Whitewater and Habitat Improvements

Illinois River, Siloam Springs, Arkansas

Stormwater Management Plan

May 2013

Prepared by
Recreation Engineering and Planning
485 Arapahoe
Boulder, CO 80302
www.boaterparks.com
303-808-7734

Recreation
Engineering & Planning
www.boaterparks.com

Reviewed by
Crist Engineers, Inc.
Stewart Noland, P.E., President
Recreation Engineering and Planning
Gary Lacy, P.E., President

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 4787
STEWART W. NOLAND

Stewart Noland
6-4-13

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Introduction

The Siloam Springs Whitewater and Habitat Improvements Project is a proposed multi-use park located 6 miles south of Siloam Springs on the Illinois River at the historic Fisher Ford Bridge site. The project area is less than 5 acres with the majority of the development on the north or river right bank. The proposed project will include two in-stream whitewater structures designed to improve fish habitat and recreational boating opportunities, as well as related bank and access improvements. These improvements will be designed with ADA access and opportunities in mind. The project will also include an improved parking lot, picnic area and changing facilities. These improvements will help strengthen the tie between the river and the community, will provide a whitewater paddling amenity for the local community, and create a whitewater and fishing resource for the region.

Existing Conditions

Currently the site is primarily agricultural and is used as a river access site without any improvements. The site can be divided into 3 small on-site drainage basins. For the purpose of this report, there is also approximately 5 acres of off-site contributing runoff to this site.

Based on Natural Resource Conservation Service (NRCS) soils report for the area, the soils on-site are occasionally flooded Healing Silt Loams. These soils are hydrologic group B soils which have a moderate infiltration rate and are moderately well drained. See the Appendices for the soil survey or go to websoilsurvey.nrcs.usda.gov.

All of the proposed project area is in a Zone A flood delineation, which does not include any base flood elevations. In conjunction with this project, Recreation Engineering and Planning completed a Base Flood Elevation Determination for the site. The results of this report showed the base flood elevation to be 946.5 feet.

Hydrologic Modeling

To determine the runoff and peak discharge from the contributing drainage basin, the WinTR-20 model, created by the Natural Resources Conservation Service (NRCS) was used. This model is a storm event surface water hydrologic model applied at a watershed scale. It is based upon unit hydrograph theory. Model input includes lot area, a weighted runoff curve number and the time of concentration to calculate the direct runoff from rainfall occurring over specified areas. It is used to analyze current watershed conditions as well as assess the impact of proposed changes (alternates) made within the watershed.

Method

To meet the drainage requirements for Benton County, calculations for the 25 year storm are required. The 25 year storm has a 4% chance of occurring in any given year. For comparison, the 100 year event is also included. The 100 year event has a 1% chance of occurring in any given year. The regulatory duration of both storms is 24 hours. The difference in runoff between the present and proposed land use for the 25 year storm is used to determine the required storm water detention volume. Discharge values from the 100 year event are used to verify the capacity of all drainage infrastructure. Rainfall values for both the 25 and 100 year event were taken from the NOAA Atlas 2, Volume III Isopluvial Maps which show peak rainfall for a given storm as contour lines across the state.

The runoff curve number which indicates the imperviousness of a given tract of land is based on standard values from the NRCS for different land uses. A Land Use Table showing runoff curve numbers for the different hydrologic groups can be referenced in the appendices. For the existing conditions, a runoff curve number of 79, “Pasture, grassland or range” was used. For all of impervious area, including the trails, parking areas and paved roadways for the developed conditions a runoff curve number of 98 “Impervious Areas” was used. Last for the temporary access road a runoff curve number of 85 was used.

The Time of Concentration was calculated using the SCS Lag Formula which is applicable for small watersheds such as the proposed development where surface flow is dominant. The SCS Lag Formula uses the flow length (L), Slope (S) and the Curve Number (CN) to calculate the Time of Concentration. These calculations are summarized in the appendices. The time of concentration for the proposed development is 37 minutes or 0.6 hours.

Table 1 - Stormwater Drainage Calculations for Benton County

Project : Fisher Ford

Developed Area: 104544 SF
Developed Area: 2.40 Acres
Hydrologic Soil Group: B

Present Land Use

Description	Area (Sq. Ft.)	CN	CN*A
Undeveloped Area	104544	79	8258976
Composite	104544	79.0	8258976

Proposed Land Use

Description	Area (Sq. Ft.)	CN	CN*A
Concrete Trails and Paved Parking	57470	98	5632060
Base Coarse Roadway	6695	85	569075
Undeveloped Area	40379	79	3189941
Composite	104544	89.8	9391076

Discharge Calculations

	Present Land Use	Proposed Land Use	Difference
25 Year Discharge (cfs)	12.3	15.5	3.2
100 Year Discharge (cfs)	19.4	36.1	16.7
25 Year Runoff (in)	4.8	6.1	1.3
100 Year Runoff (in)	6.3	7.6	1.3

25 year Required Pond Volume = 11326 Cu. Ft.

