0.12	0
s7780	Raftriver-Dahar-Codquin-Bullump (s7780)	0.49	0.27	0
s7781	Rock outcrop-Rexmont-Clavicon (s7781)	0.27	0.14	27
s7782	Tarnach-Cliffdown (s7782)	0.15	0.06	0
s7783	Ridgecrest family-Parkay family-Eyre family-Broad Canyon family-Bickmore family (s7783)	0.79	0.55	0
s7784	Ridgecrest family-Parkay family-Broad Canyon family-Bickmore family (s7784)	0.70	0.47	0
s7785	Sterling-Sheep Creek-Richmond-Foxol-Elzinga-Agassiz (s7785)	0.26	0.13	5
s7786	Middle-Broad (s7786)	0.34	0.19	0
s7787	Sterling-Samaria (s7787)	0.36	0.18	0
s7788	Timpanogos-Parleys-Kearns-Fielding (s7788)	0.20	0.09	0
s7789	Thiokol-Stingal-Sanpete-Hansel (s7789)	0.25	0.11	0
s7790	Kilburn-Kidman-Fielding (s7790)	0.36	0.18	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
s7791	Thiokol-Mellor-Heydlauff-Bram (s7791)	0.15	0.06	0
s7792	Roshe Springs-Logan-Kirkham-Honeyville-Greenson-Collett (s7792)	0.21	0.10	0
s7793	Stokes-Placeritos-Lasil-Fridlo-Airport (s7793)	0.19	0.08	0
s7794	Rock outcrop-Ridd-Barton (s7794)	0.55	0.31	25
s7795	Pleasant View-Kilburn-Francis (s7795)	0.65	0.38	0
s7796	Preston-Kidman-Francis (s7796)	1.79	1.53	0
s7797	Timpanogos-Parleys-Kidman (s7797)	0.37	0.17	0
s7798	Layton-Kidman (s7798)	1.10	0.69	0
s7799	Sunset-Steed-Refuge-Martini-Kirkham (s7799)	0.40	0.21	0
s7800	Logan-Leland-Ironton-Harrisville-Draper (s7800)	0.41	0.23	0
s7801	Warm Springs-Syracuse-Layton (s7801)	0.90	0.52	0
s7802	Warm Springs-Syracuse-Payson-Leland (s7802)	0.33	0.15	0
s7803	Salt Lake-Logan-Cardon-Airport (s7803)	0.22	0.11	0
s7804	Trenton-Jordan-Cache (s7804)	0.12	0.04	0
s7805	Roshe Springs-Nibley-Millville-Greenson-Collett (s7805)	0.22	0.10	0
s7806	Quinney-Lewiston-Layton-Kidman (s7806)	0.78	0.44	0
s7807	Wheelon-Mendon-Curtis Creek (s7807)	0.25	0.12	0
s7808	Wheelon-Parleys-Collinston (s7808)	0.14	0.05	0
s7809	Timpanogos-Sterling-Ricks-Parleys-Nibley-McMurdie (s7809)	0.28	0.13	0
s7810	Sterling-Nebeker-Hendricks-Crowshaw (s7810)	0.41	0.23	0
s7811	Yeates Hollow-Obray-LaPlatta-Goring-Ant Flat (s7811)	0.19	0.09	0
s7812	Sheep Creek-Hoskin-Curtis Creek-Agassiz (s7812)	0.25	0.12	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s7813	Dateman-Bradshaw-Bickmore-Agassiz (s7813)	0.21	0.10	5
s7814	Poleline-Lucky Star-Cluff-Bickmore (s7814)	0.51	0.32	0
s7815	Wader variant-Wader-Saleratus-Bear Lake (s7815)	0.31	0.16	0
s7816	Saleratus-Rich-Cowco (s7816)	0.14	0.06	0
s7817	Cowco-Bockston (s7817)	0.34	0.17	0
s7818	Woodpass-Wiscow-Poposhia-Pancheri-Lariat-Alhark (s7818)	0.17	0.06	0
s7819	Slinger-Duckree (s7819)	0.38	0.21	0
s7820	Thatcher-Richsum-Kearl-Econ (s7820)	0.20	0.08	0
s7821	Jebo-Dennot-Cutoff (s7821)	0.39	0.21	0
s7822	Solak-Rexmont-Highams variant-Gridge-Falula-Ellett (s7822)	0.24	0.11	0
s7823	Yeljack-Lucky Star-Charcol-Baird Hollow (s7823)	0.53	0.32	0
s7824	Sambrito-Lucky Star-Condie (s7824)	0.55	0.33	0
s7825	Utaba-Sunset-Steed-Redola-Pringle-Eastcan-Crooked Creek-Brownlee (s7825)	0.39	0.21	0
s7826	Stoda-Parleys-Nebeker-Manila-Lamondi (s7826)	0.29	0.14	0
s7827	Ostler-Manila-Hawkins-Donner-Bertag (s7827)	0.24	0.12	0
s7828	Yeates Hollow-Durfee (s7828)	0.24	0.12	0
s7829	Wallsburg-Van Wagoner-Rock outcrop-Harkers (s7829)	0.36	0.19	30
s7830	Kilfoil-Isbell-Hades-Croydon (s7830)	0.28	0.14	0
s7831	Yeates Hollow-Guilder-Etchen-Bullnel (s7831)	0.25	0.13	0
s7832	Smarts-Rock outcrop-Horrocks-Durst-Burgi (s7832)	0.30	0.15	10
s7833	Yeates Hollow-St marys-Moweba-Hoskin-Holmes (s7833)	0.22	0.11	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s7834	Sessions-Poleline-Patio (s7834)	0.28	0.15	0
s7835	Lucky Star-Charcol (s7835)	0.54	0.33	0
s7836	Rock outcrop-Geertson-Cristo-Broad Canyon (s7836)	0.27	0.13	10
s7837	Yence-Richens-Lucky Star-Herd-Ercan (s7837)	0.24	0.12	0
s7838	Rock outcrop-Patio-Nagisty-Broad Canyon (s7838)	0.28	0.15	25
s7839	Timpanogos-Parleys-Kearns-Fielding (s7839)	0.20	0.09	0
s7840	Picayune family-Lucky Star-Hades-Ant Flat (s7840)	0.37	0.20	0
s7841	Tooele-Timpie-Cliffdown (s7841)	0.33	0.15	0
s7842	Yenrab-Skumpah-Dynal (s7842)	0.22	0.09	0
s7843	Kapod-Donnardo-Borvant-Abela (s7843)	0.30	0.15	0
s7844	Taylorsflat-Medburn-Hiko Peak-Berent (s7844)	0.37	0.17	0
s7845	Skumpah-Saltair-Logan-Kanosh-Bramwell (s7845)	0.19	0.08	0
s7846	Timpanogos-Parleys-Bluffdale-Bingham (s7846)	0.19	0.08	0
s7847	Wallsburg-Rock outcrop-Harkers-Broad-Agassiz (s7847)	0.30	0.16	15
s7848	Wallsburg-Rock outcrop-Horrocks-Butterfield-Agassiz (s7848)	0.22	0.11	10
s7849	Rock outcrop-Henefer-Harkers-Gappmayer (s7849)	0.30	0.15	10
s7850	Wasatch-Ridd-Kilburn (s7850)	0.62	0.36	7
s7851	Woodrow-Mellor-Harding-Genola-Cheebe (s7851)	0.09	0.03	0
s7852	Terminal-Saltair-Lasil-Decker-Bramwell variant (s7852)	0.22	0.09	0
s7853	Taylorsville-Hillfield-Harrisville-Bramwell-Bluffdale (s7853)	0.16	0.06	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s7854	Wagonbox-Magna-Ironton-Decker-Bramwell (s7854)	0.25	0.12	0
s7855	Welby-Parleys-Kidman (s7855)	0.33	0.15	0
s7856	Wasatch-Knutsen-Kearns-Bingham (s7856)	0.83	0.49	0
s7857	Rock outcrop-Picayune-Emigration-Deer Creek-Brad-Agassiz (s7857)	0.26	0.13	20
s7858	Provo Bay-McBeth-Holdaway-Chipman (s7858)	0.22	0.11	0
s7859	Typic Fluvaquents-Payson-Logan-Jordan-Arave (s7859)	0.20	0.09	0
s7860	Welby-Vineyard-Taylorsville-Bramwell (s7860)	0.18	0.07	0
s7861	Sunset-Pleasant Vale-Martini-Kirkham-Benjamin (s7861)	0.36	0.19	0
s7862	Steed-Redola-Provo-Pleasant View-Pleasant Vale-Keigley (s7862)	0.53	0.30	0
s7863	Kirkham-Benjamin (s7863)	0.11	0.04	0
s7864	Pleasant Grove-Kilburn-Cleverly (s7864)	0.60	0.37	0
s7865	Preston-Layton-Lakewin (s7865)	0.97	0.60	0
s7866	Welby-Taylorsville-Hillfield (s7866)	0.21	0.09	0
s7867	Rake-Picayune variant-Picayune (s7867)	0.19	0.09	5
s7868	Towave-Podo-Minnimaud-Cabba family (s7868)	0.20	0.09	5
s7869	Uinta family-Trag-Senchert family-Senchert-Midfork family-Croydon (s7869)	0.56	0.35	0
s7870	Walknolls-Casmos-Badland (s7870)	0.14	0.06	5
s7871	Pathead-Guben-Curecanti family (s7871)	0.35	0.18	0
s7872	Trag-Senchert-Midfork family-Falcon-Beje (s7872)	0.33	0.17	0
s7873	Nelman-Lanver-Atchee (s7873)	0.37	0.19	5
s7874	Rock outcrop-Mikim family-Atchee (s7874)	0.24	0.11	10

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
s7875	Winteridge-Towave-Castner-Atchee (s7875)	0.17	0.07	4
s7876	Whetrock-Towave-Rock outcrop-Pathead-Castner-Atchee (s7876)	0.23	0.11	10
s7877	Walknolls family-Thedalund family-Pennell (s7877)	0.20	0.08	0
s7878	Thedalund family-Dast family (s7878)	0.16	0.06	5
s7879	Travessilla family-Travessilla-Rock outcrop-Gerst (s7879)	0.29	0.13	25
s7880	Walknolls-Rock outcrop-Casmos-Atchee (s7880)	0.17	0.06	10
s7881	Tipperary-Denco-Badland (s7881)	0.30	0.13	7
s7882	Yeates Hollow-Obrast-Deer Creek-Bagard (s7882)	0.15	0.06	0
s7883	Towave-Tosca-Sheepcan-Badland-Atchee (s7883)	0.20	0.08	5
s7884	Roundy-Fitzgerald-Daybell (s7884)	0.29	0.15	3
s7885	Flygare-Clayburn-Baird Hollow (s7885)	0.54	0.33	0
s7886	Yeates Hollow-Lucky Star-Hoskin-Horrocks-Gappmayer-Cloud Rim-Bradshaw-Ant Flat (s7886)	0.30	0.16	5
s7887	Trag-Skutum family-Kovich-Coberly variant (s7887)	0.27	0.13	0
s7888	Zillion family-Luhon family-Blazon-Abra family (s7888)	0.22	0.09	3
s7889	Zillion family-Uinta-Senchert-Geertson-Croydon (s7889)	0.40	0.22	4
s7890	Little Pole-Broadhead-Ayoub (s7890)	0.21	0.10	5
s7891	Poleline-Hailman-Fitzgerald (s7891)	0.40	0.22	3
s7892	Yeates Hollow-Wallsburg-Manila-Henefer-Gappmayer (s7892)	0.29	0.15	3
s7893	Van Wagoner-Rock outcrop-McPhie-Cloud Rim (s7893)	0.44	0.24	13

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s7894	Yeates Hollow-Watkins Ridge-Deer Creek-Clegg (s7894)	0.27	0.14	5
s7895	Rasband-Kovich-Holmes-Center Creek (s7895)	0.39	0.20	0
s7896	Kovich variant-Kovich-Fluventic Haploborolls-Cudahy-Crooked Creek (s7896)	0.40	0.23	5
s7897	Moweba-Manila-Kovich (s7897)	0.42	0.24	0
s7898	Watkins Ridge-Sowcan-Pringle-Kovich-Irim family-Ant Flat (s7898)	0.64	0.41	0
s7899	Richsum-Cutoff family-Ayoub (s7899)	0.19	0.08	3
s7900	Starley-Rock outcrop-Poleline (s7900)	0.29	0.15	35
s7901	Tipperary-Nakoy-Hiko Springs-Fruitland (s7901)	0.81	0.43	0
s7902	Turzo-Poganeab-Green River (s7902)	0.16	0.05	1
s7903	Travessilla family-Rock outcrop-Montwel-Begay (s7903)	0.37	0.17	10
s7904	Winona-Rock outcrop-Honlu-Clapper (s7904)	0.21	0.09	10
s7905	Travessilla family-Strell-Rock outcrop-Reepo (s7905)	1.10	0.77	30
s7906	Tyzak-Tridell-Atchee (s7906)	0.20	0.08	5
s7907	Tipperary-Nakoy-Montwel-Mivida (s7907)	0.54	0.25	3
s7908	Worland family-Montwel-Gerst-Denco-Badland (s7908)	0.15	0.05	0
s7909	Winona-Tridell-Honlu-Clapper (s7909)	0.19	0.08	4
s7910	Hanksville (s7910)	0.05	0.01	0
s7911	Utaline-Avalon (s7911)	0.19	0.07	0
s7912	Werlog-Turzo-Fruitland (s7912)	0.15	0.05	0
s7913	Morval family-Flynncove-Diagulch (s7913)	0.37	0.19	0
s7914	Zillion family-Namon-Flynncove-Dahlquist family (s7914)	0.26	0.13	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s7915	Tolman family-Namon-Lap family-Grapit (s7915)	0.22	0.09	0
s7916	Utaline-Minchey-Leeko-Greybull-Avalon (s7916)	0.20	0.07	0
s7917	Walknolls-Rock outcrop-Muff family-Motto-Crustown-Casmos (s7917)	0.17	0.06	20
s7918	Vasquez-Shakespeare-Mirror Lake-Marsell-Duchesne (s7918)	0.60	0.36	6
s7919	Vasquez-Teewinot-Rubble land-Rock outcrop-Mirror-Haverly (s7919)	0.56	0.32	25
s7920	Sessions family-Mirror Lake-Clark Fork family (s7920)	0.42	0.23	0
s7921	Yarts-Tridell-Travessilla family-Strell-Honlu-Henrieville-Boxwell family (s7921)	0.45	0.22	5
s7922	Tridell-Flynncove-Dahlquist family-Clapper-Brownsto (s7922)	0.37	0.19	2
s7923	Utaline-Uffens-Turzo-Muff family-Greybull-Badland (s7923)	0.22	0.08	5
s7924	Greybull-Clapper-Badland-Abra family (s7924)	0.23	0.10	0
s7925	Yarts-Paradox family-Hillto-Clapper-Ashley (s7925)	0.35	0.17	2
s7926	Uinta-Skutum-Lucky Star (s7926)	0.47	0.28	0
s7927	Yarts-Mivida-Henrieville-Gerst-Clapper (s7927)	0.35	0.17	0
s7928	Swissvale-Rentsac family-Circleville-Brownsto (s7928)	0.20	0.08	5
s7929	Windham family-Namon family (s7929)	0.26	0.13	3
s7930	Yarts-Tebbs-Patent family-Mikim family-Henrieville-Glendive-Countryman (s7930)	0.49	0.24	0
s7931	Henefer-Gappmayer-Fitzgerald (s7931)	0.26	0.13	7
s7932	Mespun-Honlu-Hillto-Clapper (s7932)	0.63	0.36	5
s7933	Turzo-Stutzman family-Green River variant-Gotho-Fruitland (s7933)	0.18	0.06	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s7934	Menefee-Lockerby-Hovenweep (s7934)	0.10	0.03	0
s7935	Rock outcrop-Montvale-Monticello (s7935)	0.36	0.18	20
s7936	Northdale-Monticello-Hovenweep (s7936)	0.33	0.16	0
s7937	Shay-Northdale-Monticello (s7937)	0.32	0.15	0
s7938	Ruinpoint-Rizno-Cahona (s7938)	0.06	0.02	0
s7939	Rock outcrop-Rizno-Mellenthin-Littlenan-Bodot (s7939)	0.12	0.03	12
s7940	Strych-Rock outcrop-Rizno-Montvale-Monticello (s7940)	0.28	0.13	30
s7941	Strych-Shay-Pack-Menefee-Abajo (s7941)	0.16	0.06	0
s7942	Strych-Pring-Cahona (s7942)	0.55	0.30	0
s7943	Strych-Skos-Bookcliff (s7943)	0.23	0.10	0
s7944	Rock outcrop-Myton family-Moenkopie (s7944)	0.47	0.25	37
s7945	Nakai-Limeridge-Bluechief (s7945)	0.57	0.29	0
s7946	Skos-Rock outcrop-Piute-Mido (s7946)	0.32	0.14	53
s7947	Sheppard-Rock outcrop-Piute (s7947)	1.80	1.15	41
s7948	Strych-Rizno (s7948)	0.22	0.09	0
s7949	Yarts-Rizno-Barx (s7949)	0.41	0.19	0
s7950	Skos-Rizno-Myton family-Milok (s7950)	0.12	0.04	0
s7951	Rock outcrop-Moenkopie (s7951)	1.15	0.70	78
s7952	Rock outcrop-Moenkopie-Hoskinnini (s7952)	0.59	0.29	22
s7953	Thoroughfare-Sheppard-Nakai (s7953)	1.22	0.82	0
s7954	Ustic Torriorthents-Rock outcrop-Lithic Torriorthents (s7954)	0.66	0.38	26
s7955	Rock outcrop-Rizno-Mido (s7955)	0.36	0.16	65
s7956	Redbank-Moab-Kidman (s7956)	0.76	0.43	0
s7957	Rock outcrop-Rizno (s7957)	0.12	0.04	36
s7958	Hagerman-Cahona-Begay (s7958)	0.85	0.49	0
s7959	Rock outcrop-Rizno (s7959)	0.12	0.04	44

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
s7960	Ustollic Haplargids-Ustollic Calciorthids-Ustic Torriorthents (s7960)	0.54	0.29	0
s7961	Waas-Tomasaki-Herm-Falcon (s7961)	0.56	0.34	0
s7962	Toone-Tomasaki-Herm-Falcon (s7962)	0.58	0.36	0
s7963	Toone-Skylick-Flygare (s7963)	0.88	0.62	0
s7964	Leighcan-Duchesne-Broad Canyon (s7964)	0.34	0.18	0
s7965	Rubble land-Meredith-Leighcan (s7965)	0.28	0.13	50
s7966	Ravola-Hunting-Billings (s7966)	0.19	0.08	0
s7967	Persayo-Chipeta-Badland (s7967)	0.13	0.04	0
s7968	Ravola-Persayo-Moffat (s7968)	0.26	0.11	0
s7969	Travessilla-Strych-Stormitt (s7969)	0.41	0.20	0
s7970	Strych-Mivida-Hernandez family (s7970)	0.35	0.17	0
s7971	Travessilla-Strych-Gerst (s7971)	0.36	0.18	5
s7972	Travessilla-Rock outcrop-Midfork family (s7972)	0.42	0.23	33
s7973	Podo-Pathead-Beje (s7973)	0.27	0.13	0
s7974	Rock outcrop-Midfork family-Guben (s7974)	0.44	0.27	27
s7975	Yenrab-Uvada family-Uvada-Lynndyl-Hiko Springs family (s7975)	0.72	0.37	0
s7976	Trook-Sagers-Ravola (s7976)	0.19	0.06	0
s7977	Sheppard-Nakai-Moffat (s7977)	1.72	1.22	0
s7978	Sheppard-Rock outcrop-Moenkopie (s7978)	0.99	0.62	29
s7979	Rock outcrop-Moffat-Moenkopie (s7979)	1.13	0.68	20
s7980	Nakai-Moenkopie-Milok (s7980)	0.91	0.50	0
s7981	Casmos-Badland-Antelope Springs (s7981)	0.17	0.06	0
s7982	Sagers-Killpack-Chipeta (s7982)	0.08	0.02	0
s7983	Trachute-Sandbench-Moenkopie (s7983)	1.31	0.79	0
s7984	Stormitt-Chipeta-Badland (s7984)	0.12	0.05	0
s7985	Welring-Strych (s7985)	0.20	0.08	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s7986	Roshe Springs-Logan-Fridlo-Airport (s7986)	0.31	0.16	0
s7987	Wayneco-Travessilla-Milok (s7987)	0.85	0.49	0
s7988	Mesa-Mack-Chipeta (s7988)	0.33	0.16	0
s7989	Skumpah-Killpack-Blueflat (s7989)	0.07	0.02	0
s7990	Rock outcrop-Moenkopie-Badland (s7990)	0.31	0.15	36
s7991	Rock outcrop-Nakai-Moenkopie (s7991)	0.62	0.33	18
s7992	Rock outcrop-Rizno-Begay (s7992)	0.69	0.38	24
s7993	Rogert family-Myton family-Kamack-Castino family (s7993)	0.30	0.15	2
s7994	Ute-Richens-Kildor-Embargo-Cluff-Castino (s7994)	0.36	0.20	0
s7995	Zeesix-Sessions-Perinos-Pahreah-Adobe (s7995)	0.30	0.16	0
s7996	Repp family-Falcon family-Detra (s7996)	0.19	0.07	5
s7997	Wiggler family-Repp family-Podo-Pathead-Caval-Ahlstrom (s7997)	0.34	0.15	5
s7998	Rabbitex family-Guben-Doney family-Datino family (s7998)	0.42	0.22	0
s7999	Senchert family-Pando family-Elwood-Bundo (s7999)	0.48	0.28	0
s8000	Faim-Embargo-Cluff-Clayburn family (s8000)	0.40	0.22	0
s8001	Tolman family-Harpole-Falcon family-Cabin-Bookcliff (s8001)	0.28	0.12	0
s8002	Namon family-Flygare family-Dranyon-Broad Canyon family (s8002)	0.46	0.27	5
s8003	Tomasaki-Sessions-Richens-Harpole-Broad Canyon family (s8003)	0.31	0.15	0
s8004	Sheppard-Moffat-Blackston (s8004)	0.96	0.55	0
s8005	Sheppard-Robroost-Mivida-Goblin-Farb (s8005)	0.79	0.43	0
s8006	Hanksville-Chipeta (s8006)	0.08	0.03	5

