Cooksville Creek - August 2009 Flooding

Introduction

Significant flood damages occurred within the Cooksville Creek watershed during the month of August 2009. Flood damages occurred to basements (Figure 1), to municipal infrastructure (Figure 2), to fences and pedestrian bridges (Figure 3), to front and rear yards (Figure 4), to trails, and to channel protection measures.

Significant rainfall occurred during the month of August 2009. The Meteorological Services of Canada (MSC) rainfall gauge located at Pearson International Airport recorded approximately 144 mm of rainfall. The average August rainfall (1971 to 2000) for the Pearson gauge is approximately 79.6 mm. Table 1 shows the daily rainfall recorded at Pearson International Airport.

On August 4, 2009 a localized high intensity storm occurred over the Cooksville Creek watershed. Approximately 67.6 mm of rainfall was recorded in one hour at the City of Mississauga's rainfall gauge (Station 6) located at the Mississauga Valley Community Centre.

The highest streamflow rate ever recorded by the Water Survey of Canada (WSC) Cooksville Creek Near Cooksville Gauge (02HB030) occurred on August 4, 2009. The gauge is located at Central Parkway East. The gauge has been in operation for approximately two (2) years.

This Report focuses on flooding along Cooksville Creek and will document recorded rainfall, recorded water levels, estimated streamflow rates, and estimated floodlines.

Flood Damages

The storm of August 4, 2009 generated a large number of inquiries, service requests and claims to the City of Mississauga, and the Regional Municipality of Peel as a result of flooding. Flood damages included the following :

- Water damage to basements;
- Trail damage at Richard Jones Park;
- Overturned fences;
- Fallen trees;
- Deposition of debris, and eroded bed and bank material;
- Dislodged bank protection material; and
- Erosion and deposition of material when King Street and Paisley Boulevard were overtopped by Cooksville Creek flood waters.

The majority of claims to the City and the Region resulted from water damage to basements as a result of storm and sanitary sewer surcharging.

Estimated floodlines along Cooksville Creek are shown on Figures 5 through 9. The floodlines are based on extrapolated flow rates, past hydraulic modelling, and observed water levels.

Rainfall

The Corporation of the City of Mississauga operates ten (10) rainfall gauges as shown on Figure 10. Meteorological Services of Canada operates three (3) gauges in the City of Mississauga. Rainfall recorded at the MSC gauges was not available at the time of writing of this Report.

The August 4th, 2009 storm was approximately 60 minutes in duration. The greatest 60 minute rainfall contours are shown on Figure 10.

The recorded rainfall distributions are shown in Table 2. The greatest 60 minute rainfall (67.6 mm) was recorded at the Station 6 gauge that is located roughly at the centre of the Cooksville Creek watershed. The rainfall mass curves developed from the rainfall distributions are shown on Figure 11.

The temporal rainfall distribution recorded at Station 6 during the storm is shown on Figure 12. The rainfall intensity duration values are shown on Figure 13. Rainfall intensities exceeded the 100 year values for durations between 30 and 100 minutes.

The August 4th, 2009 storm is shown on Figure 14 with the 12 hour Regional Storm. The Regional Storm is used to derive the Regulatory Floodlines along Cooksville Creek. The August 4th, 2009 storm has approximately 1/3 the volume of the Regional Storm. On Figure 15 the August 4 storm is shown alongside the 100 year design storm.

Recorded Streamflow

WSC measures Cooksville Creek water levels at the upstream face of the Central Parkway East crossing (WSC gauge number 02HB030). Water levels recorded during August 2009 are shown on Figure 16.

Water levels are converted to flow rates using a rating table that is created from measured streamflow rates. The rating table for the Cooksville Creek gauge (Table 3 and Figure 17) was developed from streamflow measurements over a two (2) year period. The rating table is only partially complete. Approximately 11 measurements (Table 4) were made to develop the rating table. The minimum measured streamflow rate was 0.046 m^3/s at a gauge height of 1.974 m. A gauge height of 1.8 m corresponds to the invert of the Creek and a streamflow rate of 0.0 m^3/s. The maximum measured streamflow rate was 11.4 m^3/s at a gauge height of 2.791 m.

The maximum flow rate from the rating table is 32.4 m^3/s at a gauge height of 3.3 m. The maximum height of the gauge recorded on August 4 was 4.56 m. Given the streamflow measurements were made at gauge heights much less than the maximum recorded height on August 4, the streamflow rates derived for the August 4th, 2009 storm (Figure 18) should be viewed with caution. The recorded water levels on August 4 are shown in Table 5.

