JH
4/11/2019
Item. 13

ORDINANCE 2019-04-11-0306

AMENDING CHAPTER 35, UNIFIED DEVELOPMENT CODE, OF THE CITY CODE OF SAN ANTONIO, TEXAS, BY AMENDING APPENDIX H, STORM WATER DESIGN CRITERIA MANUAL, TO INCORPORATE UPDATED RAINFALL DATA FROM THE ATLAS 14 RAINFALL STUDY, AND PROVIDING FOR PUBLICATION.

* * * * *

WHEREAS, Atlas 14 is a study of rainfall frequency and intensity which was published by the National Oceanic and Atmospheric Administration (NOAA) in September 2018; and

WHEREAS, Transportation & Capital Improvements (TCI) proposes to implement Atlas 14 rainfall data through a Unified Development Code (UDC) Amendment to comply with federal and local standards that require the use of the best available data for drainage and floodplain design; and

WHEREAS, this proposed amendment includes increasing design rainfall depths by 10-30% for the 100-year (1% annual chance) storm when compared to previously accepted studies; and

WHEREAS, TCI, in coordination with the Bexar Regional Watershed Management (BRWM) partnership and its Watershed Technical Committee (WTC), led a thorough stakeholder engagement process to assess the implications of implementing Atlas 14; and

WHEREAS, the WTC included staff from TCI, Bexar County, and the San Antonio River Authority (SARA) and discussed and reviewed impacts associated with flood risk reduction policies and programs, capital project development and delivery, land development, coordination with floodplain mapping efforts and implications for the community; and

WHEREAS, in the summer of 2018, TCI organized the Atlas 14 Land Development Stakeholder Group consisting of more than two dozen members, including representatives from the public and private sectors, including engineering consultants of varying size, technical specialties, and regional presence, and the group met officially seven times between August 2018 and February 2019 to discuss Atlas 14 implementation impacts and proposed UDC amendments; and

WHEREAS, the proposed UDC amendment was presented and approved by the following committees: Community Health and Equity Committee on January 24, 2019, Planning Commission Technical Advisory Committee on February 25, 2019, and Planning Commission on March 27, 2019; **NOW THEREFORE,**

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF SAN ANTONIO:

SECTION 1. Appendix H, of Chapter 35, Unified Development Code, of the City Code of San Antonio, Texas, is hereby amended by adding the language that is underlined (added) and deleting the language that is stricken (~~deleted~~) to the existing text as set forth in **ATTACHMENT I**.

SECTION 2. All other provisions of Chapter 35, Unified Development Code, of the City Code of San Antonio, Texas shall remain unchanged and in full force and effect unless expressly amended by this Ordinance.

SECTION 3. Should any Article, Section, Part, Paragraph, Sentence, Phrase, Clause, or Word of this Ordinance, for any reason be held illegal, inoperative, or invalid, or if any exception to or limitation upon any general provision herein be held to be unconstitutional or invalid or ineffective, the remainder shall, nevertheless, stand effective and valid as if it had been enacted and ordained without the portion held to be unconstitutional or invalid or ineffective.

SECTION 4. The City Clerk is directed to publish notice of this ordinance amending City Code, Chapter 35, Unified Development Code. Publication shall be in a newspaper in the City in accordance with Section 17 of the City Charter.

SECTION 5. The publishers of the City Code of San Antonio, Texas are authorized to amend said City Code, Chapter 35, Unified Development Code to reflect the changes adopted herein and to correct typographical errors and to index, format and number paragraphs to conform to the existing Code.

SECTION 6. This Ordinance shall become effective on April 14, 2019 on passage with eight (8) affirmative votes of the City Council, and if passed upon by fewer than eight votes, then on the tenth (10^{th}) day after passage.

PASSED AND APPROVED this 11^{th} day of April, 2019.

M A Y O R
Ron Nirenberg

ATTEST:

Leticia M. Vacek, City Clerk

APPROVED AS TO FORM:

Andrew Segovia, City Attorney
FOR

Agenda Item:	**13**
Date:	04/11/2019
Time:	11:53:54 AM
Vote Type:	Motion to Approve
Description:	Ordinance amending the Unified Development Code, Chapter 33 Appendix H Storm Water Design Criteria Manual, to incorporate updated rainfall data for drainage and floodplain design from the federal Atlas 14 Rainfall Study. [Peter Zanoni, Deputy City Manager; Razi Hosseini, Interim Director, Transportation & Capital Improvements]
Result:	Passed

Voter	Group	Not Present	Yea	Nay	Abstain	Motion	Second
Ron Nirenberg	Mayor		x				
Roberto C. Treviño	District 1		x				x
Art A. Hall	District 2		x				
Rebecca Viagran	District 3	x					
Rey Saldaña	District 4	x					
Shirley Gonzales	District 5		x				
Greg Brockhouse	District 6		x				
Ana E. Sandoval	District 7		x			x	
Manny Pelaez	District 8		x				
John Courage	District 9		x				
Clayton H. Perry	District 10		x				

Attachment I

Amendments to Appendix H, Chapter 35 Unified Development Code, City of San Antonio

Attachment I

Amendments to Appendix H, Chapter 35 Unified Development Code, City of San Antonio

Appendix H. Storm Water Design Criteria Manual

* * *

FIGURES

* * *

TABLES

* * *

CHAPTER 1
INTRODUCTION

* * *

1.2 ACRONYMS AND ABBREVIATIONS

A14	Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 11, Version 2.0: Texas (as published by NOAA)
AASHTO	American Association of State Highway Officials
* * *	* * *
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent

* * *

CHAPTER 5
HYDROLOGY

* * *

5.3 RATIONAL METHOD

The Rational Method is appropriate for estimating peak discharge for small areas up to (200) acres with no significant flood storage. This method provides a peak discharge value but no time-series of flow or flow volume:

(Equation 5.3.1)

$$Q = C\ I\ A$$

Q = Peak Discharge (cfs)
C = Runoff coefficient
I = Average rainfall intensity (in./hr.)
A = Drainage area (acres)

Runoff coefficients (C) may need to be calculated as a weighted runoff coefficient where multiple values are present in one drainage area.
To determine the intensity (I) it is necessary to calculate the Time of Concentration (Tc). This value is used to identify the rainfall intensity found in Figures 5.5.1.A through Figures 5.5.1.E of this manual.

* * *

5.5 RAINFALL DATA

Rainfall data in this section is based on NOAA Atlas 14, Volume 11 (A14) precipitation frequency estimates. A14 data indicates that precipitation depths vary across the region for each storm frequency. For the purposes of storm water and floodplain design and analysis, the region is broken into five (5) Precipitation Areas (PAs). Figure 5.5 shows the limits of each PA relative to Bexar County, major highways, and major watersheds. Properties within each respective PA will use the corresponding data from Tables 5.5.1.A-E and 5.5.2.1.A-E.
Refer to the San Antonio River Basin (SARB) Regional Modeling Standards for more information on how the A14 precipitation estimates were converted to Intensity-Duration-Frequency (IDF) and Depth-Duration-Frequency (DDF) tables. To complement Figure 5.5, the SARB Regional Modeling Standards indicate which sub-basins, streams, creeks, and tributaries fall within each PA. In the event that it is unclear whether a property or project is in a specific PA, contact the floodplain administrator for determination.

