Section 5.0 – Water Resources

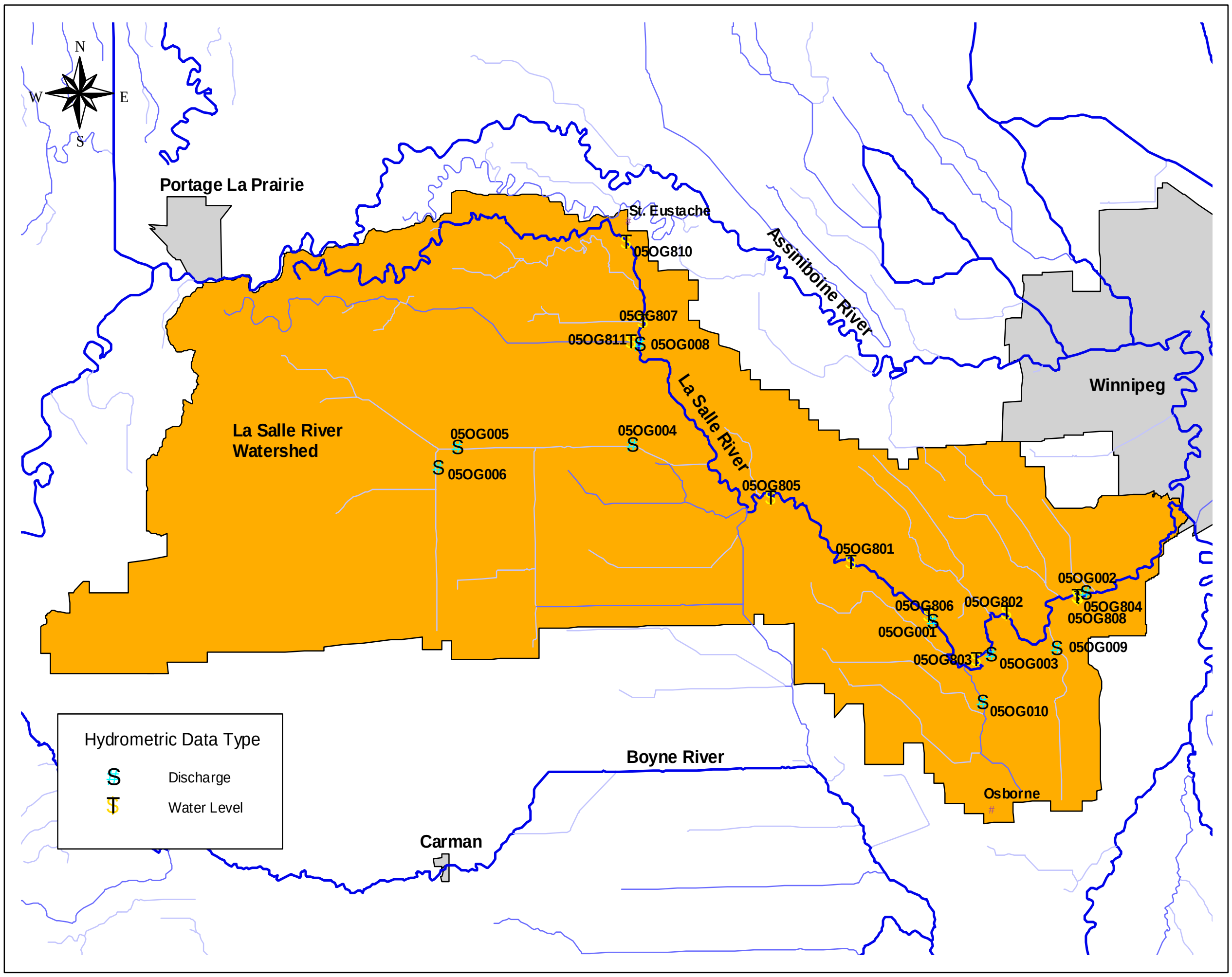
Section 5.2 – Surface Water Hydrology Report (source: Manitoba Water Stewardship)

Disclaimer: The hydrologic conditions presented in this report are estimates to indicate the health of the watersheds as of 2006. They should not be used for licensing or design purposes. The trends are based on historical records and are subject to change as more hydrological information becomes available. Factors such as climate change or land use changes could impact the values in the future. Utilization of this information on a specific case by case basis requires detailed analysis by trained professionals and is intended for demonstration purposes only.

Planning Area Boundary:

The La Salle River planning area extends from Portage La Prairie east to the City of Winnipeg and from the Community of Osborne north to the Community of St. Eustache. The La Salle River planning area is shown on Figure 1.

Figure 1: La Salle River Planning Area and Location of Hydrometric Gauging Stations



The planning area in this case is a watershed, but is made up of a number of sub-watersheds including the Elm Creek Channel, Domain Drain and others. By definition, a watershed is the land area that contributes surface water runoff to a common point. It is separated from adjacent watersheds by a land ridge or divide. Watersheds can vary in size, from a few acres to thousands of square kilometers. A larger watershed can contain many smaller sub-watersheds which are defined in the same manner as a watershed. On a larger scale, a basin is defined as a collection of watersheds that feed into a common main tributary or large body of water (e.g. the Red River Basin). A sub-basin is a division of a basin and will be made up of multiple watersheds.

Watershed and basin boundaries form a prime ecological unit for:

- information and knowledge management and analysis, and
- water and land use planning and management.

Watershed and basin boundaries are defined through the application of the best available science and modified with documented and verifiable local input. Agriculture and Agri-Food Canada through the efforts of the Prairie Farm Rehabilitation Administration (AAFC-PFRA) and Manitoba Water Stewardship have delineated a system of watershed and basin boundaries for Manitoba. These boundaries have been designed to extend to the mouths of some rivers and streams and along large bodies of water. The La Salle River planning area boundaries were established using this system of watersheds.

Climate:

The La Salle River planning area is considered to be within the Lake Manitoba ecoregion which is part of the Prairie ecozone. The region is considered to be one of the warmest and most humid regions in the Canadian Prairies. The mean annual temperature is approximately 2.5°C. The mean summer temperature is 16.5°C and the mean winter temperature is -13.0°C[1]. The mean annual precipitation is approximately 560mm[2]. Approximately 434mm, or 78%, of this precipitation falls as rain, the rest falls as snow. Approximately 7.9% of the average annual precipitation results in streamflow. The potential mean annual gross evaporation increases in a northeasterly direction from 790mm in Portage La Prairie to 834mm in Winnipeg[3].

