Manitoba Water Stewardship is pleased to welcome you to:

A public review of the rules of operation for the **Red River Floodway**

Our purpose is to provide the public an opportunity to review and comment on the Red River Floodway rules of operation.

Manitoba

Why a Public Review?

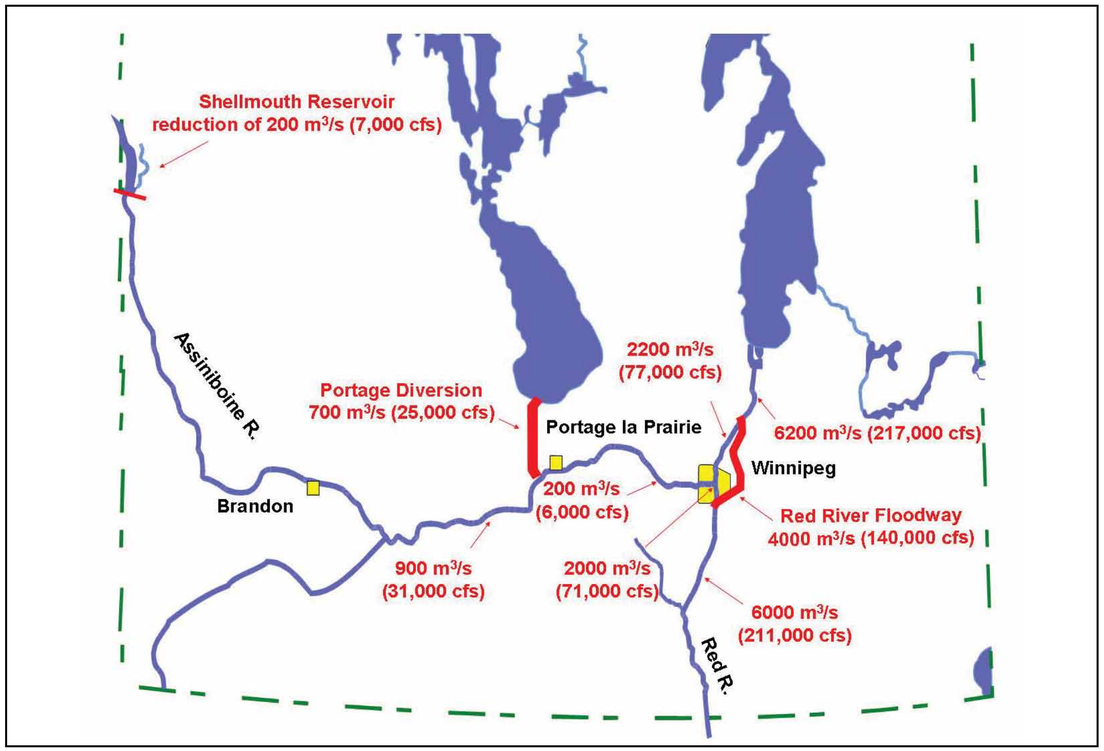
- To comply with Clause 15 of *The Environment Act Licence # 2691:*

"The Department shall conduct a public review of the rules of operation of the Development not less than once every five years, commencing with the date of this Licence..."

Visit us online at:
manitoba.ca/waterstewardship

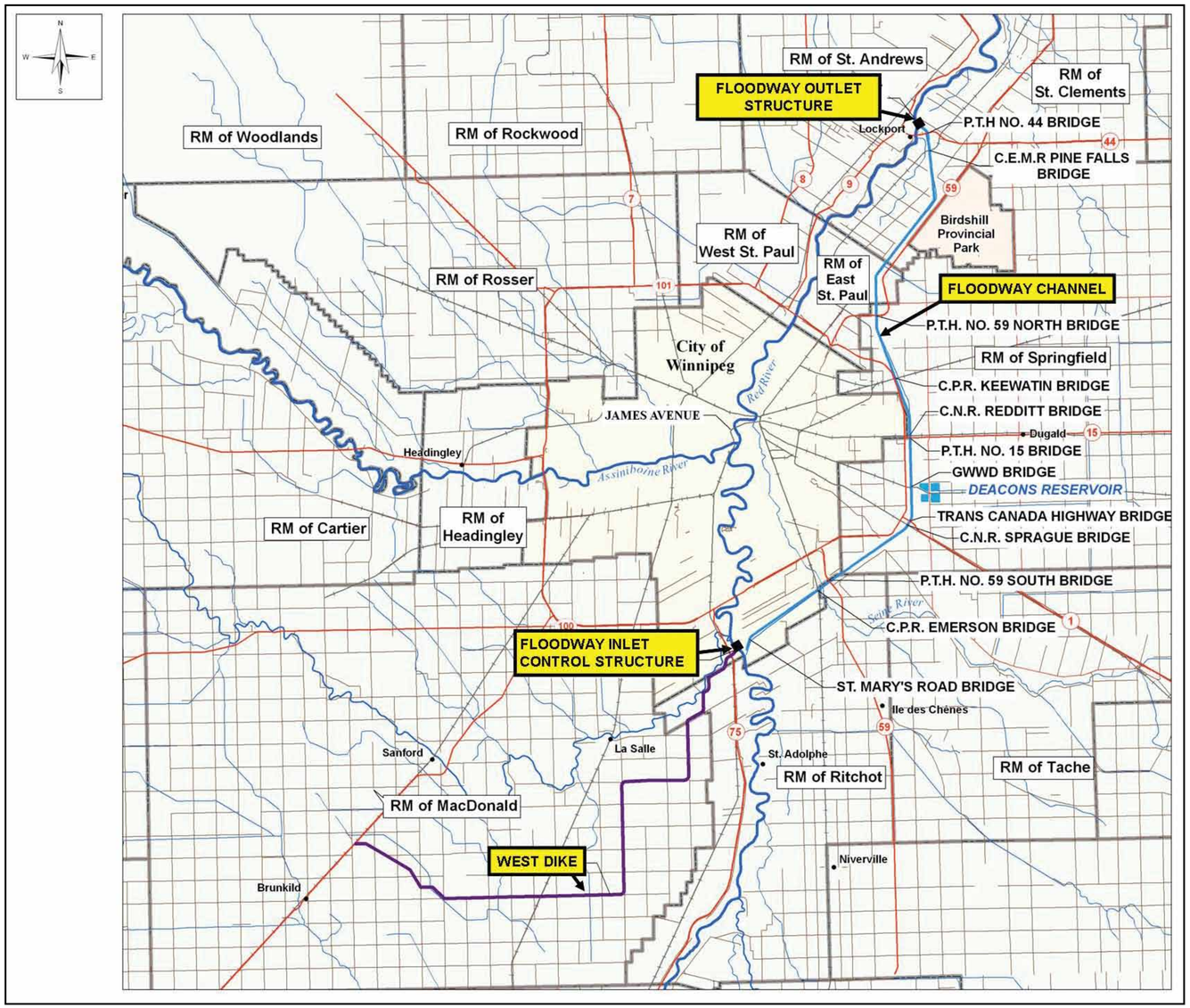
Background

- The original floodway was built between 1962 and 1968; after the 1950 flood.
- It cost $63 million and has saved Manitoba more than $30 billion in flood damage.
- It was built to protect the City of Winnipeg from a 160-year flood.
- Flood protection measures also included the construction of the Portage Diversion (diverts flows up to 700 m3/s (25,000 cfs) from the Assiniboine River) and the Shellmouth Dam (reduction up to 200 m3/s (7,000 cfs) in Assiniboine River).
- The expansion of the current floodway system (including the West Dike and outlet expansions) began after the 1997 flood and was the most cost effective way to protect the City of Winnipeg from a 700-year flood.
- The original floodway earthwork project was larger than the Suez Canal, but smaller than the Panama Canal:
  - original Panama Canal excavation = 177 million cubic metres (currently being expanded)
  - original Suez Canal excavation = 75 million cubic metres (lengthened from 160 km to 190 km)
  - original floodway excavation = 76 million cubic metres
  - floodway expansion excavation = 21 million cubic metres
  - total floodway excavation = 97 million cubic metres
- The floodway is recognized as one of 16 of the world's engineering marvels by the International Engineering Association.



Design flood flows shown.