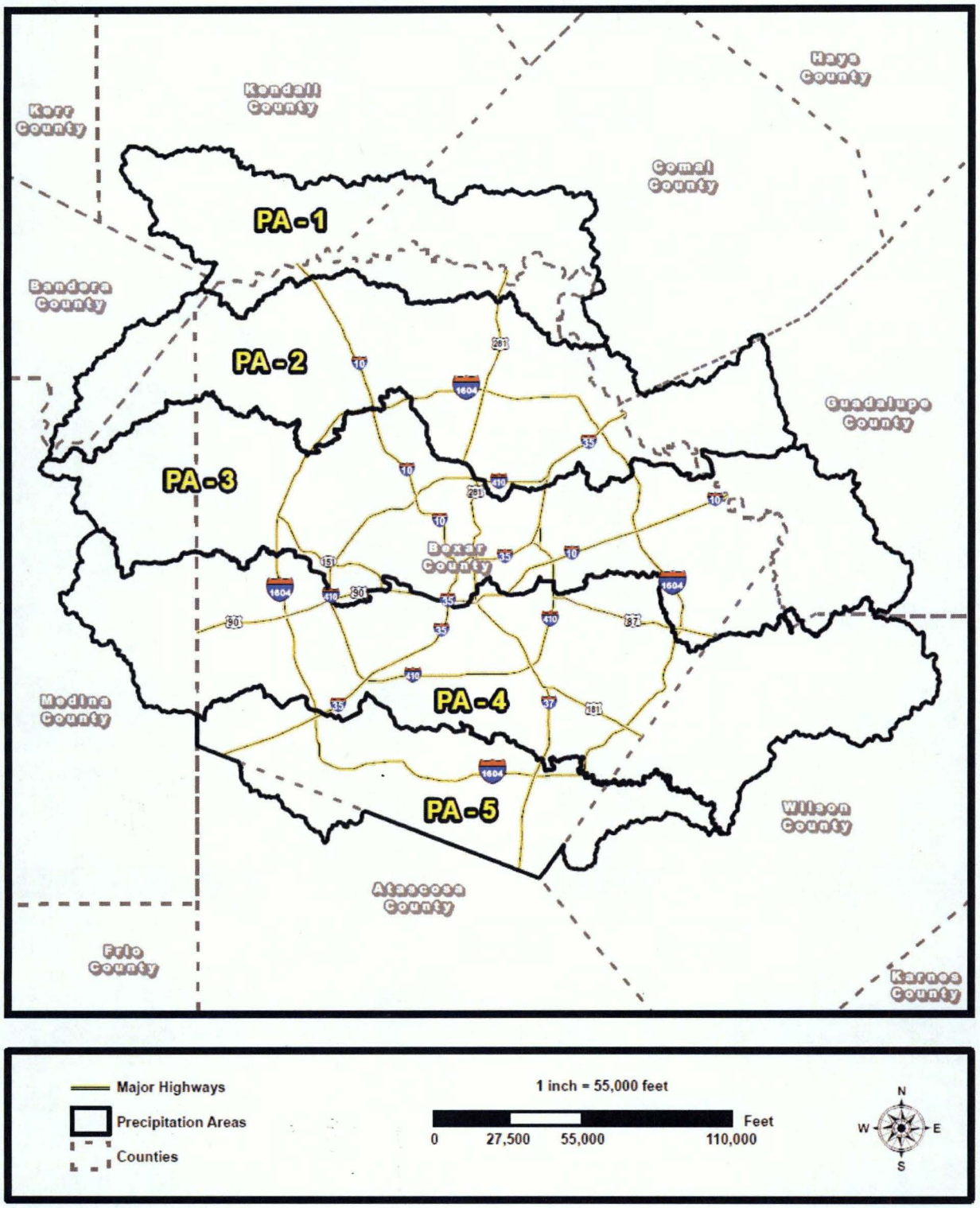

Figure 5.5- Precipitation Area (PA) Map for Major San Antonio River Watersheds
(Precipitation Areas are available in GIS format at https://www.sanantonio.gov/GIS)

5.5.1 Rainfall Intensity-Duration

Use Tables 5.5.1.A through 5.5.1.E to determine rainfall intensity.

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~~**Table 5.5.1.A** – Rainfall Intensity Duration~~

TIME MINUTES	FREQUENCY						
	2-YEAR	5-YEAR	10-YEAR	25-YEAR	50-YEAR	100-YEAR	500-YEAR
5	7.200	8.400	9.413	11.100	12.432	13.542	18.204
6	6.684	7.836	8.830	10.331	11.648	12.877	17.258
7	6.277	7.381	8.365	9.722	11.025	12.341	16.497
8	5.944	7.009	7.982	9.224	10.512	11.894	15.864
9	5.666	6.696	7.658	8.806	10.079	11.514	15.327
10	5.427	6.427	7.380	8.447	9.707	11.184	14.862
11	5.220	6.194	7.137	8.136	9.382	10.893	14.453
12	5.038	5.988	6.923	7.862	9.095	10.635	14.090
13	4.877	5.805	6.731	7.618	8.839	10.403	13.763
14	4.731	5.641	6.558	7.399	8.608	10.192	13.468
15	4.600	5.480	6.400	7.200	8.400	10.000	13.200
16	4.458	5.296	6.159	6.959	8.088	9.551	12.765
17	4.328	5.129	5.942	6.741	7.806	9.147	12.368
18	4.209	4.977	5.743	6.541	7.549	8.781	12.005
19	4.099	4.836	5.562	6.357	7.314	8.449	11.672
20	3.998	4.707	5.395	6.188	7.098	8.146	11.364
21	3.904	4.587	5.241	6.031	6.898	7.867	11.079
22	3.816	4.476	5.098	5.886	6.713	7.610	10.814
23	3.734	4.372	4.965	5.749	6.541	7.373	10.566
24	3.658	4.275	4.841	5.622	6.380	7.153	10.335
25	3.586	4.184	4.725	5.503	6.229	6.947	10.117
26	3.518	4.098	4.616	5.390	6.088	6.756	9.913
27	3.453	4.017	4.514	5.284	5.955	6.576	9.720
28	3.393	3.941	4.417	5.184	5.830	6.408	9.538
29	3.335	3.868	4.326	5.089	5.711	6.250	9.365
30	3.280	3.800	4.240	5.000	5.600	6.100	9.200
31	3.209	3.723	4.155	4.905	5.501	6.003	9.025
32	3.142	3.650	4.074	4.814	5.407	5.911	8.870
33	3.078	3.580	3.997	4.727	5.318	5.823	8.722
34	3.018	3.514	3.924	4.644	5.233	5.739	8.581
35	2.960	3.450	3.854	4.565	5.152	5.658	8.446
36	2.906	3.390	3.787	4.490	5.074	5.581	8.317
37	2.853	3.332	3.723	4.418	4.999	5.507	8.194
38	2.803	3.277	3.662	4.349	4.928	5.435	8.075
39	2.755	3.224	3.604	4.283	4.859	5.367	7.961
40	2.709	3.173	3.548	4.219	4.793	5.301	7.852
41	2.665	3.124	3.494	4.158	4.729	5.238	7.747
42	2.623	3.077	3.442	4.099	4.668	5.176	7.646
43	2.582	3.032	3.392	4.043	4.609	5.117	7.548
44	2.543	2.989	3.345	3.988	4.552	5.060	7.454
45	2.505	2.947	3.298	3.936	4.497	5.005	7.363
46	2.469	2.907	3.254	3.885	4.444	4.952	7.275
47	2.434	2.868	3.211	3.836	4.393	4.900	7.190
48	2.400	2.830	3.169	3.788	4.343	4.850	7.108
49	2.368	2.794	3.129	3.743	4.295	4.802	7.028
50	2.336	2.759	3.090	3.698	4.248	4.754	6.951
51	2.306	2.724	3.052	3.655	4.203	4.709	6.876
52	2.276	2.691	3.016	3.613	4.159	4.664	6.804
53	2.247	2.659	2.980	3.573	4.117	4.621	6.733
54	2.220	2.628	2.946	3.534	4.075	4.579	6.665
55	2.193	2.598	2.913	3.496	4.035	4.538	6.598
56	2.167	2.569	2.880	3.459	3.996	4.499	6.534
57	2.141	2.541	2.849	3.423	3.958	4.460	6.471
58	2.117	2.513	2.819	3.388	3.921	4.422	6.410
59	2.093	2.486	2.789	3.354	3.885	4.386	6.350
60	2.070	2.460	2.760	3.320	3.850	4.350	6.300
120	1.285	1.555	1.775	2.175	2.550	2.900	4.050
180	0.933	1.140	1.317	1.633	1.900	2.200	3.133
360	0.552	0.668	0.767	0.950	1.083	1.250	1.767
720	0.315	0.383	0.450	0.533	0.625	0.733	1.033
1440	0.185	0.223	0.250	0.313	0.375	0.417	0.571

Table 5.5.1.A – Intensity-Duration-Frequency (IDF) Values for PA-1

Time (minutes)	Atlas 14 Rainfall Intensity (inches/hour) by Storm Frequency						
	2-YEAR	5-YEAR	10-YEAR	25-YEAR	50-YEAR	100-YEAR	500-YEAR

