

**RIVERSBEND  
APPROX. 900 S 3500 W  
WEBER COUNTY, UTAH 84401  
STORM WATER STUDY**

Project No. 21N724

6-9-2021

Revised 8-4-2021

Revised 8-24-2021

**General Site Information:**

The proposed residential site is located approximately at 900 South 3500 West. The site is situated about 1,000 ft to the west of the Weber River in Weber County, Utah. Construction will consist of a 97-lot residential subdivision prepared for development along with site grading, sidewalks, curb and gutter, underground utilities, and landscaped areas when completed.

Storm water from the site will be collected in inlet boxes and catch basins and will continue via storm drain to the northwest and northeast corners of the study area. Storm water will be detained in a detention pond located at each of those corners of the site. The site is divided into two phases with 48 lots on the west side (Phase 1) and 49 lots on the east side (Phase 2). Each phase is allowed a unit-release of 0.1 cfs per acre for the 100-yr storm. Phase 1 discharges into an existing ditch which meanders northerly, westerly, and southerly before combining with the Weber River. Phase 2 discharges into an existing ditch near the east side of the site, which flows northerly and easterly before combining with the Weber River. The attached figure shows the project site and location of the storm water outfall. Detention calculations have been provided for the site. (See attached figure and calculations).

The study area is broken up into 6 drainage areas (labeled A-1 through A-6). A runoff coefficient of 0.15 is used for natural ground and landscaped areas. A runoff coefficient of 0.90 is used for asphalt, concrete, buildings, and other hard surfaced areas. An average runoff coefficient was calculated for each of the drainage areas. The calculated coefficients are 0.52, 0.53, 0.46, 0.50, 0.51 and 0.50 for A-1 through A-6 respectively. This yields a coefficient of 0.50 for the overall study area.

Times of concentration are calculated using the FAA method assuming flow resistance coefficients of  $K=0.35$  for landscape and  $K=0.91$  for hardscape for each of the areas. The times of concentration are about 20, 19, 22, 16, 20 and 24 respectively for areas A-1 through A-6. These times are based on the hydraulically longest drainage path inside each respective drainage area over grass or other vegetation, asphalt, concrete, and/or through a pipeline as applicable. Times calculated to be less than 5 minutes are rounded to 5 minutes (as applicable) when using this method. Rainfall Intensities were taken from NOAA Atlas 14 for pipe sizing and detention requirements. The values obtained were interpolated as necessary. A copy of these data is attached.

Data showing area information, runoff coefficient, time of concentration, peak flows, and detention storage requirements for the site are also provided and can be found in the attached calculations.

### **Design Requirements:**

The design storms and allowable stormwater release rate were found at the weber county website and verified with the County Engineer on 5/28/2021. For storm drain piping, the requirement is listed as the “10-year frequency storm” for multiple initial collection points and conveyance (pipes) and “0.1 cfs/acre per 100-year frequency rainfall event” for major collection (detention pond) of multiple initial systems.

### **Pipe Sizes:**

Storm water pipes in the project are proposed to be concrete pipe (CP), and/or reinforced concrete pipe (RCP). All pipes in the project are sloped to provide the design capacity while maintaining a minimum scour speed of at least 2 feet per second when the pipes are flowing at least half full. The pipes and inlet boxes have enough capacity to convey the 10-year storm without surcharging.

### **Orifice Plate:**

An orifice plate will be used in the detention pond serving each phase to control the rate that storm water flows from the project. They will be located on the downstream face of the outlet structures labeled as nodes 27 and 50 (See attached figure). The orifice openings are given designations of nodes 100 and 101 for convenience in modeling the reduced flow through the restriction. The orifice plate openings will be sized to allow a release rate of no more than 0.1 cfs/ac. The orifice plates will allow small flows to pass through without detention. As the rate of storm water into the pipes and detention facilities increase, the orifice plate will restrict the flow. The maximum flow through the plate will occur when the detention basins reach their maximum design depth. A detail for an orifice plate can be found in the construction documents for this project.

### **Required Detention:**

For Phase 1, the required detention storage for the 100-year storm with a release rate of 0.1 cfs/acre is 51,041 cf. There is capacity provided in the pond at the northwest corner of the subdivision to meet or exceed this requirement. The required detention for the design storm and allowable release is 41,455 cubic feet for Phase 2. Storage capacity will be designed/provided to meet this requirement when phase 2 is developed. In the event either detention facility experiences a storm larger than the design storm water will then spill out through an overflow structure and into the afore-mentioned existing ditches and proceed downstream.