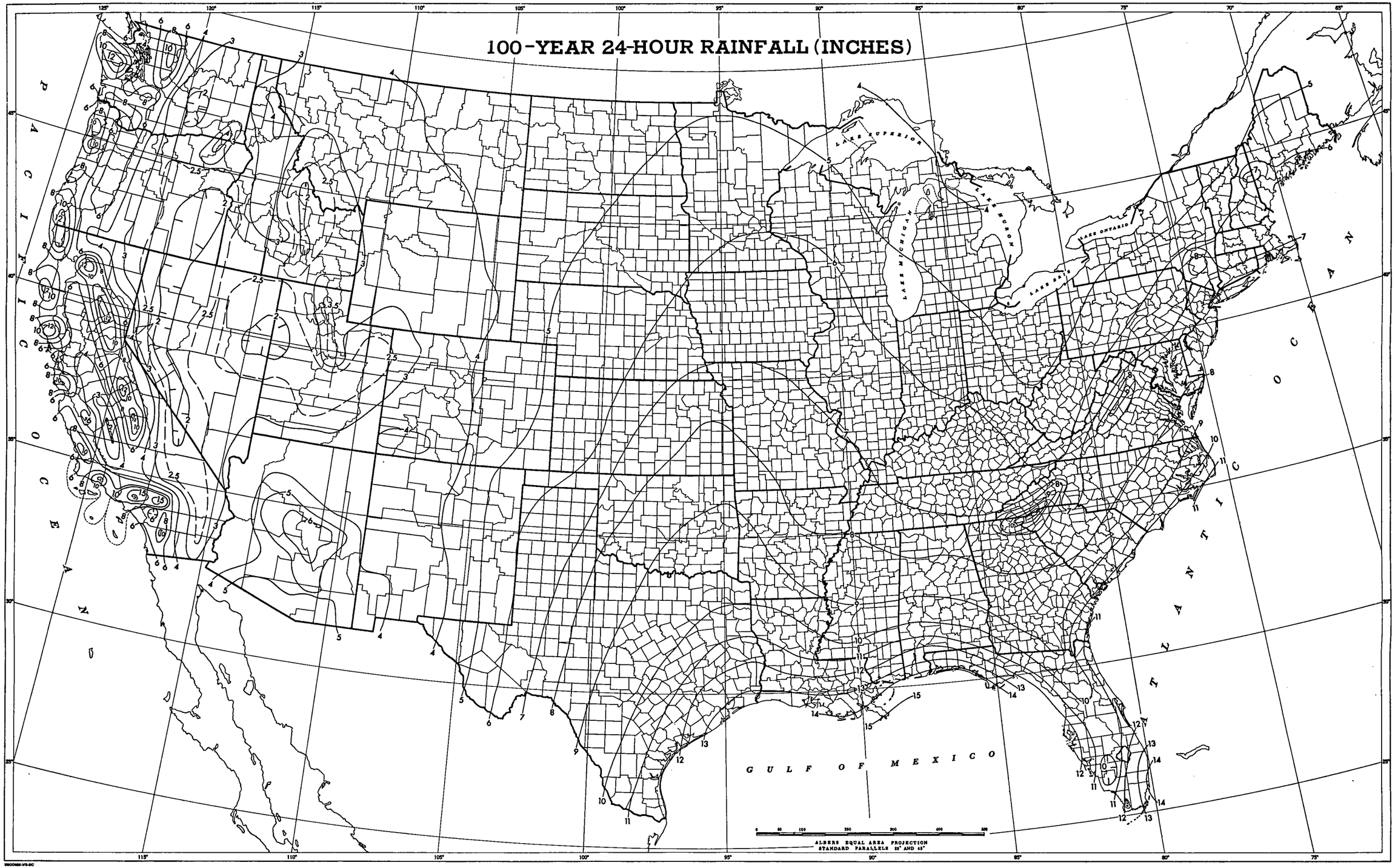
Analysis of Proposed Development

All runoff from this site will flow directly into the Illinois River and will not affect any downstream land owners.