Floodway Components



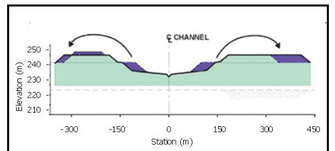
Floodway outlet structure during 1997 flood

Floodway inlet control structure

Floodway Expansion Measures

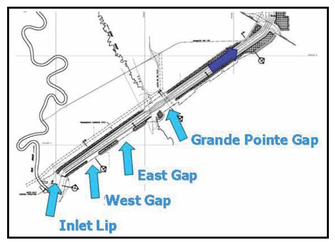
Bridge modifications
- four of six highway bridges replaced
- four of six railway bridges replaced

Channel widening
- widen on average from 35 m to 85 m (115 ft to 280 ft) for increased capacity
- excavation of up to 21 million m3 of soil (original floodway, about 76 million m3 of soil)



Typical Channel Cross Section

Entrance improvements
- post 1997 flood
  - excavated west gap and east gap
- floodway expansion in 2005
  - improvements to west gap and east gap
  - excavated Grande Pointe gap
- post 2009 flood
  - improvements to west gap



Inlet control structure improvements
- rock and riprap - erosion protection
- improved reliability - refurbish gates and system security upgrade

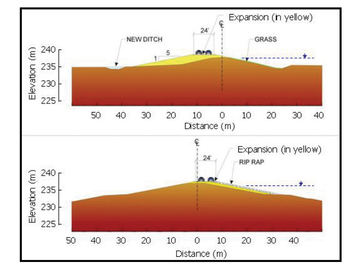
m3 = cubic metres	m3/s = cubic metres per second
m = metres	km = kilometres
mi = miles	cfs = cubic feet per second
ft = feet	

Outlet structure expansion
- widened structure by 45 m (150 ft)
- crest raised by 1.35 m (4.4 ft)
- expanded downstream outlet channel on the north side
- improved erosion protection and energy dissipation

Pre-Expansion

Post-Expansion

West Dike extension and raising
- increased protection to 700-year flood level
- increased freeboard from 0.6 m to 1.0 m (2 ft to 3.3 ft) for wind and waves
- dike lengthened by over 11 km (7 mi) after original construction
- improved erosion protection



	Original floodway	Expanded floodway
Floodway design capacity	1,700 m3/s (60,000 cfs)	4,000 m3/s (140,000 cfs)
Level of Protection (frequency of flood)	160-year (1968 analysis) 100-year (2009 analysis)	700-year
Approximate cost of work	$63 Million	$665 Million

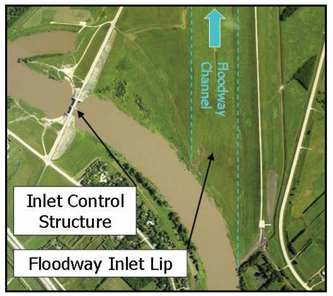
Manitoba

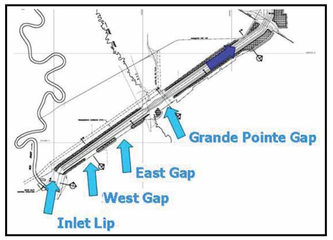
Floodway Components

Floodway Channel
- 46 km (28.6 mi) long
- 150 to 250 m (490 ft to 820 ft) wide

Floodway Channel Inlet Lip
- allows time for ice on Red River to start moving downstream before the water runs over the floodway channel inlet lip
- 228.6 m (750 ft) elevation
- 215 m (700 ft) wide

Embankment Gaps and 700-year flood capacities
- West Gap:
  - 750 m (2450 ft) wide
  - 232.7 m (763.5 ft) elevation
  - 1,200 m3/s (42,000 cfs) capacity
- East Gap:
  - 750 m (2450 ft) wide
  - 233.8 m (767.1 ft) elevation
  - 1,700 m3/s (61,000 cfs) capacity
- Grande Pointe Gap:
  - 500 m (1640 ft) wide
  - 235.0 m (771 ft) elevation
  - 900 m3/s (31,000 cfs) capacity





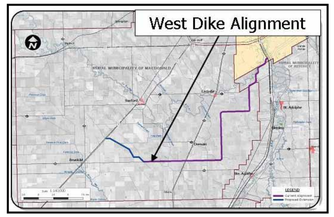
m3 = cubic metres
m = metres
mi = miles
ft = feet
m3/s = cubic metres per second
cfs = cubic feet per second

Floodway Inlet Control Structure
- two 34.3 m (112 ft) wide submersible gates
- height of gates 10.6 m (34.8 ft)

Floodway Outlet Structure
- controls the hydraulic gradient in the floodway channel
- provides erosion protection at the floodway channel exit
- 90 m (295 ft) wide
- crest elevation: 223.85 m (734.42 ft)

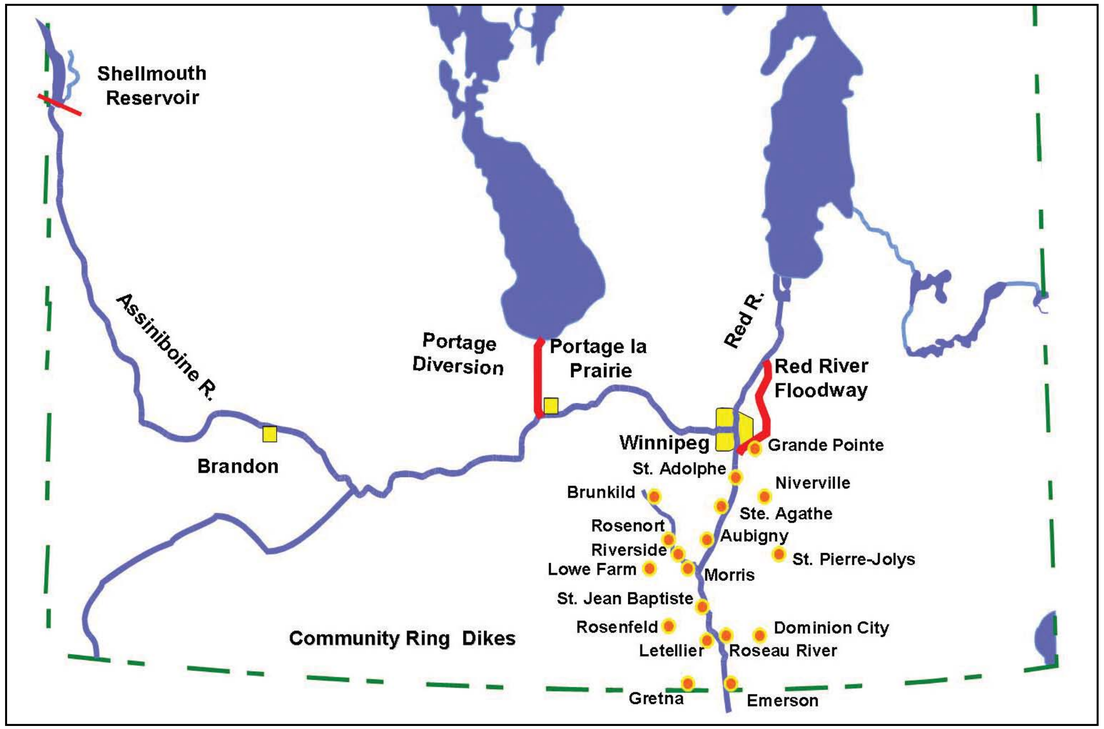
West Dike
- prevents flood water from entering the City of Winnipeg from the west
- 45 km (28 mi) long
- varies in height from 0.6 m to 9 m (2 ft to 30 ft)

Bridges and Crossings
- six railway bridges
- six highway bridges
- one low level crossing
- 22 overhead transmission lines
- two oil and gas pipelines
- two 1.6 m (5.4 ft) diameter water supply aqueducts



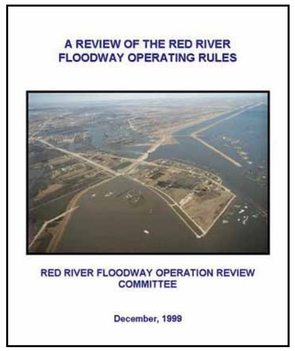
Floodway Operation

- Specific rules of operation govern the operation of the floodway.
- Floodway operation is based on four rules of operation.
- Manitoba Water Stewardship operates the floodway.
- Floodway Operation Advisory Board provides advice on operation.

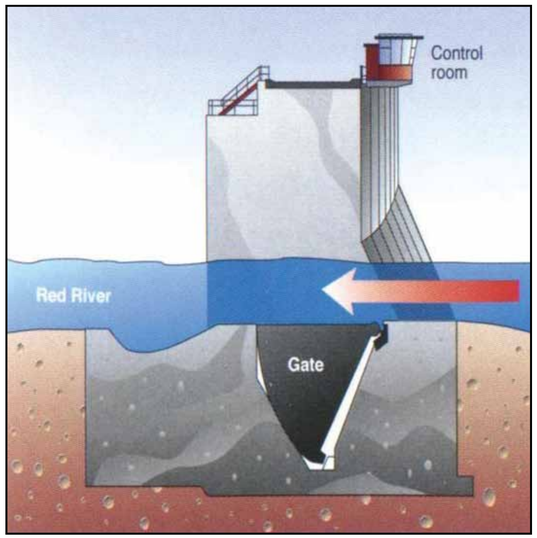


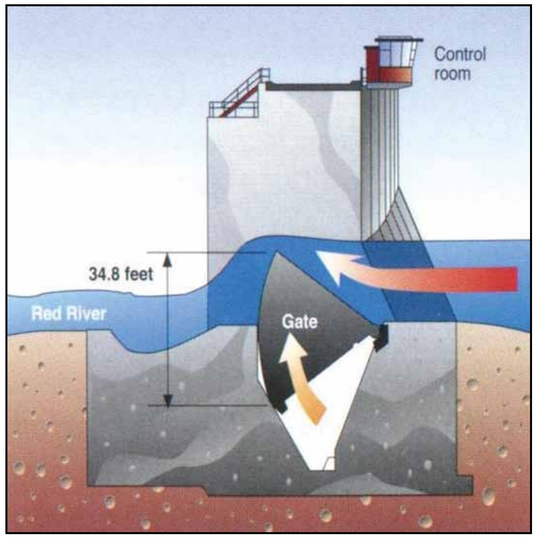
Floodway operation advisory board members:

- Manitoba Water Stewardship
- Government of Canada
- Rural Municipality of Macdonald
- Rural Municipality of Morris
- Rural Municipality of Ritchot
- City of Winnipeg
- Selkirk and District Planning Board



How Floodway Works





Low flow conditions

- The water level in the Red River is below the top of the floodway channel inlet lip.
- All of the Red River flow passes through the City of Winnipeg.

