

2023 Annual Rainfall Report

Monitoring and Modeling



Saskatoon Water
Utilities and Environment Division



EXECUTIVE SUMMARY

The following report provides a summary of Saskatoon's 2023 rainfall season (April to September) and a comparison with historical rainfall. Highlights of the report include the following:

- In 2023, 213 mm of rainfall accumulated, which was less than the historical average of 263 mm and the 33rd lowest seasonal rainfall total out of 124 years since 1900.
- On average, least 1 mm of rainfall occurred on 15% of days in 2023.
- Based on the weighted average, 29 mm was the largest amount of rainfall to accumulate in a single day.
- Saskatoon had a normal spring in 2023. The average rainfall between April and June since 1900 is 126 mm. Saskatoon received 113 mm which falls in the 47th percentile for this time period.
- Saskatoon had a dry summer in 2023. The average rainfall between July and September since 1900 is 136 mm. Saskatoon received 101 mm which falls in the 24th percentile for this time period.
- At one or more of the eight rain gauges, a 2-5 year rain event occurred on May 24, June 3, June 18, and June 30, 2023.



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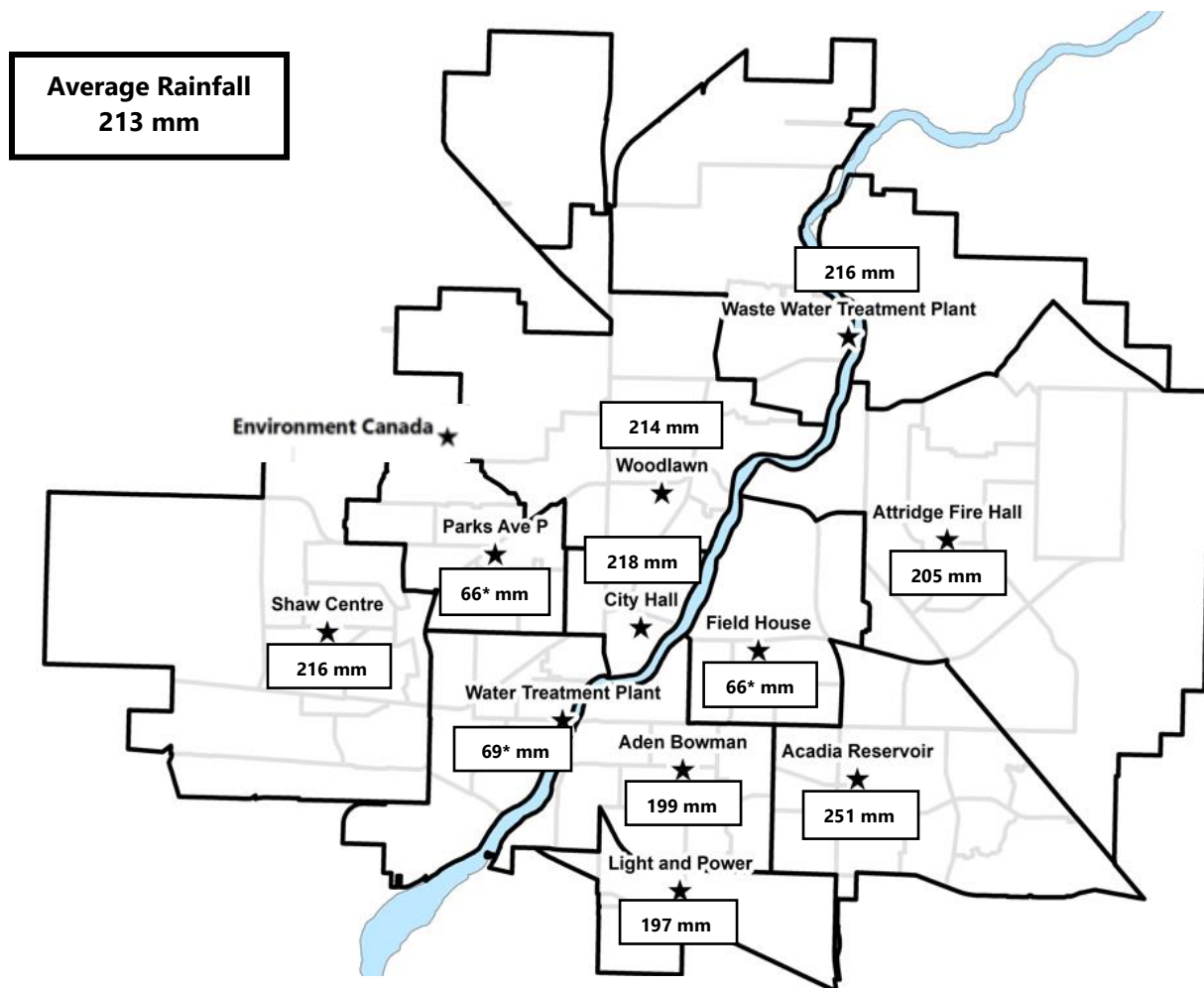
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INTRODUCTION