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s8007	Pennell-Moenkopie-Farb (s8007)	0.78	0.43	5
s8008	Rock outcrop-Farb-Chipeta-Badland (s8008)	0.28	0.13	20
s8009	Rock outcrop-Moenkopie-Arches (s8009)	0.84	0.48	55
s8010	Rock outcrop-Mido (s8010)	1.52	0.95	90
s8011	Yarts-Wayneco-Moffat-Milok-Mido-Begay (s8011)	1.33	0.83	0
s8012	Wayneco-Moffat-Mido-Mellenthin-Begay-Arches (s8012)	1.39	0.88	5
s8013	Yarts-Wayneco-Travessilla-Stormitt-Shedado (s8013)	0.58	0.31	0
s8014	Rizno-Chipeta-Begay (s8014)	0.43	0.21	0
s8015	Tolman-Stormitt-Montosa family-Circleville-Blazon (s8015)	0.21	0.09	5
s8016	Stormitt-Makoti family-Delson-Datino family-Circleville (s8016)	0.25	0.13	0
s8017	Rogert-Rock outcrop-Pando family-Olnes family (s8017)	0.39	0.22	30
s8018	Rock outcrop-Redcreek family (s8018)	0.33	0.16	40
s8019	Riverwash-Neto-Fluvaquents-Bruman (s8019)	0.52	0.26	0
s8020	Parkay-Forsey-Faim (s8020)	0.24	0.12	5
s8021	Parkay-Forsey-Faim (s8021)	0.29	0.15	0
s8022	Dune land-Bushvalley (s8022)	0.84	0.62	0
s8023	Handy-Eldgin (s8023)	0.13	0.05	0
s8024	Watkins Ridge-Wallsburg-Vicking-Trove-Henefer-Acord (s8024)	0.24	0.11	0
s8025	Krueger-Haulings-Eldgin-Dacore (s8025)	0.25	0.11	0
s8026	Tolman family-Rock outcrop-Paunsaugunt-Panguitch-Circleville (s8026)	0.14	0.06	10
s8027	Spager family-Neponset-Goldrun-Etchen-Declo-Crestline (s8027)	0.29	0.13	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s8028	Vicking-Van Wagoner-Rock outcrop-Noobab-Horrocks (s8028)	0.36	0.19	15
s8029	Van Wagoner-Rock outcrop-Pastorius-Horrocks (s8029)	0.36	0.19	25
s8030	Vicking-Van Wagoner-Rock outcrop-Horrocks-Agassiz (s8030)	0.21	0.09	20
s8031	Saxby-Rock outcrop-Noobab-Lodar family-Agassiz (s8031)	0.24	0.11	40
s8032	Spager family-Noobab-Neponset-Mountainville-Hiko Peak family (s8032)	0.19	0.08	0
s8033	Sterling-Mountainville (s8033)	0.32	0.16	0
s8034	Teton-Rubble land-Parkay-Hoosan-Elwood-Condie (s8034)	0.31	0.16	15
s8035	Sessions-Merino family-Hoodle-Herd-Faim-Cebone (s8035)	0.37	0.20	0
s8036	Zinzer-Youga-Rock outcrop-Redcreek family-Patent family-Evanston family-Cabbart (s8036)	0.26	0.12	10
s8037	Rock outcrop-Redcreek family-Patent family-Mayoworth-Luhon family-Grobutte (s8037)	0.21	0.09	10
s8038	Seitz-Rubble land-Namon-Knep-Embargo-Beardall (s8038)	0.22	0.10	10
s8039	Scandard-Rogert family-Hechtman-Elwood-Bickmore (s8039)	0.32	0.16	0
s8040	Water-Parkay-Namon-Granile-Forsey (s8040)	0.34	0.18	20
s8041	Kamack-Hourglass-Elwood-Bickmore family-Adel family (s8041)	0.50	0.30	0
s8042	Scandard-Passar-Nielsen family-Granile-Elwood-Bickmore family (s8042)	0.45	0.27	0
s8043	Parkay-Forsey-Embargo-Croydon-Condie (s8043)	0.29	0.15	0
s8044	Youga-Patent family-Hatch-Faim-Bowen-Almy (s8044)	0.21	0.10	0

Table D.26 UT STATSGO Utah General Soil Survey Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s8045	Sanpitch-Poorman-Eoj-Eldgin-Dacore-Carstump (s8045)	0.16	0.07	0
s8046	Youga-Skutum-Sessions-Passar-Clayburn family-Bear Basin (s8046)	0.50	0.29	0
s8047	Whitecap-Sessions-Mirror Lake-Merino family-Croydon-Clayburn (s8047)	0.62	0.36	0
s8048	Youga-Ranruff-Neponset-Golsum-Eoj-Eldgin (s8048)	0.25	0.12	0
s8049	Zegro-Teton-Sessions-Faim-Ellett-Duncom (s8049)	0.27	0.13	0
s8050	Tiki-Sanpitch-Hymas-Hansel family-Ellett-Eldgin (s8050)	0.25	0.11	0
s8051	Siroco-Ellett-Eldgin-Dacore-Agassiz (s8051)	0.12	0.04	0
s8052	Zinzer-Rock outcrop-Redcreek family-Patent family-Mirror Lake-Cabbart (s8052)	0.33	0.15	15
s8053	Kinghorn-Hiko Peak family-Entmoot family-Credo-Alhark-Agassiz (s8053)	0.21	0.09	0
s8054	Namon-Mine-Kamack-Granile-Croydon-Clayburn (s8054)	0.50	0.28	0
s8055	Nielsen family-Hoodle-Genoa-Embargo-Bickmore family (s8055)	0.39	0.21	0
s8056	Swapps-Sula family-Scout family-Orcap-Mirror Lake (s8056)	0.15	0.04	0
s8057	Rock outcrop-Hiko Peak family-Ellett-Dacore-Bowen-Agassiz (s8057)	0.16	0.06	10
s8058	Tellura-Rock outcrop-Pando family-Cebone-Bowen-Bickmore (s8058)	0.25	0.12	10
s8059	Rock outcrop-Hiko Peak family-Denay-Dacore-Agassiz (s8059)	0.19	0.08	15
s8060	Sessions-Mortenson-Kamack-Faim-Behanin (s8060)	0.37	0.20	0
s8061	Sessions-Faim-Embargo-Elwood-Clayburn family-Bickmore family (s8061)	0.43	0.25	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
s8062	Pando family-Herd-Condie-Cluff-Cebone-Bickmore family (s8062)	0.30	0.16	0
s8063	Passar-Eldgin-Dacore-Bowen-Agassiz (s8063)	0.19	0.08	0
s8064	Tellura-Sessions-Golsum-Gabica (s8064)	0.29	0.15	0
s8065	Scout-Parkay-Hourglass-Condie (s8065)	0.36	0.18	0
s8066	Scout-Granile-Condie-Bickmore family (s8066)	0.33	0.17	0
s8067	Scout-Scandard-Rubble land-Rogert family-Rock outcrop-Blanca (s8067)	0.50	0.27	30
s8068	Tatiyee-Rock outcrop-Nielsen family-Golsum-Condie (s8068)	0.27	0.13	15
s8069	Nielsen family-Nayped-Golsum-Deer Creek-Castino family (s8069)	0.32	0.16	0
s8070	Tellura-Sessions-Rock outcrop-Reywat-Golsum-Clayburn (s8070)	0.22	0.11	10
s8071	Scout-Rubble land-Dateman family-Condie (s8071)	0.36	0.19	10
s8072	Tatiyee-Rock outcrop-Nielsen family-Genoa-Forsey (s8072)	0.33	0.18	35
s8073	Scout-Rubble land-Losee-Blanca (s8073)	0.46	0.24	10
s8074	Scout-Rubble land-Hoodle-Genoa-Forsey-Condie (s8074)	0.27	0.13	30
s8075	Scout-Nielsen family-Condie (s8075)	0.36	0.19	5
s8076	Tatiyee-Scout-Forsey-Condie (s8076)	0.33	0.17	0
s8077	Tatiyee-Sessions-Relley-Parkay-Golsum-Faim (s8077)	0.28	0.13	0
s8078	Rock outcrop-Reywat-Promo-Pernty-Golsum-Dahlquist (s8078)	0.21	0.10	20
s8079	Van Wagoner-Rock outcrop-Relley-Golsum-Dunford-Belmill (s8079)	0.23	0.10	20
s8080	Reywat-Red Butte-Pharo family-Kanarra-Bowen-Amtoft family (s8080)	0.11	0.04	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s8081	Sessions-Poorman-Deer Creek-Dateman family-Clayburn-Castino family (s8081)	0.36	0.19	0
s8082	Rock outcrop-Pernty-Genoa-Forsey-Clayburn-Agassiz (s8082)	0.13	0.05	15
s8083	Forsey-Faim-Embargo-Dateman family-Clayburn-Adel family (s8083)	0.50	0.31	0
s8084	Relley-Golsum-Gabica-Deer Creek-Dacore-Castino family (s8084)	0.19	0.08	0
s8085	Reywat-Pernty-Mountainville-Hiko Peak-Golsum-Dacore (s8085)	0.15	0.06	0
s8086	Shotwell-Rock outcrop-Ranruff-Puett-Promo-Ellett (s8086)	0.24	0.10	20
s8087	Pernty-Leaps-Holmes-Dacore-Agassiz (s8087)	0.10	0.04	5
s8088	Rock outcrop-Nielsen family-Namon-Hourglass-Hoodle-Condie (s8088)	0.45	0.27	15
s8089	Whiteman-Parkay-Nielsen family-Namon-Elwood-Duchesne (s8089)	0.35	0.18	0
s8090	Rock outcrop-Ranruff-Elwood-Ellett-Condie (s8090)	0.24	0.11	20
s8091	Yeates Hollow-Snowville-Rake-Ostler-Dunford (s8091)	0.26	0.13	0
s8092	Winnemucca-Passar-Forsey-Condie-Clayburn-Adel family (s8092)	0.25	0.12	0
s8093	Rock outcrop-Kamack-Hourglass-Eyre family-Elwood-Condie (s8093)	0.51	0.30	15
s8094	Yeates Hollow-Pernty-Ostler-Dunford-Bowen-Agassiz (s8094)	0.18	0.08	0
s8095	Winnemucca-Passar-Forsey-Entmoot family-Condie-Clayburn (s8095)	0.25	0.12	0
s8096	Tatiyee-Parkay-Golsum-Condie (s8096)	0.32	0.17	0
s8097	Vanajo-Poganeab-Green River-Fluvaquents-Anco-Abcal (s8097)	0.19	0.07	0
s8098	Logan-Hiko Peak-Bertelson (s8098)	0.38	0.21	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
s8099	Playas (s8099)	0.03	0.01	0
s8100	Yuba family-Uvada family-Playas-Mondey family (s8100)	0.05	0.01	0
s8101	Ursine-Uffens family-Skumpah family (s8101)	0.17	0.06	0
s8102	Skumpah-Saltair-Playas-Dynal (s8102)	0.09	0.03	3
s8103	Swingler family-Penoyer family-Mazuma family-Goshute family (s8103)	0.13	0.04	0
s8104	Tosser-Sitar-Hiko Peak (s8104)	0.35	0.17	0
s8105	Yuba-Yenrab family-Biddleman family (s8105)	0.32	0.14	0
s8106	Yenrab-Uvada family-Uvada-Lynndyl-Hiko Springs family (s8106)	0.72	0.37	0
s8107	Sugarloaf-Nehar-Heist family-Goldrun family (s8107)	1.05	0.63	0
s8108	Uvada family-Papoose family-Goshute family-Dera family (s8108)	0.10	0.04	0
s8109	Sanpete family-Dera family (s8109)	0.20	0.08	0
s8110	Shabliss-Red Butte-Hiko Peak (s8110)	0.36	0.18	0
s8111	Robozo-Avalon family (s8111)	0.25	0.10	0
s8112	Rock outcrop-Hiko Peak-Cliffdown-Checkett family-Amtoft (s8112)	0.27	0.12	16
s8113	Lodar family-Amtoft family (s8113)	0.26	0.11	0
s8114	Reywat family-Lodar family-Kyler-Eaglepass (s8114)	0.27	0.12	9
s8115	Manassa-Bayfield family (s8115)	0.01	0.01	0
s8116	Yuba-Uvada-Uffens-Playas-Abbott (s8116)	0.10	0.03	0
s8117	Poganeab-Anco-Abraham-Abbott (s8117)	0.09	0.03	0
s8118	Toddler-Saltair-Playas (s8118)	0.11	0.04	0
s8119	Uvada-Rock outcrop-Hiko Springs-Checkett-Bluewing family (s8119)	0.27	0.11	13
s8120	Yenrab-Drum (s8120)	0.33	0.15	0
s8121	Sheeprock-Hiko Peak-Decca (s8121)	0.34	0.16	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s8122	Penoyer variant-Kessler-Hiko Peak-Escalante-Antelope Springs (s8122)	0.21	0.09	0
s8123	Ushar-Red Butte-Phage-Manderfield-Flowell-Deer Creek (s8123)	0.18	0.08	0
s8124	Ushar-Snake Hollow-Sheeprock-Phage-Blue Star-Blackett (s8124)	0.49	0.25	0
s8125	Ushar-Pharo-Mill Hollow (s8125)	0.15	0.06	0
s8126	Ushar-Mosida-Etta (s8126)	0.30	0.14	0
s8127	Pharo-Pass Canyon (s8127)	0.24	0.11	0
s8128	Shotwell-Oakden-McQuarrie-Firmage (s8128)	0.16	0.06	5
s8129	Paice-Black Ridge (s8129)	0.14	0.04	5
s8130	Deer Creek-Clegg (s8130)	0.24	0.12	0
s8131	Yardley-Wallsburg-Mineral Mountain-Maple Mountain (s8131)	0.19	0.08	0
s8132	Rock outcrop-May Day-Cowers-Bearskin (s8132)	0.57	0.31	40
s8133	Riverwash-Poganeab-James Canyon family-Draper-Chipman (s8133)	0.26	0.13	0
s8134	Rock outcrop-Ravola variant-Hiko Peak-Badland (s8134)	0.23	0.10	15
s8135	Rypod-Musinia-McCornick-Ebbs-Boxelder (s8135)	0.25	0.11	0
s8136	Uvada-Hiko Springs-Curdli (s8136)	0.26	0.11	0
s8137	Woodrow-Toddler-Swingler family (s8137)	0.08	0.03	0
s8138	Uvada-Goldrun (s8138)	0.72	0.35	0
s8139	Yenrab-McCornick-Kessler-Kanosh-Goldrun (s8139)	0.83	0.46	0
s8140	Kanosh-Deseret (s8140)	0.24	0.10	0
s8141	Pavant-Doyce-Donnardo-Borvant (s8141)	0.25	0.11	0
s8142	Yeates Hollow-Rake-Millard-Flowell (s8142)	0.17	0.08	0
s8143	Pavant-Donnardo-Calita (s8143)	0.22	0.10	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s8144	Ephraim-Calita-Abcal (s8144)	0.16	0.07	0
s8145	Saltair-Roshe Springs-Provo Bay-Bramwell-Benjamin (s8145)	0.16	0.06	0
s8146	Tridell-Rock outcrop-Comodore-Bruman (s8146)	0.16	0.07	10
s8147	Medburn-Linoyer-Genola (s8147)	0.33	0.14	0
s8148	Truesdale-Linoyer (s8148)	0.53	0.27	0
s8149	Scalade-Medburn-Jericho-Hiko Peak (s8149)	0.42	0.21	0
s8150	Goldrun-Dune land (s8150)	1.42	1.01	0
s8151	Nephi-Juab (s8151)	0.19	0.08	0
s8152	Yenrab-Uvada (s8152)	1.23	0.74	0
s8153	Xeric Torriorthents-Rock outcrop-Lodar (s8153)	0.20	0.08	20
s8154	Wallsburg-Rock outcrop-Broadhead-Agassiz (s8154)	0.21	0.10	25
s8155	Rock outcrop-Parkay-Kitchell-Flygare-Agassiz (s8155)	0.38	0.22	25
s8156	Woodrow-Quaker-Linoyer-Genola (s8156)	0.14	0.05	0
s8157	Sanpete-Lisade-Freedom-Denmark-Arapien (s8157)	0.46	0.23	0
s8158	Stillman-Sigurd-Sanpete (s8158)	0.47	0.24	0
s8159	Moroni-Keigley-Doyce-Collard-Birdow (s8159)	0.33	0.16	0
s8160	Watkins Ridge-Toehead-Manila-Deer Creek-Ant Flat (s8160)	0.25	0.11	0
s8161	Lodar-Fontreen-Borvant (s8161)	0.25	0.12	2
s8162	Sanpete-Rock outcrop-Amtoft (s8162)	0.33	0.17	10
s8163	Rock outcrop-Atepic-Amtoft (s8163)	0.12	0.04	50
s8164	Pavant-Mountainville-Doyce-Donnardo-Borvant (s8164)	0.30	0.14	0
s8165	Slickspots-Skumpah-Ravola-Mayfield (s8165)	0.04	0.02	0

Table D.26 UT STATSGO Utah General Soil Survey Soil Map Unit Composite XKSAT and RTIMP Values				
SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s8166	Xerofluvents-Quaker-Mellor-Manassa-Harding-Dyreng (s8166)	0.14	0.05	0
s8167	Shumway-Poganeab-Peteetneet-Kjar-Fluvaquents-Chipman-Abcal (s8167)	0.20	0.09	0
s8168	Rock outcrop-Mower-Lundy-Lizzant-Hamtah-Agassiz (s8168)	0.22	0.10	10
s8169	Povey-Pavohroo-Northwater-Hymas-Clayburn (s8169)	0.36	0.19	0
s8170	Zeesix-Toze-Tingey-Skylick-Pritchett-Mortenson (s8170)	0.41	0.23	0
s8171	Starley family-Losee family-Kamack family-Cowood family-Bickmore family (s8171)	0.20	0.08	5
s8172	Tatiyee family-Security family-Scout family-Quilt family-Parkay family-Jemez family-Hesperus family (s8172)	0.20	0.09	0
s8173	Tingey-Scout family-Namon family (s8173)	0.19	0.08	5
s8174	Windwhistle family-Telephone family-Seleez family-Security family-Rock outcrop-Bond family-Atchee family (s8174)	0.47	0.23	20
s8175	Rock outcrop-Pinitos family-Montez-Canlon family (s8175)	0.25	0.11	40
s8176	Rock outcrop-Olot family-Gralic family-Falcon family-Eyre family (s8176)	0.18	0.07	30
s8177	Pioche family-McQuarrie family-Kanarra family-Indiano family-Decan family-Bodacious family (s8177)	0.16	0.06	0
s8178	Security family-Podmor family-Pastorius family-Fughes family-Dalcan family (s8178)	0.16	0.06	0
s8179	Rock outcrop-Motoqua family-Falcon family-Dotsero family-Bernal family (s8179)	0.12	0.04	40

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s8180	Wye family-Sampson family-Pastorius family-Nehar family-Muzzler family-Mokiak family-Bernal family (s8180)	0.08	0.02	0
s8181	Tobler-St. George-Nikey-Junction-Harrisburg (s8181)	0.52	0.26	0
s8182	Winkel-Renbac-Hobog-Bermesa (s8182)	0.50	0.29	0
s8183	Toquerville-Tobler-Pintura-Ivins-Dune land (s8183)	1.43	0.96	0
s8184	Shalet-Badland (s8184)	0.26	0.12	5
s8185	Mathis-Bond family (s8185)	0.20	0.06	3
s8186	Rock outcrop-Redbank family-Mespun-Caval (s8186)	1.33	0.82	15
s8187	Pastura family-Magotsu-Curhollow (s8187)	0.25	0.11	5
s8188	Walknolls family-Rock outcrop-Rizno-Moenkopie (s8188)	0.57	0.30	55
s8189	Rock outcrop-Clapper-Badland (s8189)	0.29	0.13	30
s8190	Rock outcrop-Chipeta-Casmos family-Badland (s8190)	0.11	0.04	10
s8191	Rock outcrop-Mellenthin (s8191)	0.45	0.23	30
s8192	Windwhistle-Rock outcrop-Rizno-Palma (s8192)	0.60	0.32	15
s8193	Skyvillage-Palma-Mellenthin-Clapper-Atchee (s8193)	0.27	0.12	5
s8194	Palma-Gerst family-Barx-Arches (s8194)	0.32	0.13	3
s8195	Rock outcrop-Palma-Mespun-Arches (s8195)	1.22	0.72	25
s8196	Rock outcrop-Mespun-Arches (s8196)	1.79	1.18	10
s8197	Yarts-Palma-Neville family-Barx-Atchee (s8197)	0.38	0.17	5
s8198	Skos-Rock outcrop (s8198)	0.07	0.02	20
s8199	Sedillo-Gaynor-Clapper (s8199)	0.06	0.02	0
s8200	Dune land (s8200)	2.00	2.00	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s8201	Rock outcrop-Mathis-Krueger-Arches (s8201)	1.08	0.64	60
s8202	Uana family-Nevu family-Minu family-Decathon family-Buster family-Aned family (s8202)	0.27	0.12	0
s8203	Tombar-Pavant-Hiko Peak-Denmark-Bamos (s8203)	0.16	0.06	0
s8204	Garbo-Deerlodge family-Biblesprings (s8204)	0.33	0.15	0
s8205	Unius family-Taylorsflat-Sevy-Manselo-Hiko Peak-Escalante (s8205)	0.29	0.12	0
s8206	Wales-Taylorsflat-Sevy (s8206)	0.28	0.12	0
s8207	Wales-Taylorsflat-Medburn-Kanarra-Ashdown (s8207)	0.17	0.06	0
s8208	Sevy-Manderfield-Komo-Calcross-Ashdown (s8208)	0.13	0.04	0
s8209	Rock outcrop-Ocambee-Kinghorn (s8209)	0.17	0.07	15
s8210	Red Butte-Pavant-Hiko Peak-Dixie-Checkett-Bamos (s8210)	0.15	0.06	0
s8211	Rock outcrop-Pass Canyon-Bamos-Abela (s8211)	0.13	0.05	12
s8212	Uvada-Manselo-Antelope Springs (s8212)	0.19	0.07	0
s8213	Tolman family-Rob Roy-Doyce (s8213)	0.15	0.06	6
s8214	Wye-Motoqua-Lucero-Ironco (s8214)	0.19	0.08	3
s8215	Rypod-Poorman-Lagnaf-Acord (s8215)	0.23	0.11	0
s8216	Winnemucca-Seth-Faim (s8216)	0.29	0.15	0
s8217	Paunsaugunt-Kolob-Detra-Dalcan (s8217)	0.33	0.17	4
s8218	Welring-Tortugas family-Rock outcrop-Chilton family (s8218)	0.15	0.06	25
s8219	Tobish-Tacan-Nehar-Collbran family (s8219)	0.14	0.05	6
s8220	Villy family-Tebbs-Alldown (s8220)	0.31	0.14	0
s8221	Descot-Codley (s8221)	0.11	0.03	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s8222	Yarts-Mikim-Henrieville-Befar-Barx (s8222)	0.15	0.07	0
s8223	Playas-Frandsen (s8223)	0.16	0.06	0
s8224	Zillion-Showalter-Panguitch-Notter-Guben (s8224)	0.31	0.15	0
s8225	Yenlo-Mikim-Lazear-Clapper-Cannonville-Bayfield (s8225)	0.06	0.02	0
s8226	Venture-Tridell-Notter-Ipson-Bruman (s8226)	0.34	0.16	0
s8227	Zinzer-Yenlo-Tridell-Notter-Luhon (s8227)	0.22	0.09	0
s8228	Tridell-Ipson (s8228)	0.26	0.12	4
s8229	Zillion-Waltershow-Venture-Quilt-Ipson-Harol-Andys (s8229)	0.18	0.08	0
s8230	Waltershow-Tolman-Rock outcrop-Ipson-Comodore (s8230)	0.13	0.05	10
s8231	Tolman-Harol-Fughes-Dalcan-Bushvalley (s8231)	0.20	0.09	0
s8232	Syrett-Swapps-Skutum-Sheege-Ruko-Rock outcrop-Frandsen (s8232)	0.21	0.08	17
s8233	Zyme-Vanet-Syrett-Rock outcrop-Badland (s8233)	0.14	0.07	20
s8234	Syrett-Swapps-Skutum-Pahreah-Badland (s8234)	0.32	0.16	0
s8235	Ruko-Rock outcrop-Podo-Lazear-Dimyaw family-Cannonville-Badland (s8235)	0.16	0.07	15
s8236	Rock outcrop-Circleville-Castino (s8236)	0.21	0.10	29
s8237	Winnemucca-Echard-Callings-Behanin-Beardall (s8237)	0.44	0.24	0
s8238	Winnemucca-Tica family-Hoodle-Castino-Callings (s8238)	0.35	0.18	0
s8239	Shedado-Rock outcrop-Mespun-Batterson (s8239)	1.10	0.64	50
s8240	Rock outcrop-Rizno-Chilton family (s8240)	0.31	0.14	25
s8241	Sheppard-Rock outcrop-Arches (s8241)	1.51	1.10	50
s8242	Rock outcrop-Rizno (s8242)	0.92	0.53	70