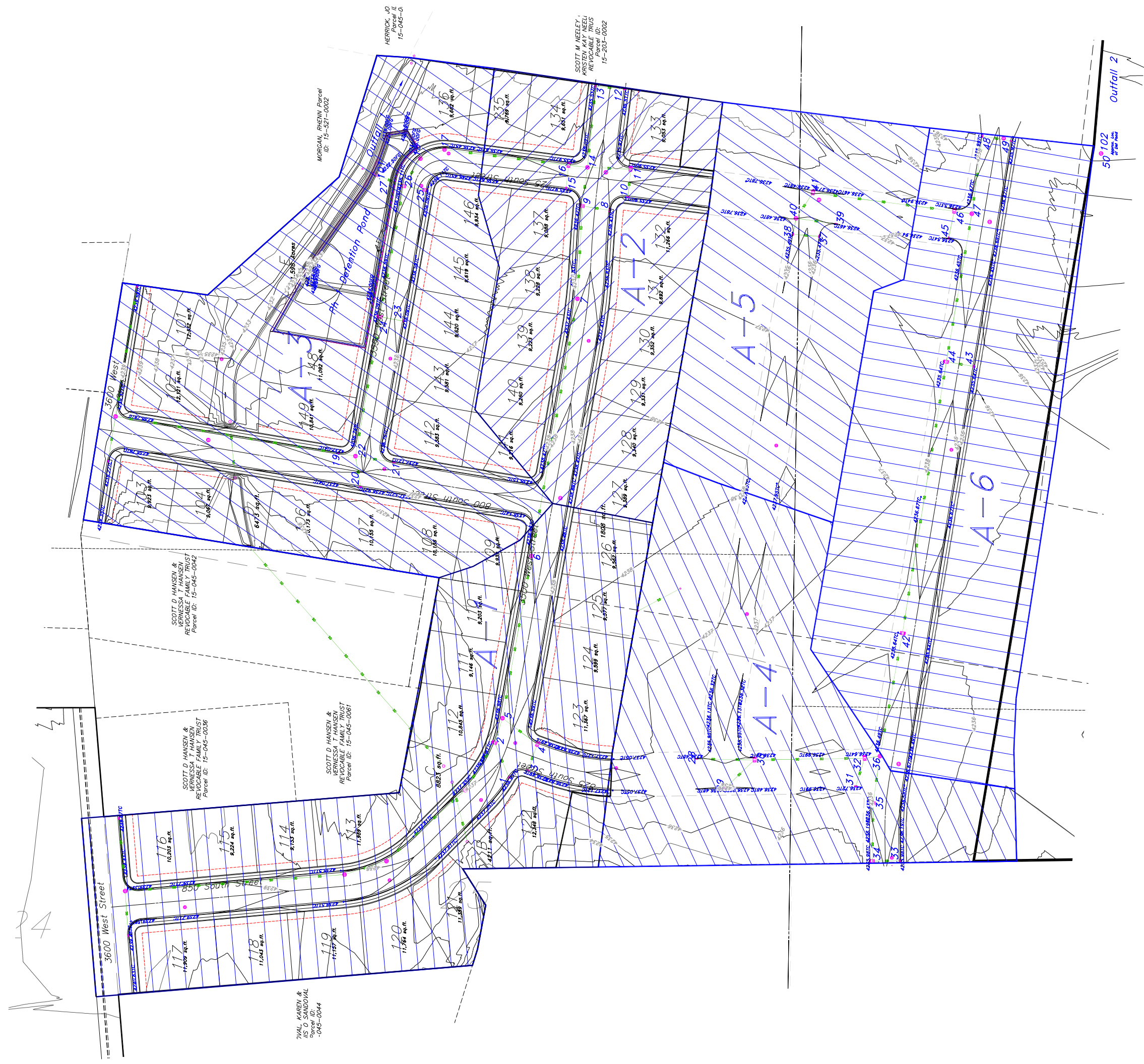
Great Basin Engineering, Inc.

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*Abhishek Amalaraj*

Reviewed/Revised by Ryan Bingham, P.E





DVAL, KAREN &  
JIS O SANDOVAL  
Parcel ID: -045-0044

SCOTT D. HANSEN &  
VERNESSA T. HANSEN  
REVOCABLE TRUST  
Parcel ID: 15-045-0036

SCOTT D. HANSEN &  
VERNESSA T. HANSEN  
REVOCABLE TRUST  
Parcel ID: 15-045-0061

SCOTT D. HANSEN &  
VERNESSA T. HANSEN  
REVOCABLE TRUST  
Parcel ID: 15-045-0042

MORGAN, RHENN Parcel  
ID: 15-521-0002

HERRICK, JO  
Parcel ID:  
15-045-0

SCOTT M. NEELY,  
KRISTEN KAY NEELY  
REVOCABLE TRUST  
Parcel ID:  
15-203-0002

50' 102'  
Outfall 2

Storm Water Calculations  
RiversBend

8/24/2021

Approx. 900 S 3500 W, Ogden, Weber County, Utah - 84401  
21N724 - PRELIM 2 SWS

**6 Detained Areas**

Hardscape C =	0.90
Landscape C =	0.15

	Zone 1 (ft <sup>2</sup> )
Avg. lot size	9825
Avg. home size	2000
Avg. patio/driveway size	1500
C =	0.417

Category Runoff Coefficients			
0.763	0.775	0.200	0.417

Drainage Areas	Total Area (acres)	60' Road Area (acres)	66' Road Area (acres)	Common Area (acres)	Zone 1 Area (acres)	C
Σ Det. Areas	33.811	2.152	7.288	2.493	21.878	0.500
Σ All Areas	33.811	2.152	7.288	2.493	21.878	0.500
A-1	6.878	0.000	2.140	0.341	4.397	0.518
A-2	4.396	0.229	1.138	0.000	3.030	0.528
A-3	7.528	0.758	1.225	1.746	3.799	0.460
A-4	4.865	0.564	0.787	0.290	3.224	0.502
A-5	3.786	0.601	0.436	0.000	2.748	0.513
A-6	6.357	0.000	1.562	0.117	4.679	0.501

**Time of Concentration--use FAA Method**

For FAA Method, use K's of..