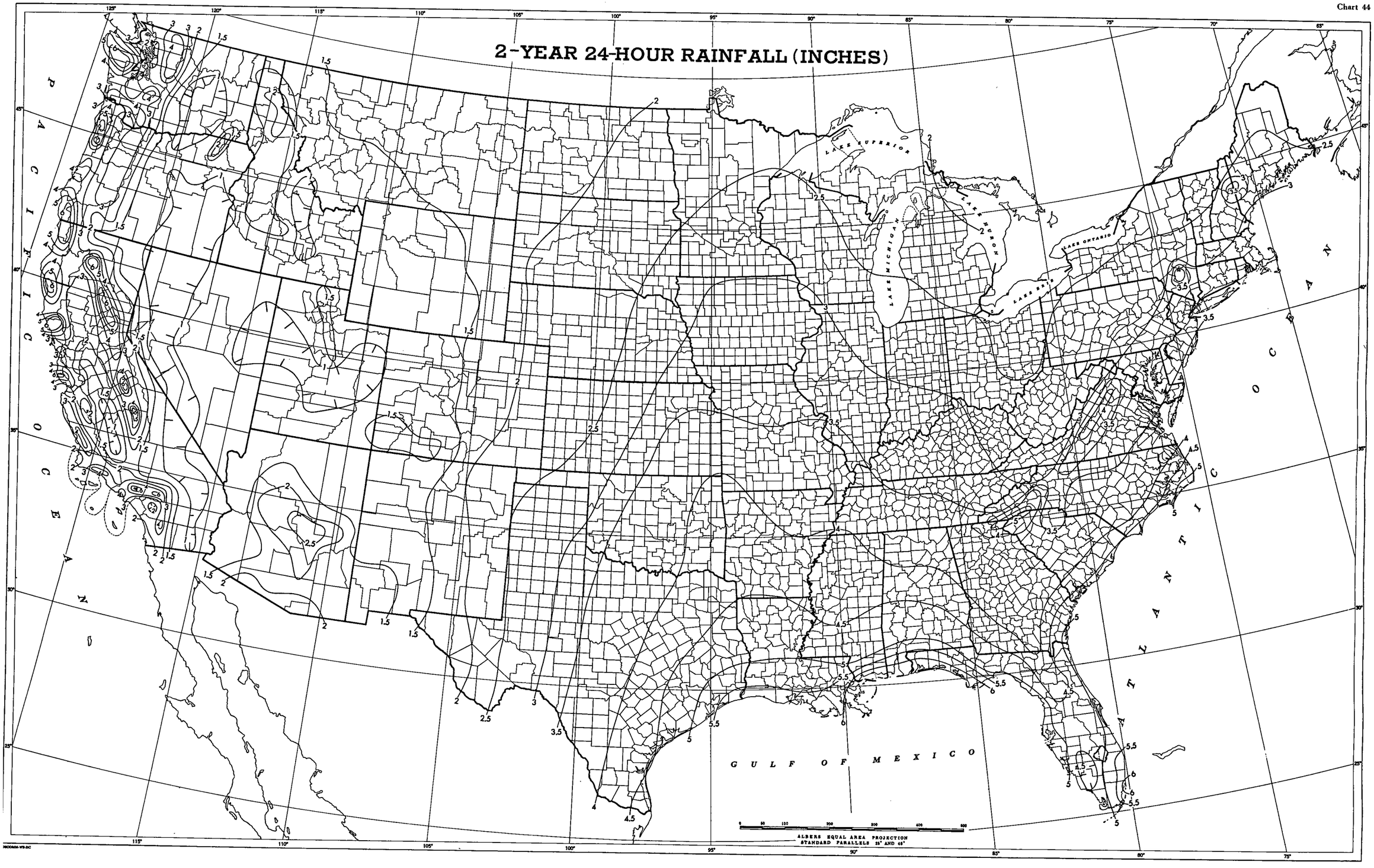
Runoff on-site will be controlled by two rain gardens and two sediment basins. The first rain garden is located in an island in the main parking lot. There will be two 24" curb cuts on the north side of this island which will convey runoff from the parking lot. Overflow from this first rain garden will discharge back into the parking lot where it can be captured by the second rain garden. The second rain garden is south west of the parking lot and west of the picnic area. This rain garden accepts runoff from the parking lot via a concrete swale. Overflow from second rain garden will flow down a rip rap swale to a small sediment basin before discharging to the Illinois River. A second sediment basin is located midway on the trail to the downstream river take out. There is little impervious area contributing to the runoff controlled by this sediment basin, so there is not a planned rain garden. Each of these rain gardens will be designed in conjunction with the Illinois River Watershed Partnership as a part of their Rain Garden Project.

The required storm water detention volume for this site is 11,326 CF. This value was computed by taking the difference in the 25-year runoff (1.3 in) and multiplying by the developed area (2.4 acres). This volume is the difference in runoff for the existing and proposed conditions. Based on the site conditions and the discharge calculations provided in this report for the 25 year storm, the on-site Rain Gardens and sediment basins will be adequate to control runoff from the Siloam Springs Whitewater and Habitat Improvements Project.