The volume of runoff from the August 4th storm is approximately 571,500 m^3 from the upstream drainage area of 20.6 km^2. The average August 4th rainfall over the upstream drainage area is approximately 45.6 mm. The resultant runoff coefficient is approximately 0.61.

Figure 1 **Basement Flood Damages**

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Figure 2 **Municipal Infrastructure Damages - Dislodged Sanitary Sewer Cap**

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Figure 3 **Fence and Pedestrian Bridge Destruction**

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Figure 4 **Front and Rear Yard Flooding**

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Table 1 **August 2009 Rainfall - Toronto Pearson International Airport**

August 2009	Daily Rainfall mm	August 2009	Daily Rainfall mm
1	--	26	2.8
2	T	27	--
3	T	28	10.8
4	18.0	29	11.4
5	--	30	T
6	--	31	--
7	--		
8	2.2	Total, mm	144.0
9	40.0		
10	1.2	T = Trace	
11	28.0		
12	2.6		
13	--		
14	--		
15	--		
16	--		
17	--		
18	0.4		
19	--		
20	25.2		
21	0.2		
22	1.2		
23	--		
24	--		
25	--		

Table 1 **August 2009 Rainfall - Toronto Pearson International Airport** … continued

	1970 to 2001	August 2009
Average August Rainfall =	79.6 mm	144.0 mm
Maximum Daily Rainfall =	80.8 mm	40.0 mm
Days with Rainfall :		
> 0.2 mm	11	13
> 5 mm	4	6
> 10 mm	2	6
> 25 mm	1	3

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Figure 5 **Estimated Floodlines Along Cooksville Creek - August 4, 2009**

