

## **Appendix D**

### **River Stage Data for 1992**

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#### **D1 Description of 1992 Dataset**

This following write-up provides the metadata associated with a water level data collected on the Red River in the spring of 1992. This dataset represents a small spring flood (or typical summer rainfall flood) with water level data collected over a flow range of 20,000 to 40,000 cfs. Red River flows around 20,000 cfs cause the river walkways to flood and a flow around 40,000 cfs levels is just high enough at the Floodway Inlet to cause overflows naturally into the Floodway channel (i.e. without operating the Floodway gates).

What is unique about this dataset is that it covers a lower flow range in which extensive water level data has not been collected to date. For example, the 1966 flood where extensive water level data was collected, only covers a flow range of 36,000 to 88,000 cfs (Table 2.3). However as discussed in Section 2.4, the 1966 flow range was limited to 44,000 to 87,000 for model calibration purposes.

The water level data collected in the spring of 1992 was carried out by G. Mohr with the assistance of fellow water resource colleagues. At the time, Mohr was collecting the water level data in preparation of a Masters Thesis. While Mohr collected the majority of the data, City of Winnipeg (McPhillips Station) provided water level data for Chief Pequis Bridge, James Avenue and Bishop Grandin Bridge and the operators at St. Andrews Lock and Dam (SALD) provided water level data upstream and downstream of the structure. The water level data collected is shown in Table D1. The location of the gauges is shown in Figure 4-1 and Table B1.

A hydrograph of the 1992 dataset is shown in Figure D1 and illustrates water levels for James Avenue and SALD. As shown in the figure, the 1992 dataset covers water levels from the spring peak on April 6 and the recession limb of the hydrograph. As shown in Figure D1 water levels continued to steadily decline up until April 18 when a widespread rain of 25 mm occurred over the basin. At that point water levels stabilized around elevation 736 ft at James Avenue. On April 28, SALD operators began to install a portion of the moveable section of the structure (i.e. spans and frames) and water levels quickly rose 3.1 ft just upstream of the structure.

The moveable section of the dam is a Camere type structure consisting of rollup curtains and operates as an underflow system. The system is unique with only four others known to have been built with only the Lockport structure and another structure in Europe remaining. A description of the structure is found in Colp (1988), photos of the structure are shown in Appendix C10.

After the initial installation of spans and frames on April 28, water levels at SALD declined slightly over the next 2 weeks. On May 11 the “wood curtains” of the Camere section were lowered and water levels rose 2.8 ft in 1 day and continued to rise over the next 4 days until normal summer water levels were achieved on the Red River within the City of Winnipeg on May 15 (Figure D2). The water level profile for May 15 (Figure D2) also shows a very gradual rise in water levels going upstream from SALD. The relative straightness of the line verifies the accuracies of the individual staff gauges benchmarks.

During the collection of the 1992 water level data, the Manitoba Water Resources Branch carried out two meterings from the Chief Pequis Bridge: on April 13, 1992 (flow was metered at 26,700 cfs); and, on April 16, 1992 (flow was metered at 20,200 cfs). These meterings fall on the Province’s James Avenue rating curve (dated December 1986 by AAW). These meterings are also consistent with a rating curve for the SALD produced by T. Lamb McManus (1968, Plate 39) using the SALD u/s<sup>A</sup> gauge shown in Table D1. A comparison of the both the James Avenue and SALD rating curves show that the flow estimates for both curves are within +/- 500 cfs of each other, indicating that both curves give a reasonable estimate of flows for this reach of the Red River.

For model-testing (see Section 4.1) water levels from days that meterings occurred on the river were selected, that is April 13 and April 16. To determine a third date near the peak, an analysis was made of what was occurring on the Assiniboine River. At the peak on the Red River, the Assiniboine River was still under ice-induced backwater conditions. A metering by Water Survey of Canada at their Assiniboine River Headingley gauge on April 8 noted 0.85 m of ice-induced backwater condition at the site. Therefore the flow estimate made prior to the metering will have some uncertainty associated with them. Examination of water levels post April 8, indicate that on April 9 water levels dropped 0.65 m at Headingley which is typically indicative of ice moving out, however WSC in their published flows kept the backwater on until April 11. Our estimate of the applied backwater on April 9 and 10 was 1589 cfs (44 m<sup>3</sup>/s). Because of some of the

uncertainty with ice backwater conditions and desiring to have a water level stage near the peak April 10 was chosen as the third date for model calibration.