K = 0.35 for landscape  
 K = 0.91 for hardscape

$$t_c = \frac{1.8(1.1 - K)\sqrt{L}}{\sqrt[3]{S}}$$

Assume Pipe Flow is at 2 ft/s Scour Speed

\*\*Note: S is in percent, 5 min is smallest allowed Tc

Area	Length on Landscape (ft)	Slope of Landscape (%)	Time on Landscape (min.)	Length on Hardscape (ft)	Slope of Hardscape (%)	Time on Hardscape (min.)	Length in Pipe (ft)	Time in Pipe (min.)	TC for entire Area (min.)
A-1	69.00	2.00	8.90	604.00	1.00	8.41	338.00	2.82	20.12
A-2	109.00	2.00	11.19	295.00	1.00	5.87	255.00	2.13	19.19
A-3	128.00	2.00	12.12	302.00	1.00	5.94	463.00	3.86	21.92
A-4	91.00	2.00	10.22	99.00	1.00	3.40	278.00	2.32	15.94
A-5	116.00	2.00	11.54	349.00	1.00	6.39	231.00	1.93	19.85
A-6	122.00	2.00	11.84	160.00	1.00	4.33	928.00	7.73	23.89

Rainfall Intensities  
Data From NOAA

**10-Year and 100-Year Intensities**

The equations used for the 10-Year and 100-Year Intensities were found using the attached Rainfall data as well as Interpolated data where applicable.

**Storm Intensities**

AREA	Tc (minutes)	I (10-yr.) (in./hr.)	I (100-yr.) (in./hr.)
A-1	20.1	1.74	3.49
A-2	19.2	1.79	3.60
A-3	21.9	1.66	3.34
A-4	15.9	1.99	4.00
A-5	19.9	1.75	3.52
A-6	23.9	1.58	3.18

Peak Flow Information  
 Use Rational Method  
 10-Year and 100-Year Intensities

Q=CIA

					Peak Flows		
					$\Sigma$ detained =	29.44	59.06
AREA	C	I10 (in./hr.)	I100 (in./hr.)	A (acres)	Q (10-yr.) (cfs)	Q (100-yr.) (cfs)	
A-1	0.518	1.740	3.490	6.88	6.20	12.43	
A-2	0.528	1.795	3.600	4.40	4.16	8.35	
A-3	0.460	1.665	3.340	7.53	5.76	11.56	
A-4	0.502	1.993	3.995	4.86	4.87	9.76	
A-5	0.513	1.754	3.518	3.79	3.41	6.84	
A-6	0.501	1.583	3.176	6.36	5.04	10.12	



**Node Inlet Requirements**

Size pipes for		10	year storm
Area	Node #	% of Total	Q (cfs)
A-1	1	40.0%	2.48
A-1	2	46.0%	2.85
A-1	3	7.0%	0.43
A-1	4	7.0%	0.43
A-1	5	0.0%	0.00
A-1	6	0.0%	0.00
A-2	7	0.0%	0.00
A-2	8	30.0%	1.25
A-2	9	30.0%	1.25
A-2	10	10.0%	0.42
A-2	11	6.0%	0.25
A-2	12	3.0%	0.12
A-2	13	3.0%	0.12
A-2	14	0.0%	0.00
A-2	15	10.0%	0.42
A-2	16	8.0%	0.33
A-3	17	0.0%	0.00
A-3	18	0.0%	0.00
A-3	19	15.0%	0.86
A-3	20	30.0%	1.73
A-3	21	12.0%	0.69
A-3	22	0.0%	0.00
A-3	23	10.0%	0.58
A-3	24	10.0%	0.58
A-3	25	11.0%	0.63
A-3	26	12.0%	0.69
A-3	27	0.0%	0.00
A-3	101	-247.2%	(14.25)
A-4	28	40.0%	1.95
A-4	29	26.0%	1.27
A-4	30	15.0%	0.73
A-4	31	5.0%	0.24
A-4	32	5.0%	0.24
A-4	33	3.0%	0.15
A-4	34	3.0%	0.15
A-4	35	3.0%	0.15
A-4	36	0.0%	0.00
A-5	37	35.0%	1.19
A-5	38	40.0%	1.36
A-5	39	5.0%	0.17
A-5	40	0.0%	0.00
A-5	41	20.0%	0.68
A-6	42	17.0%	0.86
A-6	43	43.0%	2.17
A-6	44	23.0%	1.16
A-6	45	3.0%	0.15
A-6	46	4.0%	0.20
A-6	47	0.0%	0.00
A-6	48	3.0%	0.15
A-6	49	7.0%	0.35
A-6	50	0.0%	0.00
A-6	102	-234.4%	(11.82)