The purpose of this report is to provide a summary of the 2023 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 2022 data was obtained from eight City of Saskatoon rain gauges. On August 1, 2023, three more rain gauges were added to the City of Saskatoon network for a total of 11. The name, location, approximate area, and total seasonal rainfall of each rain gauge is shown below.



*Data collected August 1 to September 30, 2023

Figure 1: Overview of rain gauges.



SUMMARY OF RAINFALL IN 2023

A daily weighted average for all City of Saskatoon rain gauges was calculated to determine the average daily rainfall for Saskatoon. The following graph depicts the average daily rainfall that occurred in Saskatoon throughout the 2023 rainfall season.

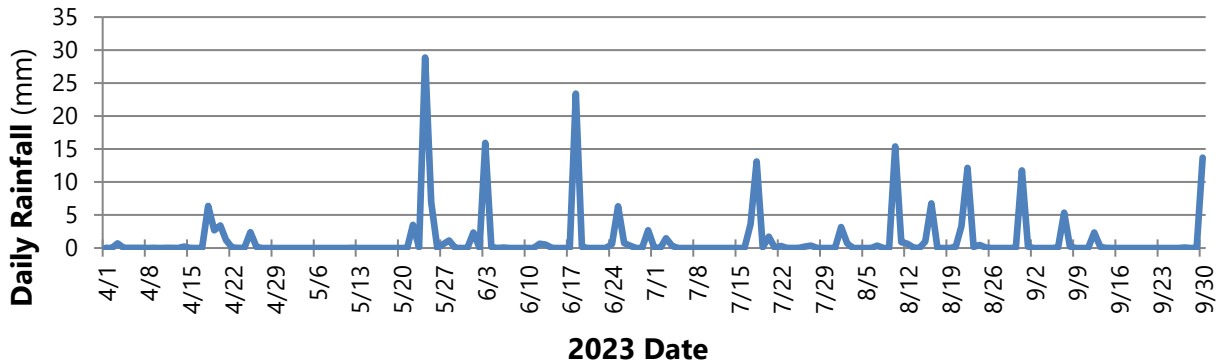


Figure 2: 2023 daily rainfall.

Based on the weighted average, the largest amount of rainfall occurred on May 24th, 2023 with a total of 29 mm. This rainfall accounted for approximately 14% of the total rainfall that occurred in 2023.

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	28%	12%	9%	5%	1%
Attridge Fire Hall	27%	16%	7%	4%	1%
Aden Bowman	22%	13%	8%	4%	0%
City Hall	25%	15%	8%	4%	1%
Light and Power	27%	13%	8%	4%	0%
Shaw Centre	25%	16%	8%	5%	1%
WWTP	28%	17%	7%	5%	1%
Woodlawn	26%	15%	8%	4%	0%
Field House*	20%	15%	11%	7%	0%
Parks Ave P*	23%	16%	8%	7%	0%
WTP*	23%	16%	8%	5%	0%
Average	25%	15%	8%	5%	0%

*Data collected from August 1 to September 30, 2023

On average, least 1 mm of rainfall occurred on 15% of days in 2023.



SUMMARY OF RAINFALL IN 2023

The daily weighted average rainfall was added together to calculate the total seasonal rainfall. The total seasonal rainfall for 2023 was 213 mm. Figure 3 depicts the accumulation of rainfall throughout the 2023 season.