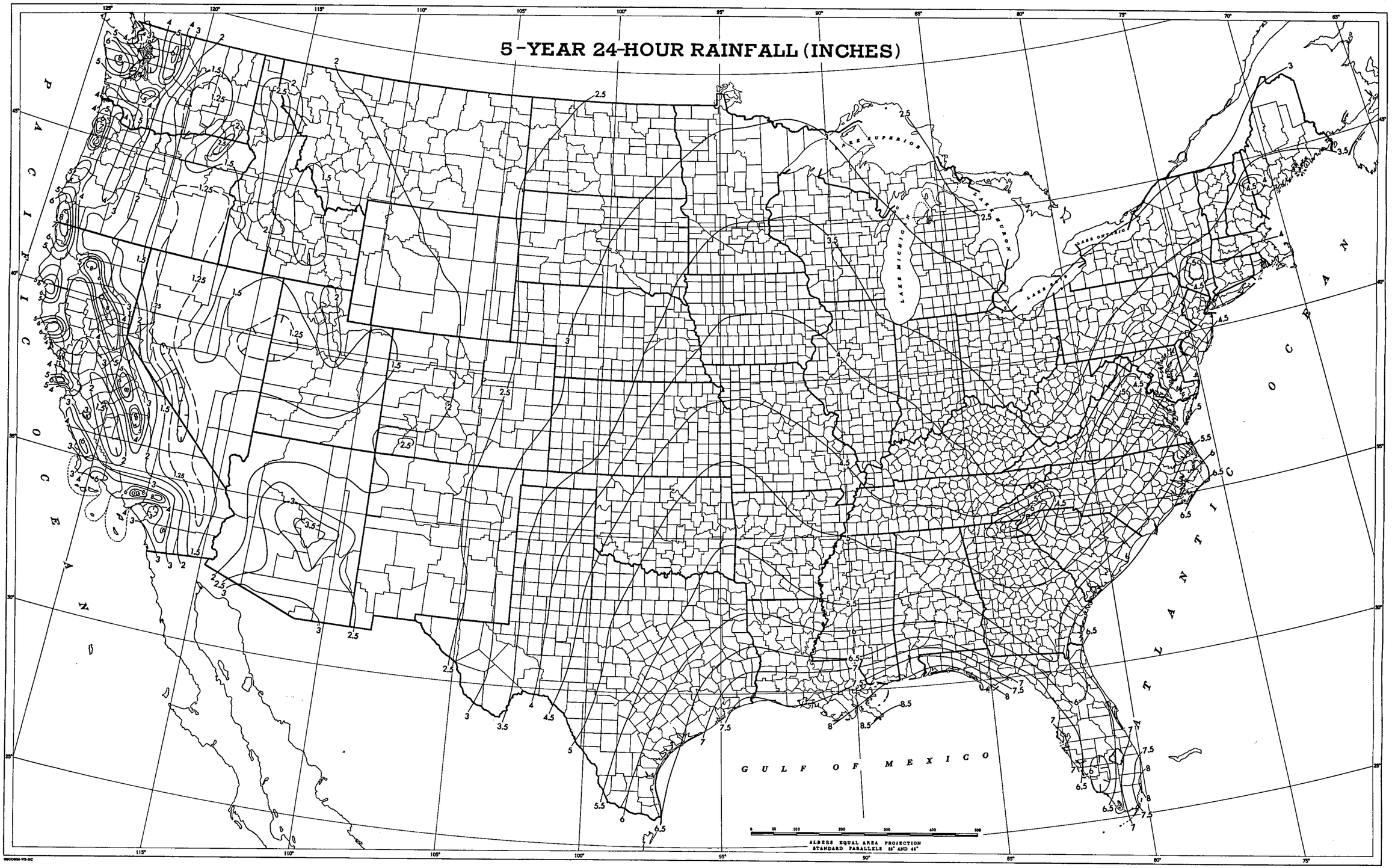
APPENDICES


100-YEAR 24-HOUR RAINFALL (INCHES)
PACIFIC OCEAN
ATLANTIC OCEAN
GULF OF MEXICO
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ONTARIO
LAKE ERIE
ALBERS EQUAL AREA PROJECTION
STANDARD PARALLELS 29° AND 45°

2-YEAR 24-HOUR RAINFALL (INCHES)



5-YEAR 24-HOUR RAINFALL (INCHES)