Table D2 shows the calculation of Assiniboine River contributions and flow splits on the Red River.

**Table D-1**

**Water Level Data for 1992 from St. Andrews Lock and Dam to South Perimeter Bridge<sup>1,2</sup>**

1992	Red River Flow Estimate (cfs)			St. Andrews Lock and Dam <sup>3</sup>			St. Andrews Church	Wayside Park	River-crest	North Perimeter Bridge	Pequis Bridge	James Avenue	Elm Park Bridge	Bishop Grandin Bridge	South Perimeter Bridge	James Avenue (JAD)	Notes	
	James Ave curve	SALD curve	meterings	d/s	u/s <sup>A</sup>	u/s <sup>B</sup>	gauge #6	gauge #5	gauge #4B									
						0.00	4	8	14.2	18.2	21.5	30.8	39.25	47.5	56.3			
						1.11	20	36	56.46			116	147			206.1	see Table B1	
27-Mar												733.8					6.2	
28-Mar												734.3					6.8	
29-Mar												735.4					7.9	
30-Mar												737.2					9.6	
31-Mar												739.4					11.8	
01-Apr												737.3		742.1			13.1	
02-Apr												737.9		742.4		743.5	14.8	
03-Apr												738.8		740.9		743.6	13.3	
04-Apr		36,000					725.90	728.7	732.7	737.4		739.3	741.1	742.2	743.6	746.0	13.5	
05-Apr		40,000					726.70	729.3	733.2	737.9		739.8	741.7	743.3	744.4	746.2	14.1	
06-Apr	42,000	42,500		724.0	726.60	727.20	730.5	734.6	739.4		741.0	743.2	744.6	745.7	748.0		15.6	
07-Apr	42,000	41,500		723.8	726.50	726.80	729.9	734.2	738.9		740.9	743.1	744.4	746.1	747.0		15.5	
08-Apr	42,000	41,500		723.4	726.50	726.90					740.8	743.0		746.0			15.4	
09-Apr	40,500	40,500		723.0	726.40	726.80					740.4	742.7		745.6			15.2	
10-Apr	38,500	38,500		722.8	726.20	726.44	729.6		739.2		740.1	742.1		744.8			14.5	
11-Apr	38,000	36,000				726.30	729.5	733.1	738.0	739.0	739.8	742.0		744.8			14.4	
12-Apr	32,000	31,500				725.80	728.5	732.0	736.7	737.6	738.6	740.3	741.4	743.5	744.2		12.7	
13-Apr	27,000	26,750	26,700	719.7	724.90	725.40	727.6	731.3	735.7	736.5	737.3	738.7	739.8	740.9	742.3		11.2	
14-Apr	24,500	23,500		718.5	724.50	724.70	726.7	730.0	734.6	735.3	736.4	737.8	738.3	740.1	740.5		10.2	
15-Apr	21,250	21,000		718.5	724.20	724.50	726.4	729.5	734.4	734.8	735.5	736.7	737.7	739.0	739.7		9.1	
16-Apr	20,000	19,500	20,200	718.5	724.00	724.34	726.0	729.1	733.8	734.4	735.1	736.3	737.1	738.1	739.0		8.7	
17-Apr	17,250	17,750				724.15	725.8	728.8	733.5	734.1	734.8	735.9	736.7	737.7	738.5		8.3	
18-Apr	18,000	17,500				724.08	725.7	728.6	733.3	733.8	734.5	735.6	736.4	737.3	738.1		8.0	
19-Apr	18,500	17,750				724.15	725.7	728.7	733.4	734.0	734.5	735.8	736.7	737.3	738.3		8.2	
20-Apr	20,500	20,200				724.34	726.1	729.2	733.9	734.6	735.1	736.5	737.2	738.1	739.3		8.9	
21-Apr	20,500	20,200		717.8	724.00	724.30	726.1	729.2	733.8	734.6	735.2	736.5	737.1	738.2	739.2		8.9	
22-Apr	19,500	20,200		717.5	723.95	724.30	726.0	729.0	733.7	734.3	734.9	736.1	736.9	737.9	738.9		8.6	
23-Apr	19,000	18,500		717.2	723.85	724.25	725.9	728.9	733.5	734.2	734.8	736.0	736.8	737.7	738.7		8.4	
24-Apr	19,000	18,500		717.0	723.85	724.25	725.9	728.9	733.5	734.2	734.9	736.0	736.8	737.7	738.7		8.4	
25-Apr	19,500	18,500				724.25	725.9	728.9	733.6	734.3	734.8	736.1	736.8	737.7	738.7		8.5	
26-Apr	19,000	18,500				724.25	725.8	728.9	733.5	734.2	734.8	736.0	736.8	737.9	738.8		8.4	
27-Apr						716.7	724.25	725.8	728.8	733.5	734.2	734.8	735.9	736.8	737.8	738.7		8.4
28-Apr						716.6	727.43	728.1	729.9	733.6	734.2	734.7	735.9	736.6	737.7	738.6		8.3
29-Apr						716.7	728.02	728.6	730.1	733.6	734.2	734.5	735.8	736.5	737.5	738.4		8.2
30-Apr						716.3						734.4	735.5	736.3	737.2	738.1		7.9
01-May						716.3						734.2	735.3	736.0	736.9	737.7		7.7
02-May							727.33	728.0	729.4	732.9	733.5	733.9	735.0	735.7	736.6	737.4		7.5
03-May							727.42	728.1	729.6	733.1	733.6	734.0	735.3	735.8	736.4	737.4		7.7
04-May						716.1	727.50	728.2	729.7	733.2	733.6	734.0	735.2	735.8	736.4	737.3		7.7
05-May						716.0	727.42	728.1	729.5	732.9	733.4	733.9	734.9	735.5	736.2	736.9		7.4
06-May						715.6	727.10	727.8	729.2	732.7		733.7	734.6	735.2	736.0	736.7		7.0
07-May						715.9	727.03	727.5	728.9		732.9	733.3	734.3	734.9	735.6	736.3		6.7
08-May							726.74	727.1	728.6	732.2	732.6	733.2	734.1	734.7	735.4	735.9		6.5
09-May							726.64	726.9	728.4	732.0	732.4	732.9	733.7	734.3	735.0	735.6		6.1
10-May							726.44	726.7	728.2	731.9	732.3	732.6	733.5	734.1	734.6	735.3		5.9
11-May						715.0	729.17	729.3	729.7	732.0	732.3	732.5	733.4	733.9	734.2	735.0		5.8
12-May						714.8	729.95	730.0	730.5	732.3	732.5	732.5	733.5	734.0	734.2	734.9		5.9
13-May						715.3	731.07	731.0	731.3	732.6	732.6	733.0	733.6	734.0	734.2	734.8		6.0
14-May						714.2	731.73	731.7	732.0	732.8	732.9	733.3	733.7	734.2	734.5	734.8		6.2
15-May							732.05	732.1	732.3	733.0	733.0	733.4	733.8	734.2	734.5	734.8		6.2
12-May-86		44,200				726.70	730.0	734.3		740.6		743.8			748.2		16.2	