Flow split begins

- The water level in the Red River is just above the top of the floodway channel inlet lip.
- Most of the Red River flow passes through the City of Winnipeg.
- Some of the flow starts going down the floodway channel.
- Inlet control structure is not operated.

Initial gate operation

- The water level in the Red River rises above the top of the floodway channel inlet lip.
- The Red River flow is split, passing through the City of Winnipeg and the floodway channel.
- The water level upstream of the floodway inlet control structure falls below natural levels.
- The gates at the inlet control structure are operated.
- The water level upstream of the floodway inlet control structure returns to natural levels.

Flood control

- The water level in the Red River continues to rise, well above the top of the floodway channel inlet lip.
- As the water levels get higher, water starts entering the floodway channel through the east embankment gaps.
- The gates at the inlet control structure continue to be operated.
- During extreme floods, the water levels upstream of the floodway inlet control structure rises above natural levels.
- Most of the Red River water passes through the floodway channel.
- Some of the water still passes through the City of Winnipeg.

Floodway Operation

- The rules are issued under the authority of *The Water Resources Administration Act*.
- The rules are a condition of *The Environment Act Licence #2691*.
- The intent of the spring operating rules is to maintain water levels upstream of the inlet control structure at, or below, what is known as the natural level, until the dikes in Winnipeg are in danger.

The term natural refers to the level that would have occurred in the absence of the flood control works, with the level of urban development in place at the time of the construction of these works.

Summary of the Red River Floodway rules of operation

Normal operation (Rule 1) – Maintain natural levels upstream of the inlet control structure, until the James Avenue level reaches 7.47 m (24.5 ft).

Major flood operation (Rule 2) – Keep the levels in Winnipeg at safe levels while allowing water to rise above natural levels upstream of the inlet control structure.

Extreme flood operation (Rule 3) – Maintain river level at floodway inlet control structure below the maximum level of the floodway west embankment and the West Dike. Additional water is allowed to go through Winnipeg.

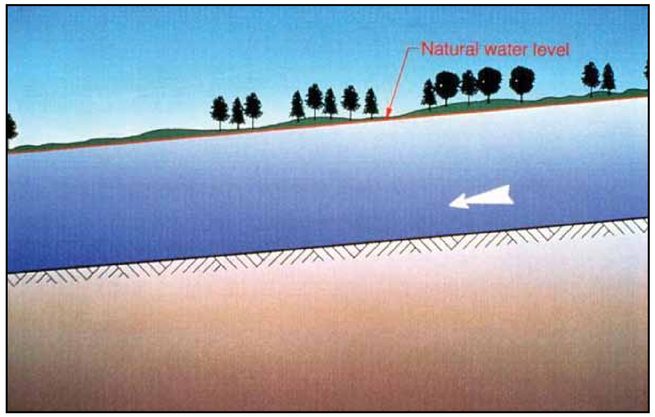
Summer operation (Rule 4) – Operate inlet control structure to reduce the risk of widespread basement flooding, health risks and damage to Winnipeg. This is to be done without raising river levels immediately upstream of the inlet control structure higher than 760 feet above sea level.

Initial gate operation – Does not start until ice is moving in the vicinity of inlet control structure.

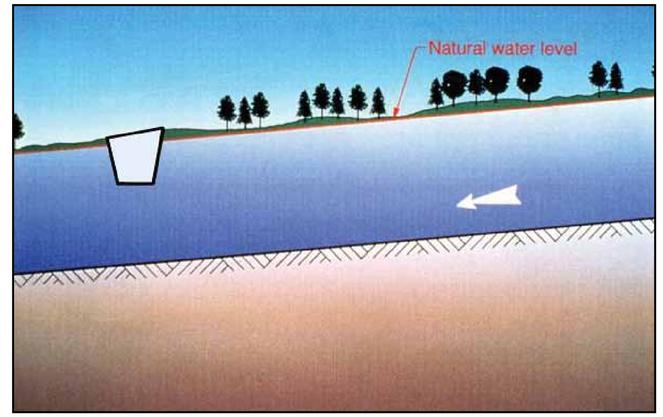
Final drop of gate – Done in consultation with the City of Winnipeg.

Horn operation – Done a half hour before the first gate operation.

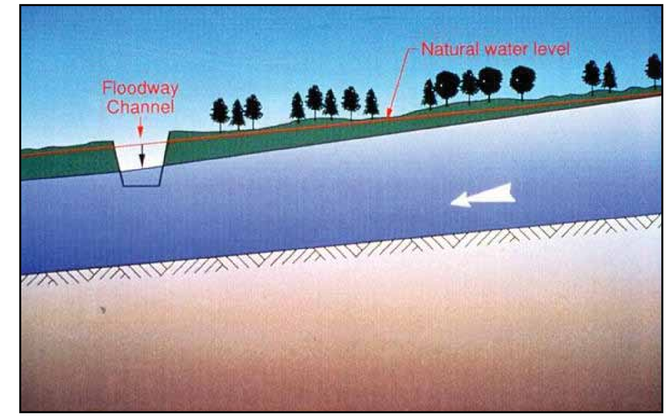
Natural Levels



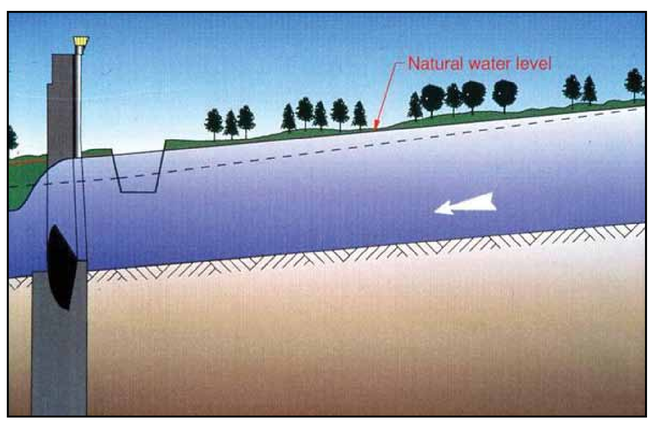
Natural flood level – before the floodway



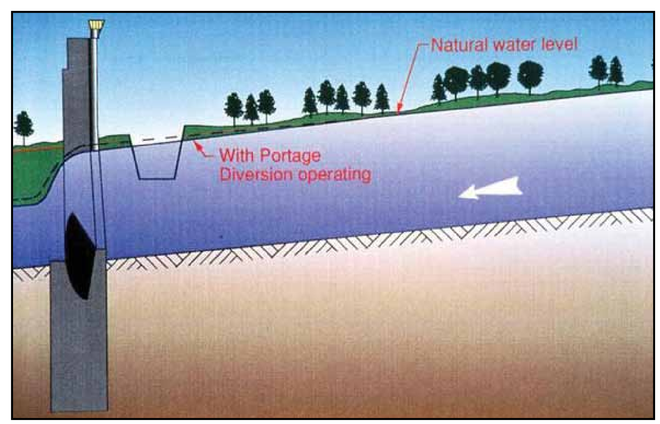
Natural flood levels – with floodway channel location shown but no water in the floodway channel



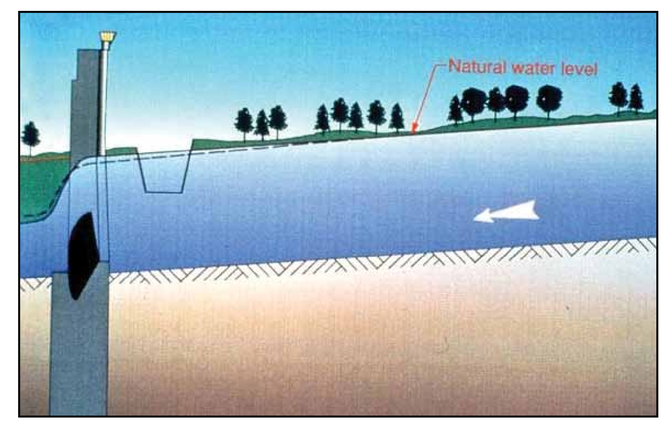
Water flow split with floodway channel in place, carrying Red River flood water – upstream water level below natural levels



Floodway inlet structure gates operating – water levels upstream restored to natural levels



Effects of Portage Diversion and Shellmouth Dam – water levels below natural with Portage Diversion flow and Shellmouth Dam flood water storage



Effects of Portage Diversion and Shellmouth Dam – gates raised and water restored to natural levels

Rule 1 – Normal Operation

Maintain natural levels at inlet until the James Avenue level reaches 7.47 m (24.5 ft).