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr DF = 1.0	XKSAT, in/hr DF = 1.1	Natural RTIMP, %
(1)	(2)	(3)	(4)	(5)
s8243	Sheppard-Nakai-Monue-Deleco-Cataract-Bluechief (s8243)	1.13	0.65	6
s8244	Yarts-Shedado-Rock outcrop-Rizno-Palma-Mivida-Barx (s8244)	0.49	0.24	10
s8245	Uvada-Sevy-McLoughlin-Decca-Crestline (s8245)	0.11	0.03	0
s8246	Rustico-Musinia-Monroe-Hiko Peak-Bandag (s8246)	0.19	0.08	0
s8247	McLoughlin-Hiko Peak-Decca-Avalon (s8247)	0.16	0.06	0
s8248	McLoughlin-Hiko Peak-Decca-Crestline (s8248)	0.24	0.10	0
s8249	Sanpete-Rock outcrop-Hiko Peak-Badland-Amtoft (s8249)	0.23	0.11	10
s8250	Redview-Redfield-Quaker-Naser (s8250)	0.12	0.04	0
s8251	Monroe-Genola-Bertelson-Annabella variant (s8251)	0.24	0.10	0
s8252	Rock outcrop-Red Butte-Logan-Hoye-Hiko Peak (s8252)	0.27	0.14	10
s8253	Rock outcrop-Red Butte-Pernty-Hiko Peak-Handy-Dacore (s8253)	0.16	0.07	20
s8254	Rock outcrop-Hiko Peak-Dacore-Checkett (s8254)	0.15	0.06	15
s8255	Poganeab-Linoyer-Haulings-Green River-Fluvaquents-Anco (s8255)	0.28	0.12	0
s8256	Tosser-Hiko Peak-Bertelson (s8256)	0.40	0.20	0
s8257	Monroe-Medburn-Green River (s8257)	0.55	0.30	0
s8258	Poganeab-Manassa-Kirkham (s8258)	0.09	0.03	0
s8259	Trook-Gypsum land-Goblin (s8259)	0.34	0.17	0
s8260	Travessilla-Rock outcrop-Gerst (s8260)	0.36	0.18	40
s8369	Water (s8369)	0.01	0.01	100
s9012	Uinta-Scout-Rock outcrop-Miracle-Millpot-Leavitt-Chittum (s9012)	0.48	0.26	10
s9014	Turson-Tetonville-Moslander (s9014)	0.38	0.20	0

Table D.26 UT STATSGO Utah General Soil Survey

Soil Map Unit Composite XKSAT and RTIMP Values

SMU	Soil Map Unit Name	XKSAT, in/hr		Natural RTIMP, %
		DF = 1.0	DF = 1.1	
(1)	(2)	(3)	(4)	(5)
s9016	Terada-Spool-Rock outcrop-Huguston-Blackhall (s9016)	0.90	0.51	40
s9017	Pando-Libeg-Lail-Bear Basin-Amsden variant-Amsden (s9017)	0.39	0.21	0
s9046	Outlet-McKinney-Gas Creek-Dobrow-Canburn-Absher (s9046)	0.33	0.17	0

E. CHECKLISTS

E.1 PURPOSE

These checklists are intended for two purposes as follows:

1. Internal use by County/District employees as a guide for reviewing drainage studies, reports and construction plans, including those submitted by the public and prepared internally at the County/District and by other agencies.
2. External use by the public for preparing drainage studies, reports and construction plans that will be reviewed by the County/District.

This should help expedite the review process and help the public better understand what the County/District will be looking for when performing a review. These checklists are not intended to be applicable for every situation. They are intended to be helpful and not mandatory. Checklist items that do not apply to a given situation should have the "N/A" box checked. The column headed with an "*" should be checked if more information or comments are necessary. Additional information and comments should be placed in the "COMMENTS" section provided at the end of each table, with the appropriate checklist item number listed at the start of the comment. Such additional information or comments may also be provided on additional pages. The engineer is encouraged to provide the appropriate checklist as a part of the study or report, as shown in Section 18. The general intended uses for each checklist are as follows:

Checklist 1: Drainage Design Report Checklist. Drainage Design Reports for subdivision preliminary and final plats, street improvement projects and drainage improvement projects. Portions of the checklist may also be appropriate for grading and drainage plans.

Checklist 2: Hydrology Specific Checklist. This checklist is to be applied for flood insurance studies, drainage planning studies, and for Drainage Design Reports where new hydrology calculations or modeling is prepared.

Checklist 3: HEC-RAS Hydraulics Specific Checklist. This checklist is to be applied for flood insurance studies, drainage planning studies, and for Drainage Design Reports and drainage and grading plans where new hydraulic modeling is done using HEC-RAS (preferable) or HEC-2.

Checklist 4: Technical Data Notebook Checklist. This checklist is to be applied for flood insurance studies.

Page Intentionally Left Blank

E.2 CHECKLIST 1: DRAINAGE DESIGN REPORT CHECKLIST

Checklist 1: Drainage Design Report Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*****
SECTION 1: GENERAL					
1	PROJECT NAME: REVISION NO: DATE:				
2	SELECT PROJECT TYPE: Preliminary Plat [ ] Final Plat [ ] Street Imp. [ ] Drainage Design [ ] Grading and Drainage Plan [ ] Other [ ]				
3	REVIEWED BY:				
4	Is this a complete drainage report, sealed by a professional Civil Engineer currently licensed to practice in Arizona?				
5	Is the *Hydrology Specific Checklist* included and completed, if appropriate?				
6	Is the *HECRAS Hydraulics Specific Checklist* included and completed, if appropriate?				
7	Is this report for floodplain delineation purposes, requiring use of the TDN format and checklist?				
8	Does the report discuss whether the site is in a subsidence area or if there are fissures present?				
9	If in a subsidence area or fissures are present, are facilities appropriately sited and designed?				
10	If a construction project, has an SWPPP been developed and an NOI submitted per ADEQ requirements?				
11	If a construction project, has a copy of the SWPPP and NOI been included in the report?				
12	Have all permit requirements been met (ie. Floodplain, Drainage Clearance, Right-of-Way, Zoning, Stormwater Quality, 401/404, etc)?				
13	Is there a section on Conclusions and Recommendations, and is it adequate?				
SECTION 2: FIELD SURVEY AND MAPPING					
1	Are company name, project number, and dates of surveying specified?				
2	Is the report sealed and signed by a professional Land Surveyor currently registered in the State of Arizona?				
3	Are the mapping and map control used in the study fully described?				
4	Are both horizontal and vertical mapping datums specified?				
5	Are the date of aerial photography, mapping scale, and contour interval specified?				
6	Other.				
SECTION 3: DRAINAGE AREA MAP					
1	Is there a drainage area map at an appropriate scale?				
2	Is each sub-basin area delineated and uniquely labeled with alpha-numeric characters in a consistent manner on the Drainage Area Map?				

Checklist 1: Drainage Design Report Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*****
3	Are directional drainage arrows shown on all streets, parking lots, paved areas, and vacant land?				
4	Is the existing zoning shown on each parcel?				
5	Are existing and proposed catch basins shown and clearly identified?				
6	Does each catch basin number correspond to the number of the sub-basin area which contributes to it?				
7	Are catch basins numbered, beginning with number 1 as the first catch basin contributing to the storm drain at the upstream end? The following catch basins contributing should be numbered consecutively.				
8	Is the same catch basin number used throughout the project – on the drainage area map, in the design report, on the Storm Drain Design Summary Sheet, and on the plans?				
SECTION 4: STORMWATER COLLECTION SYSTEMS					
1	Is the hydrologic design criteria described and does it match the jurisdiction's requirements?				
2	Is the street drainage network described (i.e. longitudinal and cross slopes, curb height, gutter width)?				
3	Is the storm drain network described (i.e. inlet and catch basin design)?				
4	Is a Storm Drain Design Summary Sheet included?				
5	Is conformance with previous drainage studies checked and differences discussed?				
6	Has a Hydraulic & Energy Grade Line Profile been submitted?				
7	Is the pipe velocity for $0.5{*}Q_{design} \geq 3$ fps, $Q_{design} \geq 5$ fps, and ≤ 15 fps?				
8	Are dry lane requirements met?				
9	Are appropriate drainage runoff volumes and discharges used?				
10	Are the diameter, length, slope, and construction material of storm drainpipe (RCP, CMP, or other) specified?				
11	Are appropriate clogging factors applied for inlets, in conformance with the jurisdiction's requirements?				
12	Is the maximum hydraulic grade line ≥ 1 ft below the grate elevation of all catch basins and inlets?				
13	Is the maximum energy grade line at or below the adjacent gutter flow line elevation?				
14	Other.				
SECTION 5: CULVERTS					
1	Is the application described (ie, roadway classification, design setting, erosion/deposition concerns)				
2	Is the hydrologic design criteria used described and does it meet or exceed the minimum standards?				
3	Is the number, diameter, length, and construction material specified appropriately? (ie, CMP, RCP, or other)				
4	For existing condition studies, are appropriate n-values assigned for pipe condition?				

Checklist 1: Drainage Design Report Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*****
5	Are appropriate clogging factors applied for inlets, in conformance with the jurisdiction's requirements?				
6	Does the culvert design for Q_{design} meet the requirements of Table 6.7?				
7	Does the inlet headwater elevation for Q_{100} meet the requirements of Table 6.7?				
8	Does the flow depth over the road for Q_{100} meet the requirements of Table 6.7?				
9	Does backwater at the inlet overtop adjacent land features and drain elsewhere, other than through the culvert?				
10	Does backwater at the inlet affect adjacent parcels of land, requiring ponding easements or establishment of minimum finish floor elevations?				
11	Is the outlet velocity ≤ 15 fps?				
12	Is outlet protection necessary?				
13	If a low water crossing is specified, are cut-off walls provided along the upstream and downstream edges of pavement to limits of flow?				
14	Is a profile provided for each culvert depicting length, slope, cover, road side slopes, design headwater elevation, and any utility conflicts?				
15	Other.				
SECTION 6: RETENTION BASINS					
1	Is the hydrologic design criteria used described and does it match the jurisdiction's requirements?				
2	Have stormwater storage and first flush requirements been met?				
3	Are stormwater storage and first flush calculations included and documented in the report?				
4	Does the maximum basin depth meet the jurisdiction's criteria?				
5	Is an emergency spillway/overflow identified in an appropriate location, and adequately protected from scour?				
6	Are side slopes 4:1 or flatter?				
7	Are appropriate clogging factors applied for inlets, in conformance with the jurisdiction's requirements?				
8	Are debris barriers specified for inlets?				
9	Are access barriers specified for outlets 18 inches in diameter and greater?				
10	Is an upstream siltation basin included if necessary?				
11	Other.				
SECTION 7: FCD FLOOD RETARDING STRUCTURES					
1	Name of structure(s):				
2	Identify phase of FCD Structures Assessment Program and any hydrologic investigations performed as part of the program.				
3	Specify hydrologic design criteria for reservoir, i.e. SPF, 100-yr.				

Checklist 1: Drainage Design Report Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*****
4	Specify inflow design flood for spillway, i.e. 100-yr, or % PMF (dependent on hazard classification).				
5	Other.				
SECTION 8: CANALS					
1	Are any canals located within the project boundaries?				
2	Is a discussion of backwater and overtopping issues provided, and are they adequately addressed?				
3	Other.				
SECTION 9: CONSTRUCTION PLANS					
1	Are all underground utilities identified in plan & profile?				
2	Is a utility “potholes requested” letter (as needed) for capital improvement projects provided?				
3	Are water, and sewer, and natural gas service taps shown in plan & profile?				
4	Are all sanitary sewer manhole rim and invert elevations shown on plans?				
5	Is any existing Portland Cement concrete pavement underlay shown?				
6	Are storm drain conflicts with other utilities identified and addressed?				
7	Have SRP, RID, and private irrigation facilities been checked for conflicts?				
8	Are waterline thrust block conflicts identified and addressed?				
9	Are pipe support locations for sanitary sewer lines above main storm drains identified?				
10	Are existing topography and buildings shown at least 30 feet beyond street R.O.W.?				
11	Are intersecting side street elevations at least 100 feet beyond curb returns noted on plans?				
12	Are potential ponding locations behind sidewalks checked and resolved?				
13	Are driveway/catch basin conflicts checked and resolved?				
14	Are finished floors appropriately elevated relative to the peak 100-year water surface elevations?				
15	Is one typical full-street cross-section with storm drain and applicable other underground utilities shown to scale on each storm drain profile sheet?				
16	Does the mainline storm drain have a minimum of 4-foot of cover (unless otherwise approved)?				
17	Is the farthest upstream catch basin located to meet the flow depth criteria in Table 6.7?				
18	Do all catch basins have a maximum spacing meeting the criteria in Table 6.9?				
19	Have soil boring(s) extending at least 2 feet below the proposed storm drain been taken and shown on the plans or provided in a report?				
20	Are soil boring logs and information including pH and resistivity shown on plans or provided in a report?				

Checklist 1: Drainage Design Report Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*****
21	Are pipe materials designed to accommodate soil conditions? Do existing soil conditions meet requirements for cast-in-place concrete pipe or concrete lined corrugated metal pipe?				
22	Are existing and proposed ground elevations shown for all mainline and connector pipe profiles?				
23	Is a *Storm Drain Key Map* included?				
24	Is a complete alternate pipe chart included?				
25	Does the alternate pipe chart show storm drain pipe diameters 6-inches larger than designed pre-cast concrete pipe diameters? The calculated pipe wall thickness for cast-in-place pipe is based on the required larger size.				
26	Does the alternate pipe chart show cast-in-place concrete pipe to be no smaller than 30 inches in diameter?				
27	Check for permanent pipe supports.				
28	Are there any ACP waterline crossings?				
29	Is there a completed *Storm Drain Design Summary* sheet included with plans?				
30	Are temporary construction easement lines for drainage work shown, if required? Are easement and right-of-way lines shown?				
31	Is the type of work on existing facilities indicated?				
32	Is the direction of flow indicated for ditches, channels, natural waterways, etc.?				
33	Are inlet and outlet elevations shown for all drainage facilities?				
34	Are existing ground line (dashed line) and finished grade line (solid line) profiles shown and labeled?				
35	Is the design slope of profile lines for drainage facilities (ditch, channel, etc.) shown as decimal in ft/ft?				
36	Are pipe culvert material and dimensions labeled?				
37	Are inlet and outlet facilities, if any, such as headwalls, wingwalls, cutoff walls and erosion protection shown and dimensioned?				
38	Are reinforced concrete box culvert dimensions and number of cells shown coupled with wingwall type/dimensions?				
39	Are the type and thickness of drainage facility linings shown?				
SECTION 10: *ADDITIONAL COMMENTS					

Checklist 1: Drainage Design Report Checklist

Item	Description	YES	NO	N/A	*

Checklist 1: Drainage Design Report Checklist					
Item	Description	YES	NO	N/A	*

E.3 CKECKLIST 2: HYDROLOGY SPECIFIC CHECKLIST

Checklist 2: Hydrology Specific Checklist					
Item	Description	YES	NO	N/A	*
SECTION 1: PROJECT DETAILS					
1	PROJECT NAME: REVISION NO: DATE:				
2	SELECT PROJECT TYPE: ADMS[ ] ADMP [ ] WCMP [ ] FDS [ ] Development Review [ ] Regulatory Review [ ] Hydrology Study [ ] Other [ ]				
3	REVIEWED BY:				
4	Are both hard and electronic copies of HEC-1 input and output files included with submittal?				
5	Is the report sealed and signed by a professional Civil Engineer currently licensed to practice in Arizona?				
6	REPORT TITLE:				
7	CONSULTANT:				
8	LIST SOFTWARE, VERSION, and FILE NAMES:				
9	Is this a CIP PROJECT?				
10	Is the development located in a flood hazard area? Check Category: Floodway[ ] Floodplain: A [ ] AH [ ] AE [ ] AO [ ] X [ ] EHZ [ ]				
11	Is there a section on Conclusions and Recommendations, and is it adequate?				
SECTION 2: HYDROLOGY MAPS					
1	Is a map provided that shows study area boundary, sub-basin boundaries, and concentration points?				
2	Check the sub-basin delineation. Are areas, soil and land use types, and topography homogenous for each sub-basin?				
3	Check sub-basin areas. Are areas measured correctly?				
4	Is the naming convention for sub-basins, concentration points, routing reaches, reservoir routes, and flow diversions identified?				
5	Is a map provided that shows time of concentration and hydrograph routing paths?				
6	Is a map provided that shows soils boundaries?				
7	Is a map provided that shows land use boundaries for both existing and developed conditions?				
8	Is the basis and method for estimating vegetation cover (existing and developed) described? Is the method appropriate?				

Checklist 2: Hydrology Specific Checklist					
Item	Description	YES	NO	N/A	*
9	Was "no contributing runoff" assumed for properties with existing 100-year on-site retention, or properties with plans for 100-year on-site retention, which have been reviewed and approved by Maricopa County Planning & Development Services?				
10	Is there a description of watershed condition and watershed resistance? Is selection of K_b and/or K_n values discussed appropriately in that context?				
11	Other.				
SECTION 3: RATIONAL METHOD					
1	Is the maximum individual basin area less than or equal to 160 acres?				
2	If not, then the unit hydrograph method must be used.				
3	Are Runoff C Coefficients and K_b values selected appropriately for each land use type per Tables 6.3 and 6.4?				
4	Have existing land-use runoff coefficients been used where contributory land is vacant or developed prior to storm water storage requirements?				
5	If the Runoff C Coefficients or K_b values do not match the values for the appropriate land use categories in Tables 6.3 and 6.4, is there appropriate written justification and computations?				
6	Are there multiple land use types within individual basins?				
7	If so, are Runoff C Coefficients and K_b values area-averaged appropriately?				
8	Are site specific Depth-Duration-Frequency (D-D-F) values computed properly using PREFRE, and a printout and digital input/output files provided?				
9	Is the T_c path of appropriate location and length on the map?				
10	Is the T_c computed using the District's Rational Method computer program?				
11	If so, is a printout provided and do the input parameters match the report values?				
12	If not, check the iterative computations closely for each basin. Are they correct?				
13	Is each T_c value at least 10-minutes?				
14	Is the peak discharge for each basin computed properly and are the values reasonable?				
15	Is the Rational Method being used to compute peak discharges at intermediate locations within a drainage area less than 160 acres in size?				
16	If so, is the procedure outlined in Section 3.6.2 of the Hydrology Manual followed?				
17	Other.				
SECTION 4: UNIT HYDROGRAPH METHOD					
1	HEC-1 JOB CONTROL RECORDS				
a.	ID record. Are dates, project name, and modeler’s name specified? Are they consistent with reports?				
b.	ID record. Are model revisions clearly identified on subsequent ID records?				