Water Courses:

The La Salle River planning area has one main watercourse; the La Salle River. Additional watercourses include the Elm River, Elm Creek Channel, Scott Coulee, Meakin Creek, King Drain, Domain Drain, Manness Drain and many others that act as tributaries and empty into the La Salle River.

The La Salle River watershed has a gross drainage area of approximately 2406.4km^2 at the point where it enters the Red River and drains in an easterly direction from its headwaters east of Portage La Prairie, Manitoba to its outlet at the Red River, south of St. Norbert, Manitoba. The watershed is shown in orange on Figure 1. The topography in this region is flat to rolling.

Hydrometric Data:

The collection of hydrometric data is critical to the understanding of the availability, variability and distribution of water resources and provides the basis for responsible decision making on the management of this resource. Historic hydrometric data provides the basis for understanding the potential extent and limitation of the resource. Water level and stream flow data collected under the Canada-Manitoba Hydrometric Agreement, which is part of a National Hydrometric Program, supports activities such as policy development, operation of water control works, flow forecasting, water rights licensing, water management investigations and hydrologic studies, ecosystem protection and scientific studies. Environment Canada, the Province of Manitoba and Manitoba Hydro operate 143 discharge and 133 water-level gauging stations under this Agreement.

Streamflow and water level data has been collected at 19 hydrometric gauging stations within the La Salle River planning area for varying time periods since the 1950s, with some sporadic data dating back to 1915. The locations of the 19 stations are shown on Figure 1. Table 1 provides information relating to the type of data collected, the years of operation and the operating periods for each station.

Streamflow (Discharge) Data:

Historic streamflow data is available on the La Salle River, Elm Creek Channel, Manness Drain and Domain Drain. Of the 9 discharge stations listed in Table 1, only 3 are still operational.

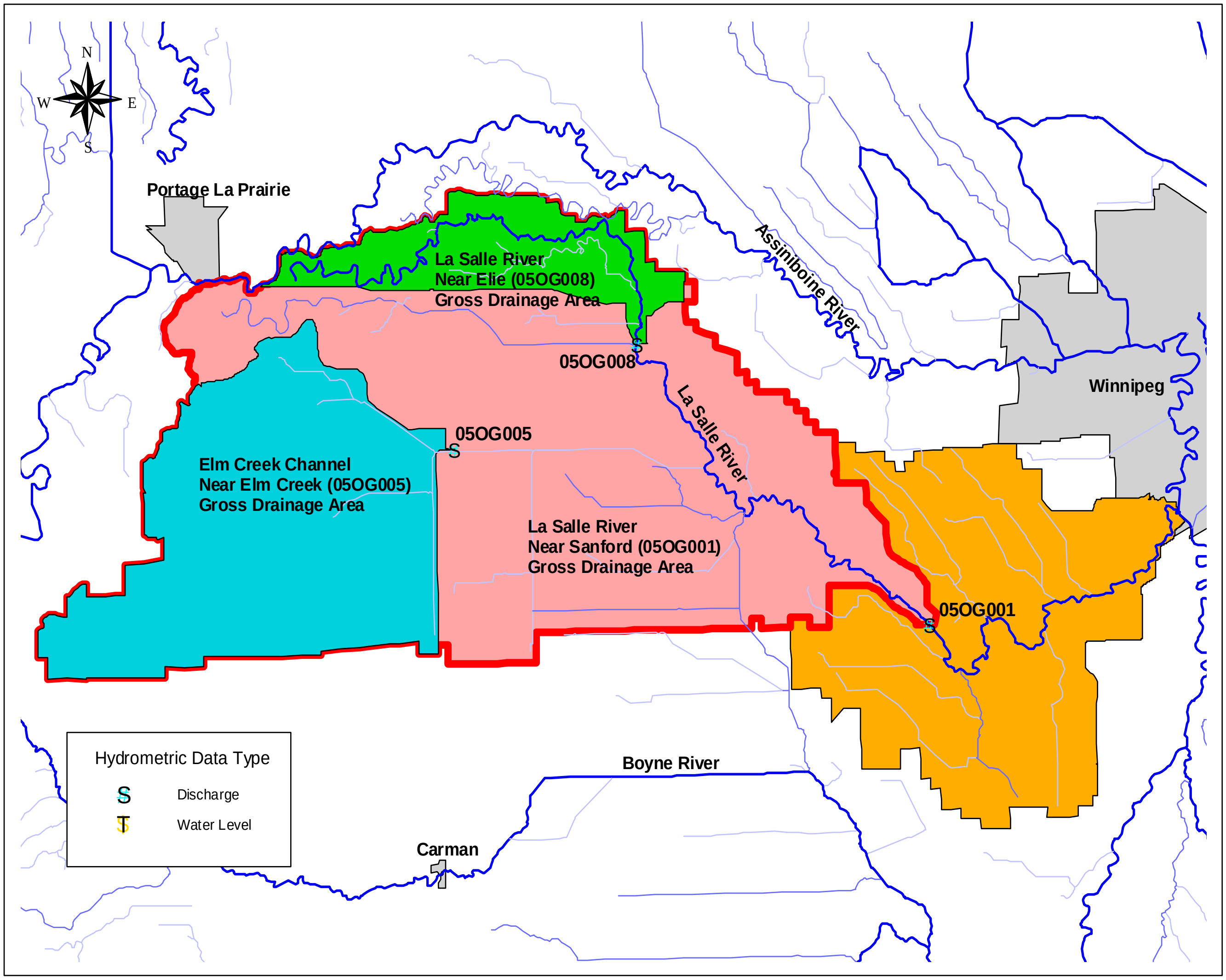
The first of these three gauges is La Salle River near Sanford (05OG001). This stations gross drainage area is equal to 1802.5km^2 and is shown on Figure 2. The gauging station operated sporadically during the years 1915 to 1934, but was then discontinued until 1956. The gauge was operational for a short time period from April 1956 to September 1958 and then annually during the entire year from 1966 to 1994. In 1995, the operating period of the gauge was reduced to the March to October period. This reduced operating period remained in affect until 2002 when the gauge was once again operated annually during the entire year. Gauging station 05OG003, located downstream of 05OG001, was operated during the years 1958 to 1966 when station 05OG001 was not.

The second operational gauge is Elm Creek Channel near Elm Creek (05OG005). This stations gross drainage area is equal to 589.0km^2 and is shown on Figure 2. The gauging station operated annually during the March to October period from 1960 to 1971. In 1972, the operating period of the gauge was reduced to the March to June period. This reduced operating period remains in affect at the present time.

