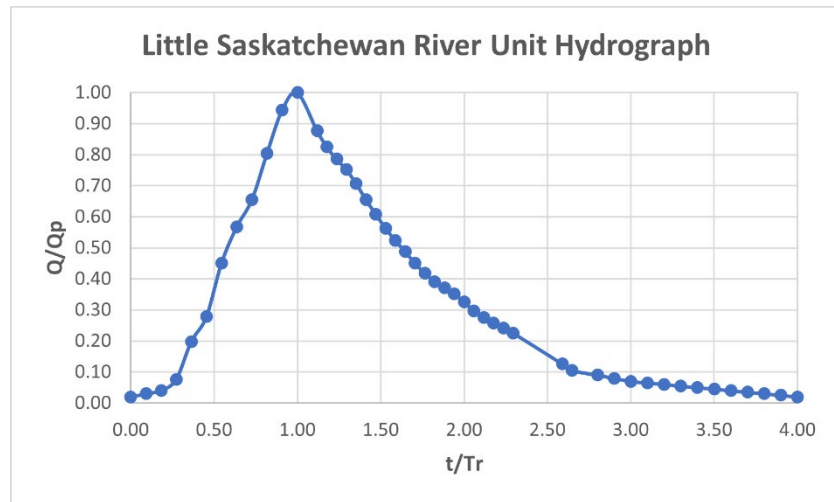
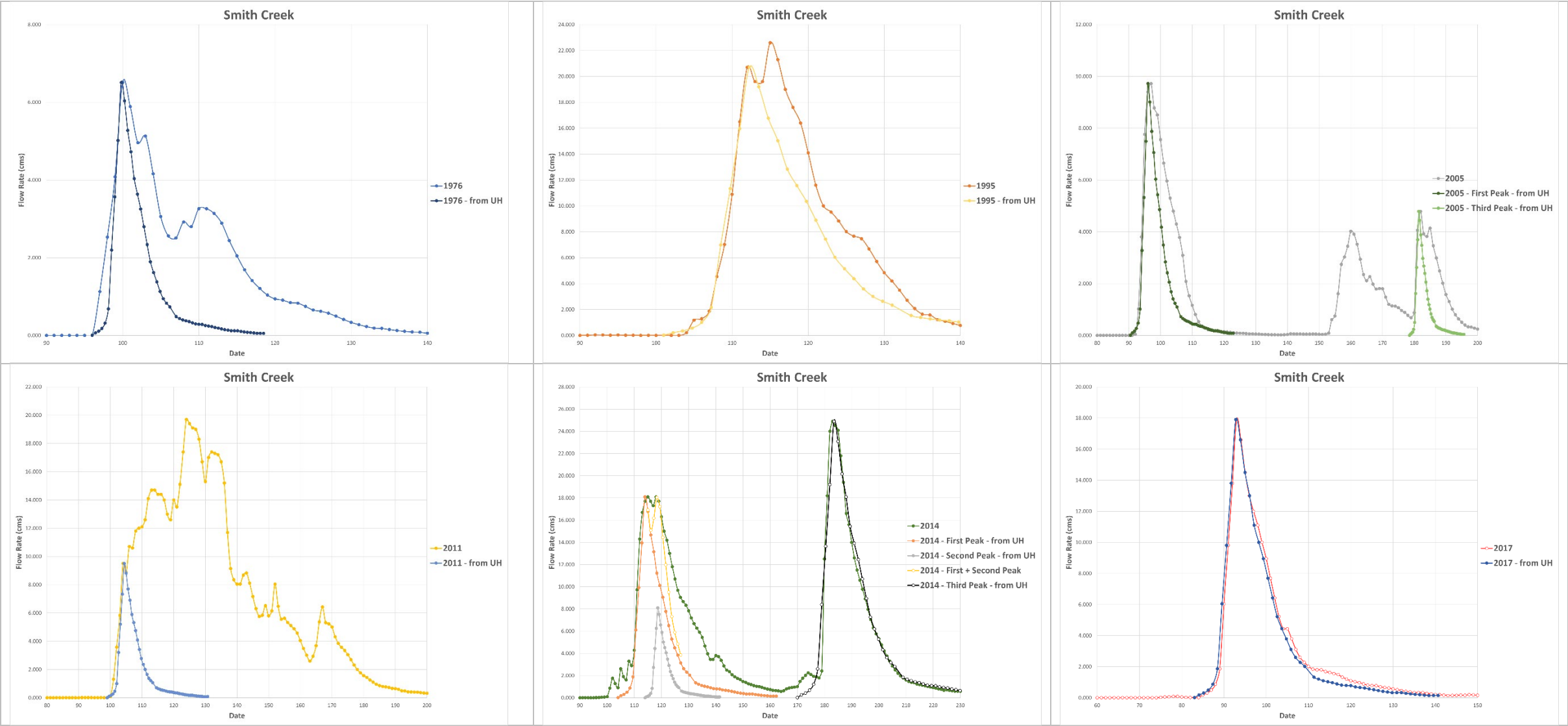


12. Little Saskatchewan River

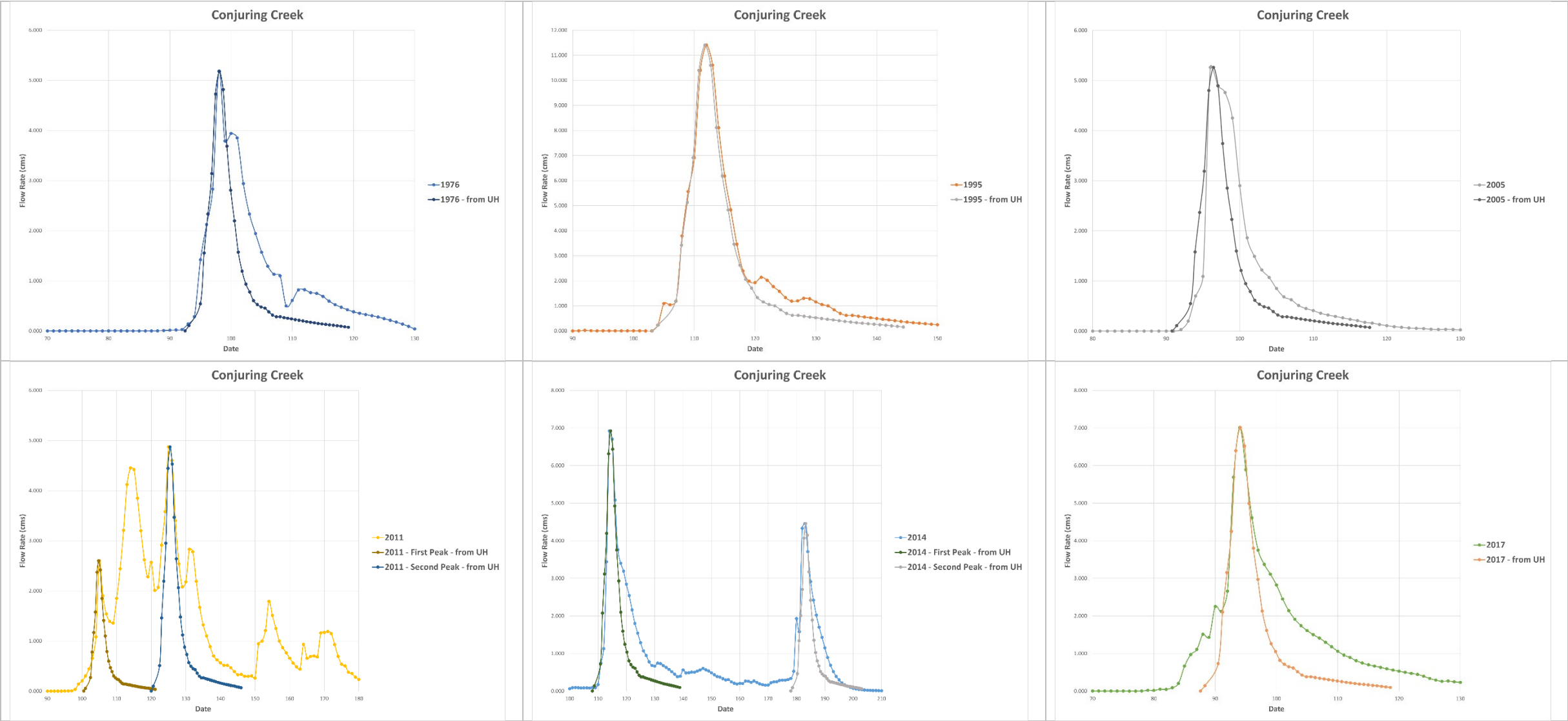


Calibration Results Comparing Recorded Hydrographs and Synthetic Hydrographs Generated from Unit Hydrographs (UH)