PIPE FLOWS

Upstream Node	Downstream node	Pipe Flow (cfs)
1	2	2.48
2	5	5.33
3	4	0.43
4	5	0.87
5	6	6.20
6	7	6.20
7	9	6.20
8	9	1.25
9	14	8.70
10	11	0.42
11	14	0.67
12	13	0.12
13	14	0.25
14	16	9.61
15	16	0.42
16	17	10.36
17	18	10.36
18	26	10.36
19	22	0.86
20	22	1.73
21	22	0.69
22	24	3.29
23	24	0.58
24	26	4.44
25	26	0.63
26	27	16.13
27	101	16.13
28	30	1.95
29	30	1.27
30	32	3.94
31	32	0.24
32	36	4.43
33	34	0.15
34	35	0.29
35	36	0.44
36	42	4.87
37	38	1.19
38	40	2.56
39	40	0.17
40	41	2.73
41	46	3.41
42	44	5.72
43	44	2.17
44	47	9.05
45	46	0.15
46	47	3.76
47	48	12.81
48	49	12.97
49	50	13.32
50	102	13.32
101	Outfall	1.88
102	Outfall	1.50

### Options for Pipe Sizes Between the Specified Nodes

Up Stream Node	Dn Stream Node	Q (cfs)	Pipe Size (in)	Design Min Slope (%)	Area (ft <sup>2</sup> )	Rh (ft)	Manning's n	Scour Min. Slope (%)	First Trial Pipe Size
1	2	2.48	15	0.147%	1.227	0.313	0.013	0.150%	15
		2.48	18	0.056%	1.767	0.375	0.013	0.120%	
		2.48	24	0.012%	3.142	0.500	0.013	0.080%	
2	5	5.33	15	0.681%	1.227	0.313	0.013	0.150%	18
		5.33	18	0.257%	1.767	0.375	0.013	0.120%	
		5.33	24	0.055%	3.142	0.500	0.013	0.080%	
3	4	0.43	15	0.005%	1.227	0.313	0.013	0.150%	15
		0.43	18	0.002%	1.767	0.375	0.013	0.120%	
		0.43	24	0.000%	3.142	0.500	0.013	0.080%	
4	5	0.87	15	0.018%	1.227	0.313	0.013	0.150%	15
		0.87	18	0.007%	1.767	0.375	0.013	0.120%	
		0.87	24	0.001%	3.142	0.500	0.013	0.080%	
5	6	6.20	15	0.920%	1.227	0.313	0.013	0.150%	18
		6.20	18	0.348%	1.767	0.375	0.013	0.120%	
		6.20	24	0.075%	3.142	0.500	0.013	0.080%	
6	7	6.20	15	0.920%	1.227	0.313	0.013	0.150%	18
		6.20	18	0.348%	1.767	0.375	0.013	0.120%	
		6.20	24	0.075%	3.142	0.500	0.013	0.080%	
7	9	6.20	15	0.920%	1.227	0.313	0.013	0.150%	18
		6.20	18	0.348%	1.767	0.375	0.013	0.120%	
		6.20	24	0.075%	3.142	0.500	0.013	0.080%	
8	9	1.25	15	0.037%	1.227	0.313	0.013	0.150%	15
		1.25	18	0.014%	1.767	0.375	0.013	0.120%	
		1.25	24	0.003%	3.142	0.500	0.013	0.080%	
9	14	8.70	15	1.812%	1.227	0.313	0.013	0.150%	24
		8.70	18	0.685%	1.767	0.375	0.013	0.120%	
		8.70	24	0.148%	3.142	0.500	0.013	0.080%	
10	11	0.42	15	0.004%	1.227	0.313	0.013	0.150%	15
		0.42	18	0.002%	1.767	0.375	0.013	0.120%	
		0.42	24	0.000%	3.142	0.500	0.013	0.080%	
11	14	0.67	15	0.011%	1.227	0.313	0.013	0.150%	15
		0.67	18	0.004%	1.767	0.375	0.013	0.120%	
		0.67	24	0.001%	3.142	0.500	0.013	0.080%	
12	13	0.12	15	0.000%	1.227	0.313	0.013	0.150%	15
		0.12	18	0.000%	1.767	0.375	0.013	0.120%	
		0.12	24	0.000%	3.142	0.500	0.013	0.080%	

