# 2018 Annual Rainfall Report

Monitoring and Modeling

Saskatoon Water
Transportation & Utilities Department

City of
Saskatoon

EXECUTIVE SUMMARY

The following report provides a summary of Saskatoon's 2018 rainfall season (April to September) and a comparison with historical rainfall. Highlights of the report include the following:

- In 2018, 206 mm of rainfall accumulated, which was less than the historical average of 265 mm.
- On average, rainfall occurred on 32% of days in 2018.
- Based on the weighted average, 19 mm was the largest amount of rainfall to accumulate in a single day.
- Saskatoon had a moderately dry spring in 2018. The average rainfall between April and June since 1900 is 127 mm. Saskatoon received 85 mm which falls in the 25th percentile for this time period.
- Saskatoon had a moderately dry summer in 2018. The average rainfall between July and September since 1900 is 137 mm. Saskatoon received 121 mm which falls in the 40th percentile for this time period.
- 2018 had an average of one rain event with a return period of two years or greater.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The purpose of this report is to provide a summary of the 2018 rainfall season in Saskatoon and a comparison of this rainfall data with historical rainfall data. Within the scope of this report, a rainfall season is defined as the time period between April 1st and September 30th. Data between 1900 and 2011 was obtained from the Environment Canada rain gauge while 2012 to 2016 data was obtained from eight City of Saskatoon rain gauges. In 2017, one of the City of Saskatoon rain gauges was decommissioned and therefore seven rain gauges remain. The name, location, approximate area, and total seasonal rainfall of each rain gauge is shown below.
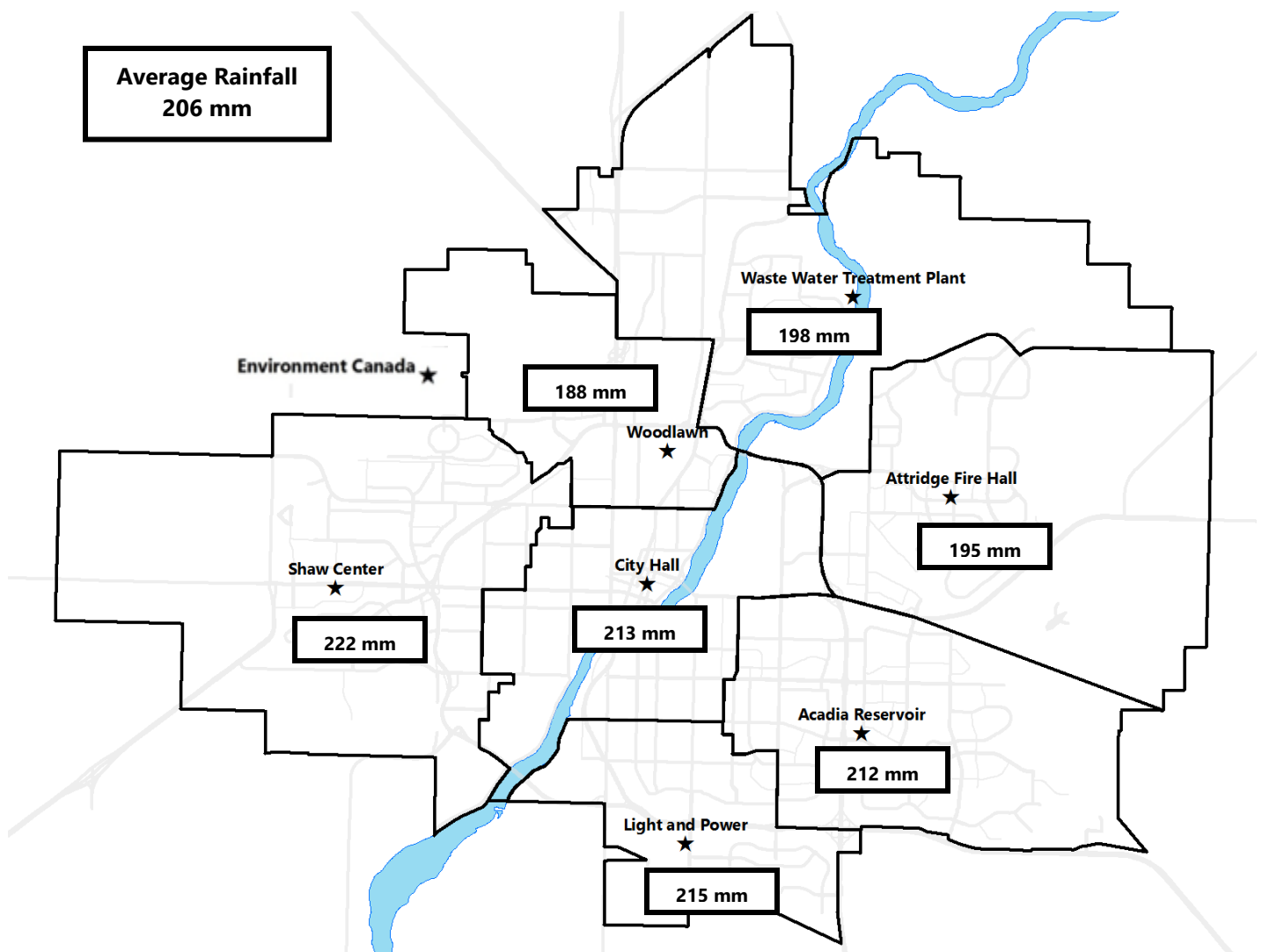
Figure 1: Overview of rain gauges.