The third operational gauge is La Salle River near Elie (05OG008). This stations gross drainage area is equal to 189.4km^2 and is shown on Figure 2. The gauging station operated annually during the March to October period from 1979 to 1996. In 1997, the gauge was discontinued. The gauge was reinstated in 2002 and operates during the March to May period at the present time.

Section 5.0 – Water Resources

Figure 2: Gross Drainage Areas for Discharge Stations 05OG001, 05OG005 & 05OG008.



Water Level Data:

Historic water level data is available on the La Salle River, Elm River, Elm Creek Channel, Manness Drain and Domain Drain. Of the 10 water level stations listed in Table 1, only 6 are still operational. The 6 stations 05OG801, 05OG804, 05OG805, 05OG806, 05OG807, 05OG808 all began operation in 1978 and operate annually during the spring-thaw to freeze-up conditions.

Realtime water level data for La Salle River near Sanford (05OG001), La Salle River near Elie (05OG008), and Elm Creek Channel near Elm Creek (05OG005) is available from Environment Canada's website: http://scitech.pyr.ec.gc.ca/waterweb/formNav.asp.

Section 5.0 – Water Resources

Table 1: La Salle River Planning Area Hydrometric Gauging Station Data

Station Number	Station Name	Years of Operation	Period of Operation	Type of Data	Gross/Effective Drainage Area (km^2)
05OG001	La Salle River near Sanford	1915 to 1934	Sporadic	Discharge	1802.5 / 1610.5
		1956 to 1958	Apr. '56 to Sep. '58		
		1966 to 1994	All Year		
		1995 to 2001	March to October		
		2002 to Present	All Year		
05OG002	La Salle River at La Salle	1935 to 1936	April to August	Discharge	2301.8 / 2109.8
05OG003	La Salle River near Sanford	1958 to 1966	All Year	Discharge	2016 / 1823.9
05OG004	Elm Creek Channel near Fannystelle	1960 to 1977	March to October	Discharge	646.7 / 454.7
05OG005	Elm Creek Channel near Elm Creek	1960 to 1971	March to October	Discharge	589 / 397.0
		1972 to Present	March to June		
05OG006	Elm Creek Channel No. 3 near Elm Creek	1960 to 1974	March to October	Discharge	384.6 / 295.2
		1975 to 1994	March to June		
05OG008	La Salle River near Elie	1979 to 1996	March to October	Discharge	189.4 / 189.4
		2002 to Present	March to May		
05OG009	Domain Drain near Domain	1981 to 1987	March to October	Discharge	76.6 / 76.6
05OG010	Manness Drain near Sanford	1981 to 1987	March to October	Discharge	50.6 / 50.6
05OG801	La Salle River above Hampson Dam	1978 to Present	Spring Thaw to Freeze-up	Water Level	1768.7 / 1576.6
05OG802	La Salle River above Hogue Dam	1978 to 2002	Spring Thaw to Freeze-up	Water Level	2118.8 / 1926.7
05OG803	La Salle River above Lewko Dam	1978 to 1996	April to October	Water Level	2008.9 / 1816.8
05OG804	La Salle River above St. Norbert Dam	1978 to Present	Spring Thaw to Freeze-up	Water Level	2356.4 / 2164.3
05OG805	La Salle River above Starbuck Dam (P.R. 332)	1978 to Present	Spring Thaw to Freeze-up	Water Level	1657.6 / 1465.5
05OG806	La Salle River above Sanford Dam	1978 to Present	Spring Thaw to Freeze-up	Water Level	1801.3 / 1609.3
05OG807	La Salle River at Elie	1978 to Present	Spring Thaw to Freeze-up	Water Level	186.9 / 186.9
05OG808	La Salle River above La Salle Dam (P.R. 330)	1978 to Present	Spring Thaw to Freeze-up	Water Level	2301.8 / 2109.8
05OG810	La Salle River near St. Eustache	1986	June to October	Water Level	88.7 / 88.7
05OG811	Elm River near Elie	1986	June to September	Water Level	159.6 / 159.6

Streamflow Characteristics:

Section 5.0 – Water Resources

La Salle River:

The daily discharge data for the gauging station on the La Salle River was statistically analyzed to determine runoff characteristics of the La Salle River planning area. The results of the analysis are presented as follows:

The streamflow data for La Salle River near Sanford (05OG001) is representative of streams in the La Salle River planning area. The gross drainage area of station 05OG001 is equal to 1802.5km^2. The station has an effective to gross drainage area ratio equal to 0.89. The gross drainage area boundary is defined as the area at a specific location, enclosed by its drainage divide, which might be expected to entirely contribute runoff to that specific location under extremely wet conditions. The effective drainage area is that portion of a drainage area which might be expected to entirely contribute runoff to the main stem during a median (1:2 year event) runoff year under natural conditions. This area excludes marsh and slough areas and other natural storage areas which would prevent runoff from reaching the main stem in a year of average runoff. The effective to gross drainage area ratio is an indication of how well an area is drained. A perfectly drained area has a ratio of one.

The mean monthly discharge data for the La Salle River is shown in Table 2. Based on available data, the average runoff during the period 1956 to 2005 is equal to 79,980dam^3 or an equivalent depth of 44mm over the gross drainage area for station 05OG001. The annual runoff depths for the La Salle River from 1956 to 2005 are shown on Figure 3. They range from a minimum of 3mm in 1981 to a maximum of 162mm in 2005. This figure also illustrates the variability in runoff from year to year, as well as the years above and below average runoff.