13	14	0.25	15	0.001%	1.227	0.313	0.013	0.150%	15
		0.25	18	0.001%	1.767	0.375	0.013	0.120%	
		0.25	24	0.000%	3.142	0.500	0.013	0.080%	
14	16	9.61	15	2.214%	1.227	0.313	0.013	0.150%	24
		9.61	18	0.837%	1.767	0.375	0.013	0.120%	
		9.61	24	0.181%	3.142	0.500	0.013	0.080%	
15	16	0.42	15	0.004%	1.227	0.313	0.013	0.150%	15
		0.42	18	0.002%	1.767	0.375	0.013	0.120%	
		0.42	24	0.000%	3.142	0.500	0.013	0.080%	
16	17	10.36	15	2.573%	1.227	0.313	0.013	0.150%	24
		10.36	18	0.973%	1.767	0.375	0.013	0.120%	
		10.36	24	0.210%	3.142	0.500	0.013	0.080%	
17	18	10.36	15	2.573%	1.227	0.313	0.013	0.150%	24
		10.36	18	0.973%	1.767	0.375	0.013	0.120%	
		10.36	24	0.210%	3.142	0.500	0.013	0.080%	
18	26	10.36	15	2.573%	1.227	0.313	0.013	0.150%	24
		10.36	18	0.973%	1.767	0.375	0.013	0.120%	
		10.36	24	0.210%	3.142	0.500	0.013	0.080%	
19	22	0.86	15	0.018%	1.227	0.313	0.013	0.150%	15
		0.86	18	0.007%	1.767	0.375	0.013	0.120%	
		0.86	24	0.001%	3.142	0.500	0.013	0.080%	
20	22	1.73	15	0.072%	1.227	0.313	0.013	0.150%	15
		1.73	18	0.027%	1.767	0.375	0.013	0.120%	
		1.73	24	0.006%	3.142	0.500	0.013	0.080%	
21	22	0.69	15	0.011%	1.227	0.313	0.013	0.150%	15
		0.69	18	0.004%	1.767	0.375	0.013	0.120%	
		0.69	24	0.001%	3.142	0.500	0.013	0.080%	
22	24	3.29	15	0.259%	1.227	0.313	0.013	0.150%	15
		3.29	18	0.098%	1.767	0.375	0.013	0.120%	
		3.29	24	0.021%	3.142	0.500	0.013	0.080%	
23	24	0.58	15	0.008%	1.227	0.313	0.013	0.150%	15
		0.58	18	0.003%	1.767	0.375	0.013	0.120%	
		0.58	24	0.001%	3.142	0.500	0.013	0.080%	
24	26	4.44	15	0.472%	1.227	0.313	0.013	0.150%	15
		4.44	18	0.178%	1.767	0.375	0.013	0.120%	
		4.44	24	0.038%	3.142	0.500	0.013	0.080%	
25	26	0.63	15	0.010%	1.227	0.313	0.013	0.150%	15
		0.63	18	0.004%	1.767	0.375	0.013	0.120%	
		0.63	24	0.001%	3.142	0.500	0.013	0.080%	

26	27	16.13	18	2.356%	1.767	0.375	0.013	0.120%	30
		16.13	24	0.508%	3.142	0.500	0.013	0.080%	
		16.13	30	0.155%	4.909	0.625	0.013	0.060%	
27	101	16.13	18	2.356%	1.767	0.375	0.013	0.120%	30
		16.13	24	0.508%	3.142	0.500	0.013	0.080%	
		16.13	30	0.155%	4.909	0.625	0.013	0.060%	
28	30	1.95	15	0.091%	1.227	0.313	0.013	0.150%	15
		1.95	18	0.034%	1.767	0.375	0.013	0.120%	
		1.95	24	0.007%	3.142	0.500	0.013	0.080%	
29	30	1.27	15	0.038%	1.227	0.313	0.013	0.150%	15
		1.27	18	0.015%	1.767	0.375	0.013	0.120%	
		1.27	24	0.003%	3.142	0.500	0.013	0.080%	
30	32	3.94	15	0.373%	1.227	0.313	0.013	0.150%	15
		3.94	18	0.141%	1.767	0.375	0.013	0.120%	
		3.94	24	0.030%	3.142	0.500	0.013	0.080%	
31	32	0.24	15	0.001%	1.227	0.313	0.013	0.150%	15
		0.24	18	0.001%	1.767	0.375	0.013	0.120%	
		0.24	24	0.000%	3.142	0.500	0.013	0.080%	
32	36	4.43	15	0.470%	1.227	0.313	0.013	0.150%	15
		4.43	18	0.178%	1.767	0.375	0.013	0.120%	
		4.43	24	0.038%	3.142	0.500	0.013	0.080%	
33	34	0.15	15	0.001%	1.227	0.313	0.013	0.150%	15
		0.15	18	0.000%	1.767	0.375	0.013	0.120%	
		0.15	24	0.000%	3.142	0.500	0.013	0.080%	
34	35	0.29	15	0.002%	1.227	0.313	0.013	0.150%	15
		0.29	18	0.001%	1.767	0.375	0.013	0.120%	
		0.29	24	0.000%	3.142	0.500	0.013	0.080%	
35	36	0.44	15	0.005%	1.227	0.313	0.013	0.150%	15
		0.44	18	0.002%	1.767	0.375	0.013	0.120%	
		0.44	24	0.000%	3.142	0.500	0.013	0.080%	
36	42	4.87	15	0.568%	1.227	0.313	0.013	0.150%	18
		4.87	18	0.215%	1.767	0.375	0.013	0.120%	
		4.87	24	0.046%	3.142	0.500	0.013	0.080%	
37	38	1.19	15	0.034%	1.227	0.313	0.013	0.150%	15
		1.19	18	0.013%	1.767	0.375	0.013	0.120%	
		1.19	24	0.003%	3.142	0.500	0.013	0.080%	
38	40	2.56	15	0.157%	1.227	0.313	0.013	0.150%	15
		2.56	18	0.059%	1.767	0.375	0.013	0.120%	
		2.56	24	0.013%	3.142	0.500	0.013	0.080%	