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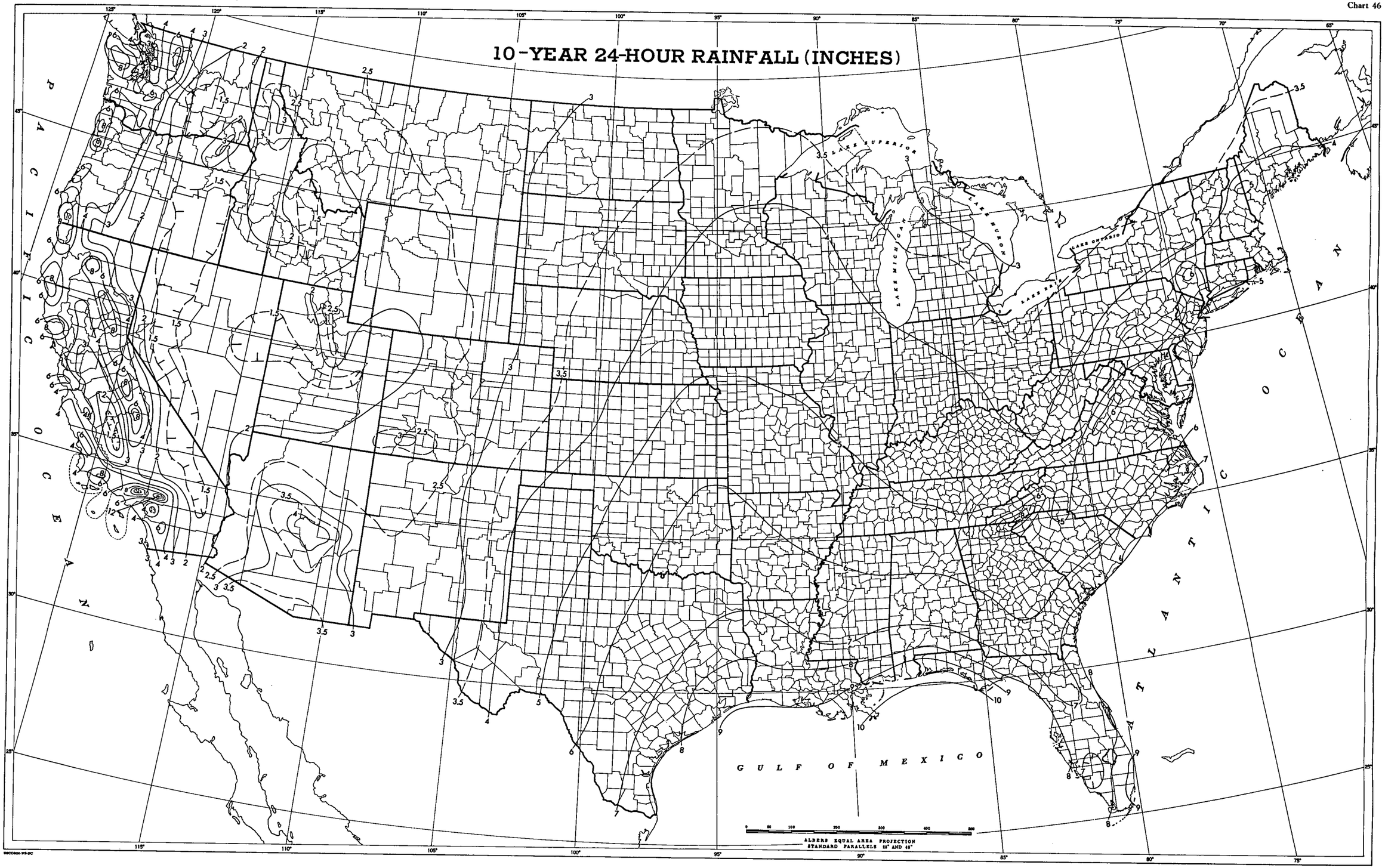