Maintain natural water levels on the Red River at the entrance to the floodway channel, until the water surface elevation at James Avenue reaches 24.5 feet (7.46 metres), or the river level anywhere along the Red River within the City of Winnipeg reaches two feet below the flood protection level of 27.83 feet (8.48 metres).

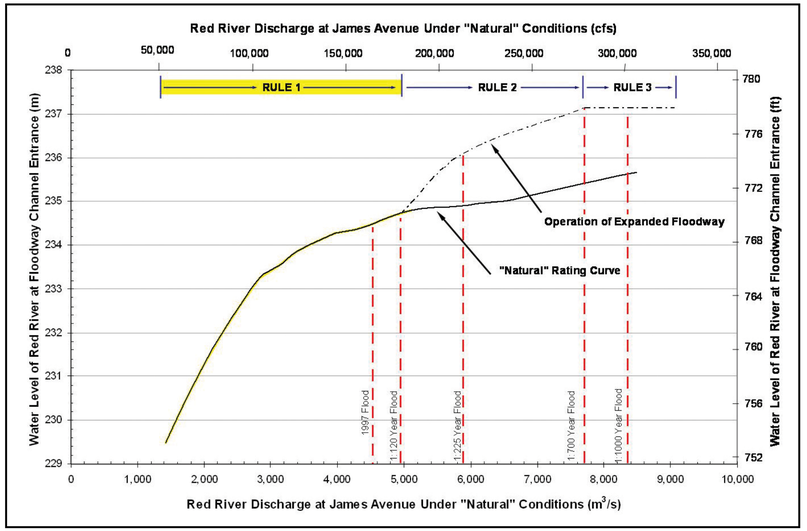


Table of Responsibilities for Rule 1

Province of Manitoba	City of Winnipeg	Municipalities
• provide warnings and public alerts • flood forecasting and monitoring • community ring dikes operation • ice jam mitigation • operate flood control works (floodway, Portage Diversion…) • deploy flood tubes • monitor groundwater • protect well and surface water • recommend movement and evacuation of grain and livestock • close roads and set up emergency access • provide and distribute provincial sandbags	• provide warnings and public alerts • close and check storm sewer gates • seal manholes in low lying locations • provide and distribute sandbags • activate flood pumping stations • set up temporary pumping locations • alert external agencies • raise secondary dikes • arrange for evacuation • arrange for the shut down of utilities and services in evacuated areas • set up minor road closures	• provide warnings and public alerts • make preliminary arrangements for dike operation and flood fighting efforts • provide and distribute sandbags • patrol existing infrastructure and property in flooded areas • set up road closures • provide emergency access • arrange shut down of utilities and services in evacuated areas • arrange evacuation • arrange movement and evacuation of grain and livestock

Rule 2 – Major flood operation*

Keep the water levels in Winnipeg at safe levels while allowing water to rise above natural upstream of floodway inlet control structure.

Once the river levels within Winnipeg reach the limits described in Rule 1, the level in Winnipeg should be held constant while levels south of the control structure continue to rise. Furthermore, if forecasts indicate that levels at the entrance to the floodway channel will rise more than two feet (0.6 metres) above natural, the City of Winnipeg must proceed with emergency raising of the dikes and temporary protection measures on the sewer systems in accordance with the flood level forecasts within Winnipeg. The levels in Winnipeg should be permitted to rise as construction proceeds, but not so as to encroach on the freeboard of the dikes or compromise the emergency measures undertaken for protecting the sewer systems. At the same time, the Province should consider the possibility of an emergency increase in the height of the floodway embankments and the west dike. At no time will the water level at the floodway channel's entrance be allowed to rise to a level that infringes on the allowable freeboard on the floodway west embankment (Winnipeg side) and the west dike.

*Used only in 1997 with pre-expanded floodway

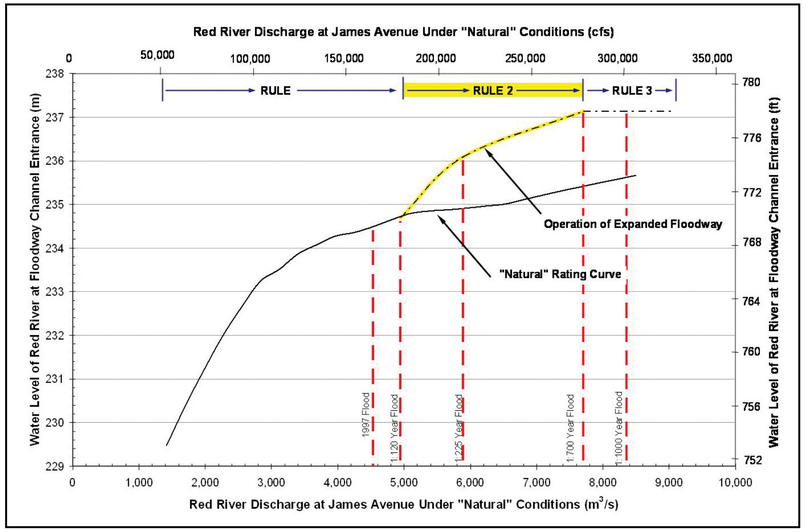


Table of Additional Responsibilities for Rule 2

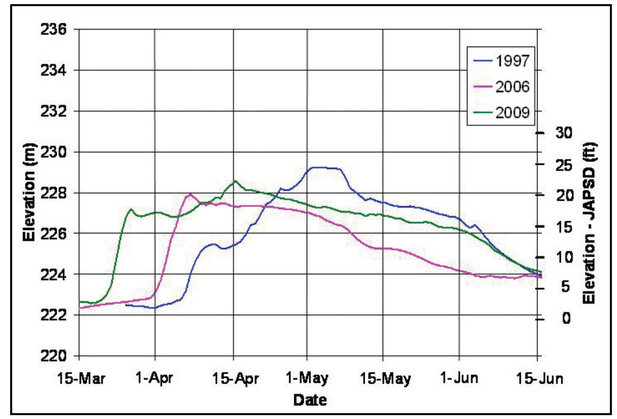
Province of Manitoba	City of Winnipeg	Municipalities
• raise community ring dikes • floodway ditch and road closures	• raise primary dikes • road closures	

Summary of Floodway Operations under Rule 1 and 2

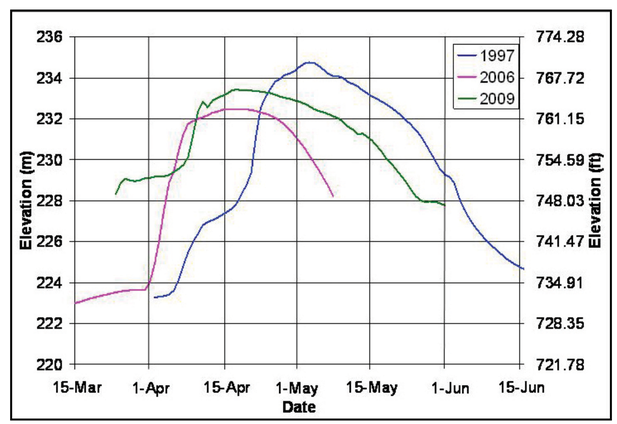
Events Where James Avenue Natural Above 25 Ft Highlighted