SUMMARY OF RAINFALL IN 2018

A daily weighted average for all City of Saskatoon rain gauges functioning on a particular day was calculated to determine the average daily rainfall for Saskatoon. The following graph depicts the average daily rainfall that occurred in Saskatoon throughout the 2018 rainfall season.
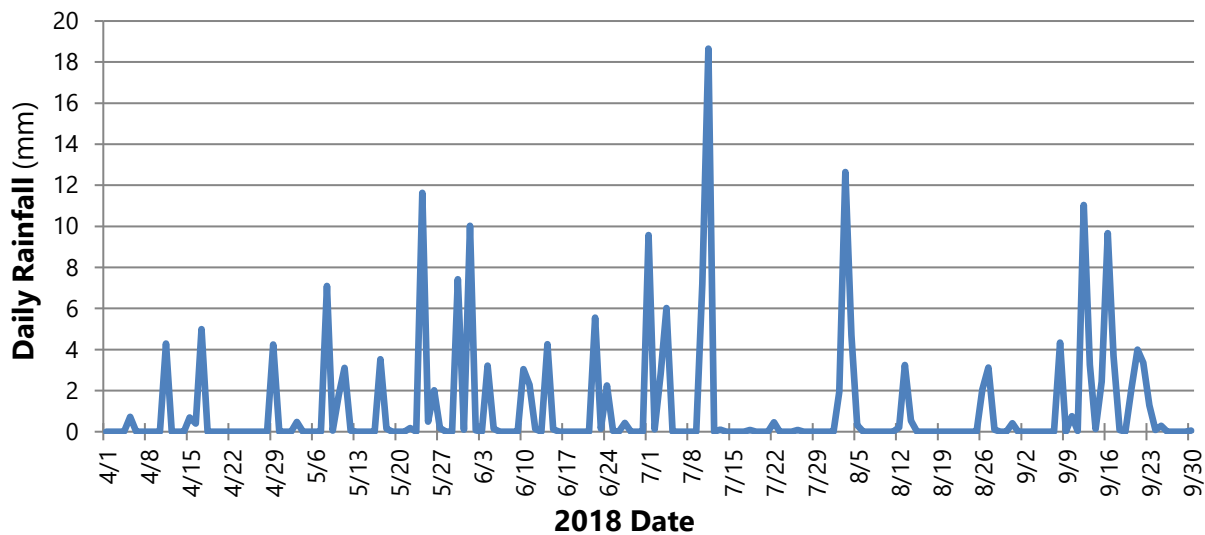
Figure 2: 2018 daily rainfall.