Notes: 1 - water level data in feet (GSC 1929 adjustment)  
 2 - majority of water collected by G. E. Mohr. SALD (d/s and u/s<sup>A</sup>) data provided by SALD operators. Chief Pequis, James Ave and Bishop Grandin data provided by City of Winnipeg.  
 3 - u/s<sup>A</sup> right at Lockport dam, u/s<sup>B</sup> gauge slightly upstream and reads +0.4 ft higher,  
 4 - SALD flow estimates based on u/s<sup>A</sup> gauge, when u/s<sup>A</sup> not available flow estimates based on 0.4 ft adjustment to u/s<sup>B</sup> data.  
 file: RED\_92S\_ver2.xls

**Table D2**  
**Flow Split Estimation**

Date	Red River (cfs)		Assiniboine River (cfs)				
	d/s of Forks <sup>1</sup>	u/s of Forks <sup>2</sup>	Head-ingley	Sturgeon Cr	Omands Cr	Estimated Local	Total
9-Apr-92			6215	498	49	49	6811
10-Apr-92	38,500	31,551	6815	204	34	34	7087
	w/o corr.	33,176				Avg.	<b>6949</b>

12-Apr-92			3287	53	20	20	3380
13-Apr-92	26,750	23,396	3227	62	19	19	3328
						Avg.	<b>3354</b>

15-Apr-92			3354	124	12	12	3503
16-Apr-92	19,500	15,938	3425	174	10	10	3620
						Avg.	<b>3562</b>

Assiniboine River (m <sup>3</sup> /s) <sup>3</sup>			
Head-ingley <sup>4</sup>	Sturgeon Cr	Omands Cr	Total
176.0	14.1	1.4	191.5
193.0	5.8	1.0	199.7