5	6.34	7.96	9.31	11.22	12.72	14.26	18.19
6	5.98	7.53	8.81	10.64	12.06	13.53	17.14
7	5.70	7.17	8.40	10.16	11.52	12.91	16.30
8	5.45	6.87	8.05	9.74	11.04	12.37	15.58
9	5.24	6.61	7.73	9.36	10.60	11.88	14.95
10	5.05	6.36	7.44	9.00	10.20	11.43	14.38
11	4.87	6.13	7.17	8.66	9.82	11.00	13.85
12	4.70	5.92	6.91	8.34	9.46	10.59	13.35
13	4.54	5.71	6.67	8.03	9.11	10.19	12.88
14	4.39	5.51	6.43	7.73	8.77	9.81	12.43
15	4.24	5.32	6.20	7.44	8.44	9.43	11.99
16	4.10	5.14	5.99	7.18	8.14	9.10	11.57
17	3.98	4.98	5.80	6.95	7.88	8.80	11.20
18	3.86	4.84	5.63	6.75	7.64	8.53	10.86
19	3.76	4.71	5.47	6.56	7.42	8.29	10.56
20	3.66	4.58	5.33	6.39	7.22	8.07	10.28
21	3.58	4.47	5.20	6.23	7.04	7.86	10.03
22	3.50	4.37	5.08	6.08	6.87	7.67	9.79
23	3.42	4.27	4.96	5.95	6.71	7.50	9.57
24	3.35	4.18	4.86	5.82	6.57	7.34	9.37
25	3.28	4.10	4.76	5.70	6.43	7.19	9.18
26	3.22	4.02	4.67	5.59	6.31	7.04	9.01
27	3.16	3.94	4.58	5.49	6.18	6.91	8.84
28	3.10	3.87	4.49	5.39	6.07	6.78	8.68
29	3.05	3.81	4.42	5.29	5.96	6.66	8.53
30	3.00	3.74	4.34	5.20	5.86	6.55	8.39
31	2.95	3.68	4.27	5.11	5.76	6.44	8.25
32	2.90	3.62	4.20	5.03	5.67	6.33	8.12
33	2.85	3.56	4.13	4.95	5.58	6.23	8.00
34	2.81	3.51	4.07	4.88	5.49	6.14	7.88
35	2.77	3.45	4.01	4.80	5.41	6.05	7.77
36	2.72	3.40	3.95	4.73	5.33	5.96	7.66
37	2.68	3.35	3.89	4.66	5.25	5.87	7.55
38	2.65	3.30	3.83	4.60	5.18	5.79	7.45
39	2.61	3.25	3.78	4.53	5.11	5.71	7.35
40	2.57	3.21	3.73	4.47	5.04	5.63	7.26
41	2.53	3.16	3.68	4.41	4.97	5.56	7.17
42	2.50	3.12	3.63	4.35	4.90	5.48	7.08
43	2.46	3.08	3.58	4.29	4.84	5.41	6.99
44	2.43	3.04	3.53	4.24	4.78	5.34	6.90
45	2.40	3.00	3.48	4.18	4.72	5.28	6.82
46	2.36	2.96	3.44	4.13	4.66	5.21	6.74
47	2.33	2.92	3.39	4.08	4.60	5.15	6.66
48	2.30	2.88	3.35	4.02	4.54	5.08	6.58
49	2.27	2.84	3.31	3.97	4.48	5.02	6.51
50	2.24	2.80	3.27	3.92	4.43	4.96	6.43
51	2.21	2.77	3.22	3.88	4.38	4.90	6.36
52	2.18	2.73	3.18	3.83	4.32	4.84	6.29
53	2.15	2.70	3.14	3.78	4.27	4.79	6.22
54	2.12	2.66	3.11	3.73	4.22	4.73	6.15
55	2.10	2.63	3.07	3.69	4.17	4.68	6.08
56	2.07	2.59	3.03	3.64	4.12	4.62	6.02
57	2.04	2.56	2.99	3.60	4.07	4.57	5.95
58	2.01	2.53	2.95	3.56	4.02	4.51	5.89
59	1.99	2.49	2.92	3.51	3.98	4.46	5.82
60	1.96	2.46	2.88	3.47	3.93	4.41	5.76
120	1.21	1.55	1.85	2.29	2.64	3.03	4.13
180	0.90	1.16	1.40	1.77	2.07	2.41	3.37
360	0.53	0.69	0.85	1.09	1.30	1.54	2.21
720	0.30	0.40	0.50	0.64	0.77	0.92	1.35
1440	0.17	0.23	0.29	0.37	0.45	0.54	0.80

Table 5.5.1.B – Intensity-Duration-Frequency (IDF) Values for PA-2

Time (minutes)	Atlas 14 Rainfall Intensity (inches/hour) by Storm Frequency						
	2-YEAR	5-YEAR	10-YEAR	25-YEAR	50-YEAR	100-YEAR	500-YEAR
5	6.34	7.94	9.29	11.14	12.60	14.01	17.68
6	5.98	7.52	8.80	10.53	11.94	13.30	16.67
7	5.70	7.17	8.39	10.03	11.40	12.69	15.85

8	5.45	6.87	8.04	9.61	10.92	12.16	15.15
9	5.24	6.60	7.73	9.23	10.48	11.68	14.54
10	5.05	6.36	7.44	8.88	10.08	11.23	13.98
11	4.87	6.13	7.17	8.56	9.70	10.81	13.46
12	4.70	5.92	6.91	8.25	9.34	10.41	12.98
13	4.54	5.71	6.67	7.96	8.99	10.02	12.52
14	4.39	5.51	6.43	7.67	8.65	9.64	12.08
15	4.24	5.32	6.20	7.40	8.32	9.27	11.65
16	4.10	5.14	5.99	7.14	8.03	8.94	11.24
17	3.98	4.98	5.79	6.91	7.77	8.64	10.88
18	3.86	4.83	5.62	6.71	7.53	8.38	10.55
19	3.76	4.69	5.46	6.52	7.32	8.14	10.26
20	3.66	4.57	5.32	6.35	7.12	7.92	9.99
21	3.58	4.46	5.19	6.19	6.94	7.72	9.74
22	3.50	4.35	5.06	6.04	6.78	7.53	9.51
23	3.42	4.26	4.95	5.91	6.62	7.36	9.30
24	3.35	4.17	4.84	5.78	6.48	7.20	9.10
25	3.28	4.08	4.74	5.66	6.34	7.05	8.92
26	3.22	4.00	4.65	5.55	6.22	6.91	8.74
27	3.16	3.93	4.56	5.44	6.10	6.78	8.58
28	3.10	3.85	4.48	5.34	5.99	6.65	8.43
29	3.05	3.79	4.40	5.25	5.88	6.53	8.28
30	3.00	3.72	4.32	5.16	5.78	6.42	8.14
31	2.95	3.66	4.25	5.07	5.68	6.31	8.01
32	2.90	3.60	4.18	4.99	5.59	6.21	7.89
33	2.85	3.54	4.11	4.91	5.50	6.11	7.77
34	2.81	3.49	4.05	4.84	5.42	6.02	7.65
35	2.77	3.43	3.99	4.76	5.34	5.93	7.54
36	2.72	3.38	3.93	4.69	5.26	5.84	7.43
37	2.68	3.33	3.87	4.63	5.18	5.76	7.33
38	2.64	3.28	3.81	4.56	5.11	5.68	7.23
39	2.61	3.24	3.76	4.50	5.04	5.60	7.14
40	2.57	3.19	3.71	4.43	4.97	5.52	7.04
41	2.53	3.14	3.65	4.37	4.90	5.45	6.95
42	2.50	3.10	3.60	4.31	4.83	5.38	6.87
43	2.46	3.06	3.56	4.26	4.77	5.31	6.78
44	2.43	3.02	3.51	4.20	4.71	5.24	6.70
45	2.40	2.98	3.46	4.15	4.65	5.17	6.62
46	2.36	2.94	3.42	4.09	4.59	5.11	6.54
47	2.33	2.90	3.37	4.04	4.53	5.04	6.46
48	2.30	2.86	3.33	3.99	4.48	4.98	6.39
49	2.27	2.82	3.29	3.94	4.42	4.92	6.31
50	2.24	2.79	3.24	3.89	4.37	4.86	6.24
51	2.21	2.75	3.20	3.84	4.31	4.80	6.17
52	2.18	2.72	3.16	3.79	4.26	4.75	6.10
53	2.15	2.68	3.12	3.75	4.21	4.69	6.03
54	2.12	2.65	3.08	3.70	4.16	4.64	5.97
55	2.09	2.61	3.05	3.66	4.11	4.58	5.90
56	2.06	2.58	3.01	3.61	4.06	4.53	5.84
57	2.04	2.55	2.97	3.57	4.01	4.48	5.77
58	2.01	2.51	2.93	3.53	3.96	4.42	5.71
59	1.98	2.48	2.90	3.48	3.92	4.37	5.65
60	1.96	2.45	2.86	3.44	3.87	4.32	5.59
120	1.21	1.54	1.84	2.26	2.60	2.98	4.02
180	0.89	1.15	1.39	1.75	2.04	2.37	3.28
360	0.52	0.69	0.84	1.07	1.28	1.51	2.15
720	0.30	0.40	0.49	0.63	0.76	0.90	1.31
1440	0.17	0.23	0.28	0.36	0.44	0.52	0.77