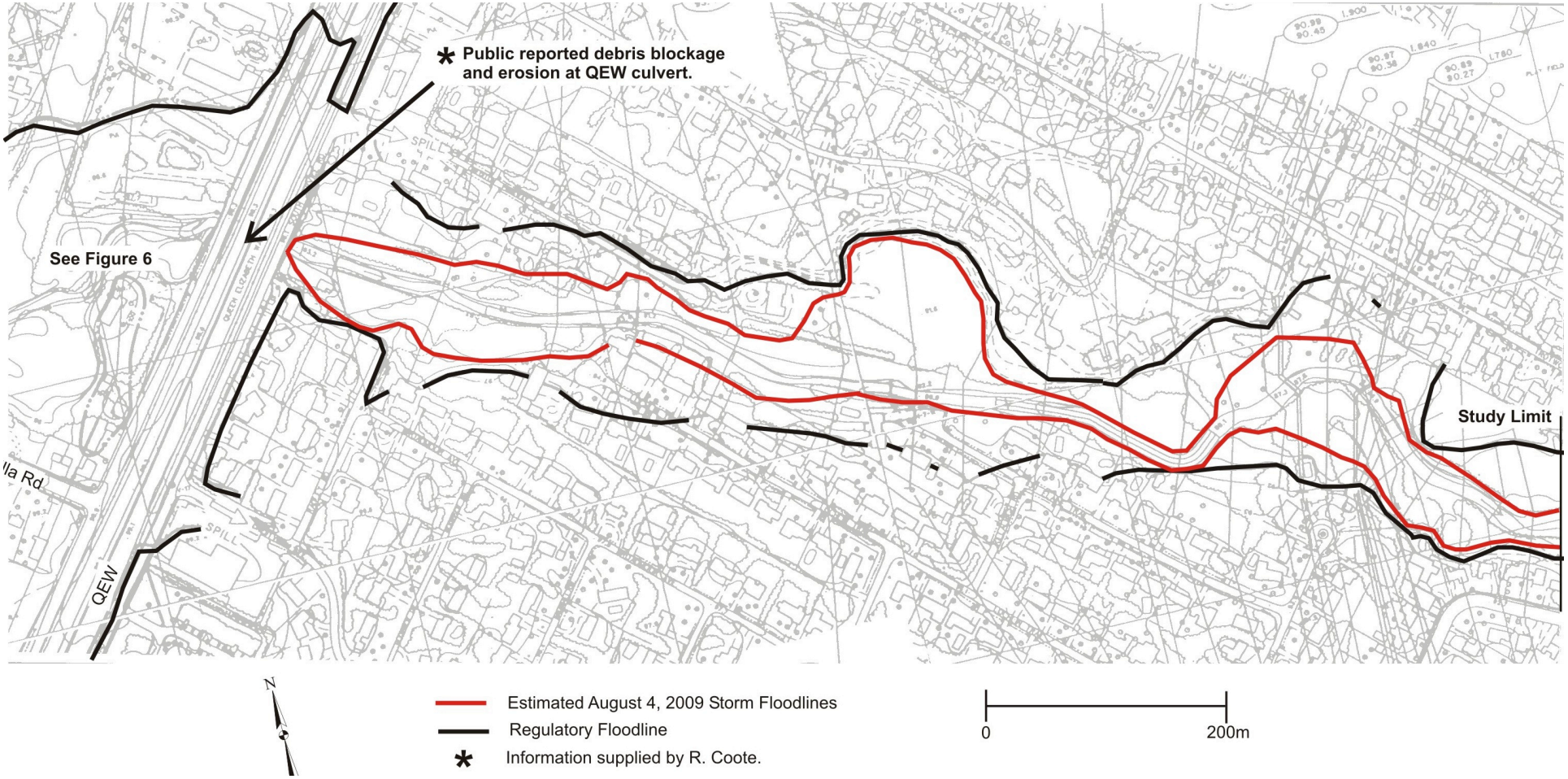

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Figure 6 **Estimated Floodlines Along Cooksville Creek - August 4, 2009**