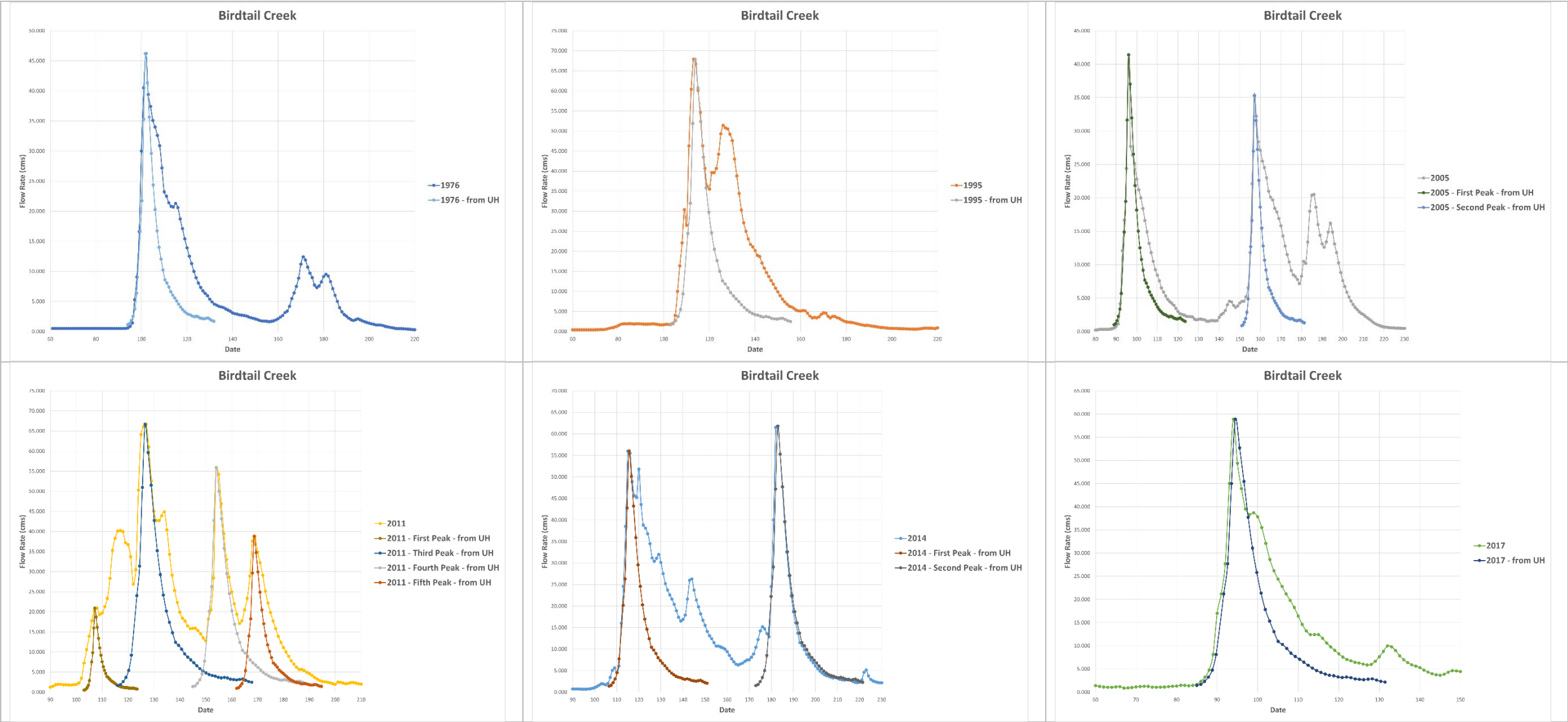
1. Smith Creek



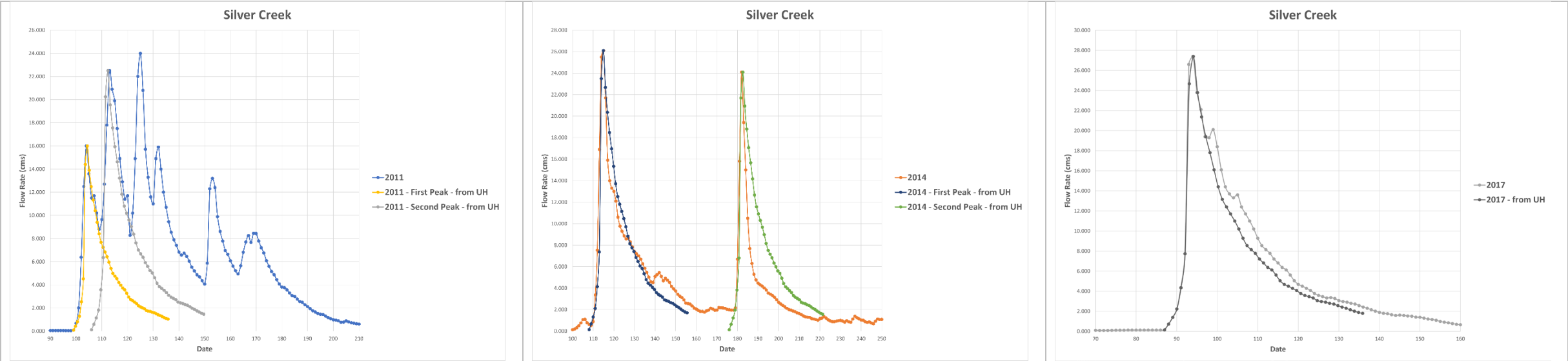
2. Conjuring Creek



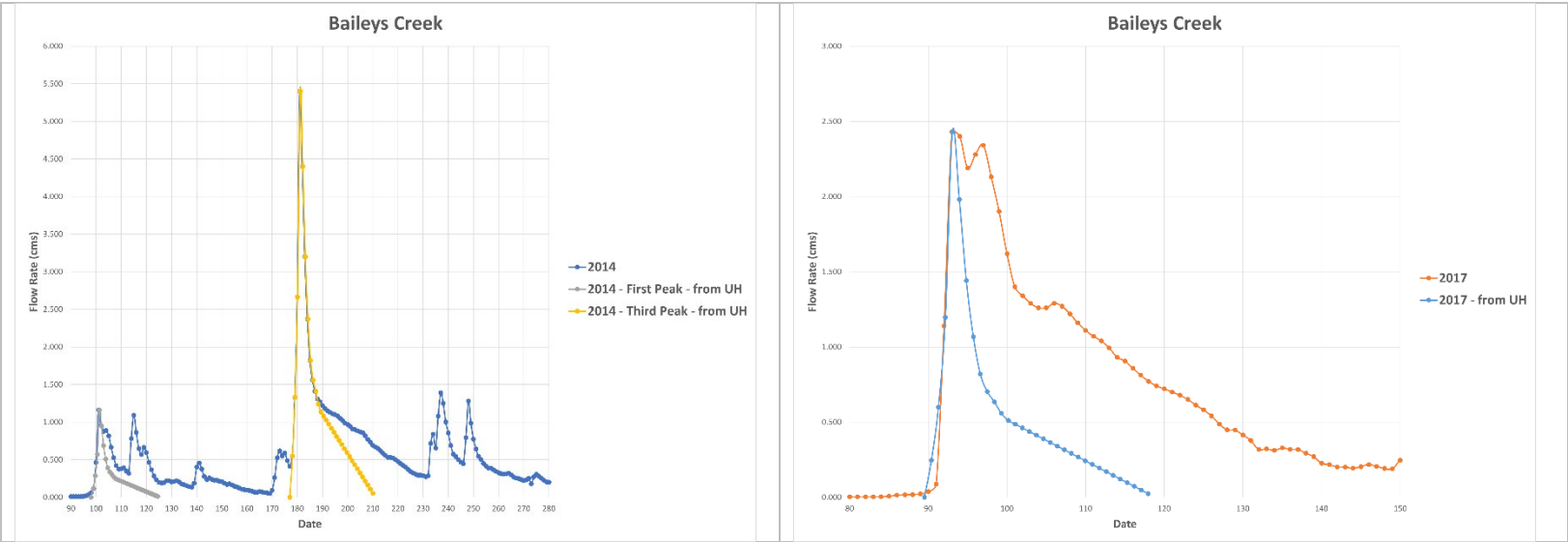
3. Birdtail Creek



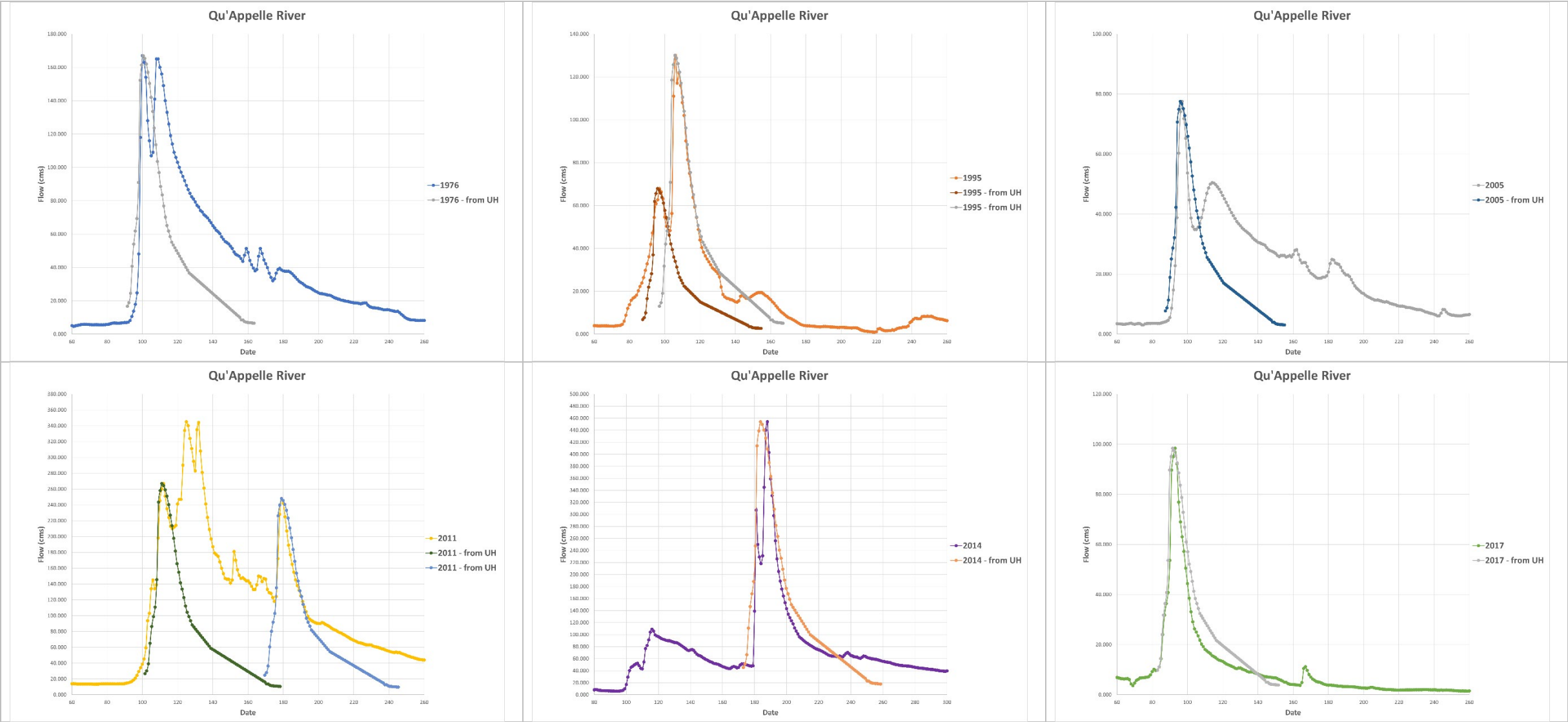
4. Silver Creek



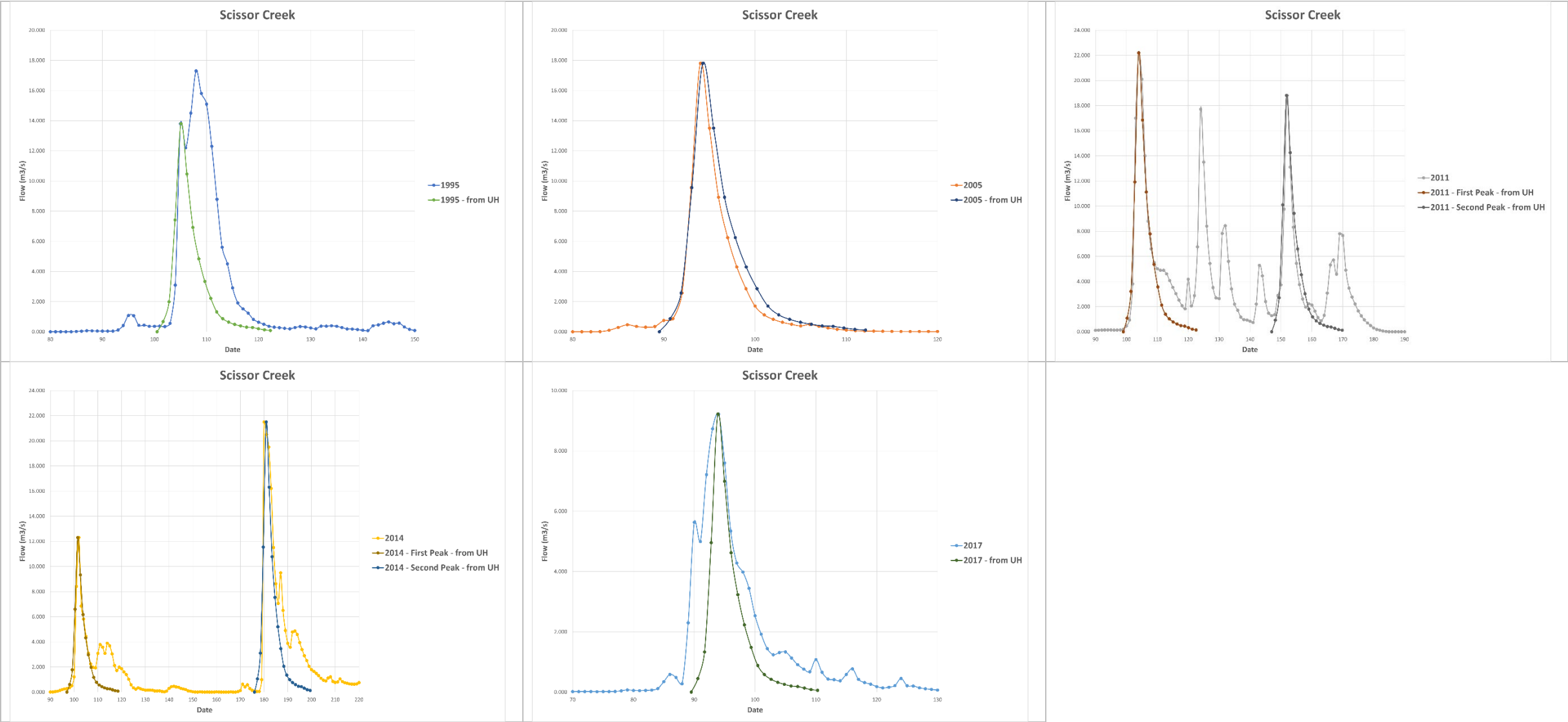