Based on the weighted average, the largest amount of rainfall occurred on July 11th, 2018 with a total of 19 mm. This rainfall accounted for approximately 9% of the total rainfall that occurred in 2018.

Table 1 presents the percentage of days with total rainfall greater than or equal to 0.2 mm, 1 mm, 5 mm, 10 mm, and 25 mm at each rain gauge.

Table 1: Total daily rainfall percent occurrence.

Location	≥ 0.2 mm	≥ 1 mm	≥ 5 mm	≥ 10 mm	≥ 25 mm
Acadia Reservoir	32%	22%	8%	2%	0%
Attridge Fire Hall	30%	20%	8%	2%	0%
City Hall	32%	20%	7%	4%	0%
Light and Power	33%	20%	8%	4%	0%
Shaw Center	33%	19%	8%	3%	1%
WWTP	31%	21%	8%	2%	0%
Woodlawn	31%	18%	7%	3%	0%
Average	**32%**	**20%**	**7%**	**3%**	**0%**

On average, rainfall occurred on 32% of days in 2018.

SUMMARY OF RAINFALL IN 2018

The total seasonal rainfall for 2018 was 206 mm. Figure 3 depicts the accumulation of rainfall throughout the 2018 season.
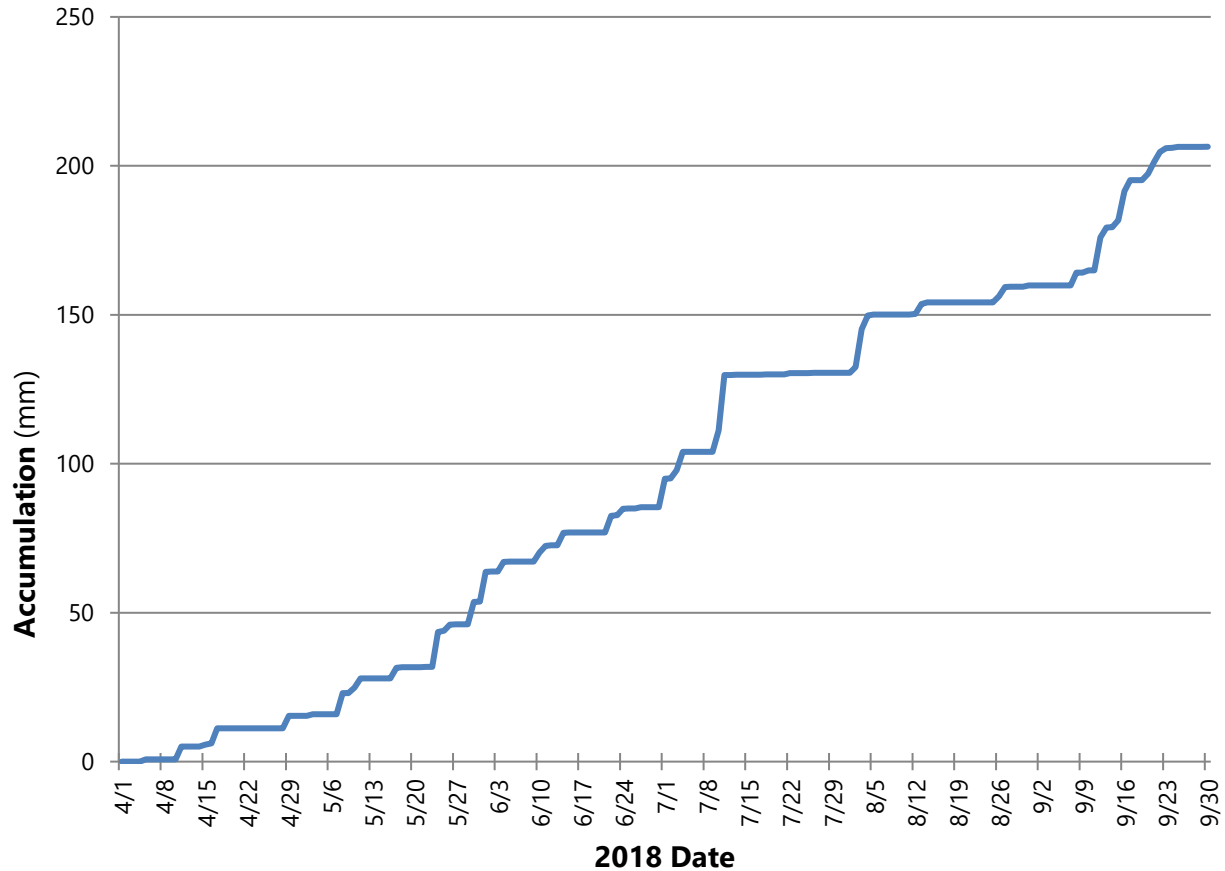
Figure 3: 2018 rainfall accumulation.