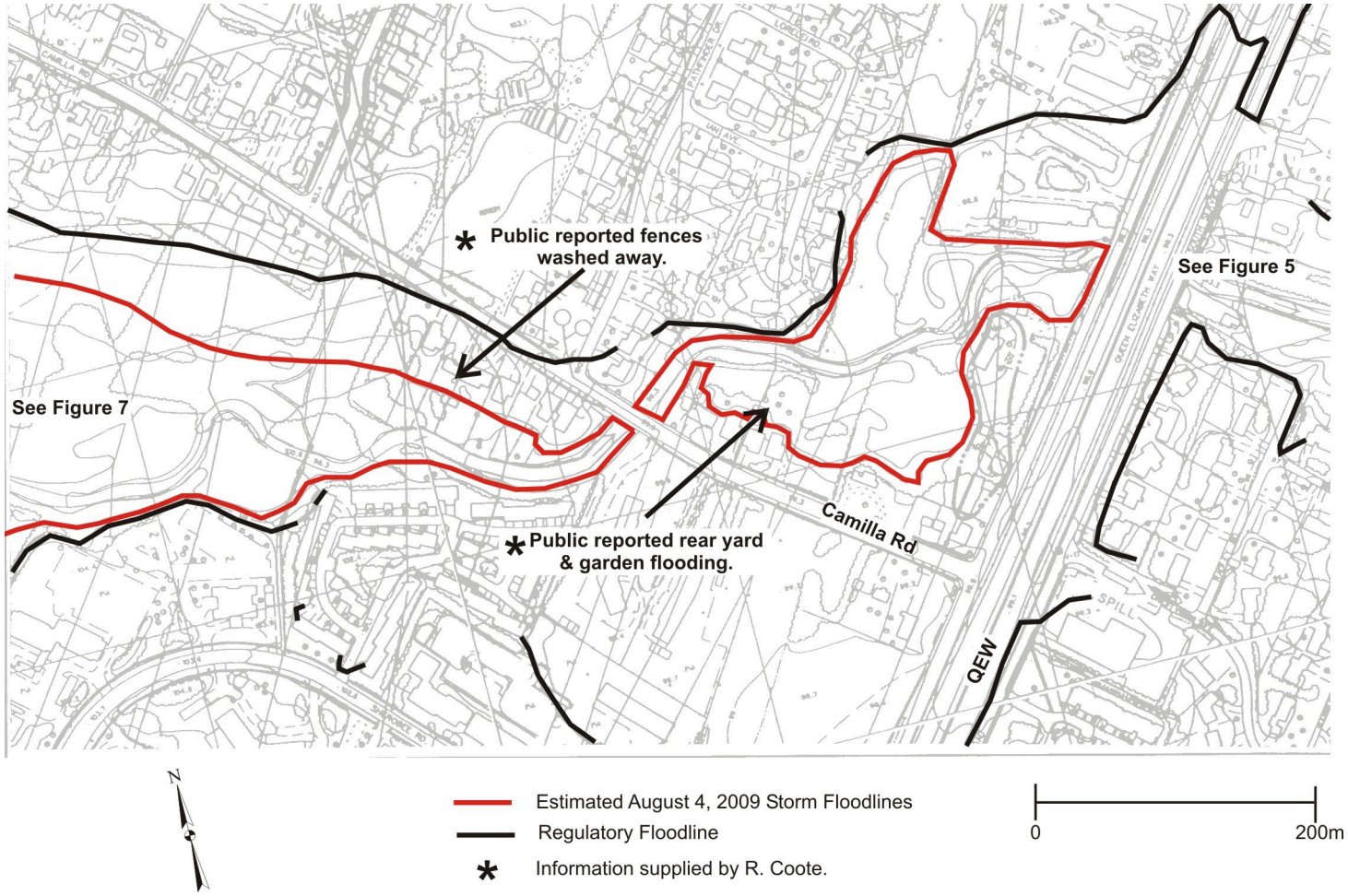

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Figure 7 **Estimated Floodlines Along Cooksville Creek - August 4, 2009**

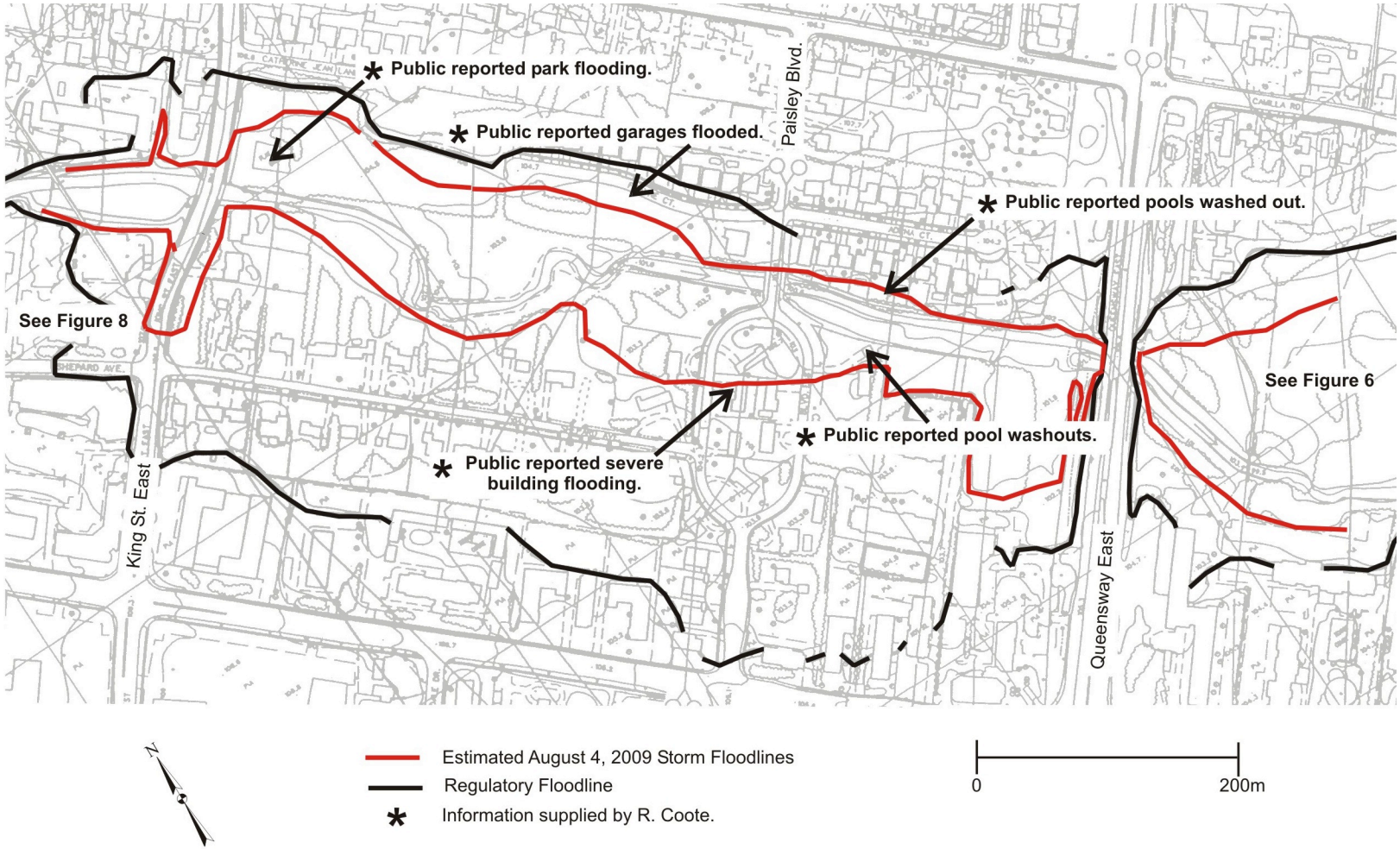

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Figure 8 **Estimated Floodlines Along Cooksville Creek - August 4, 2009**