5. Baileys Creek



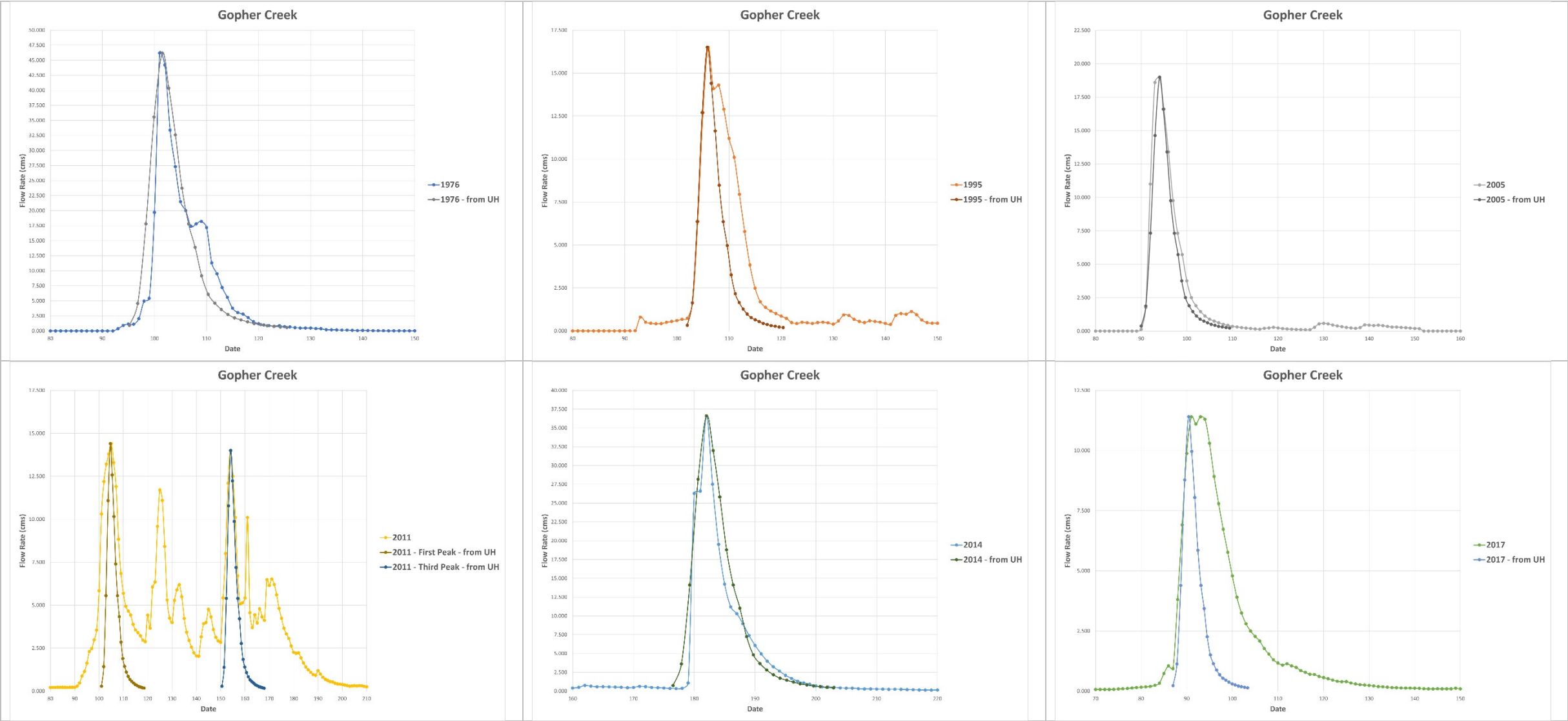
6. Qu’Appelle River



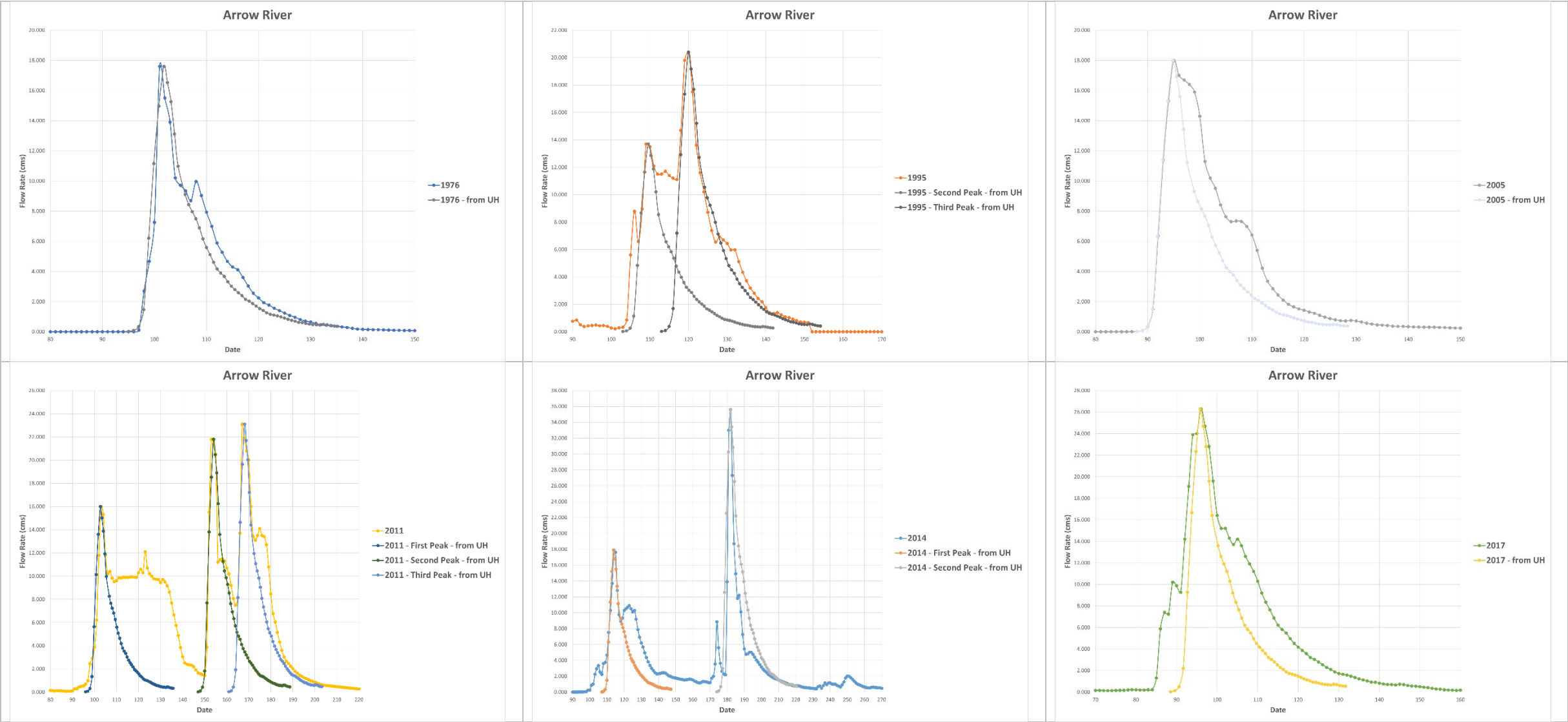
7. Scissor Creek



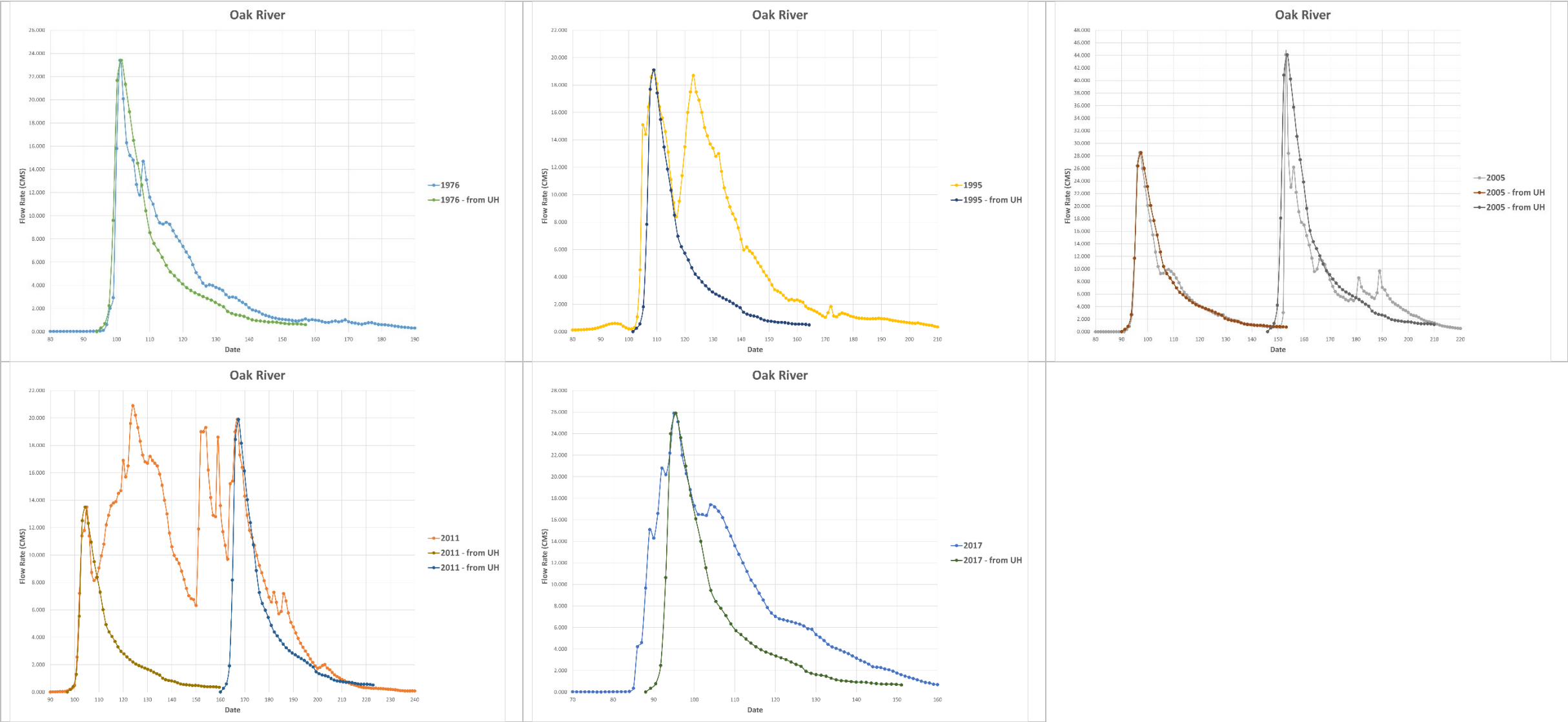
8. Gopher Creek



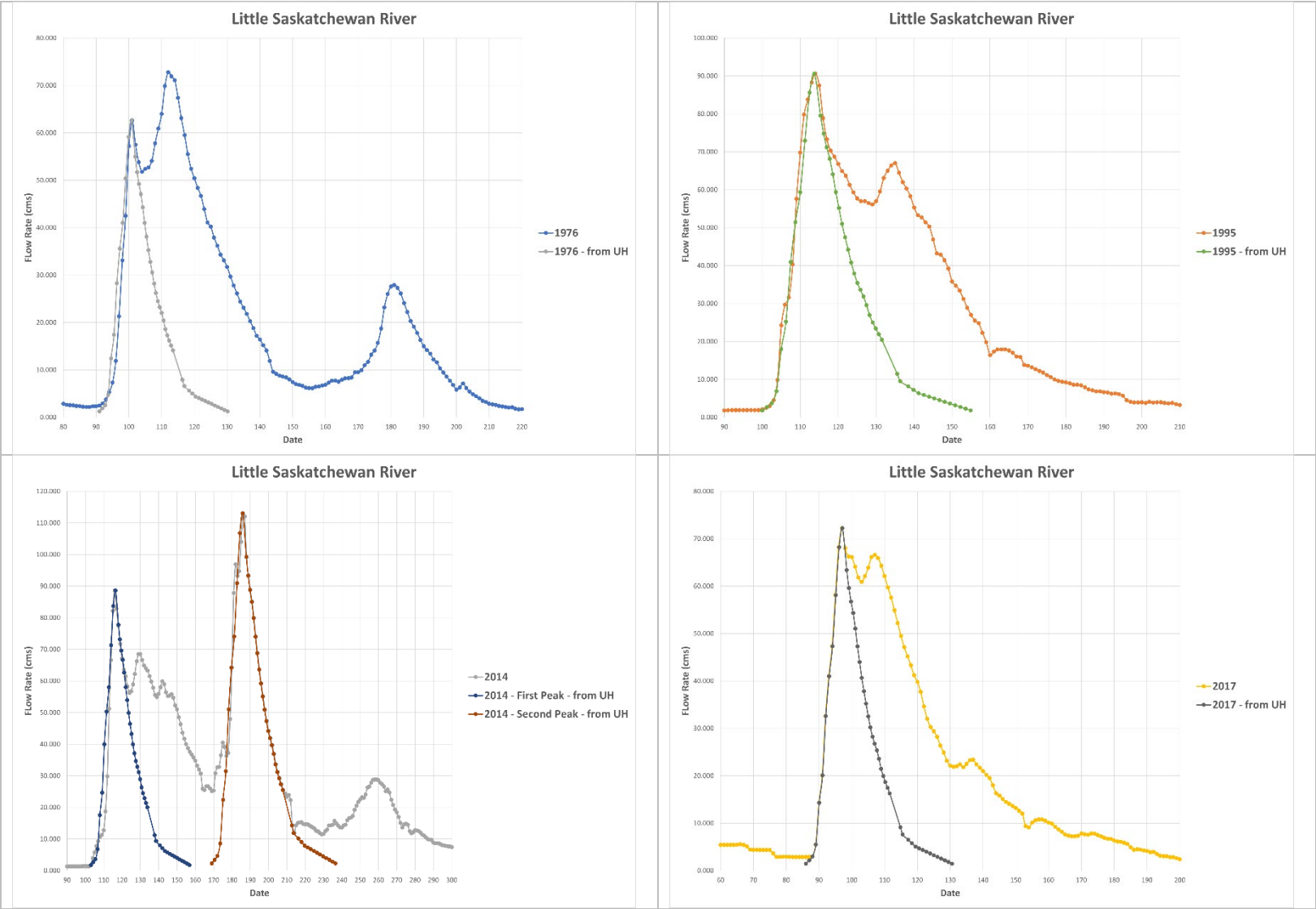
9. Arrow River



10. Oak River



11. Little Saskatchewan River



Appendix B – Peak Flow Relationships

A thick, dark green curved line that starts from the left edge of the page, dips slightly, and then rises steeply towards the top right corner, creating a modern, abstract design element.