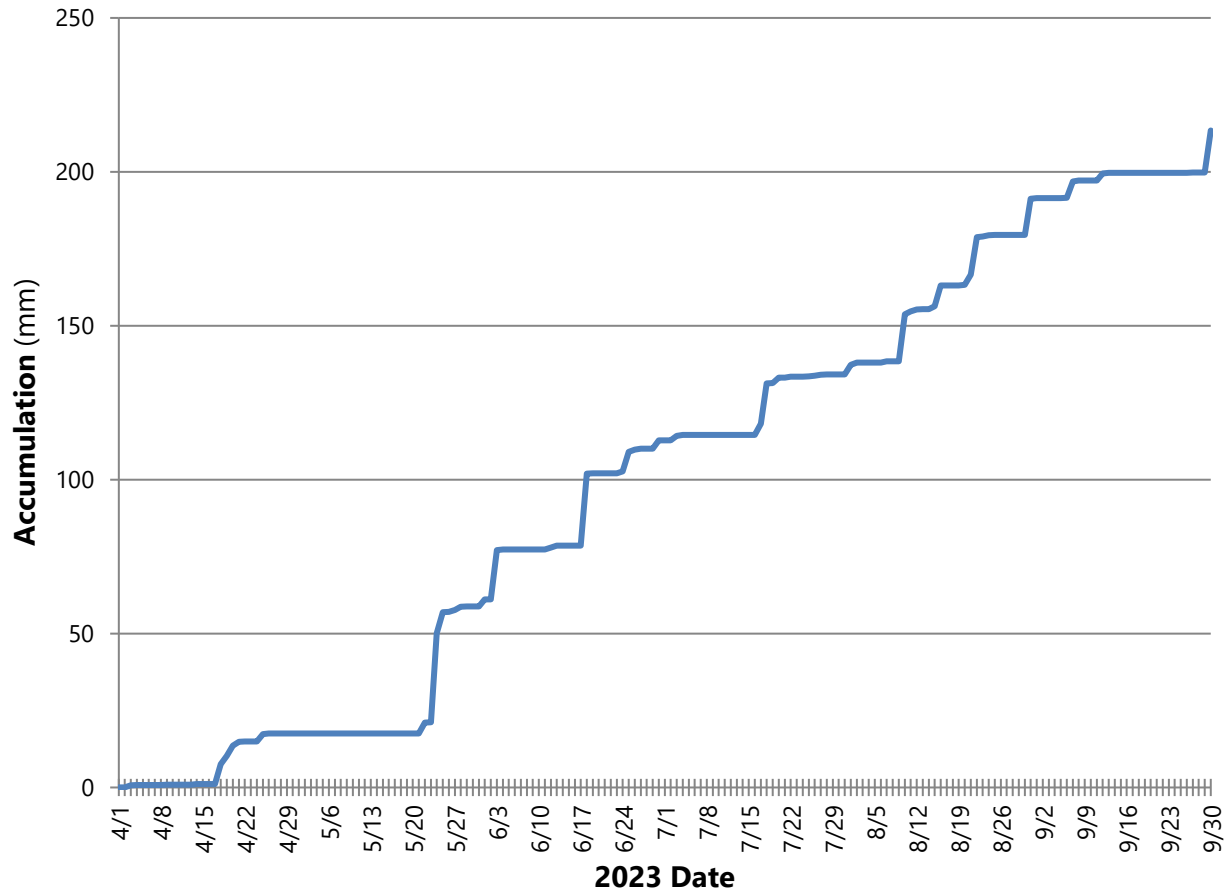


Figure 3: 2023 rainfall accumulation.

The 2023 rainfall season began with a normal spring (May to June) accumulating a total of 113 mm compared to the average spring accumulation of 126 mm. This was followed by a dry summer (July to September) which accumulated 100 mm and was the 30th lowest summer rainfall out of 124 years since 1900.



HISTORICAL COMPARISON

The average seasonal rainfall from 1900 to 2023 in Saskatoon is 263 mm which is depicted by the light blue line in Figure 4. The 2023 seasonal rainfall of 213 mm was below average and the 33rd lowest rainfall out of 124 years since 1900.

The lowest seasonal rainfall occurred in 2001 with 131 mm and the highest seasonal rainfall occurred in 2010 with 569 mm. A table containing the seasonal rainfalls from 1900 to 2023 is shown in Appendix A.