Figure 3: Equivalent Annual Runoff Depths for the La Salle River (05OG001)

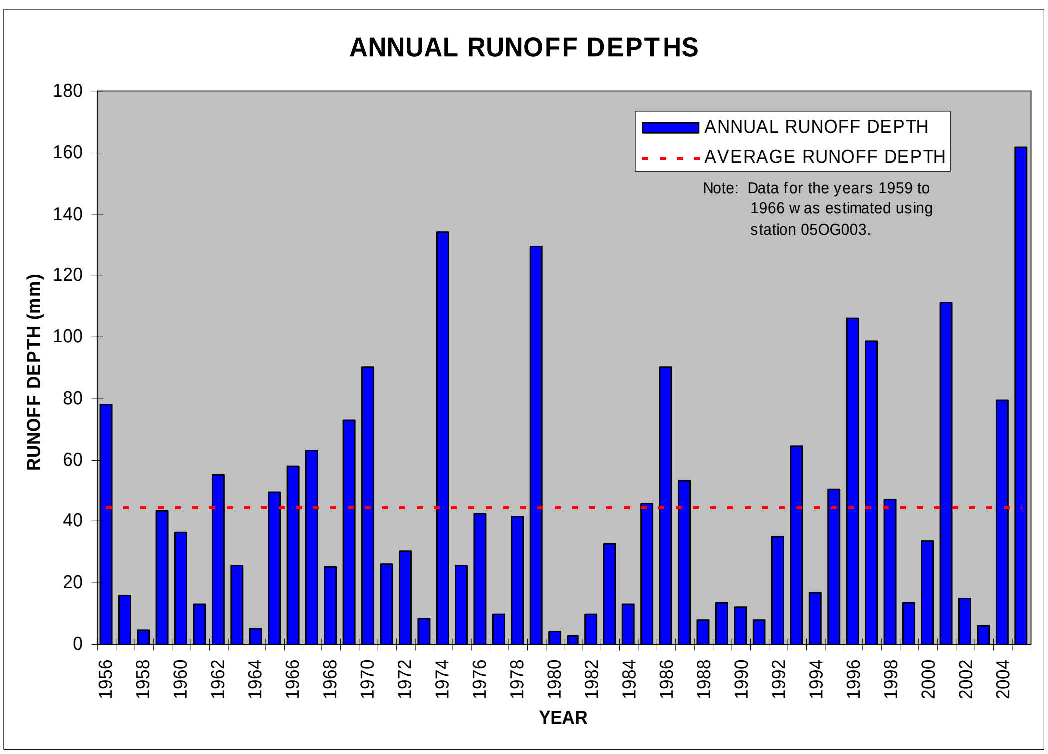


Table 2: La Salle River near Sanford (05OG001)

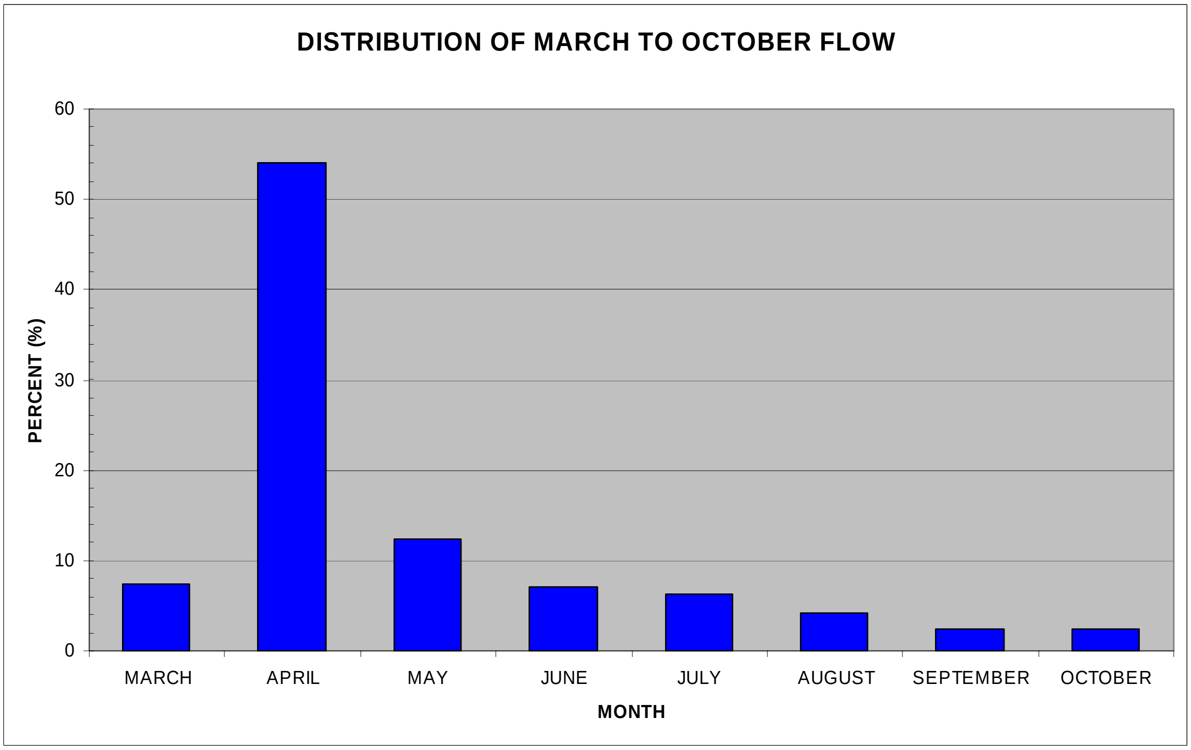
	Mean Monthly Discharge (m^3/s)												Annual Volume
YEAR	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**dam^3**
1915	-	-	-	-	-	-	-	-	-	-	-	-	-
1916	-	-	-	-	-	-	-	-	-	-	-	-	-
1920	-	-	-	-	-	-	-	-	-	-	-	-	-
1922	-	-	-	2.84	1.39	0.17	0.34	0.39	0.27	-	-	-	-
1923	-	-	-	-	20.40	1.35	1.26	0.26	-	-	-	-	-
1924	-	-	-	-	3.22	0.09	0.05	0.02	0.00	-	-	-	-
1925	-	-	3.76	19.70	0.58	2.55	1.19	0.12	0.07	-	-	-	-
1926	-	-	-	-	-	-	-	-	-	-	-	-	-
1927	-	-	-	-	18.10	3.32	1.85	0.36	0.21	-	-	-	-
1928	-	-	-	3.41	0.24	2.85	3.79	0.29	0.07	-	-	-	-
1929	-	-	-	-	0.10	0.18	0.28	0.22	0.26	-	-	-	-
1930	-	-	-	7.93	1.39	0.07	-	-	-	-	-	-	-
1932	-	-	-	-	-	-	-	-	-	-	-	-	-
1933	-	-	-	-	-	-	-	-	-	-	-	-	-
1934	-	-	-	13.00	0.80	-	-	-	-	-	-	-	-
1956	-	-	-	25.40	24.50	0.36	0.43	0.17	1.17	0.72	0.62	0.03	140,660
1957	0.05	0.03	2.50	6.75	0.43	0.37	0.24	0.10	0.29	0.09	0.02	0.00	28,470
1958	0.00	0.00	0.67	0.83	0.12	0.07	1.50	0.04	0.00	0.00	0.00	0.00	8,560
1959	0.00	0.00	0.01	13.05	1.99	0.20	0.00	0.15	0.03	11.44	2.70	0.05	78,010
1960	0.03	0.03	0.04	22.98	1.70	0.30	0.10	0.02	0.02	0.00	0.00	0.00	65,510
1961	0.00	0.00	1.02	7.13	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23,950
1962	0.00	0.00	0.00	11.62	3.81	3.85	0.47	15.38	2.36	0.04	0.01	0.00	99,030
1963	0.00	0.00	1.84	6.45	1.32	8.06	0.14	0.00	0.00	0.00	0.00	0.00	46,460
1964	0.00	0.00	0.00	2.68	0.12	0.54	0.03	0.00	0.05	0.00	0.00	0.00	8,870
1965	0.00	0.00	0.00	31.83	2.09	0.51	0.00	0.00	0.05	0.00	0.00	0.00	89,560
1966	0.00	0.00	0.01	27.00	8.62	0.00	2.50	0.26	1.67	0.00	0.00	0.00	104,830
1967	0.00	0.00	0.00	39.90	3.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	113,690
1968	0.00	0.00	0.88	1.74	0.18	0.06	0.77	10.50	2.91	0.18	0.06	0.00	45,860
1969	0.00	0.00	0.00	28.40	5.65	3.30	10.70	1.87	0.16	0.19	0.00	0.00	131,870
1970	0.00	0.00	0.00	35.50	25.90	0.47	0.03	0.00	0.00	0.00	0.00	0.00	162,700
1971	0.00	0.00	0.00	17.20	1.00	0.09	0.04	0.00	0.00	0.00	0.00	0.00	47,590
1972	0.00	0.00	0.04	20.30	0.65	0.02	0.01	0.00	0.00	0.00	0.00	0.00	54,540
1973	0.00	0.00	3.36	0.64	0.20	1.17	0.13	0.19	0.00	0.00	0.00	0.00	15,050
1974	0.00	0.00	0.00	49.00	41.40	1.41	0.00	0.00	0.00	0.00	0.00	0.00	241,550
1975	0.00	0.00	0.00	13.50	3.95	0.19	0.18	0.00	0.00	0.00	0.00	0.00	46,560
1976	0.00	0.00	0.00	27.90	0.22	1.07	0.04	0.03	0.01	0.03	0.25	0.16	77,000
1977	0.03	0.02	0.02	1.03	0.17	0.05	1.79	0.01	3.33	0.32	0.01	0.01	17,760
1978	0.01	0.01	0.05	20.90	7.07	0.35	0.12	0.02	0.22	0.05	0.01	0.01	75,320
1979	0.01	0.01	0.02	37.60	48.60	1.64	0.45	0.11	0.00	0.00	0.00	0.00	233,460
1980	0.00	0.00	0.00	2.64	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	7,420
1981	0.00	0.01	1.16	0.52	0.16	0.02	0.01	0.00	0.00	0.00	0.00	0.00	4,980
1982	0.00	0.00	0.35	6.32	0.05	0.00	0.01	0.00	0.00	0.00	0.00	0.00	17,490
1983	0.00	0.00	0.48	20.50	0.01	1.55	0.05	0.00	0.00	0.00	0.00	0.00	58,600
1984	0.00	0.00	0.07	1.26	0.28	7.05	0.16	0.00	0.00	0.10	0.04	0.14	23,630
1985	0.07	0.04	7.55	11.10	0.33	0.02	0.09	8.93	0.71	0.74	0.97	0.74	82,640
1986	0.17	0.05	8.63	25.90	20.90	0.28	4.90	0.26	0.16	0.22	0.14	0.09	162,970