Peak Flow Relationships

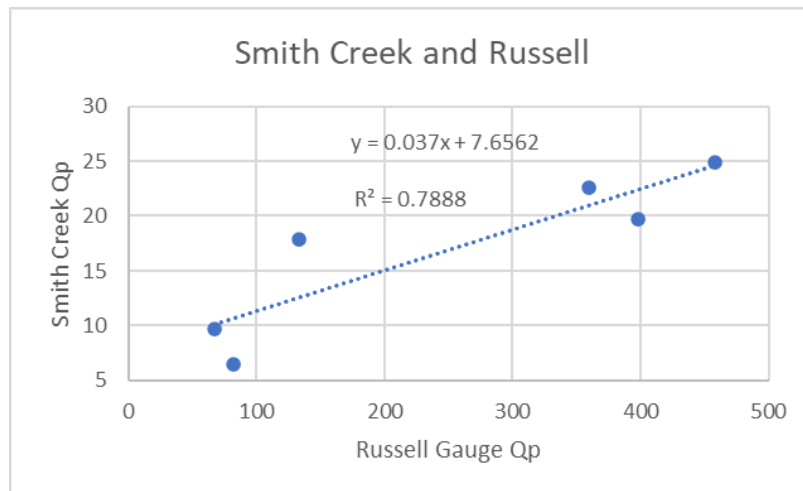
This appendix shows the peak flow (Qp) relationships between ten (10) catchments and their next downstream gauged communities (Russell, Miniota, or Brandon), as the peak flows for Shellmouth Reservoir and Qu'Appelle River have already been provided.

1. Smith Creek

Data from Calibration and verification events:

	1976	1995	2005	2011	2014	2017
Smith Creek Qp (m ³ /s)	6.51	22.6	9.72	19.7	24.9	17.9
Russell Gauge Qp (m ³ /s)	82.1	360	66.7	398	458	133

Flow relationship figure:



Flow relationship equation:

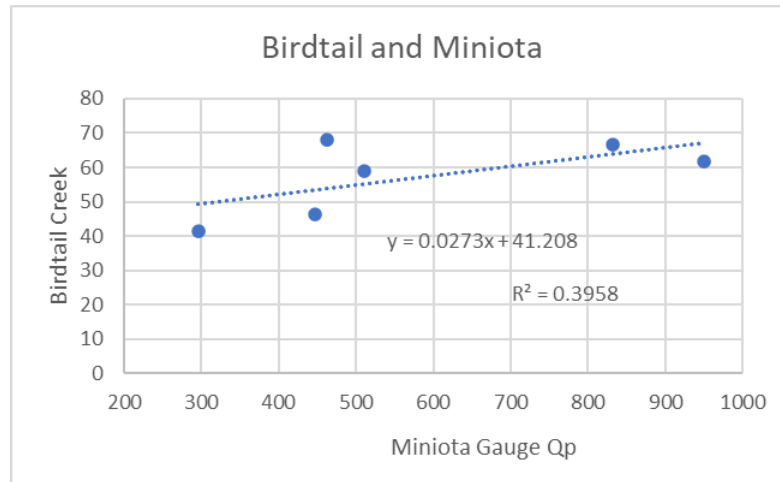
$$\text{Smith Creek Qp} = 0.037 \times \text{Russell Gauge Qp} + 7.6562$$

2. Birdtail Creek

Data from Calibration and verification events:

	1976	1995	2005	2011	2014	2017
Birdtail Creek Qp (m ³ /s)	46.2	67.9	41.4	66.7	61.8	58.9
Miniota Gauge Qp (m ³ /s)	447	463	296	832	950	510

Flow relationship figure:



Flow relationship equation:

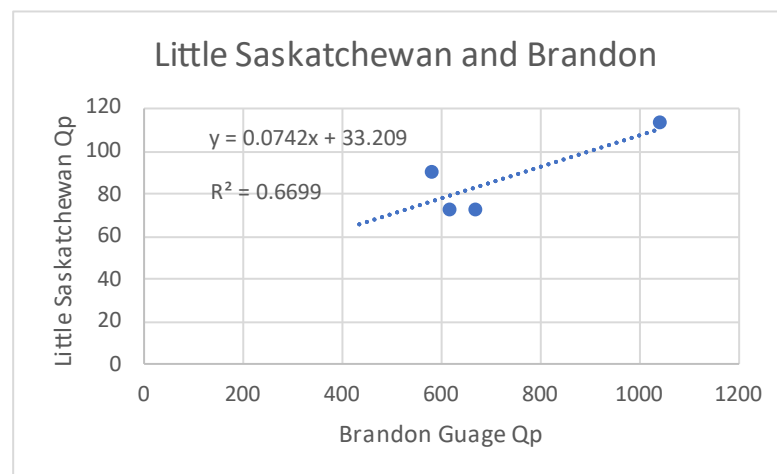
$$\text{Birdtail Creek Qp} = 0.0273 \times \text{Miniota Gauge Qp} + 41.208$$

3. Little Saskatchewan River

Data from Calibration and verification events:

	1976	1995	2005	2011	2014	2017
Little Saskatchewan River Qp (m ³ /s)	72.8	90.6	-	-	113	72.2
Brandon Gauge Qp (m ³ /s)	617	580	434	1040	1040	670

Flow relationship figure:



Flow relationship equation:

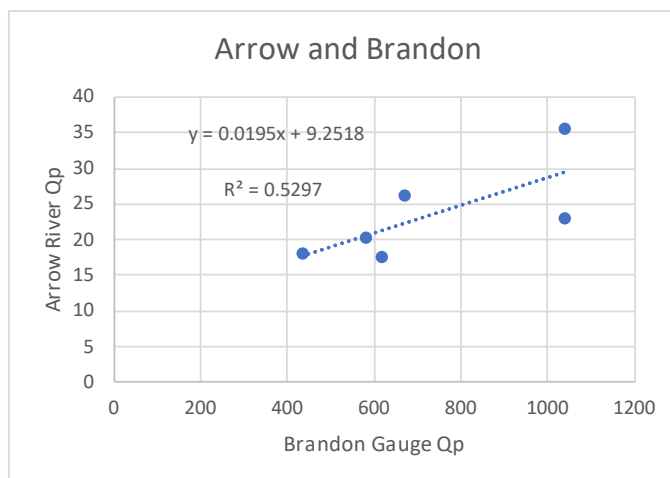
$$\text{Little Saskatchewan River } Q_p = 0.0742 \times \text{Brandon Gauge } Q_p + 33.209$$

4. Arrow River

Data from Calibration and verification events:

	1976	1995	2005	2011	2014	2017
Arrow Creek Q_p (m^3/s)	17.6	20.4	18	23.1	35.6	26.3
Brandon Gauge Q_p (m^3/s)	617	580	434	1040	1040	670

Flow relationship figure:



Flow relationship equation:

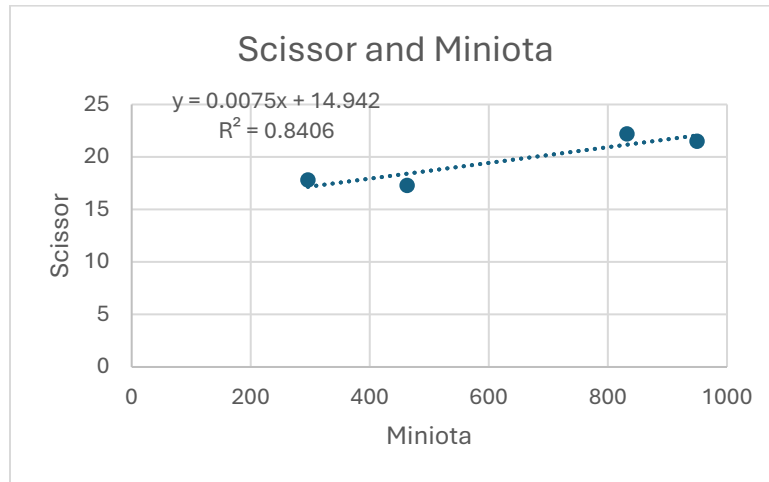
$$\text{Arrow River } Q_p = 0.0195 \times \text{Brandon Gauge } Q_p + 9.2518$$

5. Scissor Creek

Data from Calibration and verification events:

	1976	1995	2005	2011	2014	2017
Scissor Creek Q_p (m^3/s)	-	17.3	17.8	22.2	21.5	9.22
Miniota Gauge Q_p (m^3/s)	447	463	296	832	950	510

Flow relationship figure:



Flow relationship equation:

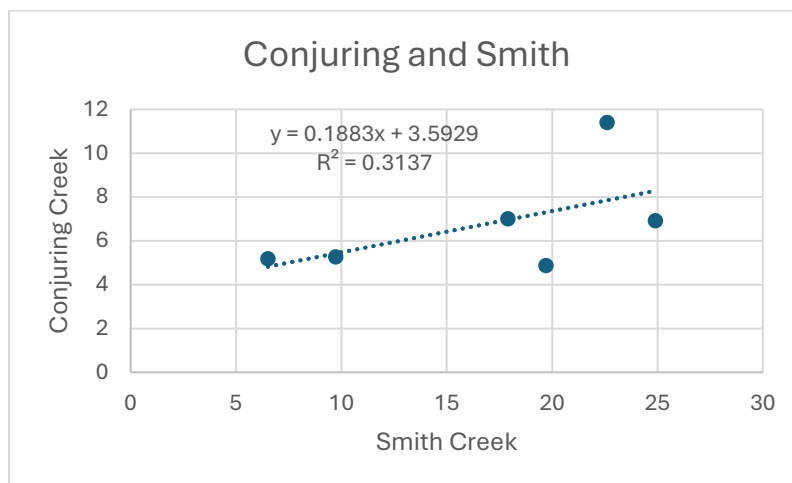
$$\text{Scissor Creek } Q_p = 0.0075 \times \text{Miniota Gauge } Q_p + 14.942$$

6. Conjuring Creek

Data from Calibration and verification events:

	1976	1995	2005	2011	2014	2017
Conjuring Creek Q_p (m^3/s)	5.18	11.4	5.26	4.87	6.92	7.01
Smith Creek Q_p (m^3/s)	6.51	22.6	9.72	19.7	24.9	17.9

Flow relationship figure:



Flow relationship equation:

$$\text{Conjuring Creek Qp} = 0.1883 \times \text{Smith Creek Qp} + 3.5929$$

7. Silver Creek

Data from Calibration and verification events:

	1976	1995	2005	2011	2014	2017
Silver Creek Qp (m ³ /s)	-	-	-	24	26.1	27.4
Miniota Gauge Qp (m ³ /s)	447	463	296	832	950	510
Silver Creek Qp/Miniota Gauge Qp (%)	-	-	-	2.88%	2.75%	5.37%

Since Silver Creek only has three years of data available, the average portion of Silver Creek Qp over Miniota Gauge Qp was used.