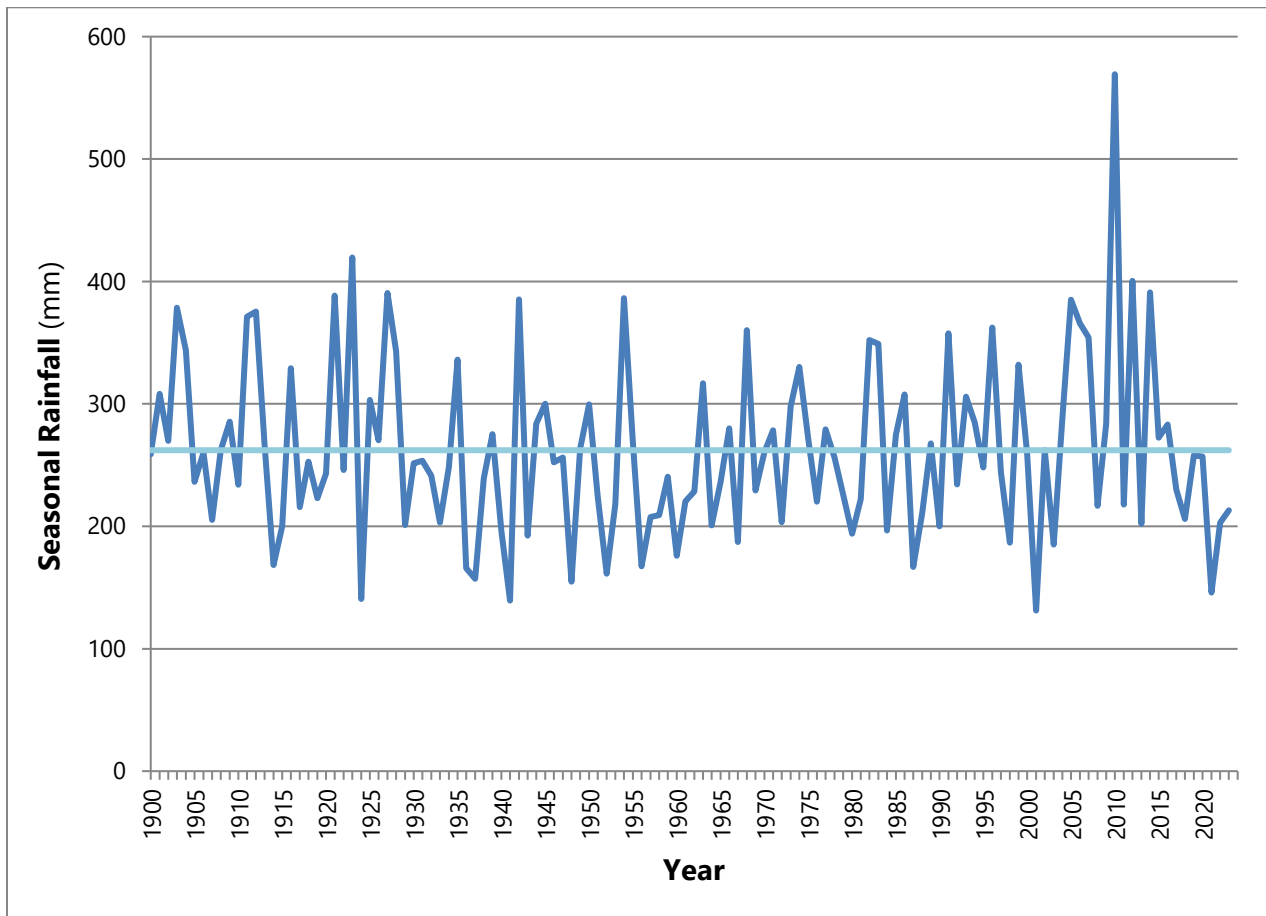


Figure 4: Seasonal rainfall (1900-2023).



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 2023 and is represented by the light blue line in Figure 5. During the 2023 rainfall season, the maximum rainfall to occur within a single day was 29 mm, which was on May 24th.