93.1	1.5	0.6	95.2
91.4	1.8	0.5	93.7

95.0	3.52	0.3	98.9
97.0	4.94	0.3	102.2

## Notes:

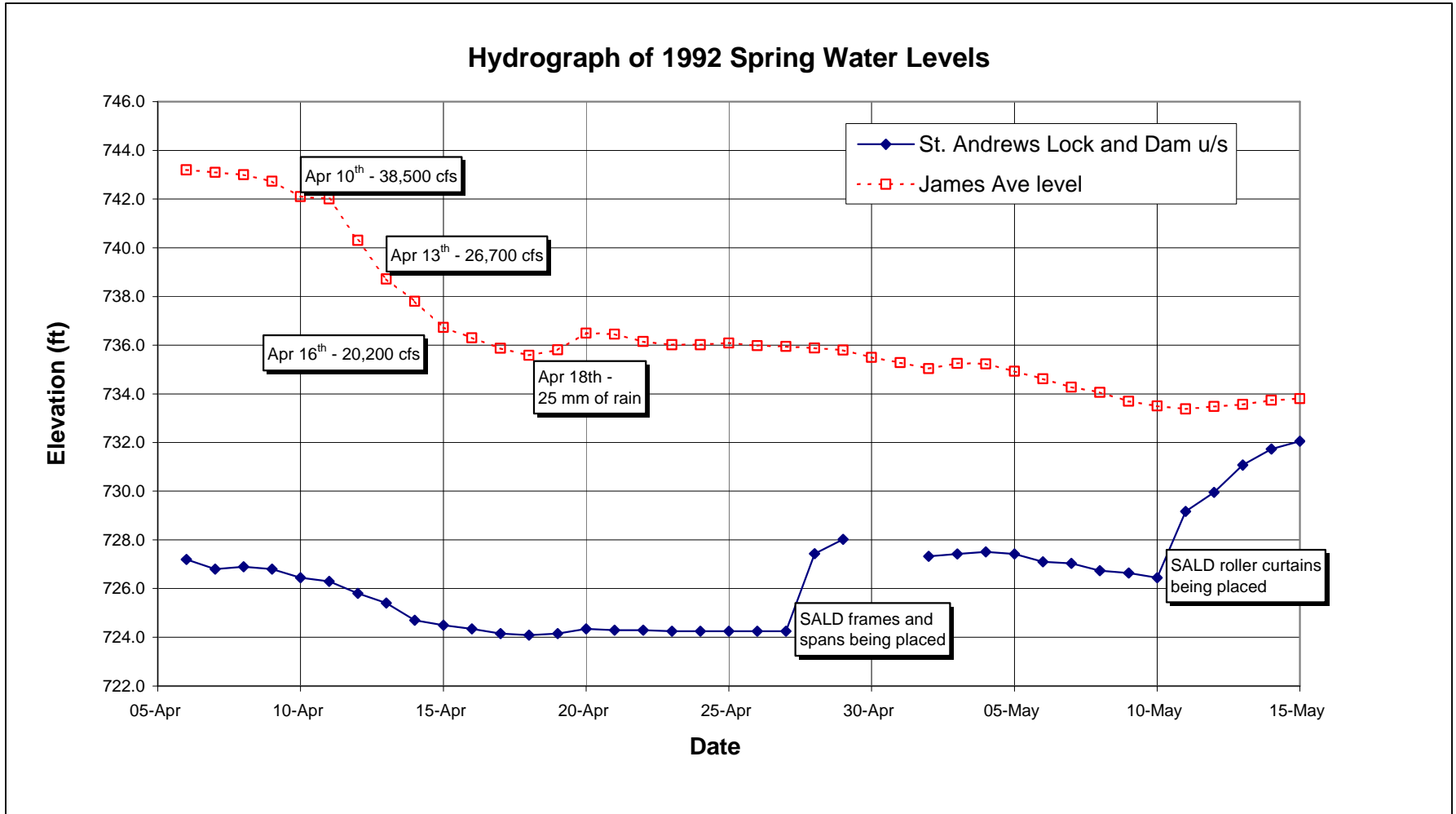
1 - data from Table D1 - James Ave column