The 2018 rainfall season experienced a moderately dry spring, with the months of April to June accumulating a total of 85 mm of rain, which is the 30th lowest spring rainfall out of 119 years since 1900. This rainfall accounted for approximately 41% of the total rainfall that occurred throughout the season. The remaining 59% of the total rainfall occurred between July and September, accumulating a total of 121 mm of rain. This is the 49th lowest summer rainfall out of 119 years since 1900.

HISTORICAL COMPARISON

The average seasonal rainfall from 1900 to 2018 in Saskatoon is 265 mm which is depicted by the light blue line in Figure 4. The 2018 seasonal rainfall of 206 mm was below average and is the 27th lowest seasonal rainfall of the 119 years of data. The lowest seasonal rainfall occurred in 2001 with 131 mm, which is less than half of the average seasonal rainfall. A table containing the seasonal rainfalls from 1900 to 2018 can be found in Appendix A.
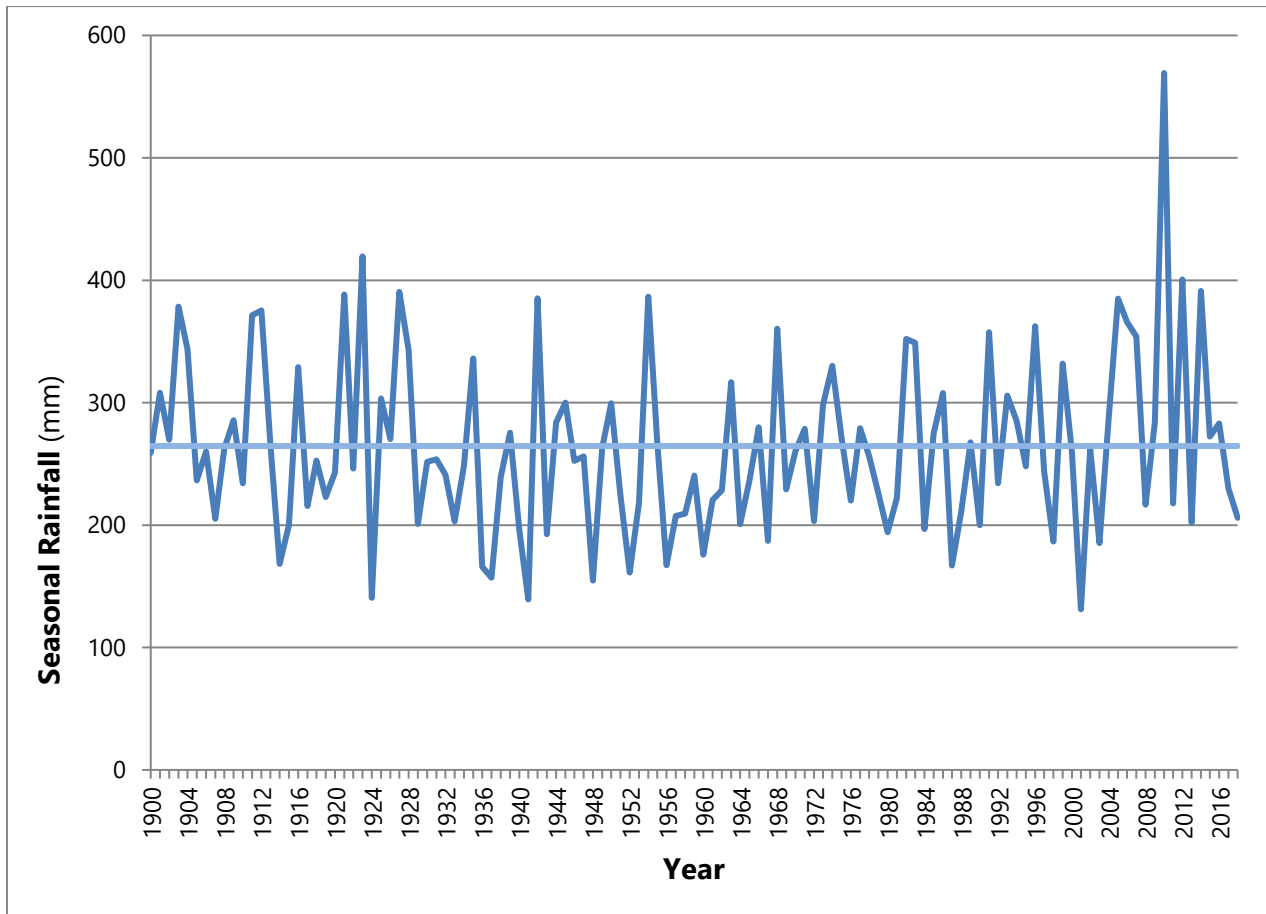
Figure 4: Seasonal rainfall (1900-2018).