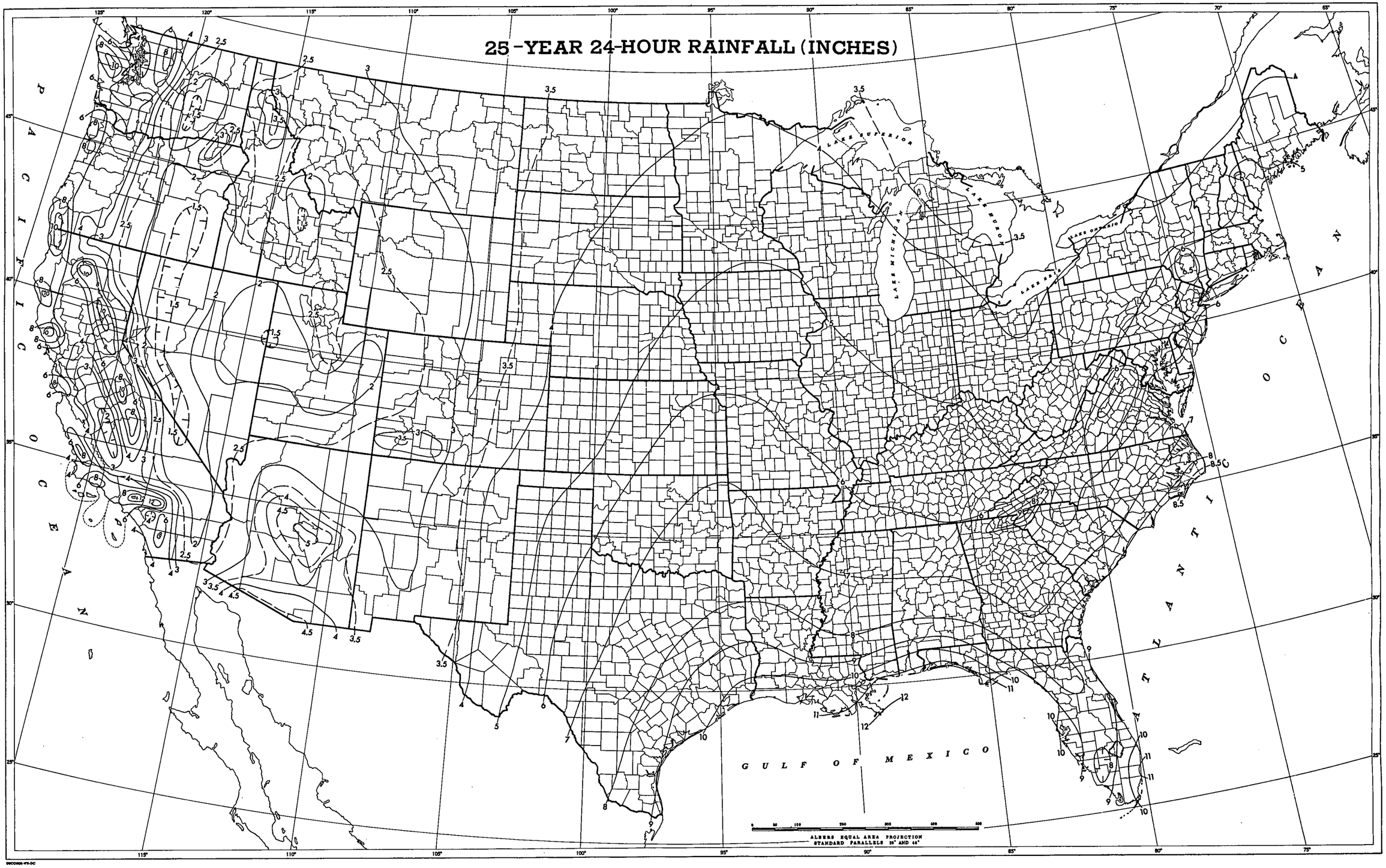
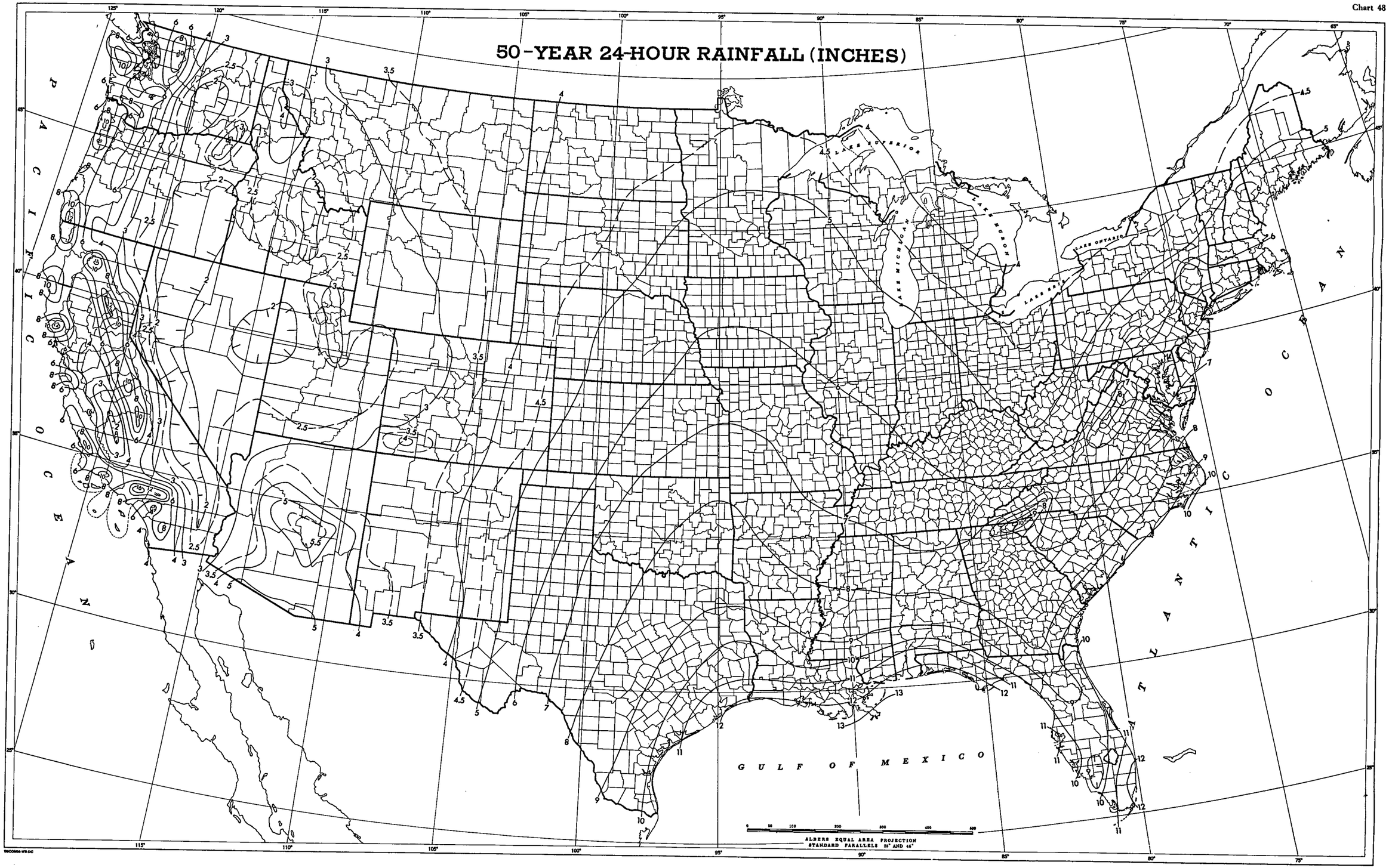
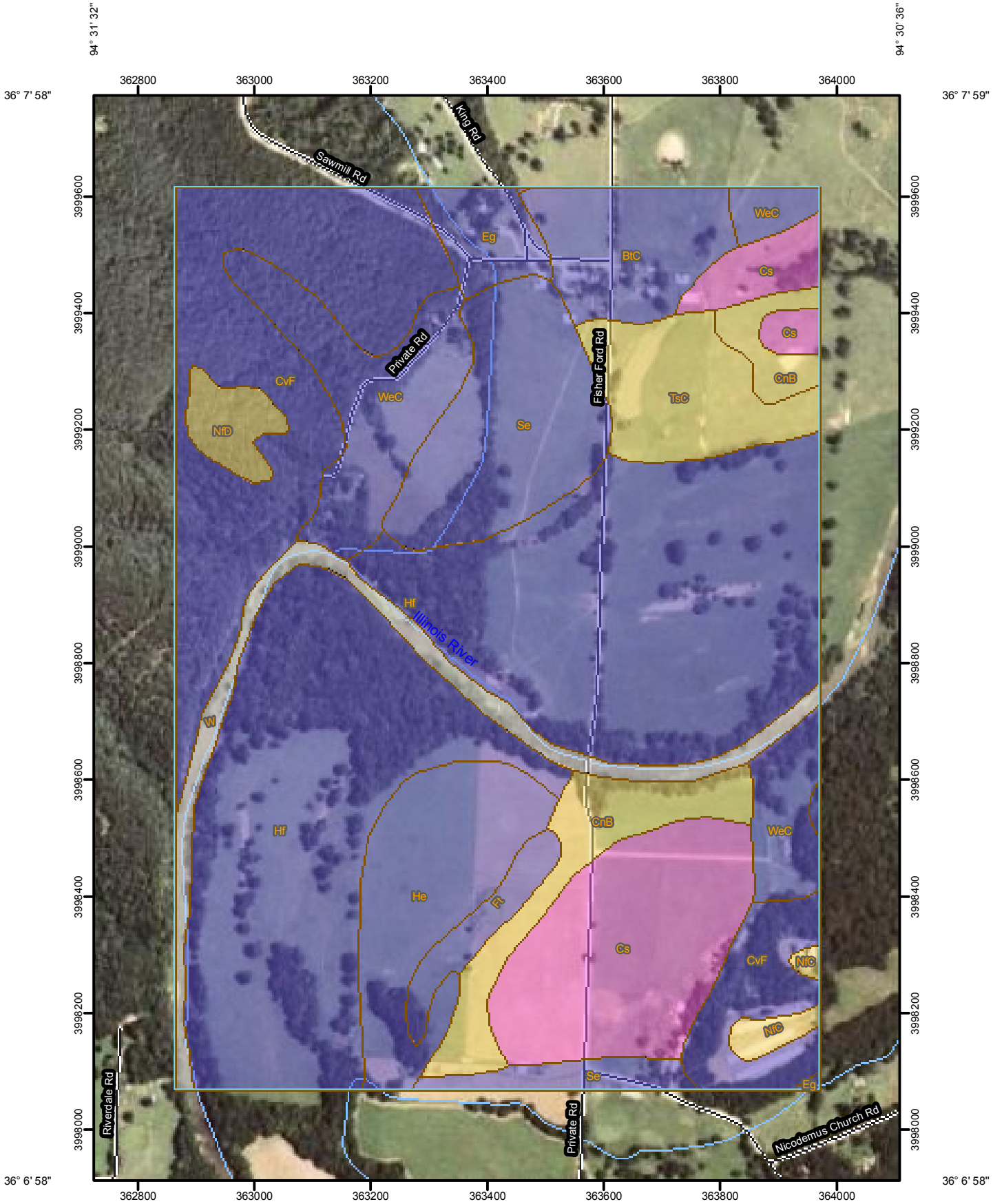