Checklist 2: Hydrology Specific Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*****
c.	IT record (NMIN). If NMIN has been revised, or changed for different models, were dependent parameters (UI, RM, NSTPS) adjusted appropriately?				
d.	IT record (NMIN). Is $0.1\ T_c \le NMIN \le 0.25\ T_c$ for the average value of T_c for the watershed, and the maximum and minimum values? Double check sub-basin delineation if extreme values of T_c make NMIN significantly outside the range.				
e.	IT record (NMIN). Is $NMIN < 0.25*T_c$ for the sub-basin with the shortest T_c?				
f.	IT record (NMIN). Can NMIN be adjusted so that NMIN is approximately equal to $0.15\ T_c$ for the average value of T_c?				
g.	IT record (NMIN). Is 60/NMIN an integer?				
h.	IT record (NMIN). Is NMIN equal to or evenly divisible by JXMIN on the IN record?				
I.	IT record (NMIN, NQ). Is NMIN*NQ at least as long as the storm duration?				
j.	IN record (JXMIN). Is the IN record used correctly?				
k.	Is *DIAGRAM specified for at least one HEC-1 model in the study? One for each model with differences other than storm frequency.				
l.	IO record (IPRT). Is Level 3 or lower output used for at least one HEC-1 model in the study? One for each model with differences other than storm frequency? Level 3 should be used for the model of the largest storm.				
m.	JP record. Is (NPLAN*NRATIO) < 45?				
n.	JP record. Is (NPLAN*NRATIO*NQ) < 4800?				
o.	JD record. Are JD records used and applied appropriately?				
p.	JD record. When using JD records for FRS volume computation, were the interpolated volumes from each sub-basin used?				
q.	Other.				
2	PRECIPITATION AND RAINFALL DISTRIBUTION				
a.	Check rainfall frequency and duration in the report and HEC-1 files. Identify the source of rainfall data, i.e. NOAA Atlas 2, HMR-49. Is the source appropriate for the study area and type?				
b.	PB record. Specify rainfall depth. Is areal reduction applied correctly and discussed in the text?				
c.	PI and PC records. Were PC or PI records checked against the IN record?				
d.	PI and PC records. Were PC or PI records checked against distribution patterns?				
e.	Are design storm distributions applied correctly?				
f.	Other.				
3	RAINFALL LOSSES				
a.	Are Green-Ampt loss rate parameters specified and are the selected values for IA, DTHETA, XKSAT, PSIF, and RTIMP reasonable?				
b.	Is the watershed moisture condition assumption described for the selection of DTHETA?				
c.	Are there different moisture condition land uses present within individual sub-basins (agricultural and natural, for instance)?				
d.	If so, are the values area averaged appropriately?				

Checklist 2: Hydrology Specific Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*****
e.	Is area averaging of Green & Ampt parameters performed using the current version of DDMSW, or by external means or old versions of DDMSW/MCUHP? Check those that use older versions of DDMSW/MCUHP more closely. Check those using external means very closely.				
f.	Is bare ground XKSAT adjusted for vegetation cover? Is the adjustment appropriate?				
g.	Does the watershed span multiple NRCS (SCS) Soil Surveys? Are differences in soil texture between adjacent soil surveys discussed in the text and addressed if necessary in the models?				
h.	Is there a discussion of natural RTIMP present in the watershed?				
I.	Is natural RTIMP assumed to be hydraulically connected, have any adjustments been made to the percentages listed for the soil types, and are the revisions reasonable and adequately documented?				
j.	Other.				
4	HYDROGRAPHS				
a.	Specify method of hydrograph generation, i.e. Clark, S-graph. Is the method appropriate?				
b.	UC record (T_c). Are T_c parameters L, S, and K_b reasonable?				
c.	Is T_c < 90 minutes for each sub-basin?				
d.	Does T_c exceed the duration of rainfall excess for any sub-basin? This should be documented in the text.				
e.	UC record (R). Is R ≥ 0.5xNMIN?				
f.	UC record (T_c). Check against similar sub-basins. Are T_c values reasonable?				
g.	UC record (T_c). Were Tc values checked to ensure that average velocities throughout the watershed are reasonable?				
h.	HC record. Are hydrographs combined properly?				
i.	HC record. Is HC ≤ 5?				
j.	HC record (TAREA). Is total area correct? Was area above the concentration point manually recalculated for diverted hydrographs?				
k.	Other.				
5	CHANNEL/PIPE ROUTING METHODS				
a.	Are specific channel/pipe routing method(s) specified, i.e. modified Puls, normal depth, Muskingum, Muskingum-Cunge, kinematic wave, and are the methods appropriate?				
b.	RC record (RLNTH). Check reach lengths. Were lengths measured correctly?				
c.	RC record (ANL, ANCH, ANR). Were Manning's "n" values developed using methodology in *Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona* (April 1991)?				
d.	RC record (ANL, ANCH, ANR). Are Manning's "n" values reasonable?				
e.	RX and RY records. Are cross sections typical for the routing reach? If not, does the reach need to be broken into multiple reaches?				
f.	Are NSTPS generally equal to L/(V_{avg} * NMIN)?				
g.	Is NSTEP for each reach within +/- 1 of TT/NMIN, where TT is the travel time for the reach computed by HEC-1?				

Checklist 2: Hydrology Specific Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*****
h.	Are transmission losses modeled? If so, is there an acceptable discussion of the reasons for modeling losses, and the source of the parameters?				
i.	Are there questionable routing operations identified above that warrant plotting and visual examination of the hydrograph?				
j.	Other.				
6	RESERVOIR (STORAGE) ROUTING METHODS				
a.	Are USGS, FCD, NWS, or other rain or stream gages used in hydrologic analysis or model calibration identified and discussed?				
b.	Are stage-storage relationships modeled correctly?				
c.	Are stage-discharge relationships modeled correctly?				
d.	RS record. Are NSTPS = 1? If NSTPS is changed, travel time and attenuation will be affected.				
e.	RS record (ITYP, RSVRIC). Are starting conditions modeled appropriately?				
f.	Are rating curves for storage and outflow hydraulics included? Are the rating curves reasonable?				
g.	Is there an acceptable discussion of the basis for estimation of storage and outflow parameters in the text, and a discussion of reservoir routing results?				
h.	Other.				
7	DIVERSION DATA				
a.	DI/DQ records. Are diversions/split flows modeled correctly?				
b.	Are hydraulic computations for diversions done appropriately and included in the report?				
c.	Are rating curves for each diversion plotted and included in the report?				
d.	Are watershed areas corrected using the HC record where diverted hydrographs are recalled into the model?				
e.	Other.				
SECTION 5: HEC-1 OUTPUT					
1	ERROR AND WARNING MESSAGES				
a.	Are there error or warning messages related to hydrograph generation or combination that are not adequately addressed in the test, or are critical?				
b.	Are there error or warning messages related to routing that are not adequately addressed in the text? Specifically check for peak discharge outside of specified range warnings and lack of hydraulic capacity for the reach cross-section.				
c.	Have error and warning messages been checked and corrected? Are error and warning messages explained adequately?				
d.	Other.				
2	SCHEMATIC DIAGRAM				
a.	Compare the schematic to the watershed map. Is the structure logical? Are all points labeled clearly? Specify any problems.				
b.	Are there < 9 hanging hydrographs?				
c.	Have all of the diverted hydrographs been accounted for?				
d.	Are all sub-areas attached and combined in the proper sequence?				
e.	Other.				
3	DRAINAGE AREA				

Checklist 2: Hydrology Specific Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*****
a.	Has the area associated with all returned diverted hydrographs been returned?				
b.	Check total drainage area. Is it accurate?				
c.	Other.				
4	RAINFALL LOSSES				
a.	Check the total rainfall, total losses, and total runoff for each sub-basin. Are there zeros or very small numbers? Explain.				
b.	Other.				
5	HYDROGRAPH ROUTING				
a.	Is outflow peak discharge < inflow peak discharge?				
b.	Is flow contained within x-sections?				
c.	Check travel time. Does travel time appear to be too short or too long? If so, check input parameters for routing. Check routing steps in the input against the output velocity.				
d.	Is attenuation of peak flows reasonable?				
e.	For kinematic wave routing, is the peak flow attenuated? If so, check model and revise.				
f.	Other.				
6	PEAK RUNOFF				
a.	Is specific yield (cfs/sq mi) for each sub-basin included in the report?				
b.	Other.				
7	TIME TO PEAK				
a.	Check the time to peak column in the HEC-1 summary table. Do times to peak increase with increasing drainage area?				
b.	Are all times to peak very close or identical to one another? If so, NMIN and routing operations may need to be revised.				
c.	Do all times to peak occur after the most intense period of rainfall (about half the rainfall duration)?				
d.	Other.				
8	RUNOFF VOLUMES				
a.	Are runoff volumes reasonable?				
b.	Other.				
SECTION 6: MODEL CALIBRATION AND INDIRECT METHODS VERIFICATION					
1	INSTRUMENTATION				
a.	Identify USGS, FCD, NWS, or other rain or stream gages used in hydrologic analysis or model calibration.				
b.	Have any gages been relocated during the period of record? Discuss.				
c.	Other.				
2	INDIRECT METHODS/STATISTICAL ANALYSES				
a.	Have statistical analyses been performed and are the results discussed?				
b.	Are USGS regression equations used, the sources identified, and are they appropriate and implemented correctly?				
c.	Is the period of record adequate for use with *Water Resources Council Bulletin 17B* (March 1982)?				
d.	Are any other Indirect Methods used, the sources identified, and are they appropriate and implemented correctly?				
e.	Are the model results reasonable based on comparisons with the results of the application of Indirect Methods?				

Checklist 2: Hydrology Specific Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*****
f.	Other.				
SECTION 7: ADDITIONAL COMMENTS					

Checklist 2: Hydrology Specific Checklist					
Item	Description	YES	NO	N/A	*

E.4 CHECKLIST 3: HEC-RAS HYDRAULICS SPECIFIC CHECKLIST

Checklist 3: HEC-RAS Hydraulics Specific Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*
SECTION 1: PROJECT DESCRIPTION					
1	PROJECT NAME: REVISION NO: DATE:				
2	SELECT PROJECT TYPE: ADMS[ ] ADMP [ ] WCMP [ ] FDS [ ] Development Review [ ] Regulatory Review [ ] Hydrology Study [ ] Other [ ]				
3	REVIEWED BY:				
4	Is there a project description?				
5	Does the description include the study name, District contract number, consultant name and address?				
6	Does the description include the purpose of the model (floodplain delineation study, channel project, …)?				
7	Are the data sources identified?				
8	Are general assumptions listed?				
9	Are the events being modeled identified (100-year, SPF, multiple year, …)?				
10	Is the project file name appropriate for the project? Names like a, b, job 1, and FIS are not acceptable.				
11	Is there an adequate map that shows the topography, cross sections, thalwegs, labels, floodplain and floodway limits, and left and right bank locations?				
12	Is the version of the hydraulic model used to do the study listed?				
13	Is there a section on Conclusions and Recommendations, and is it adequate?				
SECTION 2: FILES					
1	Note the number of geometry, flow data, and plan files. Should multiple models be created?				
2	Are the file names appropriate?				
3	Do the file names reflect the project name, and what each file includes?				
SECTION 3: FLOW DATA					
1	Are the changes in discharge input at the correct locations, and are the values correct?				
2	For floodplain studies are Floodplain (or FP) and Floodway (or FW) being used for the profile names?				
3	For other studies do the profile names reflect what is being modeled (25-yr, 50-yr, …)?				
4	Are the upstream and downstream boundary conditions appropriate for the model?				
5	Are any internal rating curves or fixed changes in water surface elevations being used?				
SECTION 4: GEOMETRY FILE					
1	Are rivers and reaches named correctly? Names like a, b, and Job 1 are not acceptable.				
2	Are the junction names acceptable?				
3	Are the cross sections identified in river miles for floodplain delineations (feet may be used for Non-FEMA delineations)?				

Checklist 3: HEC-RAS Hydraulics Specific Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*****
4	Do cross section start and stop locations and length on the map match the geometry file?				
5	Are cross sections oriented with stationing from left to right looking downstream?				
6	Are cross sections stationed using 10,000 at the thalweg?				
7	Are comments included where appropriate in the cross section descriptions?				
8	Are reach lengths measured correctly? They should be measured at the center of the mass of flow.				
9	Are the bank station locations appropriate? Bank stations can be different for different events.				
10	Are contraction/expansion coefficients appropriate? (note: culverts may use larger values than bridges)				
11	Are blocked flow, levees, or ineffective flow being used, and used correctly?				
12	Are the n values appropriate? (for design projects there should be a range of n values)				
13	Are bridges and culverts being modeled correctly? Is there pressure flow, weir flow, or both?				
14	Are any inline weirs or spillways being used?				
15	If yes, are weir coefficients acceptable and are they modeled appropriately?				
16	Are interpolated cross sections being used? If yes, why?				
SECTION 5: CALCULATIONS					
1	Does the plan file have an adequate description?				
2	Are the correct flow and geometry files being used?				
3	Is an appropriate starting WSEL method used and explained, and is it applied correctly?				
4	Are ineffective flow areas identified and addressed appropriately?				
5	Are there any breakouts?				
6	Are bridges and culverts modeled appropriately, including ineffective flow?				
6	Is the correct flow regime (sub, mixed, or super) being used (subcritical only for floodplain studies)?				
8	Are encroachments used?				
9	If encroachments are used, are they applied properly using the water surface or energy grade line and show < 1.0 foot increases at every cross section?				
10	Are the floodplain and floodway delineations done in accordance ADWR State Standards 2-96, 3-94 and 9-02?				
11	Is the flow distribution option turned on, if appropriate?				
12	Is the appropriate method used for conveyance calculations and the friction slope?				
SECTION 6: REPORT FILE					
1	Does the Report File printouts of all the input data including (geometry, flow, plan)?				
2	Are all the profiles included in the output results?				
3	Are appropriate summary tables included?				
SECTION 7: REVIEWING THE RESULTS					

Checklist 3: HEC-RAS Hydraulics Specific Checklist

Item	Description	YES	NO	N/A	*
1	Check the Froude numbers, does critical flow (or close to critical flow) occur anywhere?				
2	Does at least a portion of the flow occupy the channel?				
3	Is the percentage of flow in the main channel less than 25%? Examine model carefully if yes.				
4	Are there large changes in depth and/or velocity between cross sections?				
SECTION 8: ERRORS					
1	Are there any extended cross sections?				
2	Does divided flow occur?				
SECTION 9: *ADDITIONAL COMMENTS					

Page Intentionally Left Blank

E.5 CHECKLIST 4: TECHNICAL DATA NOTEBOOK CHECKLIST

Checklist 4: Technical Data Notebook Checklist					
Item	**Description**	**YES**	**NO**	**N/A**	*****
SECTION 1: COVER SHEET					
1	Is the Study Name included, and is it correct?				
2	Is the date correct?				
3	Are revision dates included?				
4	Is the consultant's name (address and telephone number) included?				
5	Is the District's contract number included?				
6	Are the cover and Table of Contents sealed by a professional Civil Engineer currently licensed to practice in Arizona?				
SECTION 2: DOCUMENT FORMAT AND LAYOUT					
1	Is the document prepared in accordance with ADWR SS 1-96?				
2	If new topographic mapping, survey notes and data are included, are they sealed by professional Land Surveyor currently licensed to practice in Arizona?				
3	Does the TDN Binder include all the labels and logos of the study partners, including FEMA?				
4	Are Section Corners labeled on the Study Maps?				
SECTION 3: MODEL PRINTOUT					
1	Are printouts from the hydrologic and hydraulic models included? Hydrologic and hydraulic models need to be fully documented in a way that isn't subject to change, therefore printouts of the models must be included in the TDN.				
2	Do the printouts include the input data and the results?				
3	For HEC-RAS models, is a HEC-RAS generated report included?				
4	Do HEC-RAS report files include both the input data and the detailed calculation results? Printouts which contain only HEC-RAS summary tables are not acceptable.				
5	Do the units shown on the flood profiles, such as River Miles, match those used in the hydraulic models?				
6	Are all modeled reaches included in the Floodway tables?				
SECTION 4: COMPACT DISKS					
1	Are electronic copies of the hydrologic and hydraulic models included on CD? (mandatory)? CDs are the only acceptable mediums at this time.				
2	Are all of the input and output files for all computer models used included on CD? (mandatory)? In general the input files shouldn't be zipped, but if space is a problem it is acceptable to zip the output files.				
3	Is the CD labeled with such items as the study name, contract number, consultant's name, date, general description of what is on the CD, the names of all the watercourses studied or the names of all the files on the CD? (mandatory)				
4	Is a "README" file included on the CD, and in ASCII text file format?				

Checklist 4: Technical Data Notebook Checklist

Item	Description	YES	NO	N/A	*
5	Does the minimum information in the "README" file include: Name and address of study contractor; name, county and state of the community; name of the hydrologic/hydraulic computer program used; and the name of each input and output file including a model description, stream name and date of creation? The consultant should include additional information as is necessary.				
6	Is a printed copy of the "README" file located in the TDN next to the CD? (mandatory)				
7	In the case of multiple models, is a simple line diagram included depicting the relative location of the models to each other?				
8	Are all file names unique to the project, and worded in a manner related to the project and the scenario(s) being modeled? File names like a, b, c, job 1, floodplain, and FIS are not acceptable types of names and their use should be avoided.				
9	Has the consultant included on the CD scanned images of the final (signed and sealed) drawings or exhibits, original CAD files, the TDN in electronic format, and any other electronic files the consultant may have generated? (not mandatory, but preferred)				
SECTION 5: *ADDITIONAL COMMENTS					

Checklist 4: Technical Data Notebook Checklist

Item	Description	YES	NO	N/A	*

Page Intentionally Left Blank

F. DATA FOR INDIRECT METHODS

F.1 METHOD 2 USGS DATA LISTING

Table F.1 USGS stream gage LP3 data listing

with drainage areas between 0.1 and 10,000 square miles

(sorted by Flood Region then by drainage area in ascending order)

Flood Region	Drainage Area sq. miles	Gage No.	LP3 Data From Paretti, Kennedy, Turney and Veilleux (2014), cfs					
			Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
1	1.26	9419623	3	40	104	189	321	517
1	1.79	9338500	21	118	222	334	482	676
1	3.81	9378630	12	62	108	154	209	276
1	4.04	9460150	43	712	1,940	3,690	6,550	11,000
1	4.75	9442630	61	140	191	234	281	332
1	9.33	9442695	226	866	1,420	1,960	2,610	3,400
1	9.87	9406300	144	601	1,010	1,410	1,900	2,490
1	12.10	9369500	103	270	379	471	570	678
1	16.30	9489200	103	245	332	401	474	551
1	16.80	9383600	71	221	331	428	537	660
1	18.80	9408400	68	230	358	475	613	774
1	20.40	9338000	199	375	469	540	612	686
1	23.10	9343500	189	403	526	623	724	829
1	28.90	9383400	163	403	555	681	816	963
1	29.40	9405420	213	589	859	1,100	1,370	1,680
1	31.80	9442660	169	873	1,550	2,230	3,080	4,130
1	34.50	9365500	408	921	1,220	1,460	1,700	1,960
1	35.20	9336000	418	1,620	2,610	3,550	4,670	5,990
1	37.30	9378650	127	590	1,000	1,400	1,880	2,450
1	38.40	9489070	241	925	1,470	1,960	2,540	3,190
1	39.50	9368500	320	802	1,120	1,380	1,670	1,990
1	39.80	9490800	184	323	397	454	513	573
1	44.40	9336400	744	2,390	3,680	4,870	6,260	7,900
1	45.30	9331500	186	592	896	1,170	1,480	1,830
1	46.80	9492400	259	700	1,020	1,310	1,650	2,030
1	67.60	9337000	181	551	807	1,030	1,260	1,530
1	73.10	9430600	847	4,940	9,310	14,000	20,000	27,900
1	75.20	9366000	241	836	1,330	1,790	2,350	3,010
1	78.50	9491000	412	1,020	1,420	1,770	2,160	2,590

Table F.1 USGS stream gage LP3 data listing

with drainage areas between 0.1 and 10,000 square miles

(sorted by Flood Region then by drainage area in ascending order)

Flood Region	Drainage Area sq. miles	Gage No.	LP3 Data From Paretti, Kennedy, Turney and Veilleux (2014), cfs					
			Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
1	83.40	9383500	93	357	575	777	1,020	1,300
1	90.40	9429900	200	762	1,220	1,630	2,120	2,690
1	95.60	9442692	72	354	615	870	1,180	1,560
1	105.00	9329900	75	417	771	1,140	1,620	2,230
1	105.00	9330500	489	1,550	2,380	3,160	4,070	5,140
1	114.00	9489700	647	2,290	3,610	4,820	6,260	7,920
1	128.00	9346200	1,030	1,820	2,250	2,570	2,900	3,240
1	130.00	9503800	531	1,600	2,370	3,050	3,810	4,660
1	144.00	9386100	269	687	959	1,190	1,440	1,710
1	309.00	9366500	641	2,180	3,440	4,640	6,080	7,800
1	314.00	9489100	1,730	6,260	10,000	13,600	17,900	23,100
1	319.00	9337500	848	2,350	3,340	4,180	5,100	6,090
1	333.00	9442680	841	3,540	6,150	8,840	12,300	16,700
1	419.00	9442740	311	1,310	2,160	2,970	3,930	5,050
1	556.00	9489500	2,160	7,220	11,200	14,800	19,000	23,900
1	711.00	9384000	706	2,640	4,340	5,990	8,040	10,600
2	0.10	9401300	11	47	79	110	147	193
2	0.22	9357200	127	376	548	694	855	1,030
2	0.24	9384200	41	77	96	111	127	142
2	0.27	9404310	13	66	119	173	243	330
2	0.34	9395850	120	158	174	185	195	205
2	0.35	9385800	52	205	339	468	626	816
2	0.37	9395600	72	281	452	609	792	1,000
2	0.71	9403750	4	53	129	230	383	609
2	0.78	9396400	189	558	814	1,040	1,280	1,550
2	0.79	9401245	116	246	321	380	442	506
2	0.98	9379980	68	140	181	213	247	283
2	1.06	9367400	63	312	563	825	1,160	1,600
2	1.27	9395100	36	110	164	212	266	327
2	1.31	9379060	17	80	138	197	272	363
2	1.78	9400560	119	341	496	631	782	950
2	2.05	9367840	273	894	1,350	1,760	2,210	2,730
2	2.20	9368020	125	506	829	1,140	1,500	1,940
2	2.95	9367530	96	337	532	714	931	1,190

Table F.1 USGS stream gage LP3 data listing

with drainage areas between 0.1 and 10,000 square miles

(sorted by Flood Region then by drainage area in ascending order)