HISTORICAL COMPARISON

The following graph provides a comparison of the maximum amount of rainfall to occur in a single day in each season. The average maximum rainfall in a single day in a season is 36 mm from the years 1900 to 2018 and is represented by the light blue line in Figure 5. During the 2018 rainfall season, the maximum rainfall to occur within a single day was 19 mm, which occurred on July 11th. This is the 10th lowest rainfall to occur in a single day out of the 119 years of data.
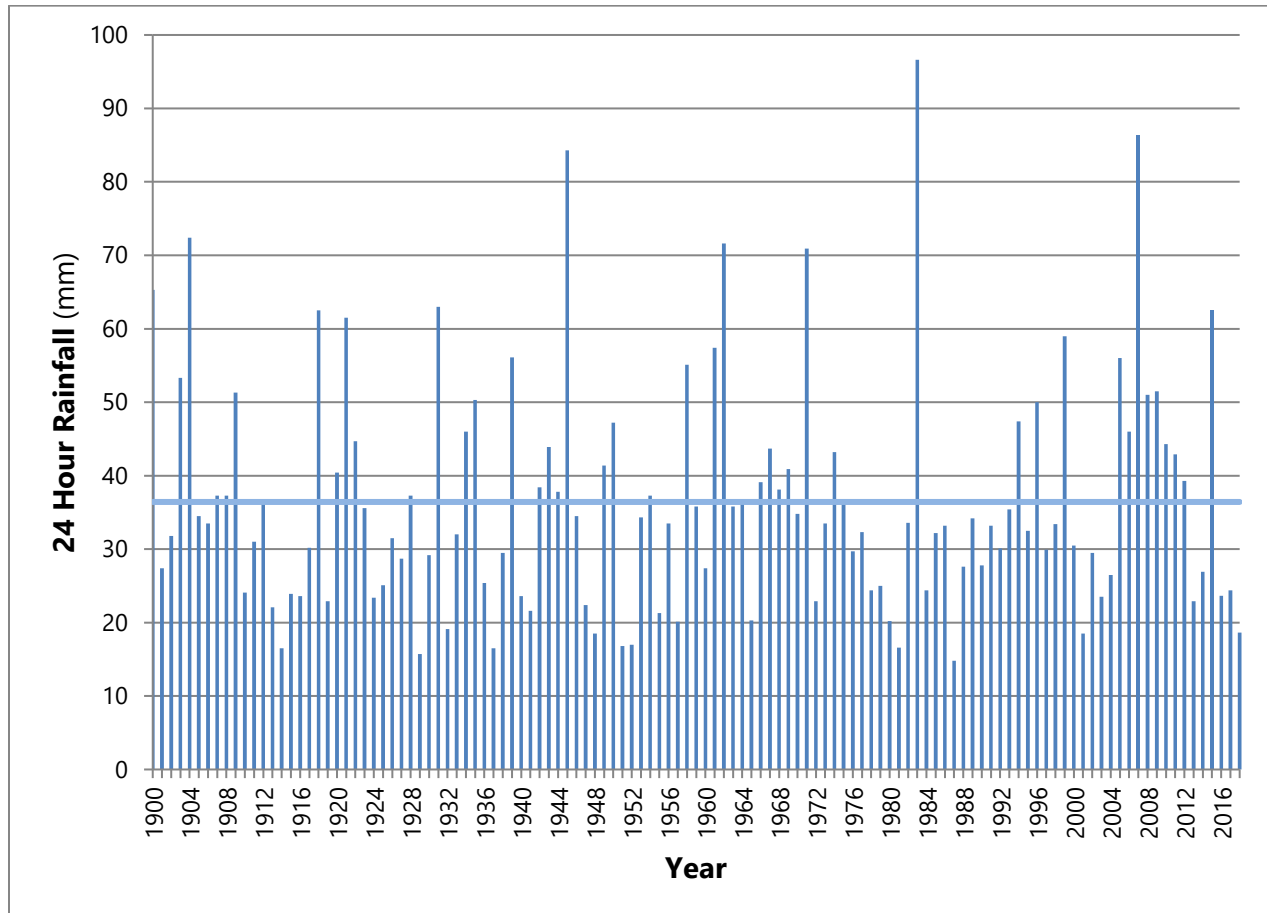
Figure 5: Maximum daily rainfall.