39	40	0.17	15	0.001%	1.227	0.313	0.013	0.150%	15
		0.17	18	0.000%	1.767	0.375	0.013	0.120%	
		0.17	24	0.000%	3.142	0.500	0.013	0.080%	
40	41	2.73	15	0.178%	1.227	0.313	0.013	0.150%	15
		2.73	18	0.067%	1.767	0.375	0.013	0.120%	
		2.73	24	0.015%	3.142	0.500	0.013	0.080%	
41	46	3.41	15	0.278%	1.227	0.313	0.013	0.150%	15
		3.41	18	0.105%	1.767	0.375	0.013	0.120%	
		3.41	24	0.023%	3.142	0.500	0.013	0.080%	
42	44	5.72	15	0.785%	1.227	0.313	0.013	0.150%	18
		5.72	18	0.297%	1.767	0.375	0.013	0.120%	
		5.72	24	0.064%	3.142	0.500	0.013	0.080%	
43	44	2.17	15	0.113%	1.227	0.313	0.013	0.150%	15
		2.17	18	0.043%	1.767	0.375	0.013	0.120%	
		2.17	24	0.009%	3.142	0.500	0.013	0.080%	
44	47	9.05	15	1.964%	1.227	0.313	0.013	0.150%	24
		9.05	18	0.743%	1.767	0.375	0.013	0.120%	
		9.05	24	0.160%	3.142	0.500	0.013	0.080%	
45	46	0.15	15	0.001%	1.227	0.313	0.013	0.150%	15
		0.15	18	0.000%	1.767	0.375	0.013	0.120%	
		0.15	24	0.000%	3.142	0.500	0.013	0.080%	
46	47	3.76	15	0.339%	1.227	0.313	0.013	0.150%	15
		3.76	18	0.128%	1.767	0.375	0.013	0.120%	
		3.76	24	0.028%	3.142	0.500	0.013	0.080%	
47	48	12.81	15	3.934%	1.227	0.313	0.013	0.150%	24
		12.81	18	1.488%	1.767	0.375	0.013	0.120%	
		12.81	24	0.321%	3.142	0.500	0.013	0.080%	
48	49	12.97	15	4.028%	1.227	0.313	0.013	0.150%	24
		12.97	18	1.523%	1.767	0.375	0.013	0.120%	
		12.97	24	0.328%	3.142	0.500	0.013	0.080%	
49	50	13.32	15	4.250%	1.227	0.313	0.013	0.150%	24
		13.32	18	1.607%	1.767	0.375	0.013	0.120%	
		13.32	24	0.347%	3.142	0.500	0.013	0.080%	
50	102	13.32	15	4.250%	1.227	0.313	0.013	0.150%	24
		13.32	18	1.607%	1.767	0.375	0.013	0.120%	
		13.32	24	0.347%	3.142	0.500	0.013	0.080%	
101	Outfall	1.88	15	0.085%	1.227	0.313	0.013	0.150%	15
		1.88	18	0.032%	1.767	0.375	0.013	0.120%	
		1.88	24	0.007%	3.142	0.500	0.013	0.080%	

102	Outfall	1.50	15	0.054%	1.227	0.313	0.013	0.150%	<b>15</b>
		1.50	18	0.020%	1.767	0.375	0.013	0.120%	
		1.50	24	0.004%	3.142	0.500	0.013	0.080%	

**RiversBend**

**Phase 1 Detention Facility (Serving A-1, A-2, and A-3)**

C = **0.50** Remaining Unit Discharge = **0.100** cfs/acre  
Area = **18.80** acres Release through Restriction = **1.880** cfs

Detention Pond Sized For The **100** Year Storm

Time min	Rainfall Intensity in./hr.	Accumulated Volume (CF)	Allowable Release (CF)	Needed Detention (CF)
5	6.54	18331	564	17767
10	4.97	27862	1128	26733
15	4.11	34561	1692	32868
20	3.50	39249	2256	36993
25	3.08	43213	2820	40392
30	2.77	46585	3385	43201
35	2.54	49806	3949	45858
40	2.31	51795	4513	47282
45	2.12	53476	5077	48399
50	1.96	54840	5641	49199
55	1.82	56112	6205	49907
60	1.71	57517	6769	50748
90	1.21	61194	10154	51041
120	0.93	62831	13538	49293
180	0.64	64278	20307	43971
360	0.36	71644	40615	31029
720	0.22	87587	81229	6358
1440	0.12	96871	162458	-65587

<- Det

Required Storage Volume = **51041** ft<sup>3</sup>



**RiversBend**

**Phase 2 Detention Facility (Serving A-4, A-5, and A-6)**

C = **0.50** Remaining Unit Discharge = **0.100** cfs/acre  
Area = **15.01** acres Release through Restriction = **1.501** cfs

Detention Pond Sized For The **100** Year Storm

Time min	Rainfall Intensity in./hr.	Accumulated Volume (CF)	Allowable Release (CF)	Needed Detention (CF)
5	6.54	14855	450	14405
10	4.97	22578	900	21678
15	4.11	28007	1351	26656
20	3.50	31806	1801	30005
25	3.08	35018	2251	32767
30	2.77	37751	2701	35050
35	2.54	40362	3152	37210
40	2.31	41973	3602	38371
45	2.12	43335	4052	39283
50	1.96	44441	4502	39938
55	1.82	45472	4953	40519
60	1.71	46610	5403	41207
90	1.21	49590	8104	41486
120	0.93	50917	10806	40111
180	0.64	52089	16209	35880
360	0.36	58058	32417	25641
720	0.22	70978	64834	6144
1440	0.12	78501	129668	-51167