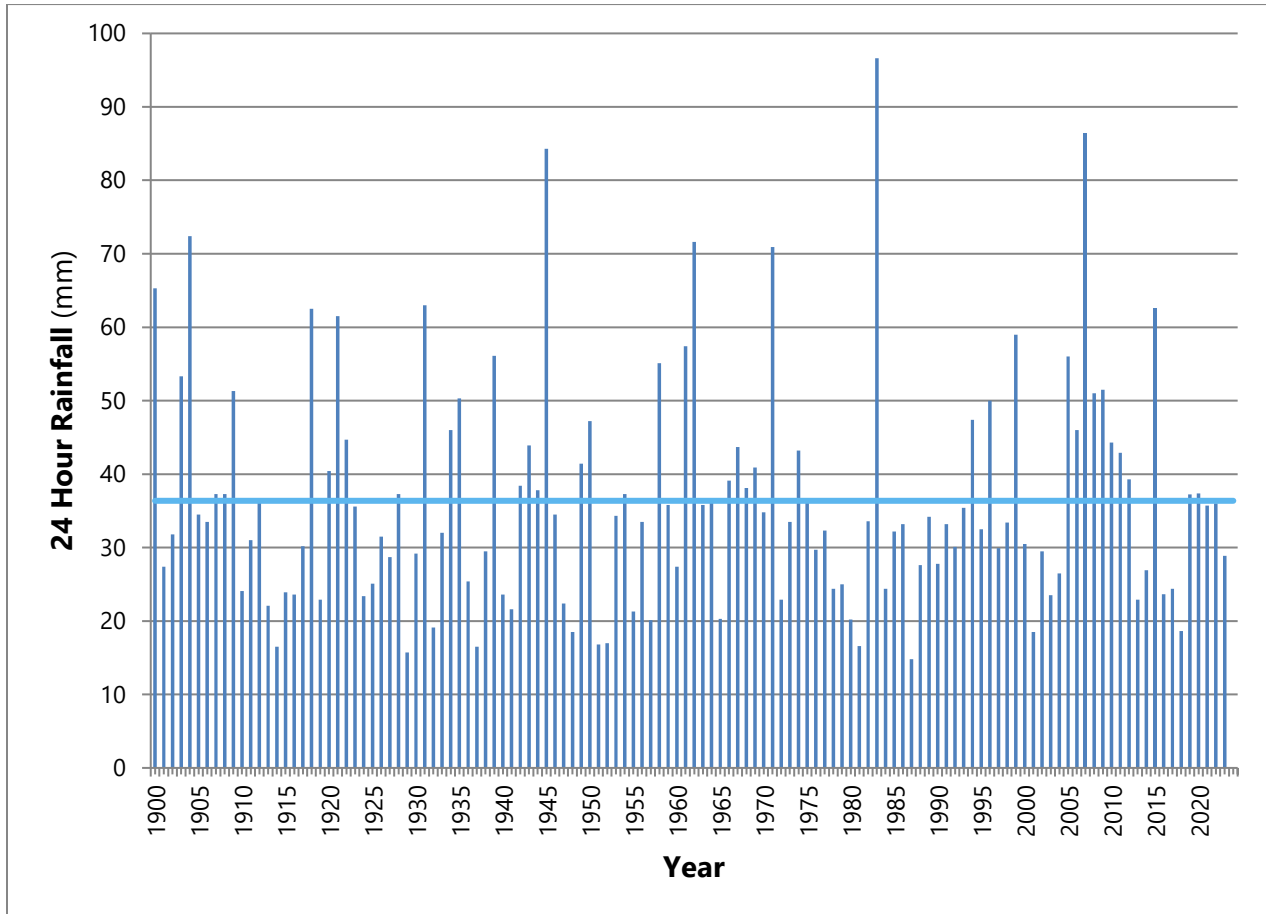


Figure 5: Maximum daily rainfall.

As can be seen in the graph above, the lowest maximum daily rainfall occurred on July 19th, 1987, with a total of 15 mm and the highest occurred on June 24th, 1983 with a total of 97 mm.



CLASSIFYING RAIN EVENTS

Rain events in Saskatoon are often localized. Therefore, a rain event may only occur at a few of the eight 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 2023. 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. The following table provides a summary of these values. A detailed table showing return periods recorded at each rain gauge is provided in Appendix B.