As can be seen in the graph above, the lowest maximum daily rainfall occurred on July 19th, 1987, with a total of 15 mm of rain. As well, only one of the last six years had a daily rainfall which exceeded the historical average.

CLASSIFYING RAIN EVENTS

Rain events in Saskatoon are often localized. Therefore, a rain event may only occur at a few of the seven rain gauges located throughout the city. In order to compare the severity of rain events, their return period must be determined. A return period provides an indication of the likelihood of an event. For example, a rain event with a return period of 2 years has a 50% chance of occurring in any given year. For comparison, a rain event with a return period of 100 years has a 1% chance of occurring in any given year. The following table provides a summary of the criteria used to determine the return period of each rain event.

Table 2: Criteria for determining return period of a rain event.

Time (minutes)	Intensity (mm/hr)			
	2-Year	**5-Year**	**25-Year**	**100-Year**
10	53	85	132	168
15	41	67	104	133
30	26.4	46.1	74	97
60	16.6	28.9	46.5	60
120	10.7	17.5	27.3	35
360	4.7	7.0	10.3	12.9
720	2.73	3.90	5.59	6.91
1440	1.56	2.18	3.07	3.76

For the purposes of this report, two different methods were utilized to determine the number of rain events with a return period of 2, 5, 25, or 100 years between 2012 and 2018. It should be noted that within this report, rain events with the same return period may include any of the durations as outlined in Table 2. The first method determined the average number of rain events for each return period by adding together the number of events in a season with the same return period at each of the city's rain gauges and dividing that number by the total number of rain gauges (seven). The following table provides a summary of these values. A more detailed table can be found in Appendix B.

Table 3: Average frequency of rain events.

	Return Period	2012	2013	2014	2015	2016	2017	2018	Total
Average	2 – 5 Year	4	1	3	1	1	1	1	12
	5 – 25 Year	0	0	0	1	0	0	0	1
	25 – 100 Year	0	0	0	0	0	0	0	0
	> 100 Years	0	0	0	0	0	0	0	0
Total		**4**	**1**	**3**	**2**	**1**	**1**	**1**	**13**

CLASSIFYING RAIN EVENTS

In Table 4, the rain events were tallied using the same method as Table 3, except only rain events with a duration of 1 hour or greater were counted.