	FLOODWAY		INLET STRUCTURE				JAMES AVENUE				PORTAGE DIVERSION
Year	Peak Flow in Floodway (cfs)	Date of Peak Flow	Start of Operation	End of Operation	No. of Days of Operation	Peak Water Level Upstream at Inlet (ft)	James Ave Natural Peak Flow (cfs)	James Ave Natural Peak level (ft)	Frequency of Flood (Years)	James Ave Actual Peak level (ft)	Portage Diversion Effect at Peak (cfs)
1969	22,100	May 3	April 13	May 17	35	-	78,000	24.1		18.5	0
1970	22,800	May 1	April 19	May 20	31	759.6	80,500	24.7		18.9	8,230
1971	9,100	April 14	April 11	April 21	10	754.0	53,900	18.6		16.6	420
1972	1,200	April 18	April 16	April 20	4	751.2	56,100	19.0		16.6	3,920
1973	-	-	-	-	-	742.4	18,700	11.5		11.6	-
1974	36,700	April 24 & 25	April 18 May 20	May 18 May 31	30 11	764.6	96,000	**28.0**	16	19.2	17,600
1975	9,400	May 7 & 8	April 30	May 11	11	754.4	59,000	19.8		15.8	5,100
1976	10,300	April 11	April 7	April 25	18	754.8	63,800	20.8		15.8	10,000
1977	-	-	-	-	-	734.4	6,600	7.0		7.0	-
1978	18,100	April 16	April 9	May 3	24	758.1	62,000	20.4		17.3	0
1979	42,000	May 9	April 20	May 29	39	764.9	107,000	**30.3**	21	19.1	6,300
1980	-	-	-	-	-	745.6	31,100	12.6		12.7	-
1981	-	-	-	-	-	735.4	5,600	7.0		7.0	-
1982	600	April 18	April 16	April 21	5	751.3	51,500	18.4		16.1	6,145
1983	900	April 11	April 10	April 13	3	751.7	49,200	17.9		16.8	3,800
1984	-	-	-	-	-	748.9	39,000	14.6		14.0	-
1985	-	-	-	-	-	747.0	37,000	14.0		14.5	-
1986	9,800	April 3	March 31 May 6	April 14 May 11	14 5	754.8	64,000	20.9		17.8	9,600
1987	17,900	April 10	April 7	April 18	11	758.3	82,600	**25.1**	11	18.6	9,400
1988	-	-	-	-	-	-	19,900	8.6		8.5	-
1989	4,800	April 24	April 21	May 1	10	752.8	49,000	17.4		16.2	0
1990	-	-	-	-	-	-	14,200	6.9		6.9	-
1991	-	-	-	-	-	-	9,800	6.4		6.4	-
1992	3,600	April 8	April 6	April 10	4	752.7	49,400	17.5		15.5	4,000
1993	-	-	-	-	-	746.9	46,000	16.7		16.5	-
1994	-	-	-	-	-	-	40,000	15.0		14.6	-
1995	13,700	March 29	March 24	April 25	32	757.4	66,200	21.5		17.7	750
1996	38,800	April 30 & May 1 & 2	April 19	June 8	50	764.6	108,000	**30.3**	22	19.2	12,000
1997	66,400	May 3 & 4	April 22	June 3	42	771.5	163,000	**34.4**	98	24.5	10,500
1998	6,700	April 1	March 29	April 5	7	754.1	55,000	18.8		16.8	0
1999	15,700	April 16	April 4	May 1	27	758.2	77,100	23.5		17.2	6,500
2000	-	-	-	-	-	749.8	44,300	15.7		15.7	-
2001	21,100	April 28	April 7	May 20	43	760.0	82,000	**25.0**	10	17.9	9,200
2002	3,200	June 19	June 18	June 25	7	752.9	53,800	18.1		17.3	-
2003	-	-	-	-	-	738.7	16,900	7.8		7.6	-
2004	15,800	April 5	April 1	April 19	18	760.0	79,700	24.4		18.9	6,000
2005	15,300	April 8	April 5	April 20	15	759.3	84,400	**25.5**	11	18.9	2,900
2005	23,400	July 4	June 30	July 27	27	762.4	89,500	**26.5**	100 (est)	20.1	9,900
2006	33,200	April 15	April 5	May 9	34	763.4	96,700	**28.5**	16	20.2	8,300
2007	4,200	April 12	April 3	April 17	14	753.6	61,000	19.6		17.7	5,400
2008	-	-	-	-	-	744.7	16,000	11.5		11.4	-
2009	43,100	April 18 to 21	April 8	May 24	47	767.1	128,000	**32.5**	39	22.3	21,000
2010	16,000	April 6	March 28	April 22	25	759.1	69,000	22.3		18.5	3,600
2010	7,000	June 2	May 30	June 3	4	756.0	62,100	20.1		18.3	1,600

NOTE: *In 2005, operation of floodway inlet structure moved from Rule 4 to Rule 1 on June 30.*
In 2010, operation of floodway inlet structure moved from Rule 1 to Rule 4 on June 3.



Red River hydrograph at James Avenue



Red River hydrograph at inlet

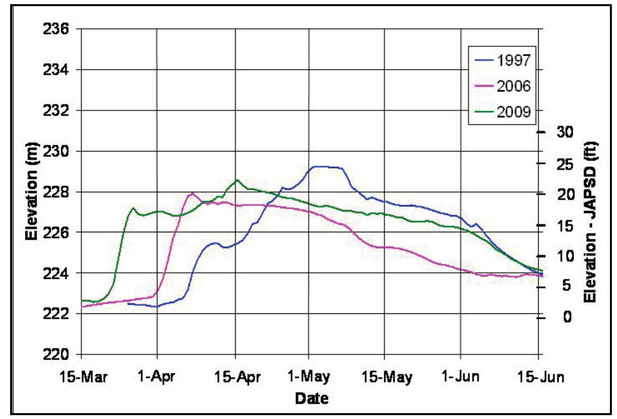
- The floodway has operated for spring floods 27 times since 1968 or about twice every three years.
- The floodway can now accommodate a greater flood event without going above the natural levels of the Red River. This is due to floodway channel expansion and the improvements to the floodway gaps.

Summary of Floodway Operations under Rule 1 and 2

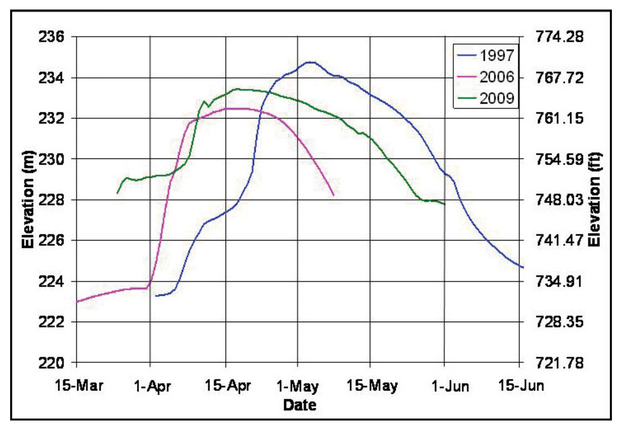
Events Where James Avenue Natural Above 25 Ft Highlighted

	FLOODWAY		INLET STRUCTURE				JAMES AVENUE				PORTAGE DIVERSION
Year	Peak Flow in Floodway (m^3/s)	Date of Peak Flow	Start of Operation	End of Operation	No. of Days of Operation	Peak Water Level Upstream at Inlet (m)	James Ave Natural Peak Flow (m^3/s)	James Ave Natural Peak level (ft)	Frequency of Flood (Years)	James Ave Actual Peak level (ft)	Portage Diversion Effect at Peak (m^3/s)
1969	626	May 3	April 13	May 17	35	-	2,209	24.1		18.5	0
1970	646	May 1	April 19	May 20	31	231.5	2,279	24.7		18.9	233
1971	258	April 14	April 11	April 21	10	229.8	1,526	18.6		16.6	12
1972	34	April 18	April 16	April 20	4	229.0	1,589	19.0		16.6	111
1973	-	-	-	-	-	226.3	530	11.5		11.6	-
1974	1,039	April 24 & 25	April 18 May 20	May 18 May 31	30 11	233.1	2,718	**28.0**	16	19.2	498
1975	266	May 7 & 8	April 30	May 11	11	229.9	1,671	19.8		15.8	144
1976	292	April 11	April 7	April 25	18	230.1	1,807	20.8		15.8	283
1977	-	-	-	-	-	223.8	187	7.0		7.0	-
1978	513	April 16	April 9	May 3	24	231.1	1,756	20.4		17.3	0
1979	1,189	May 9	April 20	May 29	39	233.1	3,030	**30.3**	21	19.1	178
1980	-	-	-	-	-	227.3	881	12.6		12.7	-
1981	-	-	-	-	-	224.1	159	7.0		7.0	-
1982	17	April 18	April 16	April 21	5	229.0	1,458	18.4		16.1	174
1983	25	April 11	April 10	April 13	3	229.1	1,393	17.9		16.8	108
1984	-	-	-	-	-	228.3	1,104	14.6		14.0	-
1985	-	-	-	-	-	227.7	1,048	14.0		14.5	-
1986	278	April 3	March 31 May 6	April 14 May 11	14 5	230.1	1,812	20.9		17.8	272
1987	507	April 10	April 7	April 18	11	231.1	2,339	**25.1**	11	18.6	266
1988	-	-	-	-	-	-	563	8.6		8.5	-
1989	136	April 24	April 21	May 1	10	229.5	1,388	17.4		16.2	0
1990	-	-	-	-	-	-	402	6.9		6.9	-
1991	-	-	-	-	-	-	278	6.4		6.4	-
1992	102	April 8	April 6	April 10	4	229.4	1,399	17.5		15.5	113
1993	-	-	-	-	-	227.7	1,303	16.7		16.5	-
1994	-	-	-	-	-	-	1,133	15.0		14.6	-
1995	388	March 29	March 24	April 25	32	230.9	1,875	21.5		17.7	21
1996	1,099	April 30 & May 1 & 2	April 19	June 8	50	233.1	3,058	**30.3**	22	19.2	340
1997	1,880	May 3 & 4	April 22	June 3	42	235.2	4,616	**34.4**	98	24.5	297
1998	190	April 1	March 29	April 5	7	229.8	1,557	18.8		16.8	0
1999	445	April 16	April 4	May 1	27	231.1	2,183	23.5		17.2	184
2000	-	-	-	-	-	228.5	1,254	7.1		7.2	-
2001	597	April 28	April 7	May 20	43	231.6	2,322	**25.0**	10	17.9	261
2002	91	June 19	June 18	June 25	7	229.5	1,523	17.3		17.3	-
2003	-	-	-	-	-	225.2	479	7.8		7.6	-
2004	447	April 5	April 1	April 19	18	231.6	2,257	24.4		18.9	170
2005	433	April 8	April 5	April 20	15	231.4	2,390	**25.5**	11	18.9	82
2005	663	July 4	June 30	July 27	27	232.4	2,534	**26.5**	100 (est)	20.1	280
2006	940	April 15	April 5	May 9	34	232.7	2,738	**28.5**	16	20.2	235
2007	119	April 12	April 3	April 17	14	229.7	1,727	19.6		17.7	153
2008	-	-	-	-	-	227.0	453	11.5		11.4	-
2009	1,220	April 18 to 21	April 8	May 24	47	233.8	3,625	**32.5**	39	22.3	595
2010	453	April 6	March 28	April 22	25	231.4	1,954	22.3		18.5	102
2010	198	June 2	May 30	June 3	4	230.4	1,758	20.1		17.7	45

NOTE: *In 2005, operation of floodway inlet structure moved from Rule 4 to Rule 1 on June 30.*
In 2010, operation of floodway inlet structure moved from Rule 1 to Rule 4 on June 3.