25-YEAR 24-HOUR RAINFALL (INCHES)
PACIFIC OCEAN
ATLANTIC OCEAN
GULF OF MEXICO
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ONTARIO
LAKE ERIE
ALBERS EQUAL AREA PROJECTION
STANDARD PARALLELS 29° AND 45°

50-YEAR 24-HOUR RAINFALL (INCHES)



Hydrologic Soil Group—Benton County, Arkansas
(Fisher Ford)



Map Scale: 1:8,880 if printed on A size (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 300 600 1,200 1,800

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Political Features

Cities

Water Features

Oceans

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:8,880 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 15N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Benton County, Arkansas
Survey Area Data: Version 8, Apr 4, 2008

Date(s) aerial images were photographed: 7/18/2003

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Benton County, Arkansas				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
BtC	Britwater gravelly silt loam, 3 to 8 percent slopes	B	16.2	3.8%
CnB	Captina silt loam, 1 to 3 percent slopes	C	18.7	4.4%
Cs	Cherokee silt loam	D	40.4	9.5%
CvF	Clarksville extremely gravelly silt loam, 12 to 50 percent slopes	B	63.6	15.0%
Eg	Elsah soils, occasionally and frequently flooded	B	7.3	1.7%
Ft	Fatima silt loam, occasionally flooded	B	5.6	1.3%
He	Healing silt loam, rarely flooded	B	25.2	6.0%
Hf	Healing silt loam, occasionally flooded	B	144.4	34.1%
NfC	Nixa very gravelly silt loam, 3 to 8 percent slopes	C	2.7	0.6%
NfD	Nixa very gravelly silt loam, 8 to 12 percent slopes	C	5.1	1.2%
Se	Secesh gravelly silt loam, occasionally flooded	B	32.1	7.6%
TsC	Tonti gravelly silt loam, 3 to 8 percent slopes	C	17.0	4.0%
W	Water		13.4	3.2%
WeC	Waben very gravelly silt loam, 3 to 8 percent slopes	B	31.9	7.5%
Totals for Area of Interest			**423.6**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Lower

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.

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

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

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

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

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1]

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

[1] Average runoff condition, and I_a=0.2S
[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.
[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

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

Table 2-2c Runoff curve numbers for other agricultural lands [1]

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

1 Average runoff condition, and $I_a = 0.2S$.
2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.
3 *Poor*: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.
4 Actual curve number is less than 30; use CN = 30 for runoff computations.
5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.
6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1]

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

1 Average runoff condition, and I_a, = 0.2S. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

Time of Concentration Calculations

SCS Lag Formula

$$t_c = 0.00526L^{0.8}(1000/CN-9)^{0.7}S^{-0.5}$$

On-Site

(CN) Curve Number	81.7
(L) Flow Length (ft)	350
(S) Slope (ft/ft)	0.01
(tc) Time of Concentration (min)	37.1
(tc) Time of Concentration (hour)	0.62

Use a Time of Peak of 0.6 for TR20 hydrologic model.

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WinTR-20 Printed Page File      Beginning of Input Data List
C:\Program Files (x86)\USDA\WinTR-20 version 1.11.11\Sample Files\Siloam.inp

WinTR-20: Version 1.11                  0         0         .1        0
Siloam Springs

SUB-AREA:
          North     Outlet    Arkansas  0.00375   58.       0.1
          Middle    Outlet    Arkansas  0.00344   58.       0.1
          South     Outlet    Arkansas  .0013     58.       0.1
          Parking   Outlet    Arkansas  0.0021    98.       0.1
          Ponding   Outlet    Arkansas  0.00375   79.       .6


ALTERNATE ANALYSIS:
Proposed  Proposed Conditions Pond Volume Calculation
          AREAS
          Ponding   Outlet    Arkansas  0.00375   89.8      .6

STORM ANALYSIS:
          100 Year  Arkansas  0.        8.9       Rain  2   2         4.2
          25 Year   Arkansas  0.        7.3       Rain  2   2         4.2
          10 Year   Arkansas  0.        6.1       Rain  2   2         4.2
          5 Year    Arkansas  0.        5.2       Rain  2   2         4.2




RAINFALL DISTRIBUTION:
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                    0.0       0.00340   0.00670   0.01010   0.01340
                    0.01740   0.02140   0.02540   0.02940   0.03440
                    0.03950   0.04450   0.04950   0.05640   0.06320
                    0.07010   0.07690   0.08590   0.09480   0.10710
                    0.11930   0.13540   0.15730   0.19350   0.67360
                    0.73020   0.75730   0.77580   0.79010   0.80040
                    0.81070   0.81870   0.82660   0.83240   0.83820
                    0.84400   0.84980   0.85430   0.85870   0.86320
                    0.86760   0.87120   0.87490   0.87850   0.88210
                    0.88520   0.88840   0.89150   0.89460   0.89740
                    0.90020   0.90300   0.90580   0.90860   0.91140
                    0.91420   0.91700   0.91950   0.92200   0.92450
                    0.92700   0.92940   0.93190   0.93440   0.93690
                    0.93910   0.94140   0.94360   0.94590   0.94810
                    0.95030   0.95260   0.95480   0.95680   0.95890
                    0.96090   0.96300   0.96500   0.96700   0.96910
                    0.97110   0.97300   0.97490   0.97670   0.97860
                    0.98050   0.98230   0.98420   0.98610   0.98780
                    0.98960   0.99130   0.99310   0.99480   0.99650
                    0.99830   1.00000