Table 3: Average frequency of rain events.

Return Period	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Average 2 – 5 Year	4	1	3	1	1	1	1	3	2	1	1	1	20
5 – 25 Year	0	0	0	1	0	0	0	0	0	0	1	0	2
25 – 100 Year	0	0	0	0	0	0	0	0	0	0	0	0	0
> 100 Years	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	4	1	3	2	1	1	1	3	2	1	2	1	22



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	2019	2020	2021	2022	2023	Total
Average	2 – 5 Year	3	1	2	1	0	1	0	1	2	1	0	1	13
	5 – 25 Year	0	0	0	1	0	0	0	0	0	0	0	0	1
	25 – 100 Year	0	0	0	0	0	0	0	0	0	0	0	0	0
	> 100 Years	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	3	1	2	2	0	1	0	1	2	1	0	1	14

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	2019	2020	2021	2022	2023	Total
Overall	2 – 5 Year	8	5	6	3	3	2	3	5	2	2	0	4	43
	5 – 25 Year	0	1	1	0	0	1	0	2	0	1	1	0	7
	25 – 100 Year	0	0	0	1	0	0	0	0	0	0	1	0	2
	> 100 Years	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	8	6	7	4	3	3	3	7	2	3	2	4	52

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	2019	2020	2021	2022	2023	Total
Overall	2 – 5 Year	6	4	3	1	2	1	2	2	2	1	0	3	27
	5 – 25 Year	0	0	0	0	0	1	0	0	0	1	0	0	2
	25 – 100 Year	0	0	0	1	0	0	0	0	0	0	1	0	2
	> 100 Years	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	6	4	3	2	2	2	2	2	2	2	1	3	31



CONCLUSION

Overall, the 2023 rainfall season was moderately dry compared to the historical seasonal average. In 2023, four rain events occurred with a maximum return period of 2 – 5 years. Based on a weighted average, the most rainfall to occur within a single day was 29 mm, which was on May 24th, 2023.



APPENDICES

Appendix A – Total Seasonal Rainfall (1900-2023)



APPENDIX A

Year	Rain (mm)	Rank	Year	Rain (mm)	Rank	Year	Rain (mm)	Rank
1900	259	58	1942	385	8	1984	197	106
1901	308	27	1943	193	109	1985	275	44
1902	270	48	1944	284	37	1986	308	28
1903	379	10	1945	300	31	1987	167	116
1904	344	20	1946	252	65	1988	211	93
1905	236	75	1947	256	62	1989	268	50
1906	260	56	1948	155	120	1990	200	104
1907	205	97	1949	263	52	1991	358	16
1908	262	53	1950	300	32	1992	234	77
1909	286	35	1951	224	83	1993	306	29
1910	234	78	1952	161	118	1994	285	36
1911	371	12	1953	218	88	1995	248	68
1912	375	11	1954	387	7	1996	362	14
1913	266	51	1955	268	49	1997	244	70
1914	168	114	1956	167	115	1998	187	111
1915	200	105	1957	208	95	1999	332	23
1916	329	25	1958	209	94	2000	259	57
1917	216	91	1959	241	73	2001	131	124
1918	253	64	1960	176	113	2002	262	54
1919	223	84	1961	221	86	2003	185	112
1920	243	71	1962	229	81	2004	288	34
1921	389	6	1963	317	26	2005	385	9
1922	246	69	1964	201	103	2006	366	13
1923	420	2	1965	236	76	2007	354	17
1924	141	122	1966	280	40	2008	217	90
1925	303	30	1967	187	110	2009	284	38
1926	270	47	1968	360	15	2010	569	1
1927	391	5	1969	229	80	2011	218	89
1928	343	21	1970	261	55	2012	401	3
1929	201	102	1971	279	42	2013	202	101
1930	252	66	1972	203	98	2014	391	4
1931	254	63	1973	298	33	2015	272	45
1932	241	72	1974	330	24	2016	283	39
1933	203	99	1975	271	46	2017	230	79
1934	249	67	1976	220	87	2018	206	96
1935	336	22	1977	279	41	2019	258	59
1936	166	117	1978	256	61	2020	257	60
1937	157	119	1979	226	82	2021	146	121
1938	239	74	1980	194	108	2022	203	100
1939	275	43	1981	222	85	2023	213	92
1940	196	107	1982	352	18			
1941	139	123	1983	349	19			