Table 4: Average frequency of rain events greater than or equal to 1 hour duration.

	Return Period	2012	2013	2014	2015	2016	2017	2018	Total
Average	2 – 5 Year	3	1	2	1	0	1	0	8
	5 – 25 Year	0	0	0	1	0	0	0	1
	25 – 100 Year	0	0	0	0	0	0	0	0
	> 100 Years	0	0	0	0	0	0	0	0
Total		**3**	**1**	**2**	**2**	**0**	**1**	**0**	**9**

The second method determined the number of days per year that a major rain event occurred at one or more rain gauges. If the rain gauges throughout the City recorded varying return periods on a given day, the maximum return period was counted as the rain event for that day. The following table provides the number of days per year that a major rain event occurred at one or more rain gauges.

Table 5: Overall frequency of rain events.

	Return Period	2012	2013	2014	2015	2016	2017	2018	Total
Overall	2 – 5 Year	8	5	6	3	3	2	3	30
	5 – 25 Year	0	1	1	0	0	1	0	3
	25 – 100 Year	0	0	0	1	0	0	0	1
	> 100 Years	0	0	0	0	0	0	0	0
Total		**8**	**6**	**7**	**4**	**3**	**3**	**3**	**34**

In Table 6, the days per year were tallied using the same method as Table 5, except only days with a rain event of 1 hour duration or greater were counted.

Table 6: Overall frequency of rain events greater than or equal to 1 hour duration.

	Return Period	2012	2013	2014	2015	2016	2017	2018	Total
Overall	2 – 5 Year	6	4	3	1	2	1	2	19
	5 – 25 Year	0	0	0	0	0	1	0	1
	25 – 100 Year	0	0	0	1	0	0	0	1
	> 100 Years	0	0	0	0	0	0	0	0
Total		**6**	**4**	**3**	**2**	**2**	**2**	**2**	**21**

CONCLUSION

Overall, the 2018 rainfall season had an accumulation which was marginally less than the historical seasonal average. During these six months, three rain events occurred with a return period of 2-5 years. The largest rain event occurred on July 11th and was determined to be a 2-5 year return period event. However this event was only experienced at two of the City's seven rain gauges. The remaining five rain gauges experienced a rain event with a smaller average intensity resulting in an event with a return period which was less than two years.

Appendix A – Total Seasonal Rainfall (1900-2018)

APPENDIX A

Year	Rain (mm)	Rank	Year	Rain (mm)	Rank	Year	Rain (mm)	Rank
1900	259	58	1942	385	8	1984	197	102
1901	308	27	1943	193	105	1985	275	44
1902	270	48	1944	284	37	1986	308	28
1903	379	10	1945	300	31	1987	167	112
1904	344	20	1946	252	63	1988	211	90
1905	236	73	1947	256	60	1989	268	50
1906	260	56	1948	155	116	1990	200	100
1907	205	94	1949	263	52	1991	358	16
1908	262	53	1950	300	32	1992	234	75
1909	286	35	1951	224	81	1993	306	29
1910	234	76	1952	161	114	1994	285	36
1911	371	12	1953	218	86	1995	248	66
1912	375	11	1954	387	7	1996	362	14
1913	266	51	1955	268	49	1997	244	68
1914	168	110	1956	167	111	1998	187	107
1915	200	101	1957	208	92	1999	332	23
1916	329	25	1958	209	91	2000	259	57
1917	216	89	1959	241	71	2001	131	119
1918	253	62	1960	176	109	2002	262	54
1919	223	82	1961	221	84	2003	185	108
1920	243	69	1962	229	79	2004	288	34
1921	389	6	1963	317	26	2005	385	9
1922	246	67	1964	201	99	2006	366	13
1923	420	2	1965	236	74	2007	354	17
1924	141	117	1966	280	40	2008	217	88
1925	303	30	1967	187	106	2009	284	38
1926	270	47	1968	360	15	2010	569	1
1927	391	5	1969	229	78	2011	218	87
1928	343	21	1970	261	55	2012	401	3
1929	201	98	1971	279	42	2013	202	97
1930	252	64	1972	203	95	2014	391	4
1931	254	61	1973	298	33	2015	272	45
1932	241	70	1974	330	24	2016	283	39
1933	203	96	1975	271	46	2017	230	77
1934	249	65	1976	220	85	2018	206	93
1935	336	22	1977	279	41			
1936	166	113	1978	256	59			
1937	157	115	1979	226	80			
1938	239	72	1980	194	104			
1939	275	43	1981	222	83			
1940	196	103	1982	352	18			
1941	139	118	1983	349	19			