Flood Region	Drainage Area sq. miles	Gage No.	LP3 Data From Paretti, Kennedy, Turney and Veilleux (2014), cfs					
			Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
2	3.16	9403930	22	212	465	763	1,180	1,760
2	3.22	9356400	311	888	1,300	1,660	2,070	2,540
2	3.23	9400910	5	59	138	238	387	598
2	4.68	9367550	125	958	1,970	3,110	4,680	6,770
2	4.75	9383020	18	252	650	1,190	2,030	3,300
2	5.04	9350700	11	76	158	253	386	570
2	5.41	9400580	86	534	1,030	1,560	2,260	3,170
2	5.42	9392800	30	402	1,010	1,810	3,050	4,890
2	5.43	9401210	27	70	99	122	149	177
2	5.93	9400530	66	179	254	318	389	467
2	6.00	9379560	480	1,370	2,010	2,580	3,220	3,940
2	6.18	9400650	40	244	458	684	974	1,340
2	6.40	9400565	340	1,000	1,470	1,880	2,330	2,840
2	7.06	9367900	455	1,720	2,740	3,680	4,760	6,020
2	7.92	9400100	222	849	1,370	1,870	2,460	3,150
2	8.81	9367860	1,080	3,760	5,830	7,690	9,820	12,200
2	9.10	9356520	67	405	765	1,140	1,640	2,260
2	15.40	9408000	150	1,340	2,990	5,010	7,980	12,200
2	16.70	9395200	96	519	950	1,400	1,970	2,700
2	17.80	9363100	214	533	736	905	1,090	1,280
2	19.80	9400290	641	896	1,010	1,090	1,170	1,240
2	20.40	9387050	73	264	422	570	747	957
2	21.60	9367980	146	1,230	2,690	4,460	7,040	10,700
2	22.00	9381100	897	3,270	5,260	7,160	9,450	12,200
2	22.10	9355700	314	1,090	1,690	2,240	2,880	3,620
2	26.70	9367880	1,660	4,110	5,660	6,940	8,310	9,790
2	27.50	9397800	134	473	740	984	1,270	1,600
2	45.70	9367930	805	1,400	1,710	1,940	2,180	2,410
2	56.30	9330120	525	1,880	2,950	3,930	5,070	6,380
2	58.00	9355000	395	907	1,240	1,520	1,840	2,180
2	60.20	9350800	140	751	1,370	2,010	2,840	3,880
2	65.50	9379300	2,200	6,090	8,720	11,000	13,400	16,100
2	68.00	9390500	311	2,570	5,530	9,040	14,000	21,000
2	68.90	9400300	621	1,360	1,800	2,150	2,510	2,900

Table F.1 USGS stream gage LP3 data listing

with drainage areas between 0.1 and 10,000 square miles

(sorted by Flood Region then by drainage area in ascending order)

Flood Region	Drainage Area sq. miles	Gage No.	LP3 Data From Paretti, Kennedy, Turney and Veilleux (2014), cfs					
			Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
2	74.50	9404450	101	361	582	794	1,050	1,370
2	76.50	9403500	725	1,780	2,450	3,010	3,600	4,240
2	77.40	9379030	740	2,540	3,900	5,110	6,500	8,060
2	90.90	9379800	1,350	3,970	5,790	7,360	9,110	11,100
2	101.00	9403000	433	1,560	2,520	3,430	4,530	5,850
2	113.00	9409100	93	559	1,080	1,660	2,440	3,470
2	136.00	9367561	177	1,750	3,960	6,690	10,700	16,300
2	136.00	9334000	1,190	5,000	8,340	11,600	15,400	20,100
2	148.00	9400583	442	1,110	1,540	1,900	2,290	2,720
2	194.00	9403600	332	1,650	2,920	4,210	5,830	7,830
2	199.00	9381500	2,730	6,210	8,330	10,100	11,900	13,900
2	204.00	9378700	1,100	4,620	7,860	11,100	15,200	20,200
2	251.00	9399400	455	2,490	4,530	6,620	9,270	12,600
2	257.00	9404222	455	1,680	2,690	3,630	4,740	6,050
2	272.00	9397500	1,670	9,940	18,600	27,600	39,200	53,900
2	276.00	9404208	1,640	7,720	13,500	19,200	26,400	35,200
2	277.00	9334500	2,200	5,970	8,510	10,700	13,100	15,700
2	317.00	9404900	800	3,160	5,120	6,940	9,100	11,600
2	318.00	9398500	2,430	12,200	21,600	30,900	42,500	56,800
2	346.00	9372000	920	2,040	2,700	3,240	3,800	4,390
2	478.00	9401110	1,180	2,550	3,370	4,030	4,720	5,450
2	494.00	9395900	2,480	6,010	8,200	9,980	11,900	13,900
2	527.00	9371000	1,110	2,750	3,800	4,680	5,630	6,670
2	549.00	9395500	1,670	6,860	11,300	15,500	20,500	26,500
2	578.00	9367680	593	1,810	2,730	3,570	4,530	5,650
2	607.00	9399000	2,380	13,500	25,300	37,800	54,200	75,200
2	647.00	9381800	2,570	6,790	9,630	12,000	14,700	17,700
2	759.00	9398000	2,550	10,100	16,800	23,300	31,400	41,300
2	812.00	9397100	4,660	7,120	8,310	9,170	10,000	10,900
2	840.00	9393500	2,580	7,690	11,400	14,600	18,200	22,200
2	922.00	9406000	3,770	9,780	13,900	17,300	21,200	25,600
2	1124.00	9403780	864	2,990	4,650	6,170	7,930	9,960
2	1231.00	9401260	3,180	7,170	9,530	11,400	13,400	15,500
2	1362.00	9382000	3,090	8,710	12,500	15,600	19,100	22,800

Table F.1 USGS stream gage LP3 data listing

with drainage areas between 0.1 and 10,000 square miles

(sorted by Flood Region then by drainage area in ascending order)

Flood Region	Drainage Area sq. miles	Gage No.	LP3 Data From Paretti, Kennedy, Turney and Veilleux (2014), cfs					
			Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
2	1393.00	9401280	6,850	14,600	19,100	22,600	26,300	30,200
2	1450.00	9408150	4,410	10,600	14,400	17,400	20,600	24,000
2	1731.00	9401400	3,560	8,290	11,100	13,400	15,900	18,400
2	1749.00	9386200	441	2,220	4,060	6,030	8,630	12,000
2	1881.00	9401500	3,400	6,650	8,470	9,890	11,400	12,900
2	2160.00	9396100	4,840	12,400	17,200	21,100	25,400	30,000
2	3612.00	9379200	2,060	5,950	8,730	11,200	13,900	17,000
2	3854.00	9413200	3,830	12,000	17,800	22,800	28,500	34,800
2	4370.00	9367950	3,820	6,240	7,430	8,310	9,190	10,100
2	4858.00	9415000	4,560	13,900	21,000	27,500	35,000	43,800
2	7652.00	9394500	3,720	10,500	15,000	18,700	22,900	27,300
3	0.15	9429510	27	92	142	189	242	304
3	0.28	9424050	40	96	130	159	190	223
3	0.44	9520350	17	73	123	172	232	306
3	0.56	9520110	135	223	267	299	331	362
3	0.58	7093	85	344	499	612	719	819
3	0.63	9424700	12	145	348	608	998	1,560
3	0.83	9520300	136	329	450	550	658	775
3	0.84	9517200	106	380	595	790	1,020	1,280
3	0.87	9423350	26	355	930	1,730	3,040	5,090
3	0.91	9428545	41	163	266	361	475	607
3	1.01	9512700	310	702	942	1,140	1,350	1,570
3	1.12	9428570	67	278	461	636	849	1,100
3	1.22	9419590	31	196	382	588	866	1,230
3	1.53	9520230	133	397	584	747	929	1,130
3	1.80	9427700	16	232	597	1,090	1,860	3,030
3	1.83	7113	215	705	1,080	1,420	1,820	2,280
3	1.85	9520160	204	920	1,550	2,160	2,880	3,750
3	1.87	9424430	31	442	1,140	2,090	3,590	5,880
3	2.82	9423300	44	262	495	742	1,060	1,470
3	3.13	9429150	84	484	890	1,310	1,840	2,500
3	3.64	9519600	303	692	929	1,120	1,330	1,540
3	3.92	5588	210	1,250	2,310	3,410	4,820	6,570
3	5.44	9515800	278	1,530	2,790	4,070	5,690	7,710

Table F.1 USGS stream gage LP3 data listing

with drainage areas between 0.1 and 10,000 square miles

(sorted by Flood Region then by drainage area in ascending order)

Flood Region	Drainage Area sq. miles	Gage No.	LP3 Data From Paretti, Kennedy, Turney and Veilleux (2014), cfs					
			Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
3	6.21	9516600	325	1,240	2,000	2,710	3,570	4,580
3	6.35	9520130	518	1,310	1,800	2,210	2,650	3,110
3	8.41	9423760	31	476	1,270	2,370	4,150	6,890
3	8.64	7083	300	2,180	4,450	7,010	10,500	15,300
3	9.29	9512970	515	1,470	2,130	2,700	3,340	4,050
3	10.80	5583	154	1,090	1,850	2,470	3,120	3,780
3	11.00	9520100	202	929	1,590	2,240	3,030	3,990
3	11.60	9513820	558	1,760	2,390	2,840	3,260	3,640
3	11.80	9535200	1,820	2,740	3,170	3,480	3,770	4,070
3	12.20	9520200	396	827	1,070	1,270	1,470	1,670
3	12.80	9428800	314	1,320	2,170	2,970	3,920	5,040
3	14.60	9428550	323	1,800	3,300	4,850	6,820	9,280
3	14.90	9423900	39	751	2,130	4,140	7,460	12,700
3	17.70	9419680	3	188	793	1,990	4,500	9,450
3	18.30	6953	630	1,950	2,670	3,190	3,690	4,160
3	27.50	9419682	75	1,290	3,510	6,630	11,700	19,500
3	31.70	9419545	151	2,270	6,200	11,900	21,300	36,500
3	49.60	5108	637	1,260	1,600	1,860	2,140	2,420
3	59.20	9418990	10	898	4,390	12,000	29,300	65,400
3	59.80	9512100	367	3,390	7,460	12,300	19,300	28,900
3	59.90	9512860	930	4,490	7,830	11,200	15,300	20,300
3	63.90	9517400	650	1,670	2,360	2,940	3,580	4,290
3	65.00	9513860	940	7,130	14,400	22,400	33,200	47,300
3	66.10	9419647	42	798	2,270	4,430	8,020	13,800
3	68.40	9513780	1,870	12,200	23,400	35,200	50,700	70,300
3	69.50	9519750	528	2,270	3,800	5,260	7,040	9,160
3	72.80	9512280	1,010	8,380	17,500	27,800	42,000	60,700
3	84.70	9517280	1,150	4,050	6,280	8,290	10,600	13,200
3	84.70	9513800	2,760	13,500	23,700	33,800	46,300	61,600
3	109.00	7013	1,080	8,960	18,900	30,200	45,900	67,100
3	118.00	7043	534	4,130	8,760	14,200	22,100	32,900
3	123.00	9512300	1,540	7,880	13,900	20,000	27,500	36,700
3	126.00	9519760	576	2,110	3,330	4,460	5,770	7,280
3	138.00	9516800	1,040	7,510	15,000	23,300	34,400	48,900

Table F.1 USGS stream gage LP3 data listing with drainage areas between 0.1 and 10,000 square miles (sorted by Flood Region then by drainage area in ascending order)								
Flood Region	Drainage Area sq. miles	Gage No.	LP3 Data From Paretti, Kennedy, Turney and Veilleux (2014), cfs					
			Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
3	153.00	9516790	699	2,620	4,150	5,540	7,150	9,000
3	186.00	9513835	2,360	13,700	25,300	37,400	52,800	72,100
3	244.00	9520170	2,980	6,300	8,250	9,810	11,500	13,200
3	253.00	9417300	224	2,520	6,170	11,000	18,600	30,100
3	345.00	6833	568	2,420	3,580	4,450	5,290	6,090
3	375.00	9404343	1,240	7,620	14,600	22,000	31,800	44,400
3	416.00	9515500	4,040	18,400	31,100	43,400	58,300	76,100
3	416.00	5308	2,520	17,500	34,600	53,400	78,400	111,000
3	418.00	9514200	884	3,900	6,570	9,150	12,300	16,000
3	579.00	9535100	1,000	3,720	6,060	8,310	11,100	14,400
3	606.00	9513890	3,370	19,900	37,100	55,100	78,300	108,000
3	623.00	9513910	1,780	14,500	30,100	47,700	71,700	104,000
3	709.00	5228	2,600	17,200	33,400	50,800	73,800	103,000
3	773.00	9423820	1,970	9,880	17,400	24,900	34,300	45,800
3	796.00	9516500	3,070	16,200	29,200	42,500	59,400	80,400
3	1111.00	9512800	6,650	31,700	55,700	79,900	110,000	148,000
3	1290.00	9535300	897	2,630	3,960	5,170	6,590	8,250
3	1423.00	9517000	2,800	13,700	24,100	34,500	47,600	63,500
3	1433.00	9425500	2,930	19,900	38,600	58,500	84,500	118,000
3	1681.00	9517490	681	6,820	15,300	25,400	39,900	60,000
3	3854.00	9416000	210	1,120	2,120	3,230	4,740	6,770
4	0.11	9451800	15	58	93	126	164	210
4	0.17	9504800	3	48	130	243	425	704
4	0.53	9505900	20	145	293	457	679	970
4	0.73	9451900	102	262	368	456	553	658
4	0.85	9504100	3	59	180	366	691	1,230
4	0.86	9468300	22	247	576	985	1,590	2,430
4	0.98	9512420	173	470	677	855	1,050	1,280
4	1.08	9498503	10	98	219	366	577	871
4	1.11	9456680	78	355	601	840	1,130	1,470
4	1.16	9456820	69	221	335	439	558	695
4	1.19	9504400	104	343	527	694	886	1,110
4	1.20	9455800	95	232	317	387	462	542
4	1.36	9505220	39	227	438	674	994	1,420

Table F.1 USGS stream gage LP3 data listing

with drainage areas between 0.1 and 10,000 square miles

(sorted by Flood Region then by drainage area in ascending order)

Flood Region	Drainage Area sq. miles	Gage No.	LP3 Data From Paretti, Kennedy, Turney and Veilleux (2014), cfs					
			Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
4	1.76	9462200	444	785	960	1,090	1,230	1,360
4	2.34	9424410	14	185	461	823	1,380	2,210
4	2.72	9510170	92	300	456	595	753	933
4	3.96	9430300	99	291	431	554	693	851
4	4.51	9510100	43	427	973	1,650	2,650	4,070
4	4.60	9496800	284	1,020	1,610	2,170	2,820	3,600
4	4.62	9510070	38	502	1,260	2,260	3,810	6,120
4	4.67	9458200	72	381	704	1,050	1,500	2,090
4	4.76	9507700	92	536	1,020	1,550	2,250	3,170
4	6.35	9507600	295	1,780	3,440	5,260	7,700	10,900
4	6.55	9498900	264	1,480	2,700	3,970	5,570	7,570
4	8.18	9424480	139	917	1,820	2,820	4,180	5,980
4	9.83	9510080	67	959	2,470	4,510	7,700	12,500
4	14.50	9503750	240	1,600	3,170	4,910	7,270	10,400
4	15.00	9456400	495	1,900	3,060	4,130	5,400	6,880
4	15.20	9510180	999	2,540	3,560	4,420	5,360	6,400
4	25.10	9505300	767	2,850	4,520	6,050	7,840	9,910
4	29.20	9501300	1,030	5,210	9,190	13,200	18,100	24,100
4	30.20	9502960	1,530	3,220	4,220	5,010	5,850	6,730
4	34.60	9467120	790	2,790	4,370	5,820	7,500	9,450
4	36.30	9508300	1,430	6,920	12,000	17,100	23,300	30,800
4	36.40	9498501	550	2,920	5,400	8,050	11,500	16,000
4	39.40	9503000	1,180	3,320	4,730	5,910	7,190	8,580
4	51.00	9505250	693	3,120	5,390	7,660	10,500	14,000
4	52.40	9510150	840	4,850	9,060	13,500	19,300	26,700
4	77.80	5352	560	4,430	9,110	14,400	21,500	31,000
4	83.50	9438200	641	1,930	2,840	3,640	4,520	5,510
4	89.30	9512600	1,730	5,490	8,260	10,700	13,500	16,600
4	102.00	9498502	1,400	5,480	8,990	12,400	16,500	21,400
4	107.00	9445500	665	2,000	2,970	3,820	4,780	5,870
4	109.00	9505200	3,040	7,510	10,300	12,700	15,200	17,900
4	123.00	9498870	3,290	10,400	16,000	21,200	27,200	34,300
4	135.00	9424200	3,680	7,060	8,880	10,300	11,700	13,100
4	142.00	9505350	3,430	13,700	22,200	30,200	39,600	50,600

Table F.1 USGS stream gage LP3 data listing

with drainage areas between 0.1 and 10,000 square miles
(sorted by Flood Region then by drainage area in ascending order)

Flood Region	Drainage Area sq. miles	Gage No.	LP3 Data From Paretti, Kennedy, Turney and Veilleux (2014), cfs					
			Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
4	155.00	9446000	1,290	4,430	6,860	9,060	11,600	14,500
4	164.00	9510200	2,480	12,700	22,400	32,100	44,200	59,000
4	194.00	9431130	785	3,430	5,730	7,920	10,600	13,700
4	195.00	9498400	1,350	3,510	4,930	6,120	7,410	8,810
4	200.00	9497980	1,600	8,690	15,800	23,100	32,400	43,900
4	206.00	9496000	1,110	7,870	15,700	24,500	36,200	51,700
4	226.00	9430900	3,070	6,180	7,880	9,180	10,500	11,900
4	233.00	9504420	2,890	12,300	20,500	28,400	37,900	49,400
4	241.00	9505800	3,710	13,100	20,400	27,100	34,800	43,600
4	255.00	9502800	1,520	7,600	13,400	19,300	26,700	35,800
4	290.00	9497800	3,840	10,400	14,700	18,300	22,200	26,400
4	302.00	9447800	1,150	6,510	12,200	18,200	26,100	36,200
4	326.00	9507980	4,380	14,900	22,800	29,900	38,100	47,300
4	355.00	9504500	4,430	17,700	28,600	38,700	50,500	64,100
4	383.00	9446500	2,550	9,780	15,900	21,700	28,600	36,900
4	433.00	9498800	8,750	34,000	55,200	75,100	98,800	127,000
4	441.00	9496500	2,700	12,200	20,700	28,800	38,700	50,500
4	505.00	9444200	3,430	11,500	17,800	23,700	30,500	38,400
4	585.00	9512500	5,430	16,100	23,700	30,400	37,900	46,300
4	611.00	9424447	9,670	49,100	87,300	126,000	174,000	234,000
4	621.00	9447000	2,630	13,700	24,400	35,200	48,600	65,100
4	628.00	9494000	2,910	8,190	12,100	15,700	19,800	24,500
4	672.00	9499000	11,100	34,400	50,900	65,300	81,300	99,000
4	823.00	9456000	4,150	4,900	5,190	5,390	5,580	5,750
4	1026.00	9468500	6,930	25,300	39,400	52,100	66,500	82,900
4	1130.00	9424900	4,610	16,800	26,400	35,100	45,300	57,100
4	1224.00	9490500	6,710	29,900	50,400	69,900	93,500	122,000
4	1856.00	9430500	2,120	11,300	21,100	31,500	45,300	63,300
4	2149.00	9503700	1,300	8,490	16,700	25,800	38,200	54,400
4	2243.00	9457000	4,500	9,800	13,000	15,600	18,300	21,200
4	2433.00	9431000	5,660	13,700	18,500	22,400	26,500	30,800
4	2562.00	9424450	8,610	39,100	66,300	92,600	125,000	163,000
4	2765.00	9444500	6,550	30,000	51,800	73,400	100,000	133,000
4	2828.00	9431500	5,940	17,100	25,400	32,800	41,400	51,300

Table F.1 USGS stream gage LP3 data listing

with drainage areas between 0.1 and 10,000 square miles

(sorted by Flood Region then by drainage area in ascending order)

Flood Region	Drainage Area sq. miles	Gage No.	LP3 Data From Paretti, Kennedy, Turney and Veilleux (2014), cfs					
			Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
4	2831.00	9497500	9,810	37,800	62,300	86,000	115,000	150,000
4	3143.00	9504000	5,210	22,200	37,200	51,700	69,200	90,100
4	3200.00	9432000	5,300	18,100	28,000	37,000	47,400	59,400
4	4007.00	9442000	5,850	16,900	25,100	32,400	40,900	50,600
4	4289.00	9498500	14,700	53,800	85,100	114,000	147,000	186,000
4	4650.00	9506000	8,800	42,500	75,100	108,000	150,000	202,000
4	5499.00	9508500	14,200	53,500	84,700	113,000	146,000	184,000
4	7888.00	9448500	9,490	39,200	65,900	92,100	125,000	164,000
5	0.15	9481800	25	86	132	174	223	279
5	0.21	9471087	107	329	491	633	795	977
5	0.34	9486700	141	308	410	493	583	679
5	0.38	9478600	67	194	283	361	448	546
5	0.39	9479200	43	193	326	454	610	796
5	0.47	9483040	113	254	338	406	476	551
5	0.66	9536350	45	160	251	333	430	540
5	0.68	9487140	183	502	717	899	1,100	1,320
5	0.80	9482330	97	283	412	523	646	782
5	0.90	9536100	145	318	422	505	594	687
5	1.70	9487400	168	534	806	1,050	1,320	1,640
5	1.91	9483200	91	347	554	744	966	1,220
5	1.95	9485950	109	436	712	973	1,280	1,650
5	2.37	9471700	180	729	1,200	1,640	2,170	2,800
5	3.08	9471120	320	1,530	2,640	3,720	5,050	6,660
5	3.14	9482480	60	683	1,610	2,770	4,470	6,910
5	3.34	9483300	186	381	489	573	659	747
5	3.59	9471180	155	741	1,280	1,820	2,480	3,280
5	3.59	9473200	487	2,320	4,040	5,760	7,900	10,500
5	4.16	9470750	8	112	276	487	805	1,270
5	4.43	9473600	350	767	1,020	1,230	1,450	1,680
5	4.95	9485900	67	259	418	566	742	948
5	5.24	9471195	239	1,420	2,630	3,890	5,500	7,510
5	5.70	9471130	567	2,090	3,330	4,490	5,860	7,470
5	6.33	9484510	141	240	288	324	359	395
5	6.38	9471080	354	995	1,440	1,820	2,250	2,720