1987	0.09	0.06	0.06	33.20	0.29	0.32	0.19	1.37	0.29	0.36	0.27	0.38	95,770
1988	0.21	0.24	0.33	2.96	0.14	0.02	0.03	0.01	0.37	0.58	0.39	0.27	14,420
1989	0.14	0.07	0.03	6.87	0.25	0.79	0.44	0.11	0.15	0.20	0.21	0.12	24,410
1990	0.14	0.07	0.18	5.74	0.52	0.95	0.24	0.05	0.09	0.19	0.21	0.19	22,270
1991	0.11	0.07	0.13	2.60	1.48	0.08	0.23	0.07	0.04	0.25	0.24	0.24	14,560
1992	0.20	0.13	1.55	20.30	0.71	0.15	0.27	0.15	0.26	0.21	0.15	0.09	62,880
1993	0.15	0.09	0.48	17.30	0.94	0.67	7.38	15.20	1.18	0.31	0.23	0.23	116,570
1994	0.15	0.10	2.74	2.57	0.39	0.28	0.26	0.17	0.13	4.02	0.35	0.25	30,230
1995	-	-	14.30	16.50	0.93	0.31	0.34	0.86	1.03	0.24	-	-	90,900
1996	-	-	0.99	35.18	32.60	1.44	0.84	0.63	0.61	0.40	-	-	191,460
1997	-	-	0.03	30.47	34.20	0.42	1.31	0.26	0.35	0.32	-	-	177,710
1998	-	-	10.96	18.40	0.51	0.90	1.23	0.17	0.14	0.13	-	-	85,200
1999	-	-	1.14	4.18	1.75	0.66	0.68	0.23	0.35	0.26	-	-	24,340
2000	-	-	1.64	0.35	0.29	3.38	14.70	0.41	1.28	0.67	-	-	60,400
2001	-	-	0.35	55.30	9.88	0.95	5.90	3.28	0.33	0.30	0.19	0.13	200,310
2002	0.14	0.15	0.13	2.90	0.38	5.93	0.23	0.24	0.08	0.09	0.11	0.07	27,130
2003	0.09	0.07	0.63	1.52	0.44	0.57	0.35	0.24	0.20	0.11	0.10	0.10	11,050
2004	0.11	0.09	1.79	34.40	5.30	8.39	0.48	0.89	1.31	1.11	0.91	0.20	143,350
2005	0.19	0.15	0.26	34.00	4.68	12.40	54.40	2.51	0.62	0.53	0.42	0.21	291,470
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	4980
Maximum	0	0	14	55	49	12	54	15	3	11	3	1	291470
Mean	0	0	1	16	6	1	2	1	0	0	0	0	79,980

Note: Mean monthly discharges were calculated using the entire period of record.
Mean annual volume was calculated using the years 1956 - 2005.
Data for the years 1959 to 1966 was estimated using station 05OG003.