Table 5.5.1.C – Intensity-Duration-Frequency (IDF) Values for PA-3

Time (minutes)	Atlas 14 Rainfall Intensity (inches/hour) by Storm Frequency						
	2-YEAR	5-YEAR	10-YEAR	25-YEAR	50-YEAR	100-YEAR	500-YEAR
5	6.30	7.88	9.20	11.00	12.36	13.79	17.20
6	5.95	7.45	8.73	10.43	11.75	13.08	16.21
7	5.66	7.11	8.33	9.95	11.24	12.49	15.41
8	5.42	6.81	7.98	9.54	10.78	11.97	14.74
9	5.21	6.54	7.67	9.17	10.35	11.49	14.14
10	5.02	6.30	7.38	8.82	9.96	11.05	13.60

11	4.85	6.08	7.11	8.50	9.58	10.64	13.10
12	4.68	5.86	6.85	8.19	9.22	10.24	12.62
13	4.53	5.66	6.60	7.89	8.87	9.85	12.17
14	4.38	5.47	6.36	7.60	8.53	9.48	11.74
15	4.24	5.28	6.12	7.32	8.20	9.12	11.33
16	4.10	5.10	5.91	7.07	7.91	8.79	10.93
17	3.97	4.94	5.72	6.84	7.66	8.50	10.58
18	3.86	4.80	5.55	6.63	7.42	8.24	10.26
19	3.75	4.66	5.40	6.45	7.21	8.00	9.97
20	3.66	4.54	5.26	6.28	7.02	7.79	9.71
21	3.57	4.43	5.13	6.12	6.84	7.59	9.46
22	3.49	4.33	5.01	5.98	6.68	7.41	9.24
23	3.41	4.23	4.90	5.84	6.53	7.24	9.04
24	3.34	4.14	4.79	5.72	6.39	7.08	8.84
25	3.27	4.06	4.70	5.60	6.26	6.93	8.66
26	3.21	3.98	4.60	5.49	6.13	6.80	8.50
27	3.15	3.90	4.52	5.38	6.02	6.66	8.34
28	3.09	3.83	4.43	5.28	5.91	6.54	8.19
29	3.04	3.76	4.35	5.19	5.80	6.42	8.04
30	2.98	3.70	4.28	5.10	5.70	6.31	7.91
31	2.93	3.64	4.21	5.01	5.60	6.21	7.78
32	2.89	3.58	4.14	4.93	5.51	6.11	7.66
33	2.84	3.52	4.07	4.85	5.43	6.01	7.54
34	2.79	3.47	4.01	4.78	5.34	5.92	7.43
35	2.75	3.41	3.95	4.71	5.26	5.83	7.32
36	2.71	3.36	3.89	4.64	5.18	5.74	7.22
37	2.67	3.31	3.83	4.57	5.11	5.66	7.12
38	2.63	3.26	3.78	4.50	5.04	5.58	7.02
39	2.59	3.22	3.72	4.44	4.97	5.50	6.93
40	2.55	3.17	3.67	4.38	4.90	5.43	6.84
41	2.52	3.13	3.62	4.32	4.83	5.35	6.75
42	2.48	3.08	3.57	4.26	4.77	5.28	6.66
43	2.45	3.04	3.52	4.20	4.70	5.21	6.58
44	2.41	3.00	3.48	4.15	4.64	5.15	6.50
45	2.38	2.96	3.43	4.09	4.58	5.08	6.42
46	2.35	2.92	3.39	4.04	4.52	5.02	6.35
47	2.32	2.88	3.34	3.99	4.47	4.96	6.27
48	2.28	2.84	3.30	3.94	4.41	4.89	6.20
49	2.25	2.81	3.26	3.89	4.36	4.83	6.13
50	2.22	2.77	3.21	3.84	4.30	4.78	6.06
51	2.19	2.73	3.17	3.79	4.25	4.72	5.99
52	2.16	2.70	3.13	3.74	4.20	4.66	5.92
53	2.13	2.66	3.09	3.70	4.15	4.61	5.85
54	2.11	2.63	3.05	3.65	4.10	4.55	5.79
55	2.08	2.59	3.02	3.61	4.05	4.50	5.72
56	2.05	2.56	2.98	3.56	4.00	4.45	5.66
57	2.02	2.53	2.94	3.52	3.95	4.39	5.60
58	1.99	2.49	2.90	3.47	3.90	4.34	5.54
59	1.97	2.46	2.87	3.43	3.86	4.29	5.48
60	1.94	2.43	2.83	3.39	3.81	4.24	5.42
120	1.19	1.52	1.81	2.22	2.55	2.90	3.88
180	0.88	1.14	1.37	1.71	1.99	2.30	3.15
360	0.51	0.67	0.82	1.05	1.24	1.46	2.06
720	0.29	0.39	0.48	0.61	0.73	0.86	1.25
1440	0.17	0.22	0.27	0.35	0.42	0.50	0.73

Table 5.5.1.D – Intensity-Duration-Frequency (IDF) Values for PA-4

Time (minutes)	Atlas 14 Rainfall Intensity (inches/hour) by Storm Frequency						
	2-YEAR	5-YEAR	10-YEAR	25-YEAR	50-YEAR	100-YEAR	500-YEAR
5	6.30	7.85	9.14	10.92	12.24	13.65	16.83
6	5.94	7.40	8.66	10.36	11.62	12.96	15.87
7	5.66	7.05	8.26	9.89	11.11	12.37	15.09
8	5.42	6.75	7.92	9.48	10.65	11.85	14.43
9	5.21	6.48	7.61	9.11	10.23	11.38	13.84
10	5.02	6.24	7.32	8.76	9.84	10.95	13.31
11	4.84	6.02	7.05	8.43	9.47	10.54	12.82
12	4.68	5.81	6.79	8.12	9.12	10.14	12.36
13	4.53	5.61	6.55	7.82	8.78	9.76	11.92

14	4.38	5.42	6.31	7.53	8.44	9.39	11.49
15	4.24	5.24	6.08	7.24	8.12	9.03	11.09
16	4.10	5.06	5.87	6.99	7.84	8.71	10.70
17	3.97	4.91	5.68	6.76	7.58	8.42	10.35
18	3.86	4.76	5.51	6.56	7.35	8.16	10.04
19	3.75	4.63	5.36	6.37	7.14	7.93	9.75
20	3.65	4.51	5.22	6.21	6.95	7.71	9.50
21	3.57	4.40	5.09	6.05	6.78	7.52	9.26
22	3.48	4.30	4.97	5.91	6.61	7.34	9.04
23	3.41	4.21	4.86	5.77	6.46	7.17	8.84
24	3.33	4.12	4.75	5.65	6.32	7.01	8.65
25	3.27	4.04	4.65	5.53	6.19	6.86	8.47
26	3.20	3.96	4.56	5.42	6.07	6.73	8.31
27	3.14	3.88	4.48	5.32	5.95	6.60	8.15
28	3.08	3.81	4.39	5.22	5.84	6.48	8.00
29	3.03	3.74	4.31	5.13	5.74	6.36	7.87
30	2.98	3.68	4.24	5.04	5.64	6.25	7.73
31	2.93	3.62	4.17	4.96	5.55	6.14	7.61
32	2.88	3.56	4.10	4.87	5.45	6.04	7.49
33	2.83	3.50	4.03	4.80	5.37	5.95	7.37
34	2.79	3.45	3.97	4.72	5.28	5.86	7.26
35	2.74	3.39	3.91	4.65	5.20	5.77	7.16
36	2.70	3.34	3.85	4.58	5.13	5.68	7.05
37	2.66	3.29	3.80	4.51	5.05	5.60	6.96
38	2.62	3.25	3.74	4.45	4.98	5.52	6.86
39	2.58	3.20	3.69	4.39	4.91	5.44	6.77
40	2.55	3.15	3.64	4.33	4.84	5.37	6.68
41	2.51	3.11	3.59	4.27	4.78	5.30	6.59
42	2.47	3.07	3.54	4.21	4.71	5.23	6.51
43	2.44	3.02	3.49	4.15	4.65	5.16	6.43
44	2.40	2.98	3.44	4.10	4.59	5.09	6.35
45	2.37	2.94	3.40	4.04	4.53	5.02	6.27
46	2.34	2.90	3.35	3.99	4.47	4.96	6.20
47	2.31	2.86	3.31	3.94	4.41	4.90	6.12
48	2.27	2.83	3.26	3.89	4.36	4.84	6.05
49	2.24	2.79	3.22	3.84	4.30	4.78	5.98
50	2.21	2.75	3.18	3.79	4.25	4.72	5.91
51	2.18	2.71	3.14	3.75	4.20	4.66	5.84
52	2.15	2.68	3.10	3.70	4.15	4.61	5.78
53	2.12	2.64	3.06	3.65	4.09	4.55	5.71
54	2.10	2.61	3.02	3.61	4.04	4.50	5.65
55	2.07	2.57	2.98	3.56	4.00	4.44	5.58
56	2.04	2.54	2.95	3.52	3.95	4.39	5.52
57	2.01	2.51	2.91	3.48	3.90	4.34	5.46
58	1.98	2.47	2.87	3.43	3.85	4.29	5.40
59	1.96	2.44	2.84	3.39	3.81	4.24	5.34
60	1.93	2.41	2.80	3.35	3.76	4.19	5.28
120	1.18	1.51	1.79	2.19	2.51	2.85	3.76
180	0.87	1.13	1.36	1.69	1.95	2.25	3.05
360	0.51	0.67	0.81	1.03	1.21	1.41	1.98
720	0.29	0.38	0.47	0.60	0.71	0.83	1.19
1440	0.16	0.22	0.27	0.34	0.41	0.48	0.70