Table F.1 USGS stream gage LP3 data listing

with drainage areas between 0.1 and 10,000 square miles

(sorted by Flood Region then by drainage area in ascending order)

Flood Region	Drainage Area sq. miles	Gage No.	LP3 Data From Paretti, Kennedy, Turney and Veilleux (2014), cfs					
			Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
5	7.11	2170	414	2,190	3,930	5,680	7,870	10,600
5	7.22	9470900	367	1,670	2,810	3,890	5,180	6,680
5	8.60	9470800	26	212	443	706	1,070	1,550
5	9.19	9471110	369	1,570	2,600	3,590	4,770	6,170
5	9.21	9471090	500	1,670	2,550	3,340	4,240	5,250
5	9.80	9482350	179	888	1,560	2,240	3,080	4,110
5	10.30	9481700	290	1,040	1,630	2,170	2,780	3,490
5	12.00	9488600	302	1,220	2,010	2,770	3,690	4,780
5	12.80	9487100	839	2,660	4,060	5,320	6,790	8,490
5	13.00	9482370	156	852	1,540	2,240	3,120	4,220
5	13.90	9484580	817	1,520	1,890	2,180	2,460	2,760
5	14.80	9478200	420	2,150	3,820	5,510	7,620	10,200
5	16.90	9484200	358	942	1,330	1,660	2,020	2,410
5	19.60	9482420	422	1,140	1,620	2,020	2,470	2,950
5	23.00	2070	476	2,650	4,840	7,090	9,940	13,500
5	24.00	9482200	573	1,580	2,280	2,900	3,590	4,370
5	34.10	9486590	83	1,260	3,290	6,040	10,400	17,000
5	35.20	9484000	1,240	5,350	8,920	12,300	16,400	21,200
5	36.10	9471140	1,100	3,490	5,200	6,680	8,350	10,200
5	37.10	9482450	222	751	1,170	1,550	1,990	2,510
5	38.60	9484570	838	4,670	8,760	13,200	19,000	26,600
5	42.20	1080	551	2,110	3,490	4,840	6,500	8,540
5	43.10	9483100	1,440	4,880	7,560	10,000	12,900	16,200
5	43.20	2090	1,550	9,450	18,000	27,200	39,300	54,800
5	43.30	9471190	1,040	4,260	7,050	9,740	13,000	16,900
5	44.70	9485000	842	5,050	9,350	13,800	19,400	26,300
5	50.40	4310	1,960	3,220	3,840	4,290	4,730	5,170
5	50.40	9484590	1,620	5,110	7,660	9,900	12,400	15,300
5	57.10	9471200	951	3,830	6,150	8,270	10,700	13,500
5	64.80	1100	489	3,420	6,800	10,500	15,500	22,100
5	78.80	9537200	530	3,240	6,150	9,230	13,200	18,400
5	82.00	9480000	1,320	4,760	7,410	9,790	12,500	15,600
5	143.00	9478500	3,250	11,900	19,000	25,800	33,800	43,300
5	148.00	9488650	1,010	5,760	10,800	16,100	23,100	32,000

Table F.1 USGS stream gage LP3 data listing

with drainage areas between 0.1 and 10,000 square miles

(sorted by Flood Region then by drainage area in ascending order)

Flood Region	Drainage Area sq. miles	Gage No.	LP3 Data From Paretti, Kennedy, Turney and Veilleux (2014), cfs					
			Q_2	Q_{10}	Q_{25}	Q_{50}	Q_{100}	Q_{500}
5	156.00	9471380	1,940	5,860	8,710	11,200	14,100	17,300
5	166.00	9481750	1,970	6,490	9,960	13,100	16,700	20,900
5	209.00	9481500	2,950	7,380	10,200	12,600	15,200	18,000
5	220.00	9484500	3,340	10,300	15,400	19,900	25,100	30,900
5	250.00	9486300	2,930	10,700	16,800	22,300	28,800	36,200
5	289.00	9484560	2,080	6,750	10,400	13,800	17,800	22,500
5	289.00	4280	831	4,850	8,950	13,200	18,500	25,200
5	303.00	9471400	1,310	4,930	7,980	10,900	14,400	18,600
5	456.00	9484600	2,670	10,500	16,900	22,800	29,600	37,500
5	466.00	9486800	3,580	8,940	12,400	15,300	18,500	22,000
5	532.00	9480500	3,540	10,300	15,100	19,400	24,200	29,700
5	538.00	9473000	3,970	11,900	17,800	23,100	29,300	36,300
5	599.00	9485500	2,150	9,880	16,900	23,800	32,100	42,200
5	738.00	9470500	5,560	13,300	18,200	22,200	26,400	31,000
5	785.00	9487000	3,420	9,410	13,500	17,100	21,000	25,400
5	905.00	9486000	5,050	13,400	18,900	23,500	28,400	33,800
5	1199.00	9487250	1,220	6,880	12,700	18,700	26,500	36,300
5	1213.00	9481740	2,330	7,300	11,100	14,500	18,500	23,100
5	1216.00	9471000	5,990	16,600	24,400	31,400	39,500	48,800
5	1673.00	9482000	3,210	11,700	18,600	25,200	33,000	42,300
5	1729.00	9471550	5,560	16,700	24,900	32,300	40,700	50,300
5	1734.00	9488500	1,490	7,620	13,800	20,200	28,400	38,700
5	2046.00	6040	3,460	13,900	22,600	30,900	40,700	52,200
5	2192.00	9482500	5,300	13,900	19,700	24,500	29,900	35,700
5	2487.00	9471800	6,460	17,100	24,300	30,500	37,500	45,200
5	2925.00	9472000	6,730	20,700	30,800	39,800	50,000	61,500
5	3461.00	9486500	8,380	19,800	27,300	33,700	40,800	48,500
5	3566.00	9486520	5,110	13,800	19,500	24,300	29,600	35,300
5	4451.00	9473500	7,980	25,000	38,000	49,700	63,400	79,100

F.2 METHOD 3 USGS DATA LISTING

The following is a description of each field in Table F.2:

Gage ID: The USGS or cooperating technical partner gage number.

Gage Location: Gage name and location.

Flood Region: The USGS regression equations flood region. Refer to Section 7.11 for a location map.

Area: The area of the watershed upstreram of the gage in square miles.

Location: The latitude and longitude of the gage location.

Elevation: The mean elevation of the upstream watershed. The independent variable *ELEV* is the elevastion divided by 1,000.

PRECIP: The independent variable average annual precipitation of the upstream watershed in inches.

Used: If "Yes", the gage was used in the generation of the regression equations. If "No", the gage was not used.

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9419623	Deer Creek near Charleston Park, NV	1	1.26	36.31246	-115.62029	9,680	26.2	Yes
9489080	Hannagan Creek near Hannagan Meadow, AZ	1	1.74	33.64728	-109.28952	9,040	32.1	No
9338500	East Fork Deer Creek near Boulder, UT	1	1.79	38.00138	-111.38962	9,440	19.8	Yes
9378630	Recapture Creek near Blanding, UT	1	3.81	37.75555	-109.47651	8,680	25.7	Yes
9460150	Frye Creek near Thatcher, AZ	1	4.04	32.74396	-109.83814	8,130	33.6	No
9442630	Mail Hollow near Luna, NM	1	4.75	33.79389	-108.95028	7,780	20.8	Yes
9419610	Lee Canyon near Charleston Park, NV	1	9.25	36.34030	-115.65223	9,170	21.1	No
9442695	Negro Canyon at Aragon, NM	1	9.33	33.88339	-108.55062	7,660	15.8	No
9406300	Kanarra Creek at Kanarraville, UT	1	9.87	37.53803	-113.16856	7,770	20.1	Yes
9415515	Water Canyon Creek near Preston, NV	1	10.70	38.98772	-114.95835	8,080	16.5	No

Table F.2 USGS data for stream gages used for regional regression equations (From Paretti, Kennedy, Turney and Veilleux (2014))								
Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9369500	Middle Mancos River near Mancos, CO	1	12.10	37.37389	-108.23064	9,390	30.7	Yes
9395400	Milk Ranch Canyon near Ft. Wingate, NM	1	14.40	35.43194	-108.55500	7,870	18.5	No
9489200	Pacheta Creek at Maverick, AZ	1	16.30	33.73977	-109.54064	8,600	32.9	Yes
9383600	Fish Creek near Eagar, AZ	1	16.80	34.07644	-109.46315	9,150	30.2	Yes
9408400	Santa Clara River near Pine Valley, UT	1	18.80	37.38331	-113.48329	8,640	25.4	Yes
9338000	East Fork Boulder Creek near Boulder, UT	1	20.40	38.04193	-111.45017	10,700	23.8	Yes
9343500	Rito Blanco near Pagosa Springs, CO	1	23.10	37.19362	-106.90531	9,270	33.0	Yes
9383400	Little Colorado River at Greer, AZ	1	28.90	34.01671	-109.45731	9,440	32.8	Yes
9405420	North Fork Virgin River below Bulloch Canyon near Glendale, UT	1	29.40	37.41831	-112.80049	7,820	20.7	Yes
9442660	Trout Creek at Luna, NM	1	31.80	33.84611	-108.95167	8,630	24.1	Yes
9365500	La Plata River at Hesperus, CO	1	34.50	37.28972	-108.04063	10,200	38.8	Yes
9336000	Birch Creek near Escalante, UT	1	35.20	37.76249	-111.73824	8,380	18.8	Yes
9419640	Kyle Canyon near Charleston Park, NV	1	35.40	36.27774	-115.47029	7,850	22.0	No
9378650	Recapture Creek below Johnson Creek near Blanding, UT	1	37.30	37.68083	-109.46262	7,920	21.9	Yes
9489070	North Fork Of East Fork Black River near Alpine, AZ	1	38.40	33.90311	-109.32286	9,050	28.9	Yes
9368500	West Mancos River near Mancos, CO	1	39.50	37.38166	-108.25814	9,700	33.6	Yes
9490800	North Fork White River near Greer, AZ	1	39.80	34.01394	-109.64232	9,520	36.4	Yes
9336400	Upper Valley Creek near Escalante, UT	1	44.40	37.73332	-111.71740	7,800	15.3	Yes
9331500	Ivie Creek above Diversions near Emery, UT	1	45.30	38.75831	-111.42157	8,790	18.9	Yes
9492400	East Fork White River near Fort Apache, AZ	1	46.80	33.82227	-109.81454	8,420	35.5	Yes
9337000	Pine Creek near Escalante, UT	1	67.60	37.86249	-111.63601	9,380	21.3	Yes
9338900	Deer Creek near Boulder, UT	1	68.60	37.85332	-111.35517	7,720	14.1	No
9430600	Mogollon Creek near Cliff, NM	1	73.10	33.16667	-108.64972	7,790	26.5	No
9366000	Cherry Creek near Red Mesa, CO	1	75.20	37.11889	-108.19869	7,840	21.2	Yes
9491000	North Fork White River near McNary, AZ	1	78.50	34.04588	-109.73816	9,260	37.7	Yes

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location Lat	Location Long	Elevation	*PRECIP*	Used
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9383500	Nutrioso Creek above Nelson Res near Springerville, AZ	1	83.40	34.03033	-109.18647	8,530	23.4	Yes
9429900	Snow creek near Mogollon, NM	1	90.40	33.41395	-108.49506	8,100	22.0	Yes
9442692	Tularosa River above Aragon, NM	1	95.60	33.89144	-108.51562	7,710	16.4	No
9329900	Pine Creek near Bicknell, UT	1	105.00	38.26943	-111.58407	9,340	19.2	Yes
9330500	Muddy Creek near Emery, UT	1	105.00	38.98192	-111.24934	8,920	23.5	Yes
9442700	Apache Creek near Apache Creek, NM	1	112.00	33.93061	-108.66312	7,770	17.2	No
9489700	Big Bonito Creek near Fort Apache, AZ	1	114.00	33.66727	-109.84676	8,080	31.3	Yes
9346200	Rio Amargo at Dulce, NM	1	128.00	36.93258	-106.99857	7,650	--	Yes
9503800	Volunteer Wash near Bellemont, AZ	1	130.00	35.15057	-111.89905	7,550	23.4	Yes
9386100	Largo Creek near Quemado, NM	1	144.00	34.32333	-108.52750	8,000	15.4	Yes
9366500	La Plata River at Colorado-NM, State Line	1	309.00	36.99972	-108.18869	7,600	20.2	Yes
9489100	Black River near Maverick, AZ	1	314.00	33.70755	-109.44731	8,540	28.7	Yes
9337500	Escalante River near Escalante, UT	1	319.00	37.77804	-111.57462	8,120	16.8	Yes
9442680	San Francisco River near Reserve, NM	1	333.00	33.73672	-108.77118	7,800	21.0	Yes
9442740	Tularosa River near Reserve, NM	1	419.00	33.73222	-108.70250	7,580	18.1	No
9489500	Black River below Pumping Plant near Point of Pines, AZ	1	556.00	33.47672	-109.76398	8,060	27.7	No
9384000	Little Colorado River above Lyman Lake near St. Johns, AZ	1	711.00	34.31449	-109.36232	7,830	18.4	Yes
9401300	Hamblin Wash Tributary near Cedar Ridge, AZ	2	0.10	36.34860	-111.50487	5,890	7.6	Yes
9400200	Steamboat Wash Tributary near Ganado, AZ	2	0.17	35.76390	-109.80067	6,780	11.4	No
9357200	Gallegos Canyon Tributary near Nageezi, NM	2	0.22	36.41652	-107.86324	6,930	--	Yes
9384200	Lyman Reservoir Tributary near St Johns, AZ	2	0.24	34.39171	-109.38065	6,100	11.6	No
9404310	Yampai Canyon Tributary near Peach Springs, AZ	2	0.27	35.55194	-113.38882	5,330	11.8	Yes
9357230	West Draw near Farmington, NM	2	0.31	36.59091	-108.18517	5,960	--	No
9395850	Black Creek Tributary near Window Rock, AZ	2	0.34	35.65419	-109.08954	6,800	11.2	Yes
9385800	Little Colorado River Tributary near St Johns, AZ	2	0.35	34.45115	-109.25704	6,350	11.1	Yes
9395600	Wagon Trail Wash near Gamerco, NM	2	0.37	35.65002	-108.78397	6,700	12.4	Yes

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9403750	Sagebrush Draw near Fredonia, AZ	2	0.71	36.90138	-112.37714	5,280	11.8	Yes
9396400	Dead Wash Tributary near Holbrook, AZ	2	0.78	35.07502	-109.75067	5,710	10.6	Yes
9401245	Klethla Valley Tributary near Kayenta, AZ	2	0.79	36.49805	-110.62153	6,740	11.5	Yes
9379980	Jack Bench Wash Tributary near Page, AZ	2	0.98	36.71388	-111.59238	6,170	9.4	Yes
9367400	La Plata River Tributary near Farmington, NM	2	1.06	36.78611	-108.22600	5,650	9.9	Yes
9395100	Carr Lake Draw Tributary near Holbrook, AZ	2	1.27	34.83475	-109.93400	5,460	10.2	Yes
9379060	Lukachukai Creek Tributary near Lukachukai, AZ	2	1.31	36.46945	-109.40622	5,830	8.9	Yes
9379100	Long House Wash near Kayenta, AZ	2	1.31	36.56722	-110.48875	6,960	12.2	No
9400560	Oraibi Wash Tributary near Oraibi, AZ	2	1.78	35.87223	-110.55625	5,970	10.0	Yes
9400680	Switzer Canyon at Flagstaff, AZ	2	1.99	35.21223	-111.63988	7,130	21.7	No
9367840	Yazzie Wash near Mexican Springs, NM	2	2.05	35.84374	-108.88610	7,210	13.5	Yes
9368020	Malpais Arroyo near Shiprock, NM	2	2.20	36.92583	-108.72500	5,330	9.0	Yes
9403800	Bitter Seeps Wash Tributary near Fredonia, AZ	2	2.34	36.85693	-112.75909	5,230	13.0	No
9367530	Locke Arroyo near Kirtland, NM	2	2.95	36.73826	-108.29235	5,500	9.3	Yes
9403930	West Cataract Creek near Williams, AZ	2	3.16	35.24779	-112.22517	7,210	23.1	Yes
9356400	Manzanares Canyon near Turley, NM	2	3.22	36.73657	-107.70622	6,460	--	Yes
9400910	Fay Canyon near Flagstaff, AZ	2	3.23	35.13501	-111.63071	7,020	24.0	Yes
9367550	Stevens Arroyo near Kirtland, NM	2	4.68	36.76667	-108.37008	5,470	9.0	Yes
9383020	House Rock Wash Tributary near Marble Canyon, AZ	2	4.75	36.70138	-111.92989	5,960	12.1	Yes
9404050	Spring Valley Wash Tributary near Williams, AZ	2	4.91	35.57444	-112.15405	6,130	11.8	No
9350700	Ruben Canyon near Gobernador, NM	2	5.04	36.74083	-107.24028	7,280	--	No
9400580	Castle Butte Wash near Winslow, AZ	2	5.41	35.32501	-110.42291	5,810	9.7	Yes
9392800	Long Lake Tributary near Show Low, AZ	2	5.42	34.26115	-109.99539	6,770	22.4	Yes
9401210	Slate Mountain Wash near Flagstaff, AZ	2	5.43	35.51528	-111.83544	7,350	19.7	No
9400530	Cow Canyon near Winslow, AZ	2	5.93	35.10002	-110.98820	5,420	9.8	Yes
9379560	El Capitan Wash near Kayenta, AZ	2	6.00	36.85889	-110.26597	5,650	7.8	Yes

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9400650	Sinclair Wash at Flagstaff, AZ	2	6.18	35.16390	-111.68072	7,150	23.0	Yes
9400565	Polacca Wash Tributary near Chinle, AZ	2	6.40	36.04723	-110.08123	6,860	10.7	Yes
9367900	Black Springs Wash near Mexican Springs, NM	2	7.06	35.75917	-108.81639	6,790	11.4	Yes
9400100	Ganado Wash Tributary near Ganado, AZ	2	7.92	35.71113	-109.49788	6,740	12.2	Yes
9367860	Chusca Wash near Mexican Springs, NM	2	8.81	35.81058	-108.85008	7,250	13.3	No
9356520	Burro Canyon near Lindrith, NM	2	9.10	36.27250	-107.24667	7,250	--	Yes
9408000	Leeds Creek near Leeds, UT	2	15.40	37.26748	-113.37078	6,320	17.9	Yes
9395200	Decker Wash near Snowflake, AZ	2	16.70	34.46115	-110.40484	6,700	19.6	Yes
9363100	Salt Creek near Oxford, CO	2	17.80	37.13973	-107.75340	6,760	16.9	Yes
9400290	Teshbito Wash Tributary near Holbrook, AZ	2	19.80	35.48057	-110.08818	6,320	11.6	Yes
9387050	Galestena Canyon Tributary near Black Rock, NM	2	20.40	34.97139	-108.67028	7,410	15.3	Yes
9367980	Rattlesnake Arroyo near Shiprock, NM	2	21.60	36.77055	-108.72620	5,230	7.9	Yes
9381100	Henrieville Creek at Henrieville, UT	2	22.00	37.56665	-111.98408	7,170	13.1	Yes
9355700	Gobernador Canyon near Gobernador, NM	2	22.10	36.68444	-107.42000	6,740	--	Yes
9367880	Catron Wash near Mexican Springs, NM	2	26.70	35.77080	-108.82893	7,090	13.0	Yes
9397800	Brookbank Canyon near Heber, AZ	2	27.50	34.47226	-110.64790	6,960	22.5	Yes
9367930	Hunter Wash at Bisti Trading Post, NM	2	45.70	36.27649	-108.25476	6,180	9.4	Yes
9330120	Sulphur Creek near Fruita, UT	2	56.30	38.29998	-111.26739	7,310	11.8	Yes
9355000	Spring Creek at La Boca, CO	2	58.00	37.01528	-107.59533	6,940	17.4	Yes
9350800	Vaqueros Canyon near Gobernador, NM	2	60.20	36.72306	-107.27972	7,390	--	Yes
9379300	Lime Creek near Mexican Hat, UT	2	65.50	37.21667	-109.81735	5,370	8.6	Yes
9390500	Show Low Creek near Lakeside, AZ	2	68.00	34.17949	-109.98789	7,290	27.6	Yes
9400300	Teshbito Wash near Holbrook, AZ	2	68.90	35.44862	-110.06873	6,170	11.4	Yes
9404450	East Fork Virgin River near Glendale, UT	2	74.50	37.33943	-112.60438	7,260	18.0	Yes
9403500	Kanab Creek near Glendale, UT	2	76.50	37.28332	-112.48410	7,220	18.0	Yes
9379030	Black Mountain Wash near Chinle, AZ	2	77.40	36.33334	-109.62428	5,910	8.3	Yes
9379800	Coyote Creek near Kanab, UT	2	90.90	37.13332	-111.75073	5,030	9.7	Yes