The bar graph on Figure 4 illustrates the distribution of annual runoff for the La Salle River in the March to October months. It can be seen that the majority of runoff, 54%, occurs in April as a result of snowmelt and early spring rains when the watershed is still saturated. The maximum daily discharge of each year, as well as the date it occurred, was reviewed. It revealed that in 41 of the 50 years (1956-2005), the annual peak flow occurred during the spring runoff; in 7 out of the 50 years, the peak flow occurred during the summer months of June to August; and in 2 of the 50 years, the peak flow occurred during the fall months of September to October.

Figure 4: Distribution of Annual Runoff for the La Salle River (05OG001)



The results of a statistical analysis of the La Salle River data are shown in Table 3. The expected annual peak discharge, runoff volume and corresponding unit depth for selected frequencies are given.

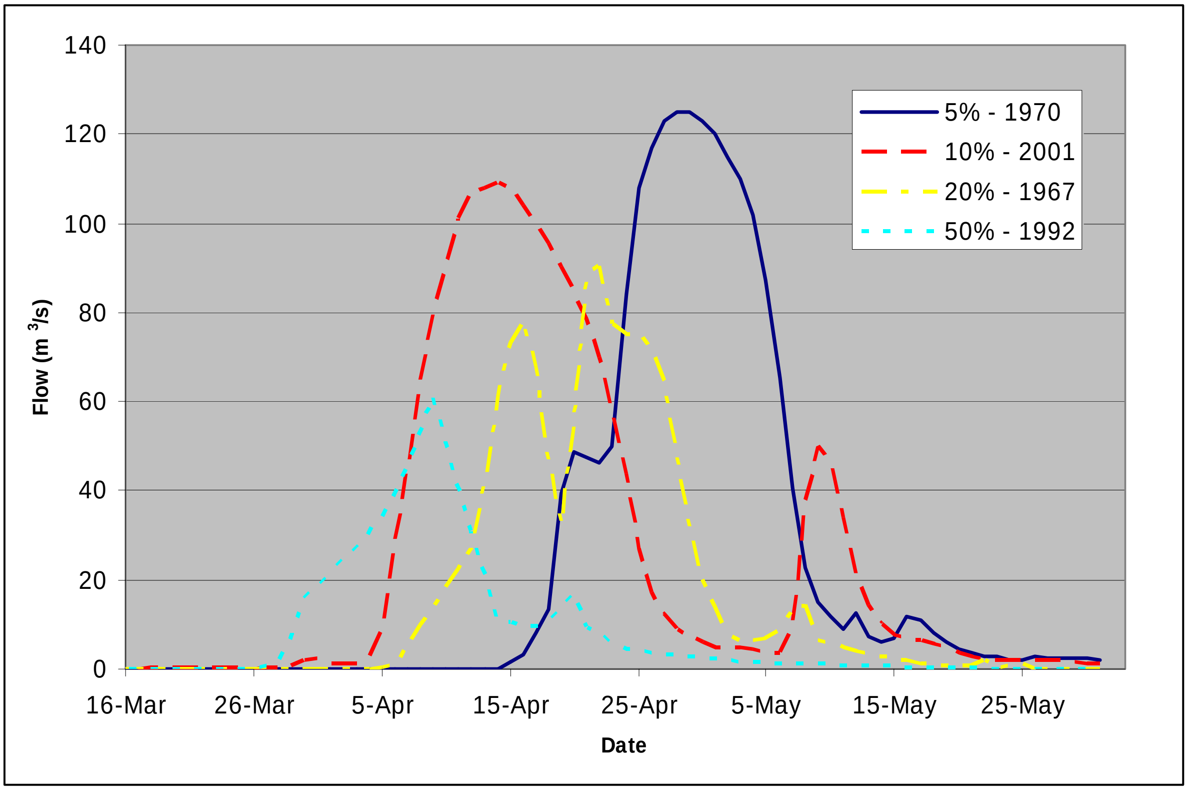
Table 3: Frequency of Flood Flows for the La Salle River (05OG001)

Flood Frequency	Annual Peak Discharge (m^3/s)	Annual Runoff Volume (dam^3)	Unit Runoff (dam^3 / km^2)
1%	154.0	422,400	234.3
2%	141.8	344,400	191.1
5%	123.8	249,400	138.4
10%	108.3	184,100	102.1
50%	61.2	55,350	30.7
80%	38.3	22,380	12.4
90%	29.1	13,420	7.4

La Salle River recorded flow hydrographs for years representative of the 5%, 10%, 20% and 50% floods are plotted on Figure 5. The spring runoff hydrographs show some variability concerning the date the peak discharge occurs. In general, the peak occurs between April 1 and April 30 with some occurrences in late March.

Section 5.0 – Water Resources

Figure 5: La Salle River near Sanford (05OG001) - Spring Runoff Hydrographs



Summary:

In summary, analysis of the available streamflow data in the La Salle River indicates the following:

- Streamflow varies considerably over the months and years.
- Annual streamflow usually peaks in April during the spring runoff period.
- On average, 70 to 75% of the annual runoff volume occurs in the period from the beginning of March to the end of May.
- The La Salle River experienced periods of zero flow and as a result is classified as an intermittent stream. The remaining watercourses in the planning area are also classified as intermittent.
- On the major watercourses, spring flooding is more significant than flooding from summer precipitation events. It is the smaller drainage areas (less than 30 km^2) that are sensitive to rainfall events. Localized flooding can occur in the smaller poorly drained areas from excessive rainfall events.

Water Allocation:

The issuance of a Water Rights License requires the determination of the availability of water for human use allocation and the determination of instream flow needs (an estimate of a threshold flow above which a user may pump water from a stream). The allocation procedure depends on whether the stream is considered to be perennial or intermittent.

Intermittent:

The total spring volume (March to May) of water available for allocation on intermittent streams is based on the eight out of ten-year (80%) risk level. This would apply to smaller tributary streams.

On intermittent streams, one half of the spring volume of water is available for human use in eight out of ten years. The other half is allocated for maintainance of stream "health" or to maintain the ecological integrity of the stream system, referred to as an Instream Flow Need (IFN). The IFN is a specified minimum instantaneous flow that determines when a user may pump from the stream. Only when the flow in the stream is greater than the IFN can pumping occur. The IFN is computed based on daily stream flow records to ensure that at the 80% spring volume, one half of the total flow goes to protecting the stream's environmental needs with the other half being allocable.