Table 5.5.1.E – Intensity-Duration-Frequency (IDF) Values for PA-5

Time (minutes)	Atlas 14 Rainfall Intensity (inches/hour) by Storm Frequency						
	2-YEAR	5-YEAR	10-YEAR	25-YEAR	50-YEAR	100-YEAR	500-YEAR
5	6.31	7.85	9.13	10.90	12.24	13.65	16.65
6	5.96	7.41	8.66	10.32	11.62	12.95	15.70
7	5.67	7.06	8.27	9.84	11.11	12.37	14.93
8	5.43	6.76	7.93	9.42	10.65	11.85	14.27
9	5.22	6.49	7.61	9.05	10.23	11.38	13.69
10	5.03	6.24	7.32	8.70	9.84	10.95	13.17
11	4.85	6.01	7.04	8.37	9.47	10.53	12.68
12	4.69	5.80	6.78	8.07	9.12	10.14	12.23
13	4.53	5.59	6.53	7.77	8.78	9.76	11.79
14	4.38	5.39	6.28	7.48	8.44	9.39	11.38
15	4.24	5.20	6.04	7.20	8.12	9.03	10.97
16	4.10	5.03	5.83	6.95	7.84	8.71	10.59

17	3.97	4.87	5.65	6.73	7.58	8.42	10.24
18	3.85	4.73	5.48	6.53	7.35	8.16	9.94
19	3.75	4.60	5.33	6.34	7.14	7.93	9.65
20	3.65	4.48	5.19	6.18	6.95	7.71	9.40
21	3.56	4.38	5.06	6.02	6.78	7.52	9.16
22	3.48	4.28	4.94	5.88	6.61	7.34	8.95
23	3.40	4.18	4.83	5.75	6.46	7.17	8.75
24	3.33	4.09	4.73	5.62	6.32	7.01	8.56
25	3.26	4.01	4.63	5.51	6.19	6.86	8.39
26	3.20	3.93	4.54	5.40	6.07	6.73	8.22
27	3.14	3.86	4.45	5.30	5.95	6.60	8.07
28	3.08	3.79	4.37	5.20	5.84	6.47	7.92
29	3.03	3.72	4.29	5.11	5.74	6.36	7.78
30	2.97	3.66	4.22	5.02	5.64	6.25	7.65
31	2.92	3.60	4.15	4.94	5.55	6.14	7.53
32	2.88	3.54	4.08	4.86	5.45	6.04	7.41
33	2.83	3.48	4.02	4.78	5.37	5.95	7.30
34	2.78	3.43	3.95	4.70	5.28	5.85	7.19
35	2.74	3.38	3.89	4.63	5.20	5.77	7.08
36	2.70	3.33	3.84	4.56	5.13	5.68	6.98
37	2.66	3.28	3.78	4.50	5.05	5.60	6.88
38	2.62	3.23	3.73	4.43	4.98	5.52	6.79
39	2.58	3.18	3.67	4.37	4.91	5.44	6.70
40	2.54	3.14	3.62	4.31	4.84	5.37	6.61
41	2.51	3.09	3.57	4.25	4.78	5.29	6.52
42	2.47	3.05	3.52	4.19	4.71	5.22	6.44
43	2.44	3.01	3.48	4.14	4.65	5.15	6.36
44	2.40	2.97	3.43	4.08	4.59	5.09	6.28
45	2.37	2.93	3.38	4.03	4.53	5.02	6.20
46	2.34	2.89	3.34	3.98	4.47	4.96	6.13
47	2.30	2.85	3.30	3.93	4.41	4.89	6.05
48	2.27	2.81	3.25	3.88	4.36	4.83	5.98
49	2.24	2.78	3.21	3.83	4.30	4.77	5.91
50	2.21	2.74	3.17	3.78	4.25	4.71	5.84
51	2.18	2.70	3.13	3.73	4.20	4.66	5.78
52	2.15	2.67	3.09	3.69	4.15	4.60	5.71
53	2.12	2.63	3.05	3.64	4.09	4.54	5.65
54	2.09	2.60	3.01	3.60	4.04	4.49	5.58
55	2.07	2.56	2.98	3.55	4.00	4.44	5.52
56	2.04	2.53	2.94	3.51	3.95	4.38	5.46
57	2.01	2.50	2.90	3.47	3.90	4.33	5.40
58	1.98	2.46	2.87	3.42	3.85	4.28	5.34
59	1.96	2.43	2.83	3.38	3.81	4.23	5.28
60	1.93	2.40	2.80	3.34	3.76	4.18	5.22
120	1.18	1.51	1.79	2.18	2.50	2.83	3.70
180	0.87	1.12	1.35	1.68	1.94	2.23	3.00
360	0.51	0.66	0.81	1.02	1.20	1.39	1.93
720	0.29	0.38	0.46	0.59	0.69	0.81	1.15
1440	0.16	0.21	0.26	0.33	0.40	0.46	0.66

5.5.2 Rainfall Depth-Duration-Frequency

5.5.2.1 Design Rainfall

For the Design Rainfall, a twenty-four (24) hour rainfall distribution shall be applied for hydrograph based runoff calculations. Table 5.5.2.1 relates storm frequency terminology to annual exceedance probability. Rainfall intensities as adopted for the City of San Antonio are given in Tables 5.5.2.1.A through 5.5.2.1.E.

Refer to the SARB Regional Modeling Standards for more information related to rainfall distribution and hyetographs.

~~Table 5.5.2.1 - Design Rainfall Values (inches)~~

~~USGS Adjusted Rainfall Values (pre-areal reduction)~~								
~~Frequency of Storm~~	~~1-year~~	~~2-year~~	~~5-year~~	~~10-year~~	~~25-year~~	~~50-year~~	~~100-year~~	~~500-year~~

~~Exceedance probability~~	~~1~~	~~0.5~~	~~0.2~~	~~0.1~~	~~0.04~~	~~0.02~~	~~0.01~~	~~0.002~~
~~Storm Duration~~								
~~Duration~~	~~Frequency~~							
	~~1-year~~	~~2-year~~	~~5-year~~	~~10-year~~	~~25-year~~	~~50-year~~	~~100-year~~	~~500-year~~
~~5 minute~~	~~0.54~~	~~0.61~~	~~0.70~~	~~0.78~~	~~0.93~~	~~1.04~~	~~1.13~~	~~1.52~~
~~15 minute~~	~~1.00~~	~~1.15~~	~~1.37~~	~~1.60~~	~~1.80~~	~~2.10~~	~~2.50~~	~~3.30~~
~~30 minute~~	~~1.46~~	~~1.64~~	~~1.90~~	~~2.12~~	~~2.50~~	~~2.80~~	~~3.05~~	~~4.60~~
~~1 hour~~	~~1.81~~	~~2.07~~	~~2.46~~	~~2.76~~	~~3.32~~	~~3.85~~	~~4.35~~	~~6.30~~
~~2 hour~~	~~2.22~~	~~2.57~~	~~3.11~~	~~3.55~~	~~4.35~~	~~5.10~~	~~5.80~~	~~8.10~~
~~3 hour~~	~~2.41~~	~~2.80~~	~~3.42~~	~~3.95~~	~~4.90~~	~~5.70~~	~~6.60~~	~~9.40~~
~~6 hour~~	~~2.86~~	~~3.31~~	~~4.01~~	~~4.60~~	~~5.70~~	~~6.50~~	~~7.50~~	~~10.60~~
~~12 hour~~	~~3.26~~	~~3.78~~	~~4.60~~	~~5.40~~	~~6.40~~	~~7.50~~	~~8.80~~	~~12.40~~
~~24 hour~~	~~3.85~~	~~4.44~~	~~5.36~~	~~6.00~~	~~7.50~~	~~9.00~~	~~10.00~~	~~13.70~~

Table 5.5.2.1 – Design Storm Frequency vs. Annual Exceedance Probability (AEP)

	Design Storm Frequency							
	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
AEP	1.0	0.5	0.2	0.1	0.04	0.02	0.01	0.002