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9403000	Bright Angel Creek near Grand Canyon, AZ	2	101.00	36.10304	-112.09628	7,310	22.1	Yes
9409100	Santa Clara River above Baker Reservoir near Central, UT	2	113.00	37.38470	-113.63191	7,400	21.7	Yes
9334000	North Wash near Hanksville (Hite), UT	2	136.00	37.89860	-110.44931	5,440	7.6	Yes
9367561	Shumway Arroyo near Waterflow, NM	2	136.00	36.77333	-108.44119	5,780	10.8	Yes
9400583	Jeddito Wash near Jeddito, AZ	2	148.00	35.57751	-110.46235	6,370	10.8	Yes
9403600	Kanab Creek near Kanab, UT	2	194.00	37.10054	-112.54798	6,530	16.8	Yes
9381500	Paria River near Cannonville, UT	2	199.00	37.48110	-112.02158	6,910	13.0	Yes
9378700	Cottonwood Wash near Blanding, UT	2	204.00	37.56055	-109.57874	6,810	15.3	Yes
9399400	Jacks Canyon Creek near Winslow, AZ	2	251.00	34.92141	-110.79764	6,500	19.1	Yes
9404222	Spencer Creek near Peach Springs, AZ	2	257.00	35.80082	-113.65883	4,780	12.8	Yes
9397500	Chevelon Fork below Wildcat Canyon near Winslow, AZ	2	272.00	34.63642	-110.71430	7,070	24.8	No
9404208	Diamond Creek near Peach Springs, AZ	2	276.00	35.76499	-113.36827	4,920	12.0	Yes
9334500	White Canyon near Hanksville, UT	2	277.00	37.79860	-110.37653	6,080	11.8	Yes
9404900	East Fork Virgin River near Springdale, UT	2	317.00	37.16415	-112.95855	6,350	16.7	Yes
9398500	Clear Creek below Willow Creek near Winslow, AZ	2	318.00	34.66753	-111.00763	7,170	27.0	No
9372000	McElmo Creek near Colorado-Utah State Line	2	346.00	37.32416	-109.01567	6,410	14.9	Yes
9379180	Laguna Creek at Dennehotso, AZ	2	454.00	36.85389	-109.84595	6,050	9.1	No
9401110	Dinnebito Wash near Sand Springs, AZ	2	478.00	35.78111	-110.93320	6,300	10.4	Yes
9395900	Black Creek near Lupton, AZ	2	494.00	35.45252	-109.12648	7,410	14.5	Yes
9371000	Mancos River near Towaoc, CO	2	527.00	37.02749	-108.74148	7,220	19.0	Yes
9395500	Puerco River at Gallup, NM	2	549.00	35.52919	-108.74536	7,280	14.6	Yes
9401220	Cedar Wash near Cameron, AZ	2	555.00	35.85861	-111.44292	6,330	13.2	No
9367680	Chaco Wash at Chaco Canyon National Monument, NM	2	578.00	36.02837	-107.91898	6,720	10.5	Yes
9399000	Clear Creek near Winslow, AZ	2	607.00	34.96947	-110.64513	6,560	20.8	No
9381800	Paria River near Kanab, UT	2	647.00	37.10748	-111.90601	6,330	12.1	No
9400562	Oraibi Wash near Tolani Lake, AZ	2	665.00	35.57973	-110.77403	6,280	10.4	No

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID (1)	Gage Location (2)	Flood Region (3)	Area, sm (4)	Location Lat (5)	Location Long (6)	Elevation (7)	*PRECIP* (8)	Used (9)
9398000	Chevelon Creek near Winslow, AZ	2	759.00	34.92641	-110.53152	6,550	19.5	No
9397100	Leroux Wash near Holbrook, AZ	2	812.00	34.90503	-110.20151	6,150	11.5	Yes
9393500	Silver Creek near Snowflake, AZ	2	840.00	34.66670	-110.04234	6,350	18.0	Yes
9400568	Polacca Wash near Second Mesa, AZ	2	912.00	35.65584	-110.56208	6,410	10.1	No
9406000	Virgin River at Virgin, UT	2	922.00	37.20415	-113.18078	6,450	18.3	Yes
9403780	Kanab Creek near Fredonia, AZ	2	1,120.00	36.86388	-112.57992	6,000	15.0	Yes
9401260	Moenkopi Wash at Moenkopi, AZ	2	1,230.00	36.10499	-111.20181	6,120	9.7	No
9382000	Paria River at Lees Ferry, AZ	2	1,360.00	36.87221	-111.59461	6,140	11.9	Yes
9401280	Moenkopi Wash near Tuba, AZ	2	1,390.00	36.10499	-111.20181	6,040	9.5	No
9408150	Virgin River near Hurricane, UT	2	1,450.00	37.16276	-113.39523	6,080	--	No
9401400	Moenkopi Wash near Tuba City, AZ	2	1,730.00	36.02360	-111.39736	5,890	9.1	No
9386200	Carrizo Creek near Salt Lake, NM	2	1,750.00	34.51088	-109.02703	7,290	13.6	Yes
9401500	Moenkopi Wash near Cameron, AZ	2	1,880.00	35.92499	-111.42153	5,810	8.9	No
9386250	Carrizo Wash near St. Johns, AZ	2	2,140.00	34.61476	-109.31843	7,120	13.3	No
9396100	Puerco River near Chambers, AZ	2	2,160.00	35.18225	-109.44705	7,000	13.6	No
9379200	Chinle Creek near Mexican Water, AZ	2	3,610.00	36.94389	-109.71067	6,240	10.1	Yes
9413200	Truxton wash near Valentine-Truxton Wash at Valentine, AZ	2	3,850.00	37.07054	-113.58273	5,410	14.7	No
9367950	Chaco River near Waterflow, NM	2	4,370.00	36.72445	-108.59147	6,330	9.9	No
9415000	Virgin River at Littlefield, AZ	2	4,860.00	36.89164	-113.92441	5,170	14.4	Yes
9394500	Little Colorado River at Woodruff, AZ	2	7,850.00	34.78281	-110.04428	6,810	14.4	Yes
9397000	Little Colorado River at Holbrook, AZ	2	11,400.00	34.89780	-110.16318	6,740	14.1	No
9397300	Little Colorado River near Joseph City, AZ	2	12,300.00	34.90114	-110.25540	6,690	13.9	No
9400350	Little Colorado River near Winslow, AZ	2	16,000.00	35.01169	-110.65124	6,590	14.1	Yes
9401000	Little Colorado River at Grand Falls, AZ	2	20,600.00	35.43334	-111.20070	6,470	13.7	No
9402000	Little Colorado River near Cameron, AZ	2	26,300.00	35.92638	-111.56737	6,320	12.8	No
9423400	Tin Can Creek near Needles, CA	3	0.08	34.85695	-114.88275	2,810	7.1	Yes
9429510	Mittry Lake Tributary near Yuma, AZ	3	0.15	32.85977	-114.43550	283	3.7	Yes

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID (1)	Gage Location (2)	Flood Region (3)	Area, sm (4)	Location: Lat (5)	Location: Long (6)	Elevation (7)	*PRECIP* (8)	Used (9)
9424050	Chemehuevi Wash Tributary near Needles, CA	3	0.28	34.50834	-114.60357	1,680	6.4	Yes
9428560	Colorado River Tributary No. 2 near Vidal, CA	3	0.42	33.98641	-114.49662	736	4.3	No
9520350	Mohawk Pass Wash at Mohawk, AZ	3	0.44	32.72894	-113.74242	607	4.4	Yes
9429240	Ogilby Wash near Palo Verde, CA	3	0.56	33.33892	-114.77996	865	4.4	No
9520110	Hot Shot Arroyo near Ajo, AZ	3	0.56	32.34700	-112.80932	1,750	7.7	Yes
9429250	Ogilby Wash No. 2 near Palo Verde, CA	3	0.57	33.34031	-114.77996	861	4.4	No
7093	Casandro Wash, AZ	3	0.58	33.96206	-112.76525	2,340	12.5	Yes
9424700	Iron Spring Wash Tributary near Bagdad, AZ	3	0.63	34.52224	-113.11269	3,410	13.7	Yes
9520300	Alamo Wash Tributary near Ajo, AZ	3	0.83	32.10006	-112.77154	2,030	10.1	Yes
9517200	Centennial Wash Tributary near Wenden, AZ	3	0.84	33.84448	-113.45076	2,110	9.0	Yes
9423350	Caruthers Creek near Ivanpah, CA	3	0.87	35.24499	-115.29888	6,400	11.7	Yes
9428545	Cunningham Wash Tributary near Wenden, AZ	3	0.91	34.00697	-113.57854	2,630	11.4	Yes
9512700	Agua Fria River Tributary No. 2 near Rock Springs, AZ	3	1.01	34.03337	-112.14571	2,170	14.1	Yes
9428570	Colorado River Tributary near Vidal, CA	3	1.12	33.97974	-114.50718	841	4.1	Yes
9419590	Detrital Wash Tributary near Chloride, AZ	3	1.22	35.43194	-114.28551	3,710	11.0	Yes
9520230	Crater Range Wash near Ajo, AZ	3	1.53	32.56228	-112.87766	1,400	7.1	Yes
9427700	Monkeys Head Wash near Parker, AZ	3	1.80	34.27779	-114.13022	1,230	6.7	Yes
7113	Powder House Wash, AZ	3	1.83	33.98083	-112.71731	2,350	12.9	Yes
9520160	Gibson Arroyo at Ajo, AZ	3	1.85	32.38006	-112.86182	2,160	8.1	Yes
9424430	Kaiser Spring Canyon Tributary near Wikieup, AZ	3	1.87	34.57224	-113.47854	2,790	12.1	Yes
9520400	Ligurta Wash at Ligurta, AZ	3	1.99	32.67588	-114.29466	497	4.2	No
9429400	Indian Wash Tributary near Yuma, AZ	3	2.24	33.10921	-114.29550	1,220	5.3	No
9423300	Piute Wash Tributary at Searchlight, NV	3	2.82	35.46666	-114.93970	3,670	7.8	Yes
9429150	Creosote Wash near Ehrenberg, AZ	3	3.13	33.62086	-114.49551	562	4.5	Yes
9519600	Rainbow Wash Tributary near Buckeye, AZ	3	3.64	33.24310	-112.63822	966	8.0	Yes
5588	Skunk Creek at New River, AZ	3	3.92	33.92614	-112.08267	2,550	15.5	Yes
9415100	Pulsipher Wash near Mesquite, NV	3	4.70	36.80109	-114.11108	1,890	6.7	No

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9515800	Hartman Wash near Wickenburg, AZ	3	5.44	33.96281	-112.82851	2,680	13.2	Yes
9516600	Ox Wash near Morristown, AZ	3	6.21	33.88337	-112.65073	2,290	12.6	Yes
9520130	Darby Arroyo near Ajo, AZ	3	6.35	32.35534	-112.82599	1,920	7.9	Yes
9423760	Little Meadow Creek near Oatman, AZ	3	8.41	35.03056	-114.30912	3,390	9.7	Yes
7083	Flying E Wash, AZ	3	8.64	33.96225	-112.78289	2,580	13.0	Yes
9512970	Cottonwood Creek near Waddell Dam, AZ	3	9.29	33.89865	-112.31155	2,300	15.3	Yes
5583	Virgin River near Bloomington, UT	3	10.80	33.90100	-112.05500	2,970	17.7	Yes
9520100	Military Wash near Sentinel, AZ	3	11.00	32.84533	-113.27963	668	5.0	Yes
9513820	Deadman Wash near New River, AZ	3	11.60	33.84170	-112.14516	1,970	13.0	Yes
9535200	Sells Wash Tributary at Sells, AZ	3	11.80	31.91536	-111.87901	2,590	14.9	Yes
9520200	Black Gap Wash near Ajo, AZ	3	12.20	32.70644	-112.84600	1,290	7.1	Yes
9428800	Tyson Wash Tributary near Quartzsite, AZ	3	12.80	33.51253	-114.21744	1,530	5.5	Yes
9428550	Bouse Wash Tributary near Bouse, AZ	3	14.60	33.90141	-113.97439	1,230	6.4	Yes
9423900	Sacramento Wash Tributary near Topock, AZ	3	14.90	34.72973	-114.31329	1,760	8.2	Yes
9419680	Cottonwood Valley near Blue Diamond, NV	3	17.70	36.00969	-115.43139	5,450	14.4	Yes
6953	Rainbow Wash, AZ	3	18.30	33.23560	-112.63920	1,080	8.2	Yes
9419682	Oak Creek near Blue Diamond, NV	3	27.50	36.04469	-115.37806	4,340	10.9	Yes
9423780	Walnut Creek near Kingman, AZ	3	31.40	35.03334	-114.01884	5,030	13.6	No
9419545	Valley Of Fire Wash near Overton, NV	3	31.70	36.40498	-114.41887	2,260	6.6	Yes
5108	Delaney Wash, AZ	3	49.60	33.46981	-112.97714	1,710	8.7	Yes
9413900	Beaver Dam Wash near Enterprise, UT	3	58.00	37.46998	-114.04665	5,950	21.5	No
9418990	Weiser Wash near Glendale, NV	3	59.20	36.66803	-114.53693	2,890	7.7	Yes
9512100	Indian Bend Wash at Scottsdale, AZ	3	59.80	33.53865	-111.91653	1,430	10.1	Yes
9512860	Humbug Creek near Castle Hot Springs	3	59.90	33.96726	-112.29350	3,960	22.2	Yes
9517400	Winters Wash near Tonopah, AZ	3	63.90	33.48948	-112.91879	1,670	8.8	Yes
9513860	Skunk Creek near Phoenix, AZ	3	65.00	33.72921	-112.11988	2,240	13.9	Yes
9419647	Las Vegas Wash Tributary near North Las Vegas, NV	3	66.10	36.30275	-115.13973	3,730	6.3	Yes

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9513780	New River near Rock Springs, AZ	3	68.40	33.97420	-112.09905	3,970	20.8	No
9519750	Bender Wash near Gila Bend, AZ	3	69.50	32.90699	-112.55210	1,930	8.7	Yes
9512280	Cave Creek below Cottonwood Creek near Cave Creek, AZ	3	72.80	33.88726	-111.95404	3,770	20.0	No
9513800	New River at New River, AZ	3	84.70	33.91142	-112.14127	3,640	19.6	No
9517280	Tiger Wash near Aguila, AZ	3	84.70	33.74170	-113.27936	2,570	10.6	Yes
7013	Martinez Creek, AZ	3	109.00	34.02911	-112.79103	3,430	15.6	Yes
9419620	Mormon Wells Wash near Las Vegas, NV	3	111.00	36.44580	-115.25362	6,440	12.0	No
7043	Cline Creek, AZ	3	118.00	33.98742	-112.79297	2,800	12.9	Yes
9512300	Cave Creek near Cave Creek, AZ	3	123.00	33.78337	-112.00737	3,310	18.1	No
9519760	Sauceda Wash near Gila Bend, AZ	3	126.00	32.87060	-112.75905	1,990	8.4	Yes
9516800	Jack Rabbit Wash near Tonopah, AZ	3	138.00	33.65892	-112.82851	2,250	10.6	Yes
9516790	Star Wash near Tonopah, AZ	3	153.00	33.63306	-112.77889	2,000	11.1	Yes
9513835	New River at Bell Road near Peoria	3	186.00	33.63837	-112.24016	2,600	15.4	Yes
9520170	Rio Cornez near Ajo, AZ	3	244.00	32.49950	-112.88127	1,930	8.4	Yes
9417300	California Wash near Moapa, NV	3	253.00	36.61025	-114.66110	2,490	6.4	Yes
6833	Waterman Wash at Rainbow, AZ	3	345.00	33.26150	-112.44400	1,480	8.5	No
9404343	Sols Wash near Matthie, AZ	3	375.00	35.38416	-113.65772	5,110	14.9	No
9515500	Hassayampa River at Box Damsite near Wickenburg, AZ	3	416.00	34.04503	-112.70990	4,540	19.8	No
5308	Hassayampa River at Box Canyon	3	416.00	34.04500	-112.71008	4,530	19.8	No
9514200	Waterman Wash near Buckeye, AZ	3	418.00	33.33032	-112.50988	1,420	8.5	Yes
9535100	San Simon Wash near Pisinimo, AZ	3	579.00	32.04424	-112.37097	2,230	10.2	Yes
9513890	New River at Peoria, AZ	3	606.00	33.59532	-112.26321	2,330	13.9	Yes
9513910	New River near Glendale, AZ	3	623.00	33.53671	-112.28182	2,290	13.8	No
5228	Hassayampa River at US60, AZ	3	709.00	33.97031	-112.72703	3,890	17.4	Yes
9423820	Sacramento Wash near Yucca, AZ	3	773.00	34.81112	-114.16190	3,300	10.3	Yes
9516500	Hassayampa River near Morristown, AZ	3	796.00	33.88503	-112.66212	3,750	17.0	No
9512800	Agua Fria River near Rock Springs, AZ	3	1,110.00	34.01559	-112.16794	4,530	19.4	No
9535300	Vamori Wash at Kom Vo, AZ	3	1,290.00	31.95118	-112.34791	2,660	14.5	No

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9517000	Hassayampa River near Arlington, AZ	3	1,420.00	33.34726	-112.72573	2,900	14.0	Yes
9425500	Santa Maria River near Alamo, AZ	3	1,430.00	34.30002	-113.51743	3,720	15.9	No
9517490	Centennial Wash at Southern Pacific Railroad Brdg, AZ	3	1,680.00	33.31032	-112.88184	1,860	8.9	No
9416000	Muddy River near Moapa, NV	3	3,850.00	36.71108	-114.69527	5,240	10.7	No
9496600	Cibecue 1 Tributary Carrizo Creek near Show Low, AZ	4	0.06	33.99116	-110.32483	5,430	21.0	Yes
9496700	Cibecue 2 Tributary Carrizo Cr, AZ	4	0.06	33.98810	-110.31122	5,220	20.6	Yes
9451800	Tollgate Wash Tributary near Clifton, AZ	4	0.11	32.85007	-109.33813	4,750	15.4	Yes
9504800	Oak Creek Tributary near Cornville, AZ	4	0.17	34.71252	-111.88127	3,580	16.0	Yes
9505900	Cottonwood Wash near Camp Verde, AZ	4	0.53	34.50558	-111.75348	3,620	16.6	Yes
9498600	Cristopher Creek Tributary near Kohl's Ranch, AZ	4	0.66	34.32226	-111.06735	6,070	34.8	No
9451900	Agricul Resrch Serv Safford Watershed W-I, AZ	4	0.73	32.84090	-109.52202	3,330	10.8	Yes
9504100	Hull Canyon near Jerome, AZ	4	0.85	34.73891	-112.14377	7,050	26.2	Yes
9468300	Sevenmile Wash Tributary near Globe, AZ	4	0.86	33.58616	-110.65066	4,410	21.1	Yes
9512420	Lynx Creek Tributary near Prescott, AZ	4	0.98	34.54753	-112.40017	5,880	22.1	Yes
9498503	South Fork Parker Creek near Roosevelt, AZ	4	1.08	33.79727	-110.96040	6,650	33.5	Yes
9456680	Agricultural Research Service Safford Watershed W-V, AZ	4	1.11	32.42229	-109.65812	4,540	14.4	Yes
9456820	Agricultural Research Service Safford Watershed W-IV, AZ	4	1.16	32.62507	-109.60063	3,620	12.9	Yes
9504400	Munds Canyon Tributary near Sedona, AZ	4	1.19	34.92224	-111.64515	6,860	27.2	Yes
9455800	Steins Creek at Steins, NM	4	1.20	32.22556	-109.00444	4,540	11.8	Yes
9505220	Rocky Gulch near Rimrock, AZ	4	1.36	34.74697	-111.49459	7,180	26.9	Yes
9462200	Agricultural Research Service Safford Watershed W-II, AZ	4	1.76	32.83562	-109.99425	3,750	13.8	Yes
9424410	Big Sandy River Tributary near Kingman, AZ	4	2.34	35.09167	-113.65911	3,680	11.0	Yes
9510170	Camp Creek near Sunflower, AZ	4	2.72	33.75977	-111.49625	3,520	23.0	No
9505600	Dirty Neck Canyon near Clints Well, AZ	4	3.33	34.51253	-111.35903	7,260	32.5	No
9430300	Copperas Canyon near Pinos Altos, NM	4	3.96	33.07840	-108.20449	7,040	21.0	Yes

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9510100	East Fork Sycamore Creek near Sunflower, AZ	4	4.51	33.94949	-111.46152	5,230	30.5	Yes
9496800	Carrizo Creek Tributary near Show Low, AZ	4	4.60	33.95449	-110.33205	5,750	21.3	Yes
9510070	West Fork Sycamore Creek above Mcfarland Canyon near Sunflower, AZ	4	4.62	33.96060	-111.48736	5,440	31.9	Yes
9458200	Deadman Creek near Safford, AZ	4	4.67	32.73312	-109.81647	7,360	29.1	Yes
9507700	Webber Creek above West Fork Webber Creek near Pine, AZ	4	4.76	34.41114	-111.37292	7,030	33.3	Yes
9507600	East Verde River near Pine, AZ	4	6.35	34.39170	-111.26875	6,400	31.7	Yes
9498900	Gold Creek near Payson, AZ	4	6.55	34.00282	-111.35902	4,700	25.9	Yes
9424480	Ash Creek near Kirkland, AZ	4	8.18	34.45336	-112.79657	4,790	20.0	Yes
9510080	West Fork Sycamore Creek near Sunflower, AZ	4	9.83	33.94587	-111.48541	5,340	31.5	Yes
9503750	Limestone Canyon near Paulden, AZ	4	14.50	34.98002	-112.40212	5,440	17.6	Yes
9456400	Gold Gulch near Bowie, AZ	4	15.00	32.34785	-109.60340	5,180	16.8	Yes
9510180	Rock Creek near Sunflower, AZ	4	15.20	33.73032	-111.50847	3,700	23.7	Yes
9505300	Rattlesnake Canyon near Rimrock, AZ	4	25.10	34.76696	-111.67376	6,450	25.8	Yes
9501300	Tortilla Creek at Tortilla Flat, AZ	4	29.20	33.52727	-111.38763	3,270	19.2	Yes
9502960	Granite Creek at Prescott, AZ	4	30.20	34.55197	-112.46239	5,950	22.6	Yes
9467120	Salt Creek near Peridot, AZ	4	34.60	33.27089	-110.30482	4,160	17.0	Yes
9508300	Wet Bottom Creek near Childs, AZ	4	36.30	34.16087	-111.69292	4,920	24.3	Yes
9498501	Pinto Creek below Haunted Canyon near Miami, AZ	4	36.40	33.41867	-111.00956	4,420	24.4	No
9503000	Granite Creek near Prescott, AZ	4	39.40	34.56308	-112.44489	5,910	22.4	Yes
9502900	Del Rio Springs near Chino Valley, AZ	4	39.90	34.82558	-112.44461	4,760	13.0	No
9505250	Red Tank Draw near Rimrock, AZ	4	51.00	34.69530	-111.71432	6,060	24.3	Yes
9510150	Sycamore Creek near Sunflower, AZ	4	52.40	33.85143	-111.45319	4,560	27.9	Yes
5352	Hassayampa River at Wagoner, AZ	4	77.80	34.31014	-112.56867	5,460	22.6	No
9438200	Animas Creek near Cloverdale, NM	4	83.50	31.57083	-108.87500	5,520	18.5	Yes
9512600	Turkey Creek near Cleator, AZ	4	89.30	34.28225	-112.20766	5,270	21.8	Yes
9498502	Pinto Creek near Miami, AZ	4	102.00	33.48783	-110.99539	4,220	23.0	Yes
9445500	Willow Creek near Point Of Pines near Morenci, AZ	4	107.00	33.37922	-109.65064	6,300	21.0	No