<- Det

Required Storage Volume = **41486** ft<sup>3</sup>



**NOAA Atlas 14, Volume 1, Version 5**  
**Location name: Ogden, Utah, USA\***  
**Latitude: 41.2558°, Longitude: -112.0612°**  
**Elevation: 4232.68 ft\*\***  
\* source: ESRI Maps  
\*\* source: USGS



**POINT PRECIPITATION FREQUENCY ESTIMATES**

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps\\_&\\_aerials](#)

**PF tabular**

<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)<sup>1</sup></b>										
<b>Duration</b>	<b>Average recurrence interval (years)</b>									
	<b>1</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	<b>100</b>	<b>200</b>	<b>500</b>	<b>1000</b>
<b>5-min</b>	<b>0.126</b> (0.110-0.146)	<b>0.158</b> (0.140-0.184)	<b>0.217</b> (0.190-0.251)	<b>0.272</b> (0.236-0.315)	<b>0.361</b> (0.306-0.421)	<b>0.445</b> (0.365-0.526)	<b>0.545</b> (0.432-0.651)	<b>0.664</b> (0.506-0.810)	<b>0.856</b> (0.616-1.08)	<b>1.04</b> (0.708-1.33)
<b>10-min</b>	<b>0.192</b> (0.167-0.222)	<b>0.241</b> (0.213-0.280)	<b>0.330</b> (0.289-0.382)	<b>0.413</b> (0.359-0.479)	<b>0.550</b> (0.466-0.641)	<b>0.677</b> (0.555-0.800)	<b>0.829</b> (0.657-0.991)	<b>1.01</b> (0.770-1.23)	<b>1.30</b> (0.937-1.64)	<b>1.58</b> (1.08-2.03)
<b>15-min</b>	<b>0.238</b> (0.207-0.275)	<b>0.299</b> (0.264-0.347)	<b>0.409</b> (0.358-0.473)	<b>0.512</b> (0.445-0.594)	<b>0.682</b> (0.578-0.795)	<b>0.839</b> (0.688-0.992)	<b>1.03</b> (0.814-1.23)	<b>1.25</b> (0.955-1.53)	<b>1.62</b> (1.16-2.04)	<b>1.95</b> (1.34-2.52)
<b>30-min</b>	<b>0.321</b> (0.279-0.370)	<b>0.402</b> (0.355-0.466)	<b>0.550</b> (0.482-0.637)	<b>0.690</b> (0.600-0.800)	<b>0.918</b> (0.778-1.07)	<b>1.13</b> (0.927-1.34)	<b>1.38</b> (1.10-1.65)	<b>1.69</b> (1.29-2.06)	<b>2.17</b> (1.57-2.74)	<b>2.63</b> (1.80-3.39)
<b>60-min</b>	<b>0.397</b> (0.345-0.458)	<b>0.498</b> (0.440-0.577)	<b>0.681</b> (0.597-0.788)	<b>0.854</b> (0.742-0.990)	<b>1.14</b> (0.963-1.32)	<b>1.40</b> (1.15-1.65)	<b>1.71</b> (1.36-2.05)	<b>2.09</b> (1.59-2.55)	<b>2.69</b> (1.94-3.39)	<b>3.26</b> (2.23-4.19)
<b>2-hr</b>	<b>0.499</b> (0.442-0.572)	<b>0.625</b> (0.554-0.715)	<b>0.807</b> (0.712-0.924)	<b>0.984</b> (0.855-1.13)	<b>1.28</b> (1.09-1.48)	<b>1.55</b> (1.28-1.82)	<b>1.87</b> (1.50-2.23)	<b>2.25</b> (1.74-2.75)	<b>2.87</b> (2.09-3.61)	<b>3.44</b> (2.38-4.43)
<b>3-hr</b>	<b>0.585</b> (0.526-0.657)	<b>0.720</b> (0.646-0.812)	<b>0.901</b> (0.806-1.01)	<b>1.07</b> (0.950-1.21)	<b>1.34</b> (1.17-1.53)	<b>1.60</b> (1.36-1.84)	<b>1.91</b> (1.59-2.24)	<b>2.29</b> (1.84-2.75)	<b>2.91</b> (2.22-3.65)	<b>3.48</b> (2.54-4.47)
<b>6-hr</b>	<b>0.792</b> (0.725-0.871)	<b>0.965</b> (0.880-1.07)	<b>1.17</b> (1.06-1.29)	<b>1.35</b> (1.22-1.50)	<b>1.63</b> (1.45-1.82)	<b>1.86</b> (1.63-2.10)	<b>2.13</b> (1.84-2.43)	<b>2.42</b> (2.04-2.82)	<b>3.04</b> (2.47-3.68)	<b>3.60</b> (2.84-4.51)