Table 5.5.2.1.A – Depth-Duration-Frequency (DDF) Values for PA-1

Atlas 14, Volume 11 Adjusted Rainfall Values (pre-areal reduction)								
Duration	Design Storm Depth (inches) by Storm Frequency							
	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
5 minute	0.45	0.53	0.66	0.78	0.94	1.06	1.19	1.52
10 minute	0.71	0.84	1.06	1.24	1.50	1.70	1.90	2.40
15 minute	0.90	1.06	1.33	1.55	1.86	2.11	2.36	3.00
30 minute	1.27	1.50	1.87	2.17	2.60	2.93	3.27	4.19
1 hour	1.65	1.96	2.46	2.88	3.47	3.93	4.41	5.76
2 hour	1.98	2.42	3.09	3.69	4.57	5.28	6.07	8.26
3 hour	2.15	2.69	3.48	4.21	5.30	6.21	7.24	10.10
6 hour	2.46	3.16	4.15	5.09	6.54	7.80	9.23	13.26
12 hour	2.78	3.62	4.80	5.94	7.70	9.25	11.02	16.23
24 hour	3.11	4.10	5.49	6.85	8.93	10.76	12.88	19.12

Table 5.5.2.1.B – Depth-Duration-Frequency (DDF) Values for PA-2

Atlas 14, Volume 11 Adjusted Rainfall Values (pre-areal reduction)								
Duration	Design Storm Depth (inches) by Storm Frequency							
	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year

5 minute	0.45	0.53	0.66	0.77	0.93	1.05	1.17	1.47
10 minute	0.71	0.84	1.06	1.24	1.48	1.68	1.87	2.33
15 minute	0.90	1.06	1.33	1.55	1.85	2.08	2.32	2.91
30 minute	1.28	1.50	1.86	2.16	2.58	2.89	3.21	4.07
1 hour	1.65	1.96	2.45	2.86	3.44	3.87	4.32	5.59
2 hour	1.97	2.41	3.08	3.67	4.52	5.20	5.95	8.03
3 hour	2.14	2.67	3.46	4.18	5.24	6.12	7.10	9.84
6 hour	2.44	3.13	4.11	5.05	6.45	7.66	9.04	12.90
12 hour	2.76	3.58	4.75	5.87	7.58	9.06	10.76	15.73
24 hour	3.10	4.04	5.44	6.76	8.74	10.45	12.47	18.45

Table 5.5.2.1.C – Depth-Duration-Frequency (DDF) Values for PA-3

Atlas 14, Volume 11 Adjusted Rainfall Values (pre-areal reduction)								
Duration	**Design Storm Depth (inches) by Storm Frequency**							
	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
5 minute	0.45	0.53	0.66	0.77	0.92	1.03	1.15	1.43
10 minute	0.71	0.84	1.05	1.23	1.47	1.66	1.84	2.27
15 minute	0.90	1.06	1.32	1.53	1.83	2.05	2.28	2.83
30 minute	1.28	1.49	1.85	2.14	2.55	2.85	3.16	3.96
1 hour	1.64	1.94	2.43	2.83	3.39	3.81	4.24	5.42
2 hour	1.96	2.38	3.04	3.62	4.44	5.10	5.81	7.75
3 hour	2.12	2.64	3.43	4.11	5.14	5.98	6.91	9.46
6 hour	2.42	3.08	4.05	4.95	6.31	7.45	8.74	12.36
12 hour	2.73	3.53	4.66	5.73	7.36	8.76	10.36	14.99
24 hour	3.07	3.96	5.31	6.56	8.46	10.06	12.00	17.51

Table 5.5.2.1.D – Depth-Duration-Frequency (DDF) Values for PA-4

Atlas 14, Volume 11 Adjusted Rainfall Values (pre-areal reduction)								
Duration	**Design Storm Depth (inches) by Storm Frequency**							
	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
5 minute	0.45	0.53	0.65	0.76	0.91	1.02	1.14	1.40
10 minute	0.71	0.84	1.04	1.22	1.46	1.64	1.82	2.22
15 minute	0.91	1.06	1.31	1.52	1.81	2.03	2.26	2.77
30 minute	1.28	1.49	1.84	2.12	2.52	2.82	3.12	3.87
1 hour	1.64	1.93	2.41	2.80	3.35	3.76	4.19	5.28
2 hour	1.95	2.37	3.02	3.58	4.38	5.02	5.70	7.51
3 hour	2.12	2.62	3.38	4.07	5.06	5.86	6.75	9.14
6 hour	2.41	3.05	4.01	4.88	6.18	7.27	8.49	11.87
12 hour	2.70	3.47	4.57	5.61	7.18	8.49	10.00	14.33
24 hour	3.02	3.91	5.16	6.40	8.20	9.75	11.49	16.70

Table 5.5.2.1.E – Depth-Duration-Frequency (DDF) Values for PA-5

Atlas 14, Volume 11 Adjusted Rainfall Values (pre-areal reduction)								
Duration	Design Storm Depth (inches) by Storm Frequency							
	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
5 minute	0.45	0.53	0.65	0.76	0.91	1.02	1.14	1.39
10 minute	0.71	0.84	1.04	1.22	1.45	1.64	1.82	2.19
15 minute	0.91	1.06	1.30	1.51	1.80	2.03	2.26	2.74
30 minute	1.28	1.49	1.83	2.11	2.51	2.82	3.12	3.83
1 hour	1.64	1.93	2.40	2.80	3.34	3.76	4.18	5.22
2 hour	1.95	2.36	3.01	3.57	4.36	4.99	5.67	7.41
3 hour	2.12	2.61	3.37	4.05	5.03	5.82	6.69	8.99
6 hour	2.41	3.04	3.98	4.85	6.12	7.18	8.36	11.60
12 hour	2.70	3.44	4.53	5.53	7.06	8.31	9.75	13.83
24 hour	3.01	3.86	5.12	6.25	8.02	9.50	11.14	15.94

5.5.2.2 Areal Reduction Factor

Calculated storm water runoff at a given point may be reduced by factors shown in Table 5.5.2.2 based on the tributary area (in square miles) draining to said point.

Table 5.2.2.2 - Areal Reduction Factors

Areal Reduction Factors (for use in calculating Point Rainfall for Bexar County)**	
Area (sq mi)	Base ARF for Area
10	0.855
25	0.79
50	0.76
100	0.73
175	0.71
300	0.67

***Source: ~~2007 Watershed Hydrology Technical Support Data Notebooks on file with San Antonio River Authority~~ San Antonio River Basin Regional Modeling Standards, on file with the San Antonio River Authority*

* * *

5.8 REFERENCES

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- Seelye, Elwyn E. (1960) *Data Book for Civil Engineers: Design Vol. 1* (3rd ed.). New York, NY: John Wiley and Sons, Inc.
- San Antonio River Authority. (September 2013) *San Antonio River Basin Regional Modeling Standards for Hydrology and Hydraulic Modeling.*

* * * * *

TRANSPORTATION & CAPITAL IMPROVEMENTS (TCI)

Proposed Chapter 35 Appendix H Unified Development Code Amendment

Implementing Atlas 14 Rainfall Values as Best Available Data

City Council A Session Item 13

April 11, 2019

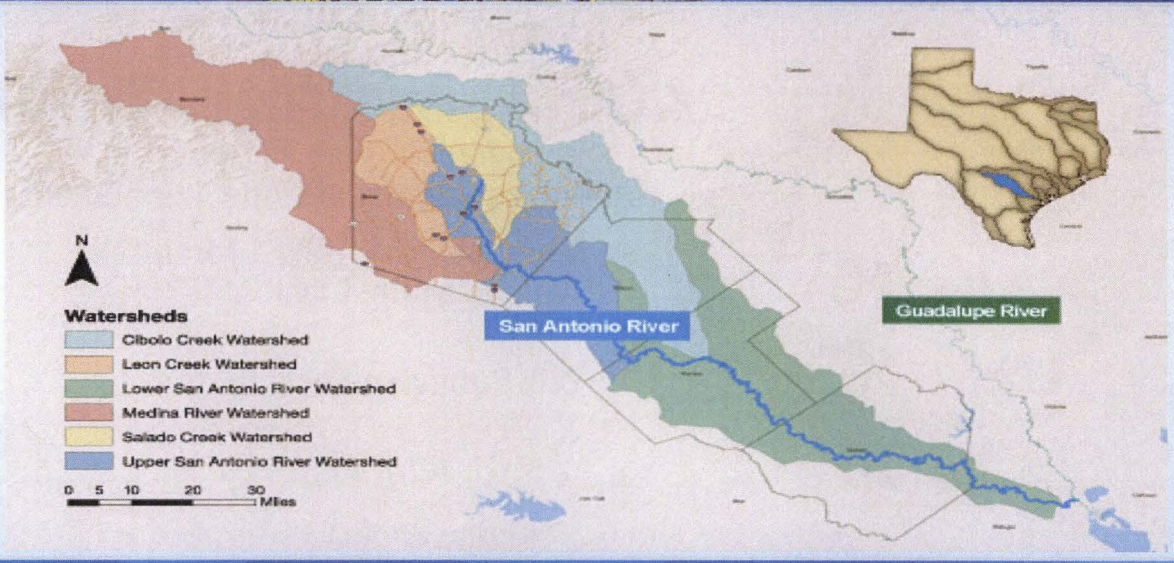
Nefi Garza, P.E., Assistant Director

PROPOSAL

- Requesting Council Action to Approve UDC Amendment
  - Ch. 35, Appendix H to incorporate *Atlas 14, Volume 11 Rainfall Data*
    - 1.2 - Acronyms and Abbreviations
    - 5.5 - Rainfall Data
    - 5.5.1 - Rainfall Intensity-Duration
    - 5.5.2 - Rainfall Depth-Duration Frequency
    - Table of Contents, Lists of Figures and Tables

CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

WATERSHEDS



CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

ATLAS 14, VOLUME 11

- Federal study published September 2018
  - National Oceanic & Atmospheric Administration (NOAA)
- Study of rainfall frequency and intensity
- Data from 3,900 rain gauges throughout Texas
  - Early to mid 1900s through 2017
- UDC requires use of Best Available Data

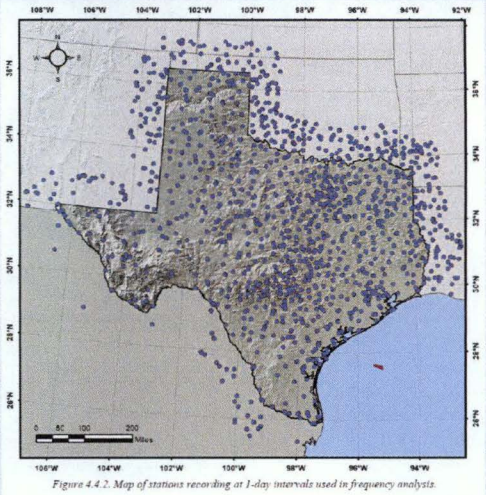
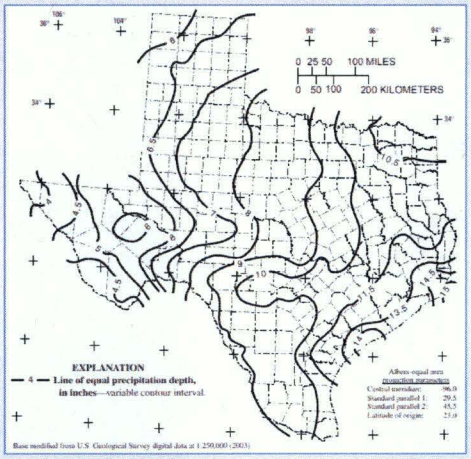


Figure 4.4.2. Map of stations recording at 1-day intervals used in frequency analysis.

CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

ATLAS 14 STUDY

2009 - Today

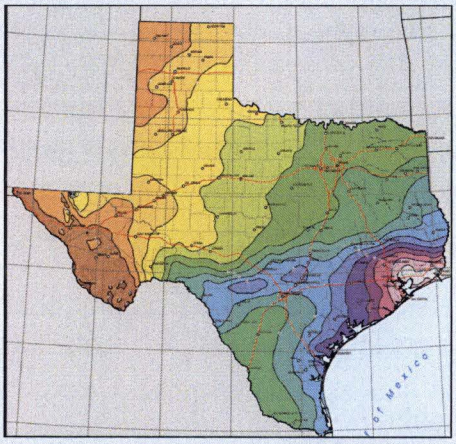


100-year 24-hour estimates (in inches)

CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

ATLAS 14 STUDY

Atlas 14

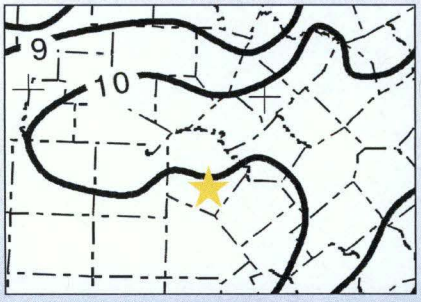


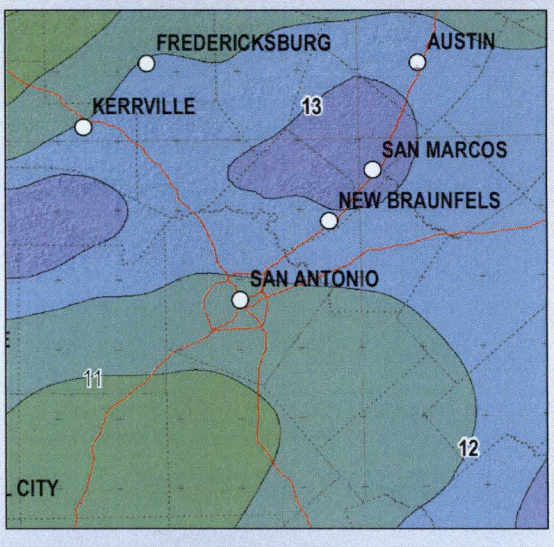
100-year 24-hour estimates (in inches)

CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

ATLAS 14 VS CURRENT STANDARDS

- Design Rainfall Depth (100-year storm)
  - Current ≈ 10"
  - Atlas 14 ≈ 11"-13"
  - 1"- 3" increase (10 - 30%)





INTEGRITY ◆ TEAMWORK ◆ INNOVATION ◆ PROFESSIONALISM 6

CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

POTENTIAL IMPLICATIONS

Group	Potential Impacts
Community	• Updated floodplain maps • Additional structures in the floodplain • Additional structures requiring flood insurance • Possible increase in flood insurance premiums
City of San Antonio	• 2017 Bond- Drainage projects to be evaluated on a case-by-case basis for effectiveness with Atlas 14 rainfall values
Development	• Potential increase in subdivision construction costs (Varies greatly depending on size, complexity, and location of site) • Wider easements • Adjustments to subdivision layout

INTEGRITY ◆ TEAMWORK ◆ INNOVATION ◆ PROFESSIONALISM 7

CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

STAKEHOLDER ENGAGEMENT

AGENCIES

- ***Bexar Regional Watershed Management (BRWM)***
  - Bexar County (BC)
  - San Antonio River Authority (SARA)
  - Transportation & Capital Improvements (TCI)
- Texas Department of Transportation (TxDOT)

CONSULTANTS

- 12+ Engineering Firms
  - Local
  - Regional/National
  - Varied Size
  - Varied Expertise

DEVELOPERS & INDUSTRY GROUPS

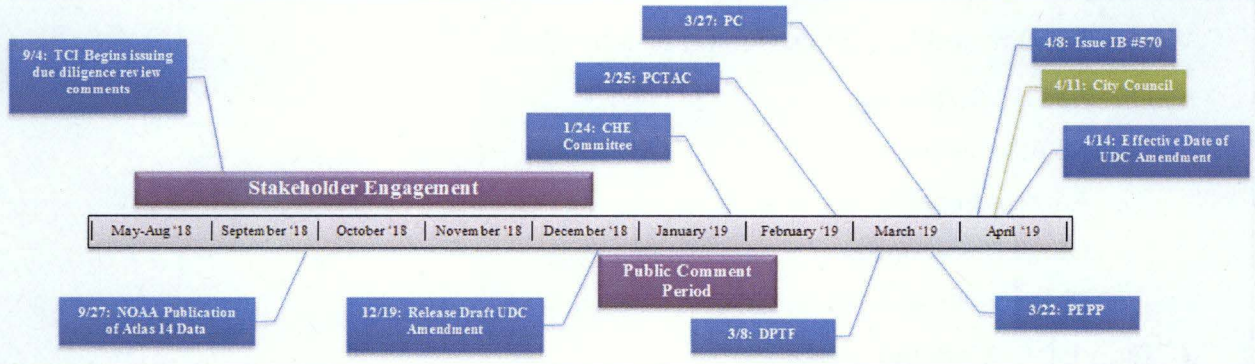
- Professional Engineers in Private Practice (PEPP)
- Real Estate Council (RECSA)