Perennial:

The Tessman Method has been adopted in Manitoba for determination of the IFN on perennial streams. This method establishes a range of instream flow recommendations for each month based on the following criteria:

1. For months where the average recorded flow for the period of record is less than 40% of the overall mean annual flow, the minimum instream flow is equal to that average monthly flow.
2. If the mean monthly flow is between 40% and 100% of the overall mean annual flow then the minimum instream flow is equal to 40% of the mean annual flow.
3. For months where the mean monthly flow is greater than the mean annual flow, then the minimum instream flow is equal to 40% of that month's overall mean flow.

Under the 80% risk level, the volume of water available for human use allocation is the 80th percentile value from a duration curve of available volumes after the IFN requirements have been satisfied.

The La Salle River is considered to be an intermittent stream. Therefore, the intermittent method described above was used in determining an allocable volume of water and the instream flow need. Using the La Salle River near Sanford (05OG001) as the index station, a volume of water was estimated at the mouth of the river (where it empties into the Red River) using a drainage area ratio. The allocable volume of water for the La Salle River watershed is equal to 5685dam^3. The instream flow need is equal to 3.42m^3/s. Again, these values were estimated based on data from the La Salle River near Sanford (05OG001) station and adjusted based simply on a drainage area ratio.

The allocable volume of water and instream flow need values are estimates only for the La Salle River at the mouth to indicate the health of the watershed as of 2006. They should not be used for design or licensing purposes. These values should be reviewed as additional hydrologic data becomes available. The determination of the availability of water for allocation and instream flow needs for other locations in the La Salle River planning area require site specific analysis. Many variables, including hydrologic conditions, selection of index station and the corresponding period of record, watershed characteristics including landuse, soils and topography, location of the site, and other

factors are considered in the analysis and can be very complex, especially in an ungauged watershed, or certain portions of a large gauged watershed.

Water Supply :

Assiniboine-La Salle River Diversions:

The Assiniboine-La Salle Diversion was constructed in 1984 to ensure a dependable water supply for the communities of Starbuck, Sanford and La Salle, as well as for domestic, stockwatering and irrigation use along the La Salle River. The project consists of three pumping stations on the Assiniboine River downstream of Portage la Prairie. The location of the three pumping stations is shown on Figure 5.

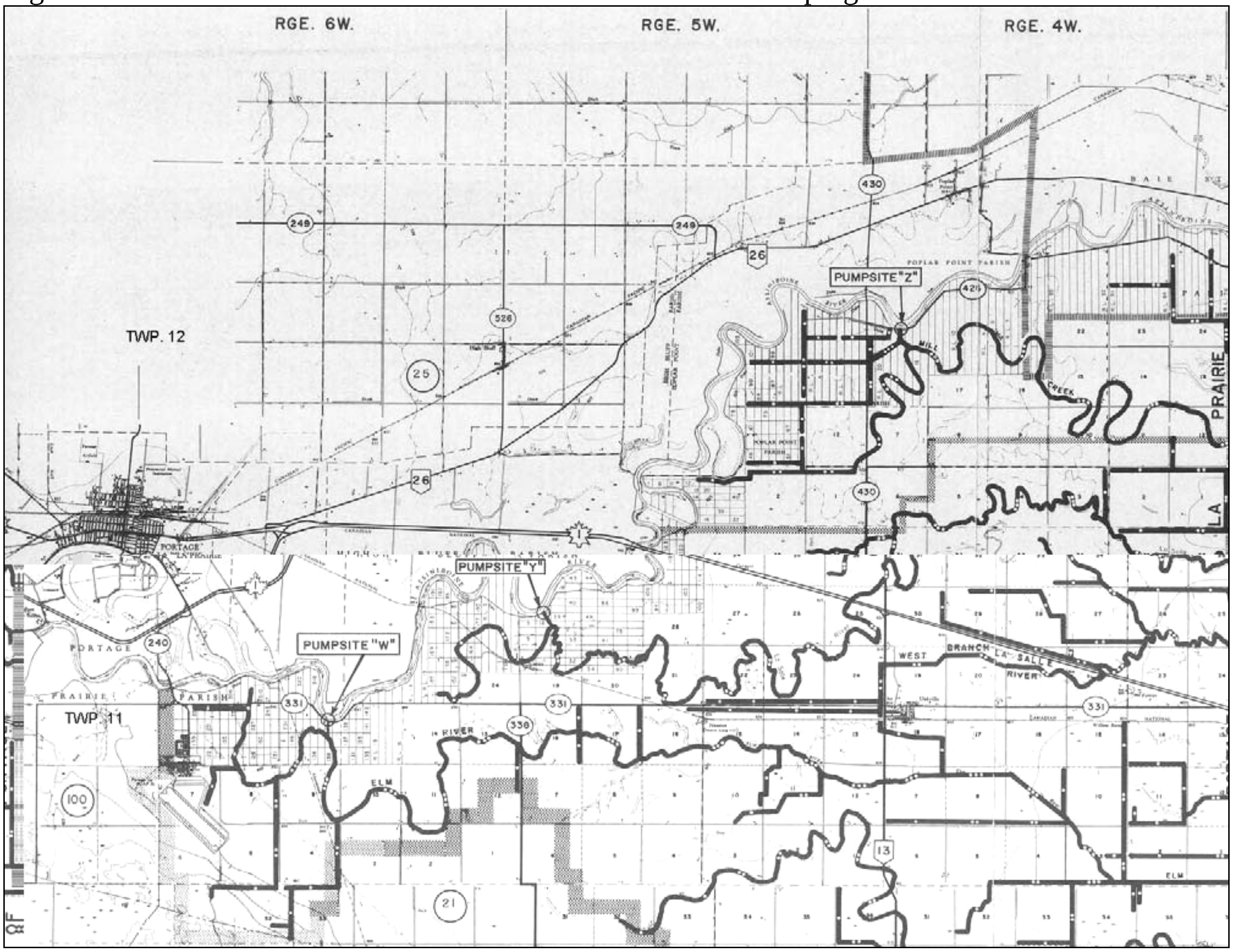
Site Y Pump station, located in section 30-11-5W, diverts water into the upper reaches of the La Salle River. The total pumping capacity of Site Y is $0.71m^3/s$, but the pumping rate is variable depending on the amount of precipitation received in the area and downstream water demands. Operation guidelines call for pumping to commence at a maximum rate of $0.71m^3/s$ from May 1 to October 31 and a maximum flow of $0.28m^3/s$ from November 1 to April 30, each year.