2 - flow based on averaging Assiniboine flow on previous day and current day

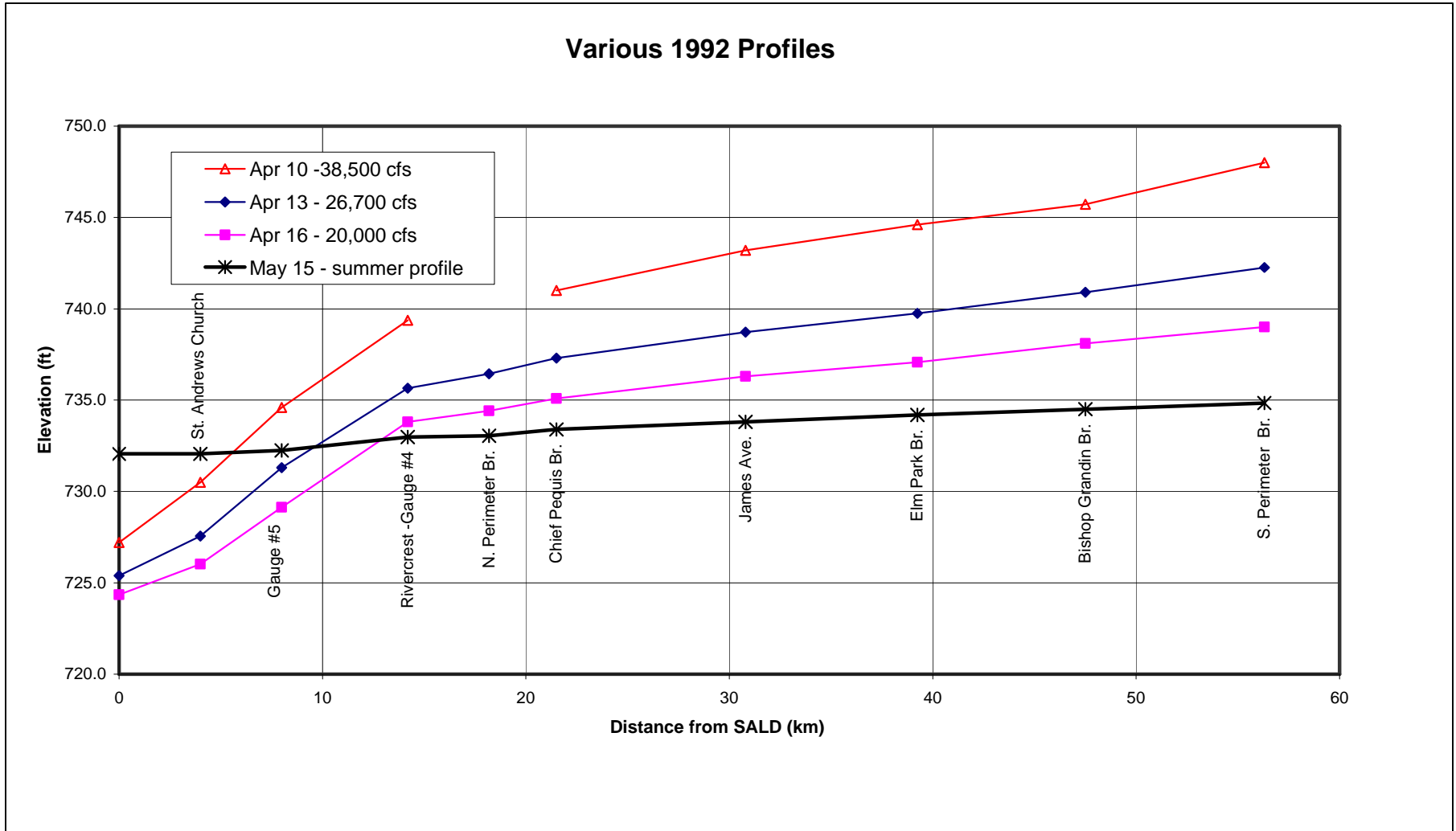
3 - published Water Survey of Canada data

4 - On April 8th, flows metered at Headingley, 0.850 m backwater due to ice, on 9th stages drop 0.65 m. WSC keeps backwater on till April 11th. If backwater off on April 9th, the Headingley flows would be 46 m<sup>3</sup>/s higher than published values. Headingley flows adjusted upwards by 46 m<sup>3</sup>/s on April 9th and 10th.

file: Red\_92S\_ver2.xls



**Figure D1**  
**1992 Spring Water Level Hydrographs**



**Figure D2**  
**Various Water Level Profiles for 1992**