GOAL

- Translating Atlas 14 into usable Best Available Data for San Antonio

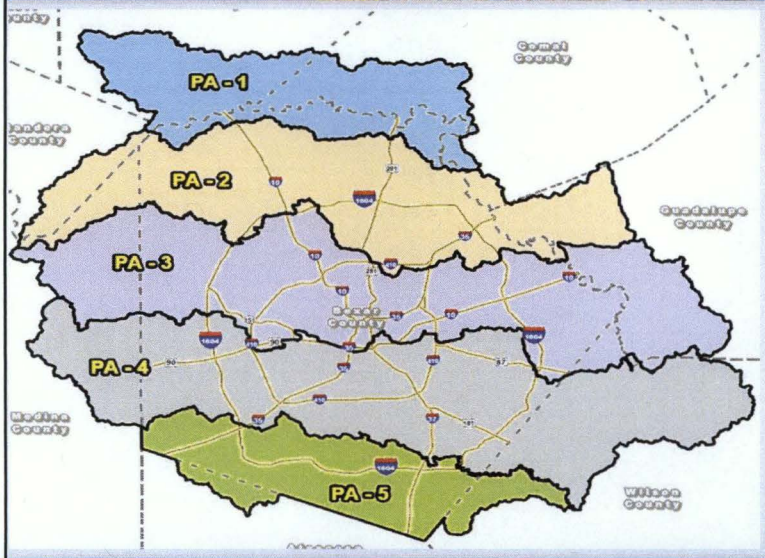
CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

TIMELINE



CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

RECOMMENDATIONS



- Amend UDC 35, Appendix H
  - Adopt Atlas 14, Volume 11
  - Establish 5 Precipitation Areas
  - Replace rainfall data tables

Precipitation Area	Atlas 14 100-Year Design Depth
PA-1	12.87"
PA-2	12.49"
PA-3	11.97"
PA-4	11.50"
PA-5	11.15"

INTEGRITY ◆ TEAMWORK ◆ INNOVATION ◆ PROFESSIONALISM 10

CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

INFORMATIONAL BULLETIN #570

- Any plat or permit submittal after UDC Amendment shall use Atlas 14 data for storm water and floodplain design and analysis
- Clarifies the following:
  - No Adverse Impact
  - Adverse Impact
  - Out of Compliance
  - Phased Mitigation
- Floodplain Mapping
- Finished Floor Elevations

INTEGRITY ◆ TEAMWORK ◆ INNOVATION ◆ PROFESSIONALISM 11

CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

PROPOSAL

- Requesting Council Action to Approve UDC Amendment
  - Ch. 35, Appendix H to incorporate *Atlas 14, Volume 11 Rainfall Data*
    - 1.2 - Acronyms and Abbreviations
    - 5.5 - Rainfall Data
    - 5.5.1 - Rainfall Intensity-Duration
    - 5.5.2 - Rainfall Depth-Duration Frequency
    - Table of Contents, Lists of Figures and Tables

CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

THROUGH **INNOVATION** AND **DEDICATION**, WE **BUILD** AND **MAINTAIN**
SAN ANTONIO'S **INFRASTRUCTURE**

Nefi Garza, P.E., Assistant Director
(210) 207-8024
Nefi.Garza@sanantonio.gov

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Back up Slides

UDC Amendments

- Add map to establish five (5) Precipitation Areas
- Replace two (2) tables with eleven (11) tables
  - Replace one (1) Intensity-Duration-Frequency (IDF) Table with five (5) IDF Tables
  - Replace one (1) Depth-Duration-Frequency (DDF) Table with five (5) IDF Tables
  - Separate Design Storm Frequency vs. Exceedance Probability information from previous DDF Table into a standalone table
  - Add two (2) paragraph narrative

Table 5.5.1.B – Intensity-Duration-Frequency Values for PA -2

Time (minutes)	Atlas 14 Rainfall Intensity (inches/hour) by Storm Frequency						
	2-YEAR	5-YEAR	10-YEAR	25-YEAR	50-YEAR	100-YEAR	500-YEAR
5	6.34	7.94	9.29	11.14	12.60	14.01	17.68
6	5.98	7.52	8.80	10.53	11.94	13.30	16.67
7	5.70	7.17	8.39	10.03	11.40	12.69	15.85
8	5.45	6.87	8.04	9.61	10.92	12.16	15.15
9	5.24	6.60	7.73	9.23	10.48	11.68	14.54
10	5.05	6.36	7.44	8.88	10.08	11.23	13.98
11	4.87	6.13	7.17	8.56	9.70	10.81	13.46
12	4.70	5.92	6.91	8.25	9.34	10.41	12.98
13	4.54	5.71	6.67	7.96	8.99	10.02	12.52
14	4.39	5.51	6.43	7.67	8.65	9.64	12.08
15	4.24	5.32	6.20	7.40	8.32	9.27	11.65
16	4.10	5.14	5.99	7.14	8.03	8.94	11.24

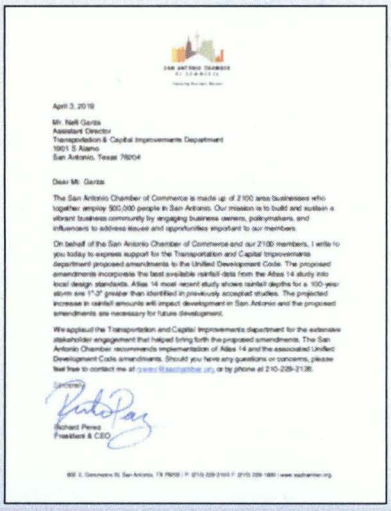
Table 5.5.2.1.A – Depth-Duration-Frequency Values for PA-1

Atlas 14, Volume 11 Adjusted Rainfall Values (pre-areal reduction)								
Duration	Design Storm Depth (inches) by Storm Frequency							
	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
5 minute	0.45	0.53	0.66	0.78	0.94	1.06	1.19	1.52
10 minute	0.71	0.84	1.06	1.24	1.50	1.70	1.90	2.40
15 minute	0.90	1.06	1.33	1.55	1.86	2.11	2.36	3.00
30 minute	1.27	1.50	1.87	2.17	2.60	2.93	3.27	4.19
1 hour	1.65	1.96	2.46	2.88	3.47	3.93	4.41	5.76
2 hour	1.98	2.42	3.09	3.69	4.57	5.28	6.07	8.26
3 hour	2.15	2.69	3.48	4.21	5.30	6.21	7.24	10.10
6 hour	2.46	3.16	4.15	5.09	6.54	7.80	9.23	13.26
12 hour	2.78	3.62	4.80	5.94	7.70	9.25	11.02	16.23
24 hour	3.11	4.10	5.49	6.85	8.93	10.76	12.88	19.12

CITY OF SAN ANTONIO
TRANSPORTATION & CAPITAL IMPROVEMENTS

Letters of Support

San Antonio Chamber of Commerce



April 3, 2019

Mr. Nefi Garza
Assistant Director
Transportation & Capital Improvements Department
1901 S Alamo
San Antonio, Texas 78204

Dear Mr. Garza:

The San Antonio Chamber of Commerce is made up of 2100 area businesses who together employ 500,000 people in San Antonio. Our mission is to build and sustain a vibrant business community by engaging business owners, policymakers, and influencers to address issues and opportunities important to our members.

On behalf of the San Antonio Chamber of Commerce and our 2100 members, I write to you today to express support for the Transportation and Capital Improvements department proposed amendments to the Unified Development Code. The proposed amendments incorporate the best available rainfall data from the Atlas 14 study into local design standards. Atlas 14 most recent study shows rainfall depths for a 100-year storm are 1"-3" greater than identified in previously accepted studies. The projected increase in rainfall amounts will impact development in San Antonio and the proposed amendments are necessary for future development.

We applaud the Transportation and Capital Improvements department for the extensive stakeholder engagement that helped bring forth the proposed amendments. The San Antonio Chamber recommends implementation of Atlas 14 and the associated Unified Development Code amendments. Should you have any questions or concerns, please feel free to contact me at [redacted], or by phone at 210-229-2136.

Sincerely,

Richard Perez
President & CEO

Professional Engineers in Private Practice

Professional Engineers in Private Practice
Bexar Chapter
A Practice Division of TSPE/ASPE

March 11, 2019

Mr. Jacob Powell, PE, CFM
City of San Antonio
Transportation and Capital Improvements
1901 S. Alamo St., 2nd Floor
San Antonio, Texas 78204

Re: Atlas 14, Volume 11 – New Precipitation Data

Dear Jake:

Professional Engineers in Private Practice (PEPP) Bexar Chapter would like to state we are in agreement with the City's rollout plan for the implementation of the recently issued rainfall data (Atlas 14) by the National Oceanic and Atmospheric Administration for the City of San Antonio.

We understand the new data impacts many municipalities in the State and wish to thank the City of San Antonio for proactively recognizing the impact of the report and creating a reasonable plan to accept and implement the new data. The multiple meetings your staff held with the engineering and stakeholder groups in the City should help make the transition to the new criteria as smooth as can be expected.

Thank you for your continued efforts and cooperation with the engineering community in San Antonio.

Sincerely,

Eric Nourse, P.E.
PEPP Chairman