Site W Pump station, located in section 16-11-6W diverts water in the upper reaches of the Elm River, a tributary of the La Salle River. The total pumping capacity rate of Site W equals $0.42m^3/s$. Operation guidelines call for pumping to commence from May 1 to October 31 each year to maintain flow in the Elm River Channel near Elie. The pumping rates are variable; depending on the amount of rainfall received in the area and downstream water demands. Unlike Site Y, there is no pumping during the winter months, for the period of November 1 to April 30, on the Elm River.

The Assiniboine-Mill Creek Diversion is located in section 19-12-4W. The total pumping capacity of Site Z is $0.28m^3/s$ but the pumping rate is variable depending on the amount of precipitation received in the area and downstream water demands. Operation guidelines call for pumping to occur from May 1 to October 31. Operation of the pump station is used to augment flows on the La Salle River during periods of peak use and/or low flows on Mill Creek. Similar to Site W, there is no pumping during the winter months, for the period November 1 to April 30.

Section 5.0 – Water Resources

Figure 5: Location of Assiniboine-La Salle River Diversion Pumping Stations



Dams:

Flows in the La Salle River are normally very low and a series of small dams have been built to provide storage and to increase low water levels for both domestic and agricultural use.

A total of 8 structures were built on the La Salle River between the communities of Elie and St. Norbert between the years 1941 and 1962. Details including the location, year of construction, full supply level (FSL) and associated storage, and the type of structure are shown in Table 4.

Section 5.0 – Water Resources

Table 4: Provincial Dam Inventory within the La Salle River Planning Area

Dam and/or Reservoir	Location	Year of Construction	Constructed By	Purpose	Full Supply Level (FSL) (m)	Total Storage @ FSL (dam^3)	Description
Elie	SE 2-11-3W	1962	P.F.R.A.	Stockwater and Water Conservation	239.499	126	Stoplog Structure
Hampson	NW 3-9-1W	1955	P.F.R.A.	Stockwater and Water Conservation	233.172	444	Fixed Crest Rock Overflow Structure
Hogue	SE 26-8-1E	1953	P.F.R.A.	Stockwater and Water Conservation	229.362	222	Fixed Crest Rock Overflow Structure
La Salle	SW 34-8-2E	1961	P.F.R.A.	Stockwater and Water Conservation	227.990	469	Fixed Crest Rock Overflow Structure
Lewko	SW 15-8-1E	1955	P.F.R.A.	Stockwater and Water Conservation	230.734	296	Fixed Crest Rock Overflow Structure
Sanford	SW 29-8-1E	1941	P.F.R.A.	Stockwater and Water Conservation	232.867	345	Stoplog Structure
Starbuck	SW 25-9-2W	1961	P.F.R.A.	Stockwater and Water Conservation	235.610	691	Fixed Crest Structure
St. Norbert	River Lot 64 St. Norbert Parish	1941	P.F.R.A.	Stockwater and Recreation	226.201	148	Stoplog Structure

Canada-Manitoba Flood Risk Mapping Program:

Flooding is a serious concern to many residents of Manitoba. Although the public is probably more aware of flooding in the Red River Valley, flooding also occurs along numerous other rivers, streams and lakes. In attempt to reduce flood damages, Canada and Manitoba signed a General Agreement Respecting Flood Damage Reduction on December 20, 1976. One aspect of the Agreement provided for the formal delineation and mapping of a communities' flood risk area which are areas inundated by a "design flood". The "design flood" for the flood risk mapping program was the greater of the 100-year flood or the largest recorded flood for that area. In other words, the maps show areas that have a 1% chance (or a lesser chance) of being flooded in any given year.

Flood risk areas for seventeen communities within Manitoba have been designated and mapped. The flood risk area mapping was completed during the 1980s and was based on available hydrologic data at that time. Studies were undertaken to determine the flood risk area and floodway of the La Salle River at the communities of Elie, Sanford, La Salle and Starbuck, including the adjoining areas in the Rural Municipality of Macdonald.

Floodways and Floodway Fringes:

The flood risk areas were divided into two zones for most of the mapped communities: the floodway and the floodway fringe. The term "floodway", is a general term that refers to the portion of the flood risk area where the water is the deepest and most destructive. "Floodway", in this case, does not refer to a man-made structure. The floodway is the area into which the flow could be confined, while causing only a moderate rise in water levels upstream, and where the water is one metre or more deep. Floodway areas were designated to indicate where new development should not be permitted. The remaining portion of the flood risk area is called the floodway fringe. In this outer zone, floodwaters tend to move more slowly, and are shallower. The floodway fringe could be completely filled in or developed without causing any problems upstream. Each of the two zones is treated differently regarding development restrictions.

Development in Flood Prone Areas:

Damages and hardships resulting from flooding have resulted in large costs to the public. Controlling the use of areas prone to flooding is one effective way of reducing these damages, as are certain structural works such as dikes or diversions. Under the terms of the General Agreement, Canada and Manitoba agreed to discourage any new development from occurring in any designated floodway area. Within a floodway area, the two governments agreed not to finance or engage in any further projects. Under this Agreement, they agreed to withhold flood assistance payments for flood damages to any structures constructed within a floodway area, after its official designation. At the same time, they agreed to encourage suitable land use, such as recreational and agricultural uses, and appropriate zoning aimed at restricting development in those areas. With respect to the floodway fringe area, it was agreed that restrictions concerning financial assistance or concerning development were not to be applied to undertakings that were adequately flood proofed. If the new development did not meet proper flood proofing requirements, financial support from government sources would not be available and assistance payments would not be made in the future.

Section 5.0 – Water Resources

Conversion Units:

Temperature: °C = 5/9 (°F – 32)

Length: 1 mm = 0.039370 inches

Area: 1 km^2 = 0.38610 mi^2

Volume: 1 dam^3 = 0.8107 acre-ft

Flow: 1 m^3/s = 35.315 ft^3/s

Resources:

[1] Environment Canada, Canadian Climate Normals or Averages 1971-2000.
[2] Agriculture and Agri-Food Canada, Mean Annual Precipitation in the Canadian Prairies for the Standard 30-Year Period 1971-2000.
[3] Agriculture and Agri-Food Canada, Mean Annual Gross Evaporation in the Canadian Prairies for the Standard 30-Year Period 1971-2000.