GLOBAL OUTPUT:
          3         .001                YNNYY     YYNYYY


VERIFICATION:
          DATA PREP Y     Y   Y Y     Y   Y   Y Y           Y Y Y Y       Y



WinTR-20 Printed Page File      End of Input Data List

                                 Siloam Springs

                           Name of printed page file:
 C:\Program Files (x86)\USDA\WinTR-20 version 1.11.11\Sample Files\Siloam.out

                                        STORM 100 Year

Area or    Drainage  Rain Gage     Runoff   ------------ Peak Flow ------------
 Reach       Area      ID or       Amount   Elevation   Time      Rate      Rate
Identifier  (sq mi)   Location      (in)      (ft)       (hr)      (cfs)     (csm)

North         0.004  Arkansas      3.775                6.02    21.817   5817.86
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Middle	0.003	Arkansas	3.774		6.02	20.013	5817.86
South	0.001	Arkansas	2.798		6.02	7.563	5817.86
Parking	0.002	Arkansas	8.355		6.00	23.034	10968.59
Ponding	0.004	Arkansas	6.326		6.25	16.093	4291.59
OUTLET	0.014		5.024		6.02	78.744	5491.24

STORM 25 Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
North	0.004	Arkansas	2.459		6.02	15.061	4016.26
Middle	0.003	Arkansas	2.376		6.02	13.816	4016.26
South	0.001	Arkansas	1.778		6.02	5.221	4016.26
Parking	0.002	Arkansas	6.407		6.00	18.877	8988.97
Ponding	0.004	Arkansas	4.836		6.28	12.277	3273.95
OUTLET	0.014		3.576		6.02	57.556	4013.66

STORM 10 Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
North	0.004	Arkansas	1.429		6.02	10.365	2764.09
Middle	0.003	Arkansas	1.405		6.02	9.508	2764.09
South	0.001	Arkansas	1.138		6.02	3.593	2764.09
Parking	0.002	Arkansas	5.161		6.00	15.756	7502.99
Ponding	0.004	Arkansas	3.613		6.29	9.395	2505.28
OUTLET	0.014		2.514		6.02	42.562	2968.09

STORM 5 Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
North	0.004	Arkansas	0.910		6.02	7.133	1902.05
Middle	0.003	Arkansas	0.909		6.02	6.543	1902.05
South	0.001	Arkansas	0.712		6.02	2.473	1902.05
Parking	0.002	Arkansas	4.268		6.00	13.407	6384.43
Ponding	0.004	Arkansas	2.685		6.28	7.338	1956.92
OUTLET	0.014		1.847		6.02	31.938	2227.17

ALTERNATE Proposed STORM 100 Year

Siloam Springs
Proposed Conditions Pond Volume Calculation

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
North	0.004	Arkansas	3.775		6.02	21.817	5817.86
Middle	0.003	Arkansas	3.774		6.02	20.013	5817.86
South	0.001	Arkansas	2.798		6.02	7.563	5817.86
Parking	0.002	Arkansas	8.355		6.00	23.034	10968.59
Ponding	0.004	Arkansas	7.640		6.27	19.410	5175.89
OUTLET	0.014		5.367		6.02	80.987	5647.64

ALTERNATE Proposed STORM 25 Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
North	0.004	Arkansas	2.459		6.02	15.061	4016.26
Middle	0.003	Arkansas	2.376		6.02	13.816	4016.26
South	0.001	Arkansas	1.778		6.02	5.221	4016.26
Parking	0.002	Arkansas	6.407		6.00	18.877	8988.97
Ponding	0.004	Arkansas	6.064		6.25	15.477	4127.12
OUTLET	0.014		3.898		6.02	59.682	4161.90

ALTERNATE Proposed STORM 10 Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
North	0.004	Arkansas	1.429		6.02	10.365	2764.09
Middle	0.003	Arkansas	1.405		6.02	9.508	2764.09
South	0.001	Arkansas	1.138		6.02	3.593	2764.09
Parking	0.002	Arkansas	5.161		6.00	15.756	7502.99
Ponding	0.004	Arkansas	4.880		6.25	12.528	3340.93
OUTLET	0.014		2.845		6.02	44.550	3106.70

ALTERNATE Proposed STORM 5 Year

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
North	0.004	Arkansas	0.910		6.02	7.133	1902.05
Middle	0.003	Arkansas	0.909		6.02	6.543	1902.05
South	0.001	Arkansas	0.712		6.02	2.473	1902.05
Parking	0.002	Arkansas	4.268		6.00	13.407	6384.43
Ponding	0.004	Arkansas	3.815		6.27	10.329	2754.52
OUTLET	0.014		2.142		6.02	33.825	2358.80

Siloam Springs

Area or Reach Identifier	Drainage Area (sq mi)	Alternate	Peak Flow by Storm 100 Year (cfs)	25 Year (cfs)	10 Year (cfs)	5 Year (cfs)	(cfs)
North	0.004		21.817	15.061	10.365	7.133	
		Proposed	21.817	15.061	10.365	7.133	
Middle	0.003		20.013	13.816	9.508	6.543	
		Proposed	20.013	13.816	9.508	6.543	
South	0.001		7.563	5.221	3.593	2.473	
		Proposed	7.563	5.221	3.593	2.473	
Parking	0.002		23.034	18.877	15.756	13.407	
		Proposed	23.034	18.877	15.756	13.407	
Ponding	0.004		16.093	12.277	9.395	7.338	
		Proposed	19.410	15.477	12.528	10.329	
OUTLET	0.014		78.744	57.556	42.562	31.938	
		Proposed	80.987	59.682	44.550	33.825	