Red River hydrograph at James Avenue



Red River hydrograph at inlet

- The floodway has operated for spring floods 27 times since 1968 or about twice every three years.
- The floodway can now accommodate a greater flood event without going above the natural levels of the Red River. This is due to floodway channel expansion and the improvements to the floodway gaps.

Rule 3 – Extreme flood operation*

Maintain river level at floodway inlet control structure below the maximum level that the floodway west embankment and the west dike can hold. Additional water allowed to go through Winnipeg.

For extreme floods, where the water level at the floodway channel's entrance reaches the maximum level that can be held by the floodway west embankment and the west dike, the river level must not be permitted to exceed that level. All additional flows must be passed through Winnipeg.

*Never been used

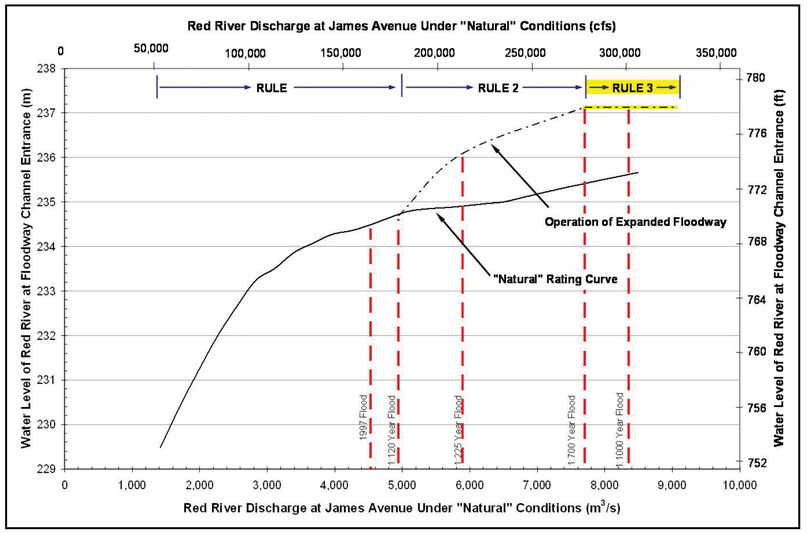


Table of Additional Responsibilities for Rule 3

Province of Manitoba	City of Winnipeg	Municipalities
	Emergency Response Plan for all levels of government	

Communications Protocol For Operation

Before operation

- Send news release on the February and March flood outlooks which are posted on the Manitoba Water Stewardship website
- Flood outlooks and floodway operation plans are given to the Red River Floodway Operation Advisory Board.
- The board provides input, guidance and advice to the Minister of Water Stewardship:
  - on the operation of the floodway control gates
  - in accordance with the approved rules of operation during floods on the Red River
- The board provides a link between local residents and government agencies:
  - about gate operations
  - regarding the impact on residents

Start of operation

- Gate operation begins when ice is moving freely.
- Province sends a news release within one hour of operation.
- Province sounds the horn a half hour before first operation.
- Manitoba Emergency Measures Organization relays information to municipal emergency coordinators.

Ongoing operation

- Floodway gates operation posted on flood information line (1-866-883-5663 or 284-4550 in Winnipeg).
- Daily flood reports posted on Manitoba Water Stewardship website.
- Daily Red River water level and forecast sheets posted on Manitoba Water Stewardship website.
- Provide City of Winnipeg with 5-day flow forecasts as required by the city.
- Press release when floodway operations cease
- All news releases posted on **manitoba.ca.**

Manitoba

Spring flood compensation

The Red River Floodway Act

- In March 2004, Manitoba introduced *The Red River Floodway Act.*
- Sets compensation for artificial spring flood damage under Rules 2 and 3.
- Goal is to restore Manitobans to their former financial, pre-flood positions.
- Not retroactive.

Program Criteria

- Everyone who has artificial flood damages is eligible including individuals, farms, businesses, non-profit organizations, and local authorities.
- Covers a broader range of damage and loss than the Disaster Financial Assistance program.
- Covers financial loss due to inability to work or carry on a business.
- There is no claim limit and no deductible.
- Claims are assessed on proof of loss rather than proof of repair.
- Claimants are expected to make reasonable efforts to avoid or reduce damage and loss.
- Claimants have to show compliance with applicable flood proofing criteria.

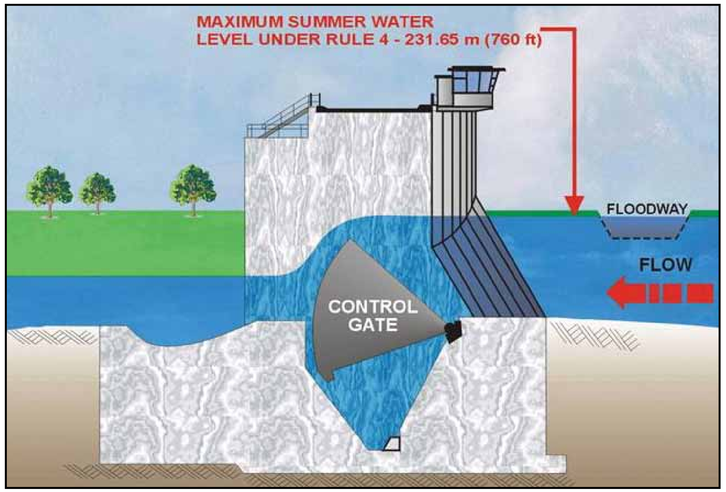
Program Administration

- The program must be fairly administered in a timely, cost-effective manner.
- Manitoba Emergency Measures Organization has an integrated, one stop claims procedure.
- The Disaster Assistance Board reviews disputed claims using the rules of the legislation.

Assistance

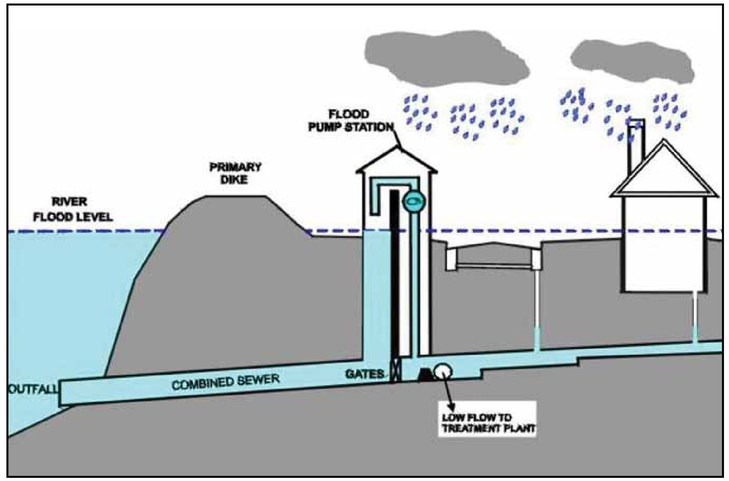
- Help to cope with flooding at the natural water levels will likely continue to be provided by the Disaster Financial Assistance program.
- Additional disaster assistance programs may be developed by the provincial and federal governments for each flood.