Flow relationship equation:

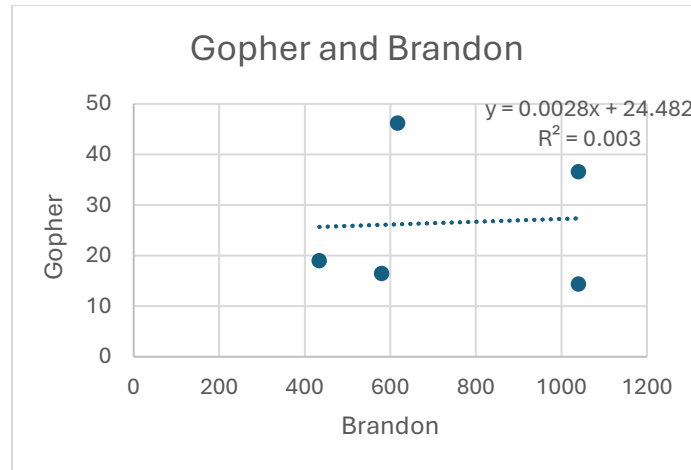
$$\text{Silver Creek Qp} = 3.67\% \times \text{Miniota Gauge Qp}$$

8. Gopher Creek

Data from Calibration and verification events:

	1976	1995	2005	2011	2014	2017
Gopher Creek Qp (m ³ /s)	46.2	16.5	19	14.4	36.6	11.4
Brandon Gauge Qp (m ³ /s)	617	580	434	1040	1040	670
Gopher Creek Qp/Brandon Gauge Qp (%)	7.49%	2.84%	4.38%	1.38%	3.52%	1.70%

Flow relationship figure:



Since the Gopher Creek Qp and Brandon Gauge Qp don't show too much relevance, the percentage of Gopher Creek Qp over Brandon Gauge Qp during the 2017 event was used.

Flow relationship equation:

$$\text{Gopher Creek Qp} = 1.7\% \times \text{Brandon Gauge Qp}$$

9. Baileys Creek

Data from Calibration and verification events:

	1976	1995	2005	2011	2014	2017
Baileys Creek Qp (m ³ /s)	-	-	-	-	5.4	2.43
Brandon Gauge Qp (m ³ /s)	617	580	434	1040	1040	670
Baileys Creek Qp/Brandon Gauge Qp (%)	-	-	-	-	0.52%	0.36%

Since Baileys Creek only has two available events data, the percentage of Baileys Creek Qp over Brandon Gauge Qp during the 2017 event was used.

Flow relationship equation:

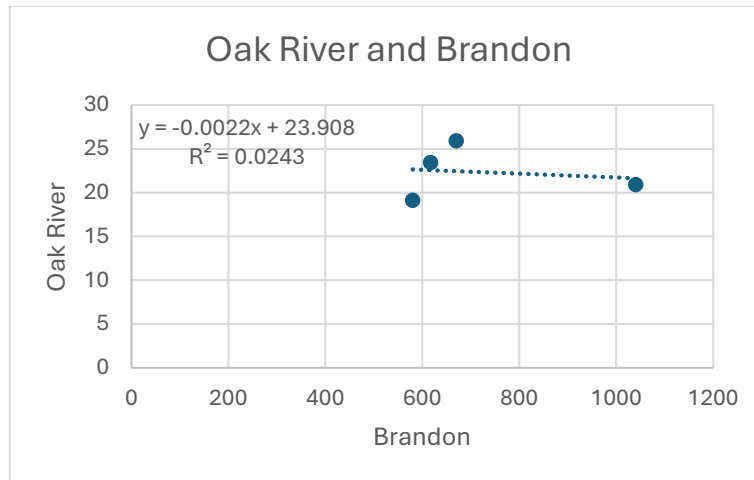
$$\text{Baileys Creek Qp} = 0.36\% \times \text{Brandon Gauge Qp}$$

10. Oak River

Data from Calibration and verification events:

	1976	1995	2005	2011	2014	2017
Oak River Qp (m ³ /s)	23.4	19.1	44.1	20.9	-	25.9
Brandon Gauge Qp (m ³ /s)	617	580	434	1040	1040	670

Flow relationship figure:



Flow relationship equation:

$$\text{Oak River Qp} = -0.0022 \times \text{Brandon Gauge Qp} + 23.908$$

Appendix C – Flowtime of Rise Relationships

Flow – Time of Rise Relationships

This appendix shows the peak flow (Qp) and time of rise (Tr) relationships for twelve (12) catchments.

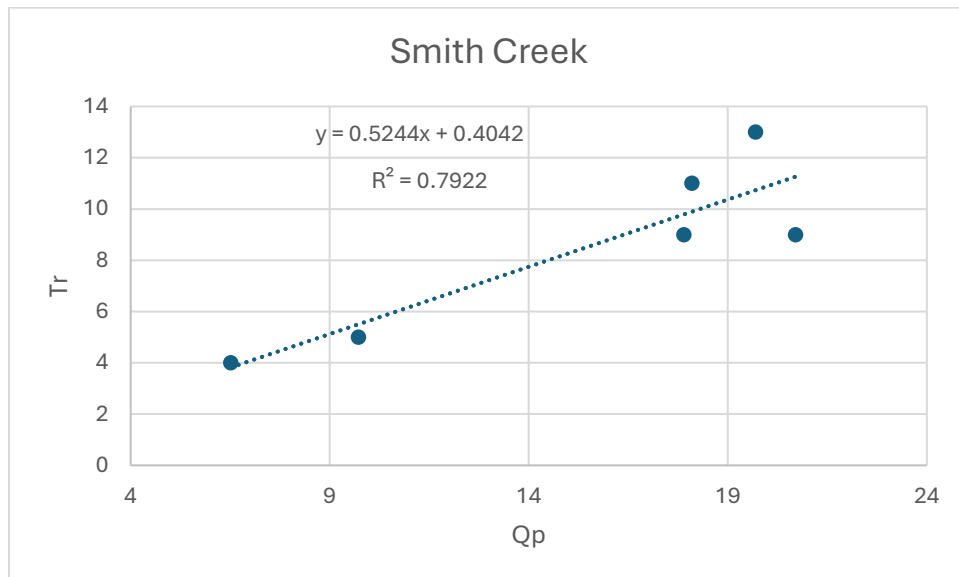
It is worth noting that the peak flows referenced in the calibration and verification events do not always correspond to the highest flows in the event years, as some of the events consist of multiple occurrences within a single year.

1. Smith Creek

Data from calibration and verification events:

	1976	1995	2005	2011	2014	2017
Qp (m ³ /s)	6.51	20.7	9.72	19.7	18.1	17.9
Tr (day)	4	9	5	13	11	9

Flow-time of rise relationship figure:



Flow-time of rise relationship equation:

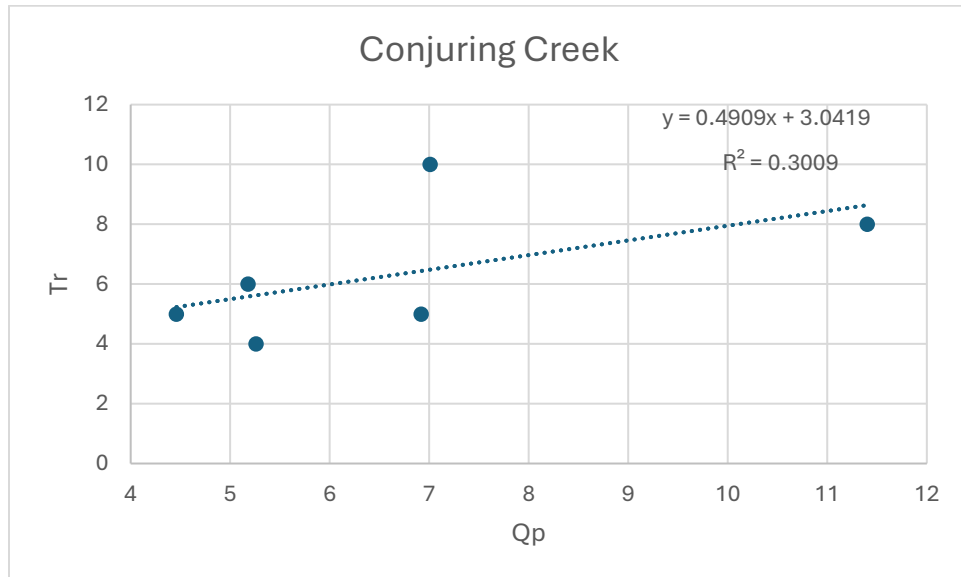
$$Tr = 0.5244 Qp + 0.4042$$

2. Conjuring Creek

Data from calibration and verification events:

	1976	1995	2005	2011	2014 May Event	2014 July Event	2017
Qp (m ³ /s)	5.18	11.4	5.26	2.6	6.92	4.46	7.01
Tr (day)	6	8	4	7	5	5	10

Flow-time of rise relationship figure:



*2011 data was excluded as an outlier.