<b>12-hr</b>	<b>1.01</b> (0.932-1.10)	<b>1.23</b> (1.14-1.35)	<b>1.49</b> (1.37-1.63)	<b>1.71</b> (1.56-1.87)	<b>2.05</b> (1.85-2.26)	<b>2.32</b> (2.07-2.58)	<b>2.62</b> (2.29-2.95)	<b>2.94</b> (2.51-3.37)	<b>3.42</b> (2.84-4.02)	<b>3.83</b> (3.09-4.59)
<b>24-hr</b>	<b>1.23</b> (1.13-1.33)	<b>1.50</b> (1.39-1.63)	<b>1.80</b> (1.66-1.95)	<b>2.04</b> (1.88-2.21)	<b>2.37</b> (2.18-2.57)	<b>2.63</b> (2.41-2.84)	<b>2.89</b> (2.64-3.13)	<b>3.15</b> (2.86-3.42)	<b>3.51</b> (3.16-4.06)	<b>3.87</b> (3.38-4.63)
<b>2-day</b>	<b>1.42</b> (1.32-1.54)	<b>1.74</b> (1.62-1.89)	<b>2.07</b> (1.92-2.23)	<b>2.34</b> (2.17-2.52)	<b>2.70</b> (2.50-2.90)	<b>2.97</b> (2.74-3.20)	<b>3.25</b> (2.99-3.50)	<b>3.52</b> (3.23-3.80)	<b>3.88</b> (3.53-4.20)	<b>4.15</b> (3.75-4.68)
<b>3-day</b>	<b>1.55</b> (1.44-1.67)	<b>1.90</b> (1.76-2.05)	<b>2.26</b> (2.09-2.43)	<b>2.55</b> (2.37-2.75)	<b>2.95</b> (2.73-3.17)	<b>3.26</b> (3.01-3.51)	<b>3.57</b> (3.28-3.85)	<b>3.89</b> (3.55-4.20)	<b>4.30</b> (3.90-4.66)	<b>4.61</b> (4.15-5.11)
<b>4-day</b>	<b>1.68</b> (1.55-1.81)	<b>2.05</b> (1.90-2.21)	<b>2.44</b> (2.27-2.63)	<b>2.77</b> (2.56-2.98)	<b>3.21</b> (2.96-3.45)	<b>3.55</b> (3.27-3.82)	<b>3.90</b> (3.58-4.20)	<b>4.25</b> (3.88-4.60)	<b>4.72</b> (4.26-5.13)	<b>5.07</b> (4.55-5.55)
<b>7-day</b>	<b>1.97</b> (1.83-2.14)	<b>2.42</b> (2.24-2.62)	<b>2.87</b> (2.67-3.10)	<b>3.25</b> (3.01-3.50)	<b>3.75</b> (3.47-4.03)	<b>4.13</b> (3.82-4.45)	<b>4.51</b> (4.16-4.86)	<b>4.89</b> (4.49-5.30)	<b>5.39</b> (4.91-5.86)	<b>5.76</b> (5.21-6.29)
<b>10-day</b>	<b>2.23</b> (2.07-2.41)	<b>2.73</b> (2.53-2.95)	<b>3.24</b> (3.01-3.48)	<b>3.64</b> (3.38-3.91)	<b>4.16</b> (3.87-4.47)	<b>4.55</b> (4.21-4.88)	<b>4.92</b> (4.55-5.29)	<b>5.28</b> (4.87-5.69)	<b>5.74</b> (5.27-6.20)	<b>6.06</b> (5.54-6.58)
<b>20-day</b>	<b>2.87</b> (2.67-3.09)	<b>3.52</b> (3.27-3.79)	<b>4.15</b> (3.86-4.46)	<b>4.63</b> (4.31-4.97)	<b>5.24</b> (4.88-5.61)	<b>5.67</b> (5.28-6.07)	<b>6.08</b> (5.65-6.52)	<b>6.46</b> (5.99-6.94)	<b>6.92</b> (6.40-7.45)	<b>7.23</b> (6.68-7.80)
<b>30-day</b>	<b>3.44</b> (3.21-3.69)	<b>4.21</b> (3.93-4.52)	<b>4.94</b> (4.61-5.28)	<b>5.49</b> (5.13-5.87)	<b>6.19</b> (5.78-6.61)	<b>6.68</b> (6.23-7.14)	<b>7.16</b> (6.66-7.65)	<b>7.59</b> (7.05-8.13)	<b>8.12</b> (7.51-8.71)	<b>8.47</b> (7.82-9.12)
<b>45-day</b>	<b>4.24</b> (3.95-4.54)	<b>5.17</b> (4.83-5.54)	<b>6.04</b> (5.66-6.45)	<b>6.71</b> (6.30-7.16)	<b>7.55</b> (7.08-8.04)	<b>8.14</b> (7.62-8.67)	<b>8.69</b> (8.13-9.26)	<b>9.19</b> (8.58-9.79)	<b>9.76</b> (9.11-10.4)	<b>10.1</b> (9.45-10.8)
<b>60-day</b>	<b>5.00</b> (4.68-5.35)	<b>6.11</b> (5.71-6.54)	<b>7.13</b> (6.68-7.62)	<b>7.91</b> (7.42-8.44)	<b>8.89</b> (8.33-9.47)	<b>9.58</b> (8.97-10.2)	<b>10.2</b> (9.56-10.9)	<b>10.8</b> (10.1-11.5)	<b>11.5</b> (10.7-12.3)	<b>11.9</b> (11.1-12.7)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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**PF graphical**