APPENDICES

Appendix B – Return Period of Rain Events by Rain Gauge



APPENDIX B

	Return Period	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Waste Water Treatment Plant	2 - 5 Year	4	0	3	1	1	1	1	3	1	1	1	1	18
	5 - 25 Year	0	0	0	1	0	0	0	1	0	0	1	0	3
	25 - 100 Year	0	0	0	0	0	0	0	0	0	0	0	0	0
	> 100 Year	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	4	0	3	2	1	1	1	1	4	1	1	2	1
Woodlawn	2 - 5 Year	5	1	3	2	1	1	0	4	2	0	2	1	22
	5 - 25 Year	0	1	0	1	0	0	0	0	0	0	0	0	2
	25 - 100 Year	0	0	0	0	0	0	0	0	0	0	0	0	0
	> 100 Year	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	5	2	3	3	1	1	0	4	1	0	2	1	24
Shaw Centre	2 - 5 Year	5	2	5	3	1	1	1	2	1	2	1	1	25
	5 - 25 Year	0	0	0	1	0	0	0	0	0	0	0	0	1
	25 - 100 Year	0	0	0	0	0	0	0	0	0	0	0	0	0
	> 100 Year	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	5	2	5	4	1	1	1	2	1	2	1	1	26
Nicholson Yards	2 - 5 Year	2	0	2	1	0								5
	5 - 25 Year	0	0	1	1	0								2
	25 - 100 Year	0	0	0	0	0								0
	> 100 Year	0	0	0	0	0								0
	Total	2	0	3	2	0								
Light and Power	2 - 5 Year	2	2	3	0	1	0	1	4		2	0	0	15
	5 - 25 Year	0	0	0	0	0	1	0	0		0	1	0	2
	25 - 100 Year	0	0	0	1	0	0	0	0		0	1	0	2
	> 100 Year	0	0	0	0	0	0	0	0		0	0	0	0
	Total	2	2	3	1	1	1	1	4		2	2	0	19
City Hall	2 - 5 Year	5	3	4	1	1	1	2	2	2	1	1	2	25
	5 - 25 Year	0	0	0	0	0	0	0	1	0	0	1	0	2
	25 - 100 Year	0	0	0	1	0	0	0	0	0	0	0	0	1
	> 100 Year	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	5	3	4	2	1	1	2	3	2	2	1	2	28
Attridge Fire Hall	2 - 5 Year	1	1	1	1	0	0	0	2		0	2	1	9
	5 - 25 Year	0	0	0	1	0	0	0	0		0	0	0	1
	25 - 100 Year	0	0	0	0	0	0	0	0		0	0	0	0
	> 100 Year	0	0	0	0	0	0	0	0		0	0	0	0
	Total	1	1	1	2	0	0	0	2		0	2	1	10
Aden Bowman	2 - 5 Year									1	0	0	0	1
	5 - 25 Year									0	0	1	0	1
	25 - 100 Year									0	0	1	0	1
	> 100 Year									0	0	0	0	0
	Total										1	0	2	0
Acadia Reservoir	2 - 5 Year	4	1	2	1	2	2	0	2	2	0	1	4	21
	5 - 25 Year	0	0	0	1	0	0	0	1	0	1	1	0	4
	25 - 100 Year	0	0	0	0	0	0	0	0	0	0	0	0	0
	> 100 Year	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	4	1	2	2	2	2	0	3	2	1	2	4	25



	Return Period	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Field House*	2 - 5 Year												0*	0
	5 - 25 Year												0*	0
	25 - 100 Year												0*	0
	> 100 Year												0*	0
	Total													0*
Parks Ave P*	2 - 5 Year												0*	0
	5 - 25 Year												0*	0
	25 - 100 Year												0*	0
	> 100 Year												0*	0
	Total													0*
WTP*	2 - 5 Year												0*	0
	5 - 25 Year												0*	0
	25 - 100 Year												0*	0
	> 100 Year												0*	0
	Total													0*

* Data collected from August 1 to September 30, 2023