Appendix B – Return Period of Rain Events by Rain Gauge

APPENDIX B

	Return Period	2012	2013	2014	2015	2016	2017	2018	Total
Waste Water Treatment Plant	2 - 5 Year	4	0	3	1	1	1	1	11
	5 - 25 Year	0	0	0	1	0	0	0	1
	25 - 100 Year	0	0	0	0	0	0	0	0
	> 100 Year	0	0	0	0	0	0	0	0
	Total	**4**	**0**	**3**	**2**	**1**	**1**	**1**	**12**
Woodlawn	2 - 5 Year	5	1	3	2	1	1	0	13
	5 - 25 Year	0	1	0	1	0	0	0	2
	25 - 100 Year	0	0	0	0	0	0	0	0
	> 100 Year	0	0	0	0	0	0	0	0
	Total	**5**	**2**	**3**	**3**	**1**	**1**	**0**	**15**
Shaw Centre	2 - 5 Year	5	2	5	3	1	1	1	18
	5 - 25 Year	0	0	0	1	0	0	0	1
	25 - 100 Year	0	0	0	0	0	0	0	0
	> 100 Year	0	0	0	0	0	0	0	0
	Total	**5**	**2**	**5**	**4**	**1**	**1**	**1**	**19**
Nicholson Yards	2 - 5 Year	2	0	2	1	0	n/a	n/a	5
	5 - 25 Year	0	0	1	1	0	n/a	n/a	2
	25 - 100 Year	0	0	0	0	0	n/a	n/a	0
	> 100 Year	0	0	0	0	0	n/a	n/a	0
	Total	**2**	**0**	**3**	**2**	**0**	**n/a**	**n/a**	**7**
Light and Power	2 - 5 Year	2	2	3	0	1	0	1	9
	5 - 25 Year	0	0	0	0	0	1	0	1
	25 - 100 Year	0	0	0	1	0	0	0	1
	> 100 Year	0	0	0	0	0	0	0	0
	Total	**2**	**2**	**3**	**1**	**1**	**1**	**1**	**11**
City Hall	2 - 5 Year	5	3	4	1	1	1	2	17
	5 - 25 Year	0	0	0	0	0	0	0	0
	25 - 100 Year	0	0	0	1	0	0	0	1
	> 100 Year	0	0	0	0	0	0	0	0
	Total	**5**	**3**	**4**	**2**	**1**	**1**	**2**	**18**
Attridge Fire Hall	2 - 5 Year	1	1	1	1	0	0	0	4
	5 - 25 Year	0	0	0	1	0	0	0	1
	25 - 100 Year	0	0	0	0	0	0	0	0
	> 100 Year	0	0	0	0	0	0	0	0
	Total	**1**	**1**	**1**	**2**	**0**	**0**	**0**	**5**
Acadia Reservoir	2 - 5 Year	4	1	2	1	2	2	0	12
	5 - 25 Year	0	0	0	1	0	0	0	1
	25 - 100 Year	0	0	0	0	0	0	0	0
	> 100 Year	0	0	0	0	0	0	0	0
	Total	**4**	**1**	**2**	**2**	**2**	**2**	**0**	**13**