Rule 4 – Emergency operation

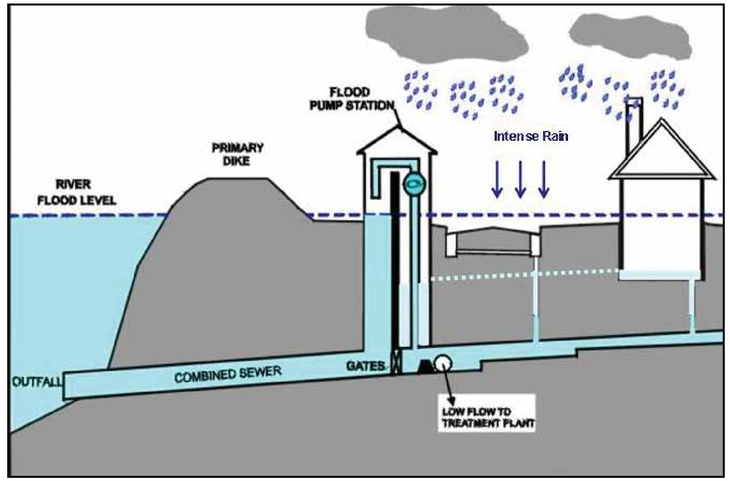


Benefits

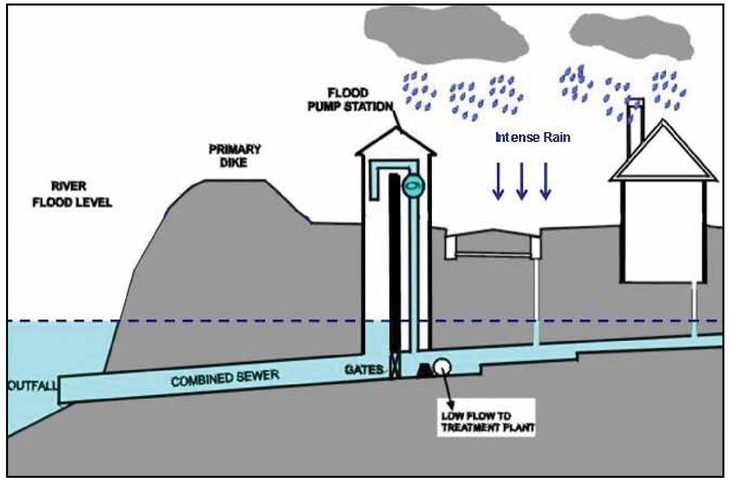
- reduces basement flooding in Winnipeg
  - lower river levels increase the sewer capacity to handle rainfall.
  - increased sewer capacity reduces the risk of basement flooding during major rainstorms.
- reduces health risk
  - high river levels can contribute to sewer back-up and increase the risk of water borne disease.
- reduces risk of property damage in Winnipeg.



Sewer flap gates closed when river levels are high. Gravity flow cannot occur. Flood pump station is operated.



Flood pump station has limited capacity. During periods of intense rain and high river levels basement flooding can result.



Capacity is increased in the city sewer system with lower river levels that occur during floodway operation under Rule 4.

Rule 4 Operation

Upstream impacts
- Water is raised above natural levels.
- Causes artificial flooding.
- River is below the main prairie level.

Summer operation restrictions
- Maximum water level is 231.65 m (760 ft) above sea level at entrance to floodway channel.
- Inlet control structure should not be operated to keep the river level at less than 9 ft at James Avenue.
- Except in circumstances of extreme urgency, river levels are not to be lowered by more than 1 ft per day.

Other requirements
- Horn sounded half an hour before first operation.
- News release to be sent out at least 24 hours before operation starts.
- A reasonable effort must be made to notify affected landowners personally.
- There must be a compensation program for affected landowners.

2005 compensation
- There were 119 residents who received flood compensation.
- Total compensation paid was $1.11 million.

Before Rule 4 came into effect, basement flood damages in the 1993 intense rainfall event in Winnipeg were $140 million.

Rule 4 – Emergency summer operation

Background

- Floodway inlet control structure was used for summer flooding for the first time in 2002.
- Rule 4 was established in 2005.
- Gates used in the summers of 2002, 2004, 2005, and 2010.
- Compensation for artificial flood damage was provided to the land owners when gates used under Rule 4.
- St. Andrews lock and dam are wide open during summer floods to reduce water levels upstream and through Winnipeg.
- The Forks walkway cannot be protected under Rule 4. The rule does not allow gate operation to keep the river level less than 9 ft at James Avenue. The walkway is at approximately 8 ft.
- The cost/benefit analysis done prior to operation includes:
  - damage caused by artificial flooding south of the inlet control structure
  - risk to the health of Winnipeg residents from sewer back-up

Conditions for Rule 4 Operation

- After the spring snowmelt crests.
- If levels for the next 10 days are forecast above 14 ft. at James Avenue.
- Dependent on weather forecast.
- Risk of high intensity rainstorms threatening basement flooding.

Summary of Floodway Operations

	FLOODWAY		INLET STRUCTURE			
Year	Peak Flow in Floodway (cfs)	Date of Peak Flow	Start of Operation	End of Operation	No. of Days of Operation	Peak Water Level Upstream at Inlet (ft)
2002	7,800	July 6	July 4	August 4	31	754.5
2004	9,000	June 11	June 10	July 31	51	756.6
2005	15,700	June 30	June 14	June 30	16	760.0
2010	12,200	June 4	June 3	June 30 (est)	27 (est)	758.3

Note:

- In 2005, floodway control structure operations changed from Rule 4 to Rule 1 on June 30 (see History of Operation board).
- In 2010, floodway control structure operations changed from Rule 1 to Rule 4 on June 3.
- Flow over floodway inlet lip also occurred in the summers of 1993 and 2007 without gate operation.

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Summary of Floodway Operations

	FLOODWAY		INLET STRUCTURE			
Year	Peak Flow in Floodway (m^3/s)	Date of Peak Flow	Start of Operation	End of Operation	No. of Days of Operation	Peak Water Level Upstream at Inlet (m)
2002	221	July 6	July 4	August 4	31	230.1
2004	255	June 11	June 10	July 31	51	230.7
2005	445	June 30	June 14	June 30	16	231.6
2010	345	June 4	June 3	June 30 (est)	27 (est)	231.0

Note:

- In 2005, floodway control structure operations changed from Rule 4 to Rule 1 on June 30 (see History of Operation board).
- In 2010, floodway control structure operations changed from Rule 1 to Rule 4 on June 3.
- Flow over floodway inlet lip also occurred in the summers of 1993 and 2007 without gate operation.

Supporting Regulations Programs and Activities

Provincial flood outlook and forecast

- The spring flood outlooks are issued the third week of February and the third week of March.
- City of Winnipeg flood outlooks are sent out as needed.
- Daily flood forecasts are widely distributed.

Environment Canada's role

- Manage the hydrometric gauging network.
- Publish and archive hydrometric data.
- Provide real-time hydrometric data.
- Forecast the weather.

The City of Winnipeg Act

- Regulates development within the floodway fringe, which is the flood prone area outside the main flow path.
- Province designates flow areas along the rivers that are needed to convey the design flood flows through the city.
- No development that could impede the river flow is allowed in the designated flow area.

The Diking Commissioner Act

- Ensures the primary dikes in Winnipeg are maintained.
- Requires that new primary dikes be built to provincial standards.

The Water Resources Administration Act

- Controls development in the designated flood area south of Winnipeg (to the 1997 level plus 0.6 m (2 ft)).
- Allows operation and maintenance of community ring dikes, floodway, and other provincial flood control structures.

The Manitoba Floodway Authority Act

- Allows floodway expansion.
- Establishes responsibility for floodway maintenance.

The Red River Floodway Act

- Sets compensation for spring artificial flooding (Rules 2 and 3).
- Requires preparation of an operation report after each spring operation.

m = metres
ft = feet

Post 1997 Research

List of studies and reports after the 1997 flood:

- *Flood Protection for Winnipeg*; International Joint Commission, December 1999
- *A Review Of The Red River Floodway Operating Rules*; Red River Floodway Operation Review Committee, December 1999
- *Stage-Damage Curves Update and Preparation of Flood Damage Maps*, KGS Group, January 2000
- *Ice-Jam Effects on Red River Flooding and Possible Mitigation Methods*, report prepared for the International Red River Basin Task Force, International Joint Commission by S. Beltaos, R. Pomerleau and R. A. Halliday, March 2000
- *The Next Flood: Getting Prepared*, International Joint Commission, April 2000
- *Living on the Red*, International Joint Commission, November 2000
- *Flood Protection Studies for Winnipeg*, KGS Group, November 2001
- *Investigation of the Merits of Management of Red River Summer Water Levels in the City Of Winnipeg*, KGS Group, November 2003
- *Re-Computation of Natural Water Levels at the Floodway Inlet*; Acres Manitoba Ltd., April 2004
- *Evaluation of the Effects of Expansion of the Winnipeg Floodway on Ice-Related Water Levels Downstream of Floodway Outlet*, Northwest Hydraulics, 2005
- *Implementation and Administration of Compensation Program of Damages Caused by Rule 4 Operation of the Red River Floodway* - Manitoba Water Stewardship, July 2006
- *Conceptual Engineering Study for Fish Passage at the Red River Floodway Inlet Control Structure*; KGS Group and North-South Consultants, January 2008
- *Human Health Risk Assessment Red River Floodway Expansion Project*, Jacques Whitford Limited, 2008
- *Wildlife Studies*, TetrES consulting (in-progress)
- *Impact of Artificial Flooding Related to the Operation of the Red River Floodway*, MMM Group (in-progress)
- *Monitoring of River Bank Stability in the Vicinity of the Control Structure*, KGS Group (in-progress)

History Of Major Ice Jamming Downstream Of Floodway Outlet

THE SELKIRK HERALD

CLEAR WATER.

THE ICE MOVES OUT OF THE RIVER

After a Stay of Five Months.

Notice to Contractors.

COURT HOUSE.

Municipality of St. Clements.

ASSESSMENT, 1884.