Flow-time of rise relationship equation:

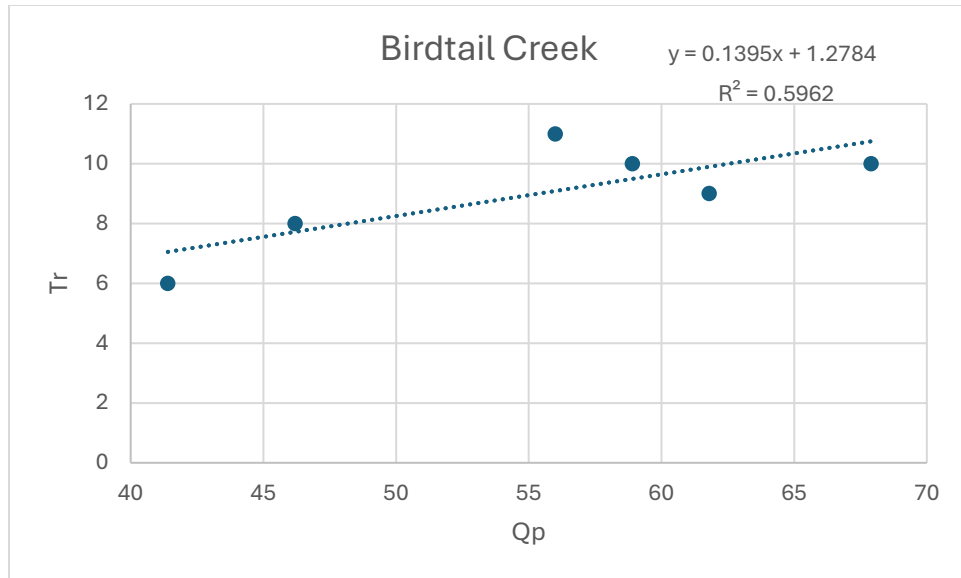
$$Tr = 0.4909 Qp + 0.3009$$

3. Birdtail Creek

Data from calibration and verification events:

	1976	1995	2005	2011	2014 May Event	2014 July Event	2017
Qp (m ³ /s)	46.2	67.9	41.4	66.7	56	61.8	58.9
Tr (day)	8	10	6	9	11	9	10

Flow-time of rise relationship figure:



*2011 data was excluded as an outlier.

Flow-time of rise relationship equation:

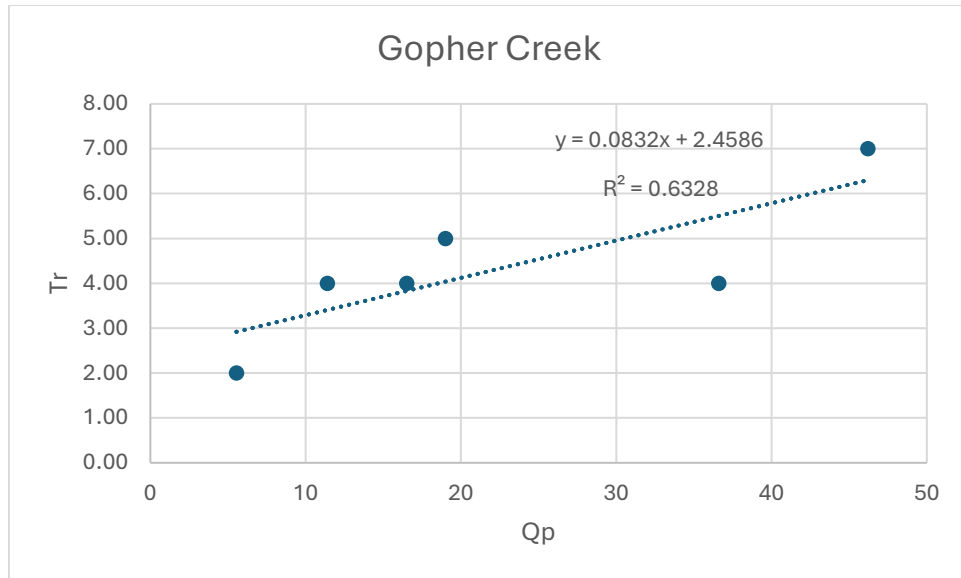
$$Tr = 0.1395 Q_p + 1.2784$$

4. Gopher Creek

Data from calibration and verification events:

	1976	1995	2005	2011	2014 May Event	2014 July Event	2017
Qp (m³/s)	46.2	16.5	19	14.4	5.54	36.6	11.4
Tr (day)	7	4	5	10	2	4	4

Flow-time of rise relationship figure:



*2011 data was excluded as an outlier.

Flow-time of rise relationship equation:

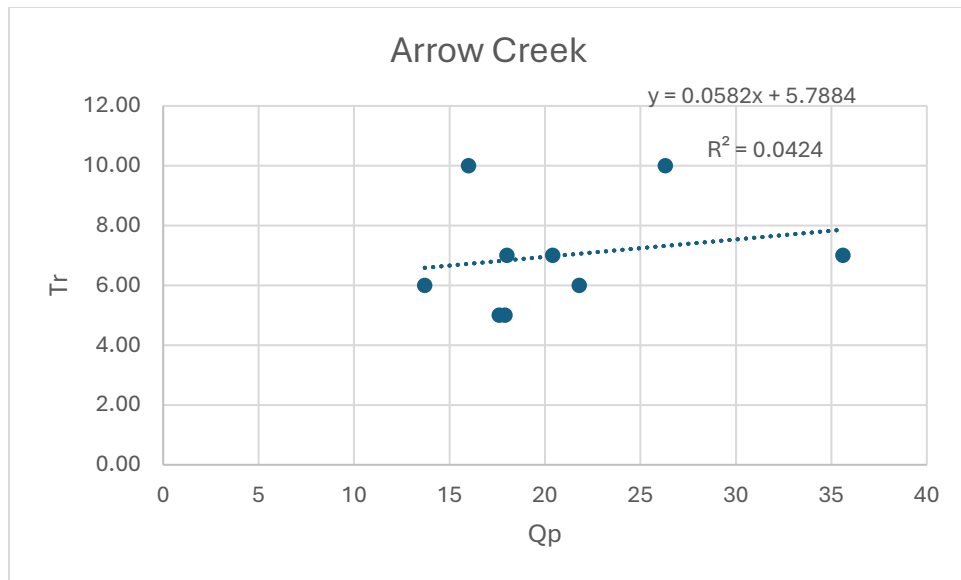
$$Tr = 0.0832 Q_p + 2.4586$$

5. Arrow River

Data from calibration and verification events:

	1976	1995	1995	2005	2011	2011	2014 May Event	2014 July Event	2017
Qp (m³/s)	17.6	13.7	20.4	18	21.8	16	17.9	35.6	26.3
Tr (day)	5	6	7	7	6	10	5	7	10

Flow-time of rise relationship figure:



Flow-time of rise relationship equation:

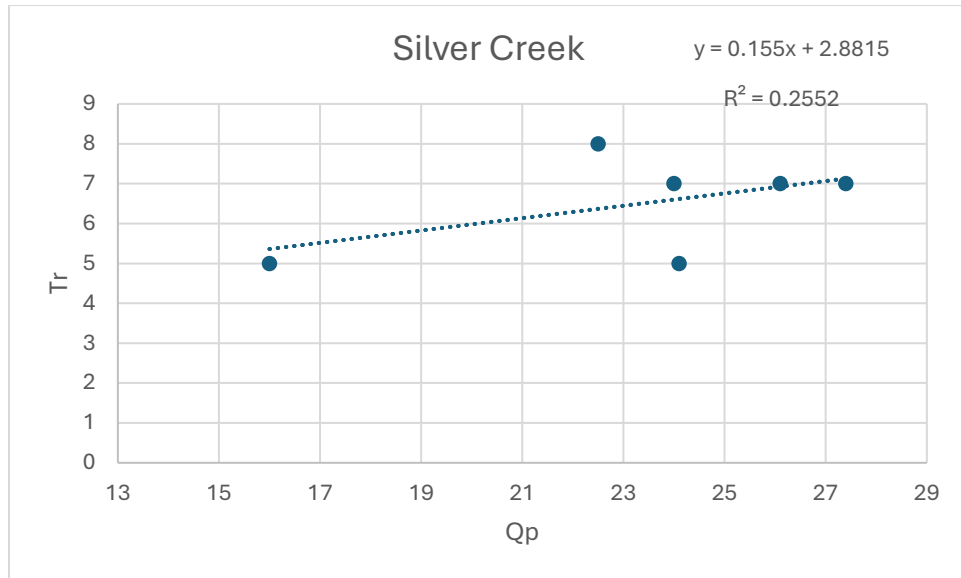
$$Tr = 0.0582 Q_p + 5.7884$$

6. Silver Creek

Data from calibration and verification events:

	2011	2011	2011	2014 May Event	2014 July Event	2017
Qp (m³/s)	16	22.5	24	26.1	24.1	27.4
Tr (day)	5	8	7	7	5	7

Flow-time of rise relationship figure:



Flow-time of rise relationship equation:

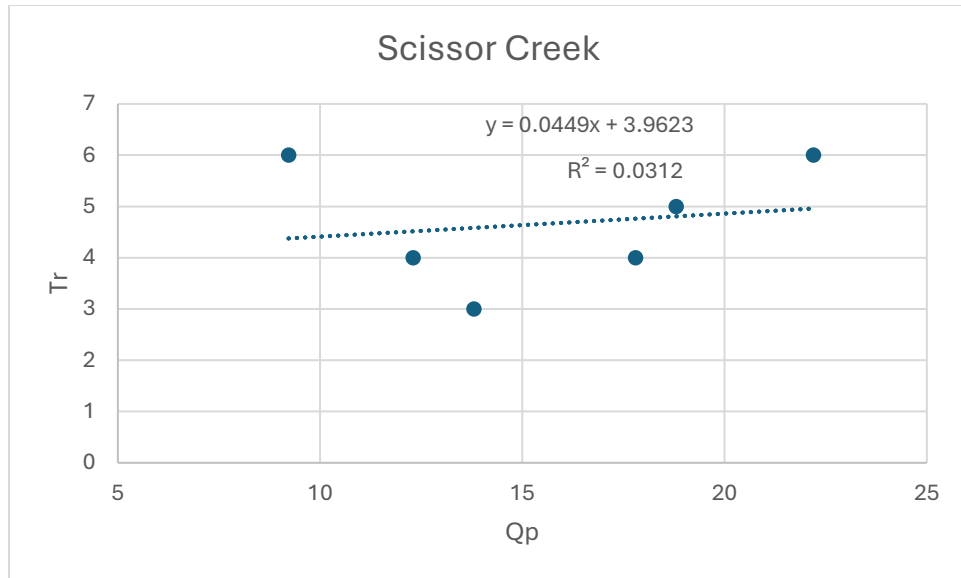
$$Tr = 0.155 Qp + 2.8815$$

7. Scissor Creek

Data from calibration and verification events:

	1995	2005	2011	2011	2014 May Event	2014 July Event	2017
Qp (m ³ /s)	13.8	17.8	22.2	18.8	12.3	21.5	9.22
Tr (day)	3	4	6	5	4	3	6

Flow-time of rise relationship figure:



Flow-time of rise relationship equation:

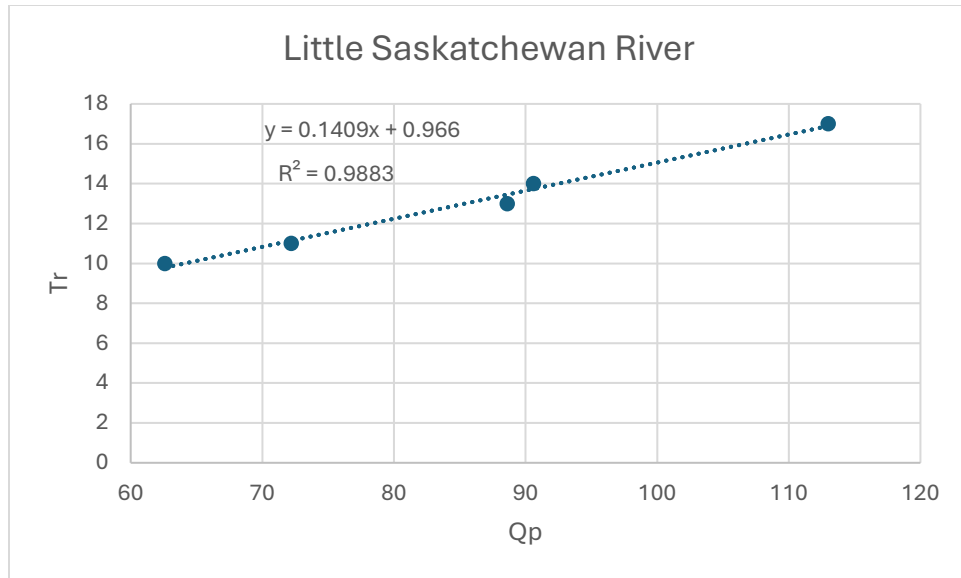
$$Tr = 0.0449 Qp + 3.9623$$

8. Little Saskatchewan River

Data from calibration and verification events:

	1976	1995	2014 May Event	2014 July Event	2017
Qp (m ³ /s)	62.6	90.6	88.6	113	72.2
Tr (day)	10	14	13	17	11

Flow-time of rise relationship figure:



Flow-time of rise relationship equation:

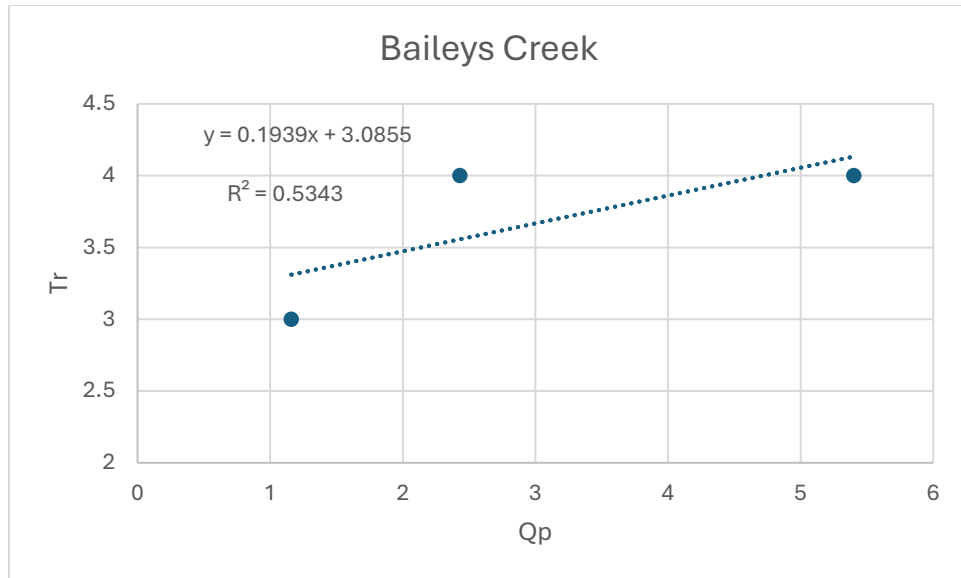
$$Tr = 0.1409 Q_p + 0.966$$

9. Baileys Creek

Data from calibration and verification events:

	2014 May Event	2014 July Event	2017
Qp (m³/s)	1.16	5.4	2.43
Tr (day)	3	4	4

Flow-time of rise relationship figure:



Flow-time of rise relationship equation:

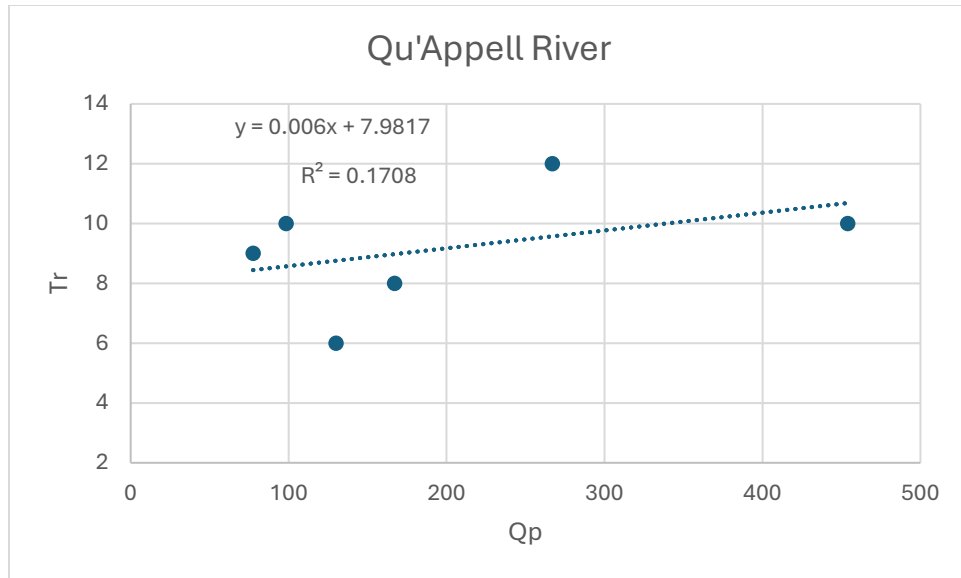
$$T_r = 0.1939 Q_p + 3.0855$$

10. Qu'Appelle River

Data from calibration and verification events:

	1976	1995	2005	2011	2014 July Event	2017
Q_p (m ³ /s)	167	130	77.5	267	454	98.4
T_r (day)	8	6	9	12	10	10

Flow-time of rise relationship figure:



Flow-time of rise relationship equation:

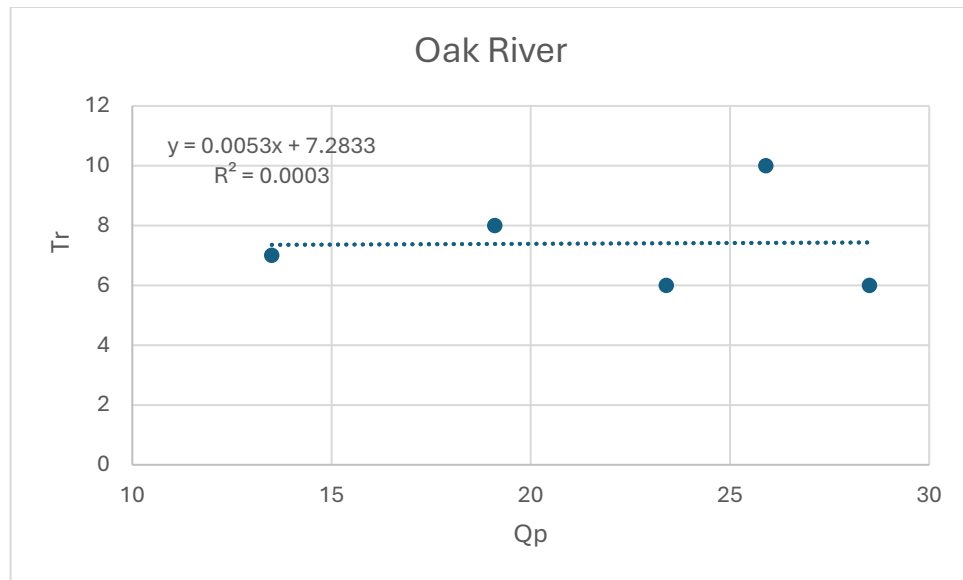
$$Tr = 0.006 Q_p + 7.9817$$

11. Oak River

Data from calibration and verification events:

	1976	1995	2005	2005	2011	2017
Q_p (m ³ /s)	23.4	19.1	28.5	44.1	13.5	25.9
T_r (day)	6	8	6	5	7	10

Flow-time of rise relationship figure:



Flow-time of rise relationship equation:

$$Tr = 0.0053 Qp + 7.2833$$

12. Shellmouth Reservoir

The Shellmouth Reservoir is a unique catchment regulated by operations during most events. Since the Shellmouth Reservoir's unit hydrograph is based on the 2014 event, the Tr/Qp rate of 0.0617 from the 2014 event is used as the flow-time of rise relationship for Shellmouth Reservoir.

Flow-time of rise relationship equation:

$$Tr = 0.0617 Qp$$

Appendix D – Assiniboine River Flood Hazard Map

A decorative graphic consisting of a thick, dark green curved line that starts from the left edge of the page, dips down, and then rises to curve upwards towards the right edge, creating a wave-like shape that separates the header area from the main content area.