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9505200	Wet Beaver Creek near Rimrock, AZ	4	109.00	34.67474	-111.67209	6,550	25.0	Yes
9498870	Rye Creek near Gisela, AZ	4	123.00	34.03337	-111.29236	4,290	22.9	Yes
9424200	Cottonwood Wash No. 1 near Kingman, AZ	4	135.00	35.18112	-113.46966	5,360	19.3	Yes
9505350	Dry Beaver Creek near Rimrock, AZ	4	142.00	34.72863	-111.77571	6,190	25.1	Yes
9446000	Willow Creek near Double Circle Ranch near Morenci, AZ	4	155.00	33.35423	-109.52564	6,240	21.0	Yes
9510200	Sycamore Creek near Fort Mcdowell, AZ	4	164.00	33.69421	-111.54180	3,800	24.3	Yes
9431130	Mangas Creek near Cliff, NM	4	194.00	32.86083	-108.56694	5,770	17.3	Yes
9498400	Pinal Creek at Inspiration Dam near Globe, AZ	4	195.00	33.57311	-110.90123	4,170	21.0	No
9497980	Cherry Creek near Globe, AZ	4	200.00	33.82783	-110.85623	5,540	26.8	Yes
9496000	Corduroy Creek near Mouth near Show Low, AZ	4	206.00	34.01838	-110.24233	6,370	22.3	No
9430900	Duck Creek at Cliff, NM	4	226.00	32.96472	-108.61111	5,630	18.1	Yes
9504420	Oak Creek near Sedona, AZ	4	233.00	34.86168	-111.76182	6,730	27.1	No
9505800	West Clear Creek near Camp Verde, AZ	4	241.00	34.53864	-111.69404	6,640	26.1	Yes
9502800	Williamson Valley Wash near Paulden, AZ	4	255.00	34.86669	-112.61323	5,140	16.6	Yes
9497800	Cibecue Creek near Chrysotile, AZ	4	290.00	33.84311	-110.55761	5,740	23.2	Yes
9447800	Bonita Creek near Morenci, AZ	4	302.00	32.95562	-109.53119	5,250	17.4	Yes
9507980	East Verde River near Childs, AZ	4	326.00	34.27642	-111.63876	5,250	26.5	Yes
9504500	Oak Creek near Cornville, AZ	4	355.00	34.76446	-111.89099	6,110	24.8	Yes
9446500	Eagle Creek near Double Circle Ranch near Morenci, AZ	4	383.00	33.30006	-109.49230	6,280	21.3	No
9498800	Tonto Creek near Gisela, AZ	4	433.00	34.12893	-111.25541	5,540	27.9	Yes
9496500	Carrizo Creek near Show Low, AZ	4	441.00	33.98588	-110.28094	6,330	22.2	Yes
9444200	Blue River near Clifton, AZ	4	505.00	33.29090	-109.19618	6,850	23.1	Yes
9512500	Agua Fria River near Mayer, AZ	4	585.00	34.31531	-112.06405	4,940	19.2	Yes
9424447	Burro Creek at Old Us 93 Bridge near Bagdad, AZ	4	611.00	34.54168	-113.44521	4,660	18.4	Yes
9447000	Eagle Creek above Pumping Plant near Morenci, AZ	4	621.00	33.06451	-109.44230	6,010	20.5	Yes
9494000	White River near Fort Apache, AZ	4	628.00	33.73644	-110.16677	7,240	29.1	Yes
9499000	Tonto Creek above Gun Creek near Roosevelt, AZ	4	672.00	33.98004	-111.30347	5,080	25.9	Yes

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9456000	San Simon River near San Simon, AZ	4	823.00	32.22508	-109.17561	4,880	16.2	No
9468500	San Carlos River near Peridot, AZ	4	1,030.00	33.29645	-110.45149	4,440	19.1	Yes
9424900	Santa Maria River near Bagdad, AZ	4	1,130.00	34.30585	-113.34714	3,990	16.9	Yes
9490500	Black River near Fort Apache, AZ	4	1,220.00	33.71283	-110.21177	7,220	25.5	Yes
9430500	Gila River near Gila, NM	4	1,860.00	33.06150	-108.53739	7,450	20.4	Yes
9457000	San Simon River near Solomon, AZ	4	2,240.00	32.80173	-109.63924	4,330	14.1	No
9431000	Gila River near Cliff, NM	4	2,430.00	32.93896	-108.60616	7,120	20.2	No
9503700	Verde River near Paulden, AZ	4	2,510.00	34.89502	-112.34295	5,460	16.2	No
9424450	Big Sandy River near Wikieup, AZ	4	2,560.00	34.46252	-113.62438	4,330	15.7	Yes
9444500	San Francisco River at Clifton, AZ	4	2,760.00	33.04951	-109.29590	6,810	20.9	Yes
9431500	Gila River near Redrock, NM	4	2,830.00	32.72694	-108.67556	6,900	19.8	No
9497500	Salt River near Chrysotile, AZ	4	2,830.00	33.79811	-110.49983	6,760	25.1	No
9432000	Gila River below Blue Creek near Virden, NM	4	3,200.00	32.64813	-108.84589	6,690	19.3	No
9504000	Verde River near Clarkdale, AZ	4	3,510.00	34.85224	-112.06599	5,620	17.3	Yes
9442000	Gila River near Clifton, AZ	4	4,010.00	32.96590	-109.31035	6,230	18.1	Yes
9498500	Salt River near Roosevelt, AZ	4	4,290.00	33.61950	-110.92150	6,180	24.5	Yes
9506000	Verde River near Camp Verde, AZ	4	5,020.00	34.44836	-111.78987	5,570	18.7	No
9508500	Verde River below Tangle Creek above Horseshoe Dam, AZ	4	5,870.00	34.07309	-111.71626	5,440	19.4	Yes
9448500	Gila River at Head of Safford Valley near Solomon, AZ	4	7,890.00	32.86840	-109.51119	6,330	19.2	Yes
9458500	Gila River at Safford, AZ	4	10,500.00	32.84729	-109.71591	5,830	17.9	No
9466500	Gila River at Calva, AZ	4	11,500.00	33.18561	-110.22009	5,660	17.6	No
9474000	Gila River at Kelvin, AZ	4	18,000.00	33.10284	-110.97650	5,160	17.7	Yes
9471185	Walnut Gulch 63.103 near Tombstone, AZ	5	0.01	31.74406	-110.05342	4,500	14.1	No
9481800	Demetrie Wash Tributary Near Continental, AZ	5	0.15	31.87092	-111.08815	3,630	15.6	Yes
9485100	Saguaro Corners Wash near Tucson, AZ	5	0.18	32.16980	-110.73814	3,080	15.2	No
9471087	Walnut Gulch 63.111 near Tombstone az	5	0.21	31.73454	-109.94841	5,010	16.0	Yes
9486700	Chiltepines Wash near Sasabe, AZ	5	0.34	31.81897	-111.43844	3,190	14.7	Yes
9478600	Queen Creek Tributary No. 3 at Whitlow Dam, AZ	5	0.38	33.29172	-111.28124	2,300	14.2	Yes

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9479200	Queen Creek Tributary A Apache Junc, AZ	5	0.39	33.40366	-111.54152	1,770	11.9	Yes
9483040	West Speedway Wash near Tucson, AZ	5	0.47	32.23897	-111.04593	2,660	12.6	Yes
9536350	Surprise Canyon near Dos Cabezas, AZ	5	0.66	32.01120	-109.35395	6,240	23.3	Yes
9487140	San Joaquin Wash near Tucson, AZ	5	0.68	32.16869	-111.13343	2,580	12.2	Yes
9471600	Canary Wash near Benson, AZ	5	0.75	31.87647	-110.34230	5,280	18.0	No
9482330	Pumping Wash near Vail, AZ	5	0.80	32.06952	-110.80703	3,000	14.6	Yes
9536100	Pitchfork Canyon Tributary near Fort Grant, AZ	5	0.90	32.58896	-109.91174	5,070	16.2	Yes
9487400	Quijotoa Wash Tributary near Quijotoa, AZ	5	1.70	32.17368	-112.10902	2,720	13.3	Yes
9512200	Salt River Tributary in South Mountain Park Phoenix, AZ	5	1.73	33.34699	-112.08487	1,800	8.8	No
9483200	Agua Caliente Wash Tributary near Tucson, AZ	5	1.91	32.26869	-110.73814	3,520	16.7	Yes
9485950	Geronimo Wash near Tucson, AZ	5	1.95	32.33230	-110.94426	3,600	17.7	Yes
9472400	Mammoth Wash near Mammoth, AZ	5	2.00	32.67646	-110.68538	3,720	17.5	No
9483030	Anklam Wash at Tucson, AZ	5	2.10	32.22508	-111.03121	2,760	13.2	No
9471700	Fenner Wash near Benson, AZ	5	2.37	31.98036	-110.21646	4,150	15.5	Yes
9471120	Walnut Gulch 63.011 near Tombstone, AZ	5	3.08	31.74120	-109.99508	4,880	15.3	Yes
9482480	Big Wash at Tucson, AZ	5	3.14	32.18619	-111.00259	2,780	13.2	Yes
9483300	Sabino Creek near Mount Lemmon, AZ	5	3.34	32.42230	-110.75204	8,040	37.8	No
9471180	Walnut Gulch 63.003 near Tombstone, AZ	5	3.59	31.73259	-110.05758	4,620	14.5	Yes
9473200	Green Lantern Wash near Winkelman, AZ	5	3.59	32.92507	-110.72705	2,590	16.2	Yes
9471310	Huachuca Canyon near Fort Huachuca, AZ	5	4.11	31.51806	-110.38722	6,810	26.4	No
9470750	Ramsey Canyon near Sierra Vista, AZ	5	4.16	31.44667	-110.30583	7,320	28.5	Yes
9473600	Tam O'shanter Wash near Hayden, AZ	5	4.43	33.02951	-110.87344	3,050	17.8	Yes
9485900	Pima Wash near Tucson, AZ	5	4.95	32.33758	-110.96037	4,520	21.2	Yes
9471195	Walnut Gulch 63.007 near Tombstone, AZ	5	5.24	31.73287	-110.09813	4,490	14.1	Yes
9471130	Walnut Gulch 63.008 near Tombstone, AZ	5	5.70	31.72315	-110.04480	4,770	15.0	Yes
9484510	Ventana Canyon Wash near Tucson, AZ	5	6.33	32.30980	-110.83953	4,660	24.0	No
9471080	Walnut Gulch 63.010 near Tombstone, AZ	5	6.38	31.72037	-110.02563	5,000	16.3	Yes

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID (1)	Gage Location (2)	Flood Region (3)	Area, sm (4)	Location Lat (5)	Location Long (6)	Elevation (7)	*PRECIP* (8)	Used (9)
2170	Ventana Canyon Wash at Sunrise Road, AZ	5	7.11	32.30875	-110.83898	4,530	23.3	No
9470900	San Pedro River Tributary near Bisbee, AZ	5	7.22	31.57010	-110.02730	4,800	15.5	Yes
9470800	Garden Canyon near Fort Huachuca, AZ	5	8.60	31.47288	-110.34786	6,710	25.8	Yes
9471110	Walnut Gulch 63.015 near Tombstone, AZ	5	9.19	31.71287	-110.04091	4,690	14.6	No
9471090	Walnut Gulch 63.009 near Tombstone, AZ	5	9.21	31.71787	-110.02508	4,850	15.4	Yes
9482350	South Fork Airport Wash near Tucson, AZ	5	9.80	32.10008	-110.90898	2,850	13.7	Yes
9481700	Calabasas Canyon near Nogales, AZ	5	10.30	31.45704	-110.98648	4,130	20.2	Yes
9488600	Silver Reef Wash near Casa Grande, AZ	5	12.00	32.68228	-111.83485	1,600	9.7	Yes
9487100	Little Brawley Wash near Three Points, AZ	5	12.80	32.12369	-111.32983	2,780	12.8	Yes
9482370	North Fork Airport Wash near Tucson, AZ	5	13.00	32.11119	-110.90898	2,970	14.4	Yes
9484580	Barrel Canyon near Sonoita, AZ	5	13.90	31.86175	-110.69119	5,010	23.7	Yes
9478200	Durham Wash near Florence, AZ	5	14.80	32.72229	-111.10900	3,670	17.4	Yes
9484200	Bear Creek near Tucson, AZ	5	16.90	32.30619	-110.80148	5,780	27.9	Yes
9482420	Julian Wash at Tucson, AZ	5	19.60	32.17091	-110.94092	2,820	13.5	Yes
2070	Tanque Verde Wash 0.5 Miles South Of Chiva Tank, AZ	5	23.00	32.26790	-110.60698	5,090	22.1	Yes
9482200	Flato Wash near Sahuarita, AZ	5	24.00	32.04536	-110.95065	3,490	16.7	Yes
9486590	Arivaca Creek near Arivaca, AZ	5	34.10	31.57231	-111.33232	4,080	21.0	Yes
9484000	Sabino Creek near Tucson, AZ	5	35.20	32.31674	-110.81037	6,080	30.2	Yes
9471140	Walnut Gulch 63.006 near Tombstone, AZ	5	36.10	31.72454	-110.05535	4,800	15.1	No
9482450	West Branch Santa Cruz River at Tucson, AZ	5	37.10	32.13341	-111.00898	3,020	13.8	Yes
9484570	Mescal Arroyo near Pantano, AZ	5	38.60	31.98980	-110.56508	4,180	17.7	Yes
1080	CaDada Del Oro Wash Northeast Of Saddlebrooke, AZ	5	42.20	32.56421	-110.84783	5,340	25.8	No
9483100	Tanque Verde Creek near Tucson, AZ	5	43.10	32.24674	-110.68008	4,860	21.3	No
2090	Tanque Verde Wash at Tanque Verde Guest Ranch, AZ	5	43.20	32.24580	-110.68277	4,860	21.3	No
9471190	Walnut Gulch 63.002 near Tombstone, AZ	5	43.30	31.73481	-110.09841	4,750	15.0	No

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9485000	Rincon Creek near Tucson, AZ	5	44.70	32.12952	-110.62591	5,100	21.4	Yes
9484590	Davidson Canyon Wash near Vail, AZ	5	50.40	31.99369	-110.64508	4,510	21.1	No
4310	Davidson Canyon Wash 0.25 Miles South Of Interstate 10, AZ	5	50.40	31.99358	-110.64517	4,510	21.1	No
9471200	Walnut Gulch 63.001 near Tombstone, AZ	5	57.10	31.72926	-110.15341	4,660	14.7	Yes
1100	CaDada Del Oro Wash at Golder Ranch Road, AZ	5	64.80	32.47808	-110.89885	4,810	23.2	Yes
9537200	Leslie Creek near McNeal, AZ	5	78.80	31.59010	-109.50896	5,330	18.2	Yes
9480000	Santa Cruz River near Lochiel, AZ	5	82.00	31.35538	-110.58953	5,090	19.7	Yes
9478500	Queen Creek below Whitlow Dam near Superior, AZ	5	143.00	33.29922	-111.27763	3,220	18.9	Yes
9488650	Vekol Wash near Stanfield	5	148.00	32.84172	-112.25181	2,260	10.0	Yes
9471380	Upper Babocomari River near Huachuca City, AZ	5	156.00	31.63500	-110.42472	5,140	18.6	Yes
9481750	Sopori Wash at Amado, AZ	5	166.00	31.72370	-111.06176	3,810	18.6	Yes
9481500	Sonoita Creek near Patagonia, AZ	5	209.00	31.49982	-110.81814	4,920	21.2	Yes
9484500	Tanque Verde Creek at Tucson, AZ	5	220.00	32.26535	-110.84120	4,370	21.1	Yes
6723	Queen Creek at Cap, AZ	5	220.00	33.23217	-111.50314	2,940	17.5	No
9486300	Canada Del Oro near Tucson, AZ	5	250.00	32.37424	-111.00927	3,930	19.0	Yes
9484560	Cienega Creek near Pantano, AZ	5	289.00	31.98564	-110.56647	4,840	19.2	No
4280	Cienega Creek at Interstate 10, AZ	5	289.00	31.98596	-110.56798	4,840	19.2	No
9471400	Babocomari River near Tombstone, AZ	5	303.00	31.70028	-110.22639	5,000	17.8	Yes
9484600	Pantano Wash near Vail, AZ	5	456.00	32.03591	-110.67758	4,620	19.1	Yes
9486800	Altar Wash near Three Points, AZ	5	466.00	31.83897	-111.40427	3,740	18.6	No
9480500	Santa Cruz River near Nogales, AZ	5	532.00	31.34454	-110.85147	4,890	19.8	Yes
9473000	Aravaipa Creek near Mammoth, AZ	5	538.00	32.84423	-110.63010	4,570	18.6	Yes
9485500	Pantano Wash near Tucson, AZ	5	599.00	32.25008	-110.85064	4,430	18.7	Yes
9470500	San Pedro River at Palominas, AZ	5	738.00	31.38010	-110.11119	5,030	19.2	No
9487000	Brawley Wash near Three Points, AZ	5	785.00	32.07563	-111.33872	3,620	17.5	Yes
9486000	Rillito Creek near Tucson, AZ	5	905.00	32.29452	-110.98537	4,300	19.1	Yes
9487250	Los Robles Wash near Marana, AZ	5	1,200.00	32.43785	-111.30427	3,290	15.8	Yes

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9481740	Santa Cruz River at Tubac, AZ	5	1,210.00	31.61287	-111.04148	4,620	20.1	Yes
9471000	San Pedro River at Charleston, AZ	5	1,220.00	31.62593	-110.17452	4,940	18.1	Yes
9537500	Whitewater Draw near Douglas, AZ	5	1,230.00	31.35233	-109.58507	4,740	15.8	No
9482000	Santa Cruz River at Continental, AZ	5	1,670.00	31.87147	-110.98009	4,390	19.6	Yes
9471550	San Pedro River near Tombstone, AZ	5	1,730.00	31.75092	-110.20119	4,900	17.7	No
9488500	Santa Rosa Wash near Vaiva Vo, AZ	5	1,730.00	32.66756	-111.92819	2,220	11.1	Yes
6040	Santa Cruz River at Valencia Road, AZ	5	2,050.00	32.13306	-110.99309	4,190	18.9	Yes
9482500	Santa Cruz River at Tucson, AZ	5	2,190.00	32.22119	-110.98176	4,100	18.5	No
9471800	San Pedro River near Benson, AZ	5	2,490.00	32.12647	-110.29007	4,750	17.1	No
9472000	San Pedro River near Redington, AZ	5	2,920.00	32.38063	-110.44647	4,680	17.1	No
9486500	Santa Cruz River at Cortaro, AZ	5	3,460.00	32.35119	-111.09454	4,080	18.5	No
9486520	Santa Cruz River at Trico Road near Marana, AZ	5	3,570.00	32.47146	-111.30761	4,040	18.3	No
9473500	San Pedro River at Winkelman, AZ	5	4,450.00	32.97729	-110.77038	4,440	17.4	No
9419623	Deer Creek near Charleston Park, NV	1	1.26	36.31246	-115.62029	9,680	26.2	Yes
9489080	Hannagan Creek near Hannagan Meadow, AZ	1	1.74	33.64728	-109.28952	9,040	32.1	No
9338500	East Fork Deer Creek near Boulder, UT	1	1.79	38.00138	-111.38962	9,440	19.8	Yes
9378630	Recapture Creek near Blanding, UT	1	3.81	37.75555	-109.47651	8,680	25.7	Yes
9460150	Frye Creek near Thatcher, AZ	1	4.04	32.74396	-109.83814	8,130	33.6	No
9442630	Mail Hollow near Luna, NM	1	4.75	33.79389	-108.95028	7,780	20.8	Yes
9419610	Lee Canyon near Charleston Park, NV	1	9.25	36.34030	-115.65223	9,170	21.1	No
9442695	Negro Canyon at Aragon, NM	1	9.33	33.88339	-108.55062	7,660	15.8	No
9406300	Kanarra Creek at Kanarraville, UT	1	9.87	37.53803	-113.16856	7,770	20.1	Yes
9415515	Water Canyon Creek near Preston, NV	1	10.70	38.98772	-114.95835	8,080	16.5	No
9369500	Middle Mancos River near Mancos, CO	1	12.10	37.37389	-108.23064	9,390	30.7	Yes
9395400	Milk Ranch Canyon near Ft. Wingate, NM	1	14.40	35.43194	-108.55500	7,870	18.5	No
9489200	Pacheta Creek at Maverick, AZ	1	16.30	33.73977	-109.54064	8,600	32.9	Yes
9383600	Fish Creek near Eagar, AZ	1	16.80	34.07644	-109.46315	9,150	30.2	Yes

Table F.2 USGS data for stream gages used for regional regression equations

(From Paretti, Kennedy, Turney and Veilleux (2014))

Gage ID	Gage Location	Flood Region	Area, sm	Location		Elevation	*PRECIP*	Used
				Lat	Long			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
9408400	Santa Clara River near Pine Valley, UT	1	18.80	37.38331	-113.48329	8,640	25.4	Yes
9338000	East Fork Boulder Creek near Boulder, UT	1	20.40	38.04193	-111.45017	10,700	23.8	Yes
9343500	Rito Blanco near Pagosa Springs, CO	1	23.10	37.19362	-106.90531	9,270	33.0	Yes
9383400	Little Colorado River at Greer, AZ	1	28.90	34.01671	-109.45731	9,440	32.8	Yes
9405420	North Fork Virgin River below Bulloch Canyon near Glendale, UT	1	29.40	37.41831	-112.80049	7,820	20.7	Yes
9442660	Trout Creek at Luna, NM	1	31.80	33.84611	-108.95167	8,630	24.1	Yes
9365500	La Plata River at Hesperus, CO	1	34.50	37.28972	-108.04063	10,200	38.8	Yes
9336000	Birch Creek near Escalante, UT	1	35.20	37.76249	-111.73824	8,380	18.8	Yes
9419640	Kyle Canyon near Charleston Park, NV	1	35.40	36.27774	-115.47029	7,850	22.0	No
9378650	Recapture Creek below Johnson Creek near Blanding, UT	1	37.30	37.68083	-109.46262	7,920	21.9	Yes
9489070	North Fork Of East Fork Black River near Alpine, AZ	1	38.40	33.90311	-109.32286	9,050	28.9	Yes