Court of REVISION

April 25, 1884 – *The Selkirk Herald*
"...first move below Sugar Point this year took place last Sunday... jam at Sugar Island...water rose steadily...overcome the jam...another jam...water commenced to rise and overflow the flats...jam held until late Tuesday...although water covered the flats and reached a considerable height no damage was done..."

April 15, 1943 – *The Selkirk Record*
"...ice jammed at Sugar Island...water attained its highest point since 1916...reported to be 11 ½ feet above summer level. ...ice rose to within a couple of feet of the top of the concrete piers under the bridge...Mr. Zegil's farm was completely under water...caused by blockade of ice which formed Saturday night for a distance of eight miles to the mouth of the river, at Ramsay Point."

Red River Goes on Rampage

Water At Heghest Point In Years

April 15, 1959 – *The Selkirk Record*
"Water and ice flow over Selkirk dock as an ice-jam occurs at Sugar Island, just north of town."

April 20 1960 – "Ice jam at Selkirk Bridge then Sugar Island 'Worst Ice Jam since 1927"

April 13, 1966 – *The Selkirk Enterprise*
"Ice jams on the Red, five miles north of Selkirk were blasted by an E.MO. crew... water levels at Selkirk and north to the river mouth exceeded 1950 flood levels by 3.6 ft. ...powerful aircraft hovering over the ice, exerting a 70 mph air stream on the sluggish areas was successful in assisting the packed ice on its way to Lake Winnipeg...ice jam near the St. John's School for Boys."

"That Old Man River He Justs Keeps Rolling... (With The Help Of Dynamite)

Red River Floods At Selkirk

Curling Club Wind-Up On This Saturday

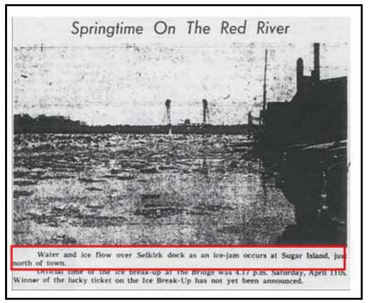
Brown's Bread To Re-Open April 17

Bible Society Elects Officers

April 12, 1967 – *The Selkirk Enterprise*
"...early break-up dumped millions of tons of ice on Selkirk... ice jam was bad...the ice jam at our bridge let go...slid down to a point north of the Boys' School where it immediately jammed again. ...second jam let go and moved five miles north of Selkirk where it stopped for the third time..."

Extracts from Sandford Fleming Report to the CPR:

May 1852 – Mr. Alexander Ross
" On the breaking up of the river, the channel got choked up with ice, which caused the water to rise seven feet in an hour or two..."



Water and ice flow over Selkirk dock as an ice-jam occurs at Sugar Island, just north of town.

January 1880 – ED. R. Abell
"I have seen the break up of the ice on the Red River...for the last fifteen consecutive seasons. ...but have known it to jam several times at Sugar Point...I have also known the ice to jam at the first point below the village of Selkirk, causing the water to overflow the low land on the east side of the river to a depth of ten feet and forcing the ice back up the creek..."

January 1880 – WM. Flett
"The highest that I have seen the water at this place was on the 24th of April 1876, when it came to 15 feet from the top of the bank. This was occasioned ...from a stopping of the ice at the Sugar Point...in close proximity to Selkirk and...The ice jams it may be said every year more or less."

January 1880 – James X. French
"...rise is caused partly if not altogether by the ice jamming at a place called Sugar Point, and at a point further down. And the ice jamming at Sugar Point is a yearly occurrence."

Manitoba

Ice Jamming Mitigation Downstream Of Floodway Outlet

Amphibex

Ice cutting machinery

Causes of ice jams

- Ice jams form when floating ice is blocked from moving downstream.
- Typical blocks:
  - downstream ice cover that has not broken up
  - sharp bends in rivers or blocking structures (for example bridge piers)
  - grounding in shallow areas
- In the Red River, floodwaters run north into solid unbroken ice. The river flow slows down as the river gradient flattens towards Lake Winnipeg.

History

- There have been ice jams in this area throughout recorded history. Ice jams are an on-going problem.
- Several areas are prone to ice jams:
  - Selkirk Bridge
  - Sugar Island
  - areas north of PTH 4
- Ice jams have formed before, after, and almost simultaneously with operation of the floodway inlet control structure.
- A 2005 independent study by Northwest Hydraulics on ice jams downstream of Winnipeg concluded that the floodway does not increase ice jam flooding downstream of the floodway.

April 3, 2004

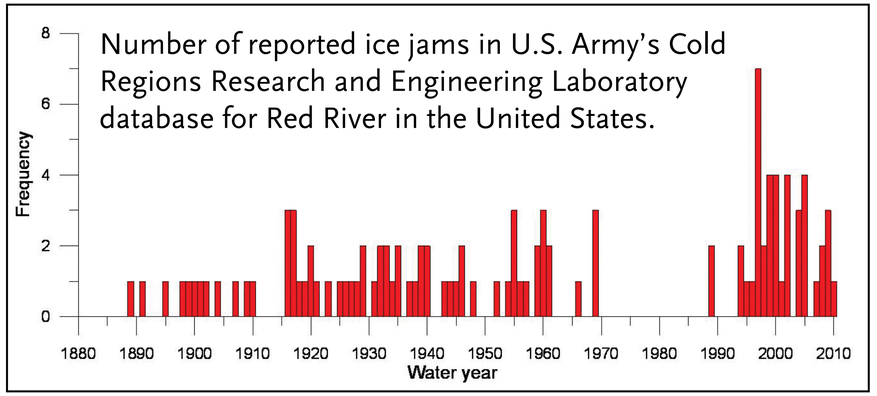
Improvements

- Since 2008, ice cutting machinery has been used to cut ice on Red River.
- Since 2006, amphibexes used to break ice on the Red River.
- The Manitoba Government has purchased the most flood-prone properties.

Recent Ice Jamming Downstream Of Floodway Outlet

From Section 8.1.4 of the Clean Environment Commission report on Floodway Expansion...

- " The Commission accepts the argument that floodway operations do not exacerbate ice jams downstream of the floodway outlet. The floodway does not increase flows downstream of the outlet except at very high flows, when ice has already been cleared from the river channel, and thus cannot have an impact on the ice regime downstream."



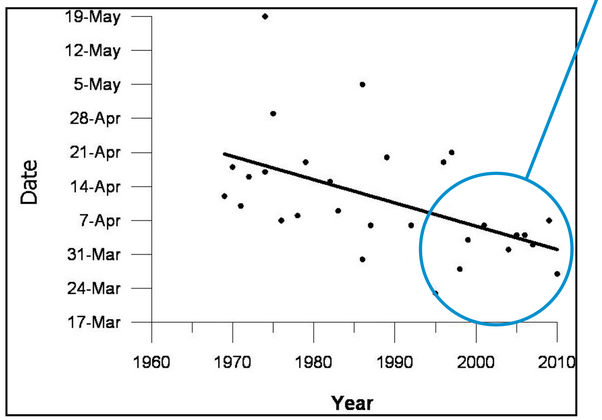
Recent Ice Jams

- More severe ice jams are currently reported more often.

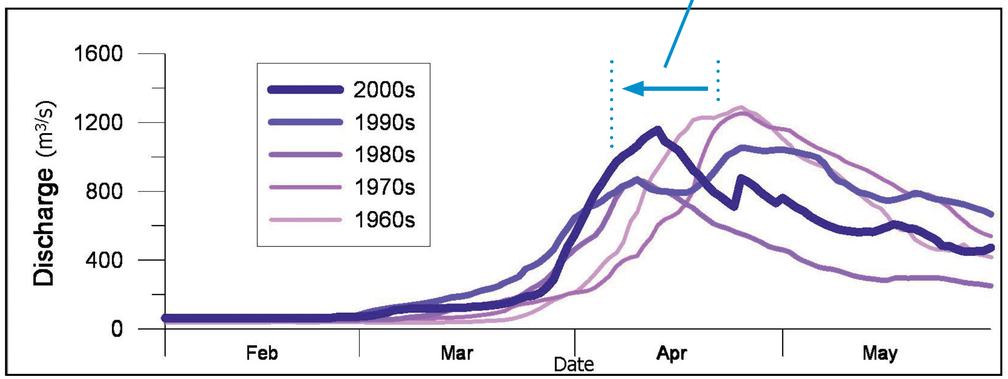
- River ice is breaking up earlier in the year (as evidenced by the earlier dates of initial floodway operation)
  - ice has less time to melt and deteriorate by warming temperatures
  - ice is thicker and stronger

- Flood waters are occurring earlier in the year
  - ice is stronger and more resistant to breakup
  - ice jams are more severe

Start Day of Floodway Operation



Average discharge in Red River at Lockport



m3/s = cubic metres per second

Manitoba

If you would like to comment on the rules of operation for the Red River Floodway please use one of our forms to provide written comments.

Thank You!
We welcome your **comments and suggestions**

Additional written comments will be accepted until September 1, 2010 at:

Manitoba Water Stewardship
Box 14, 200 Saulteaux Crescent
Winnipeg, MB R3J 3W3
ATTN: Floodway Rules of Operation Review
Email: ReviewFloodwayRules@gov.mb.ca

Manitoba