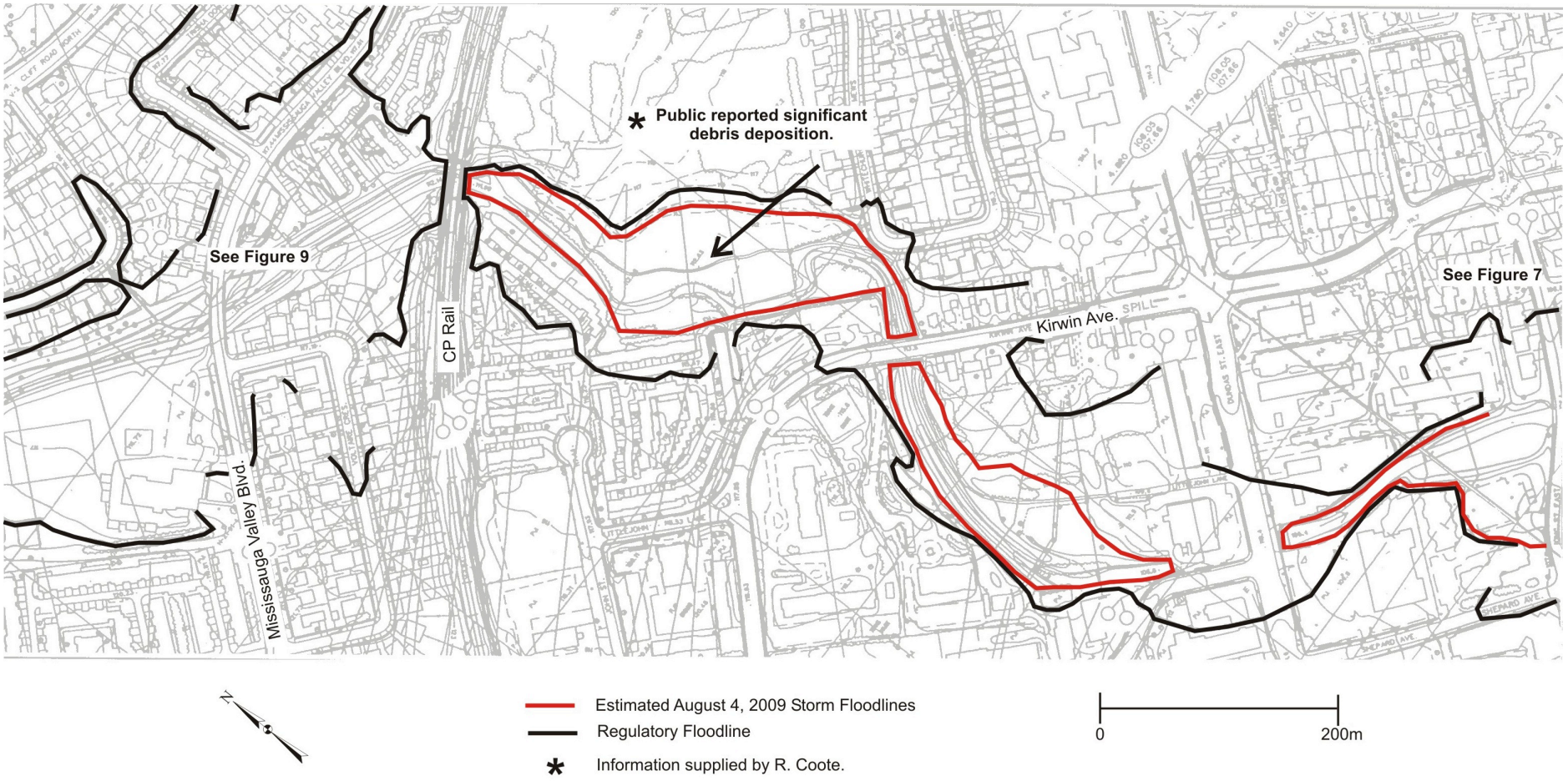

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Figure 9 **Estimated Floodlines Along Cooksville Creek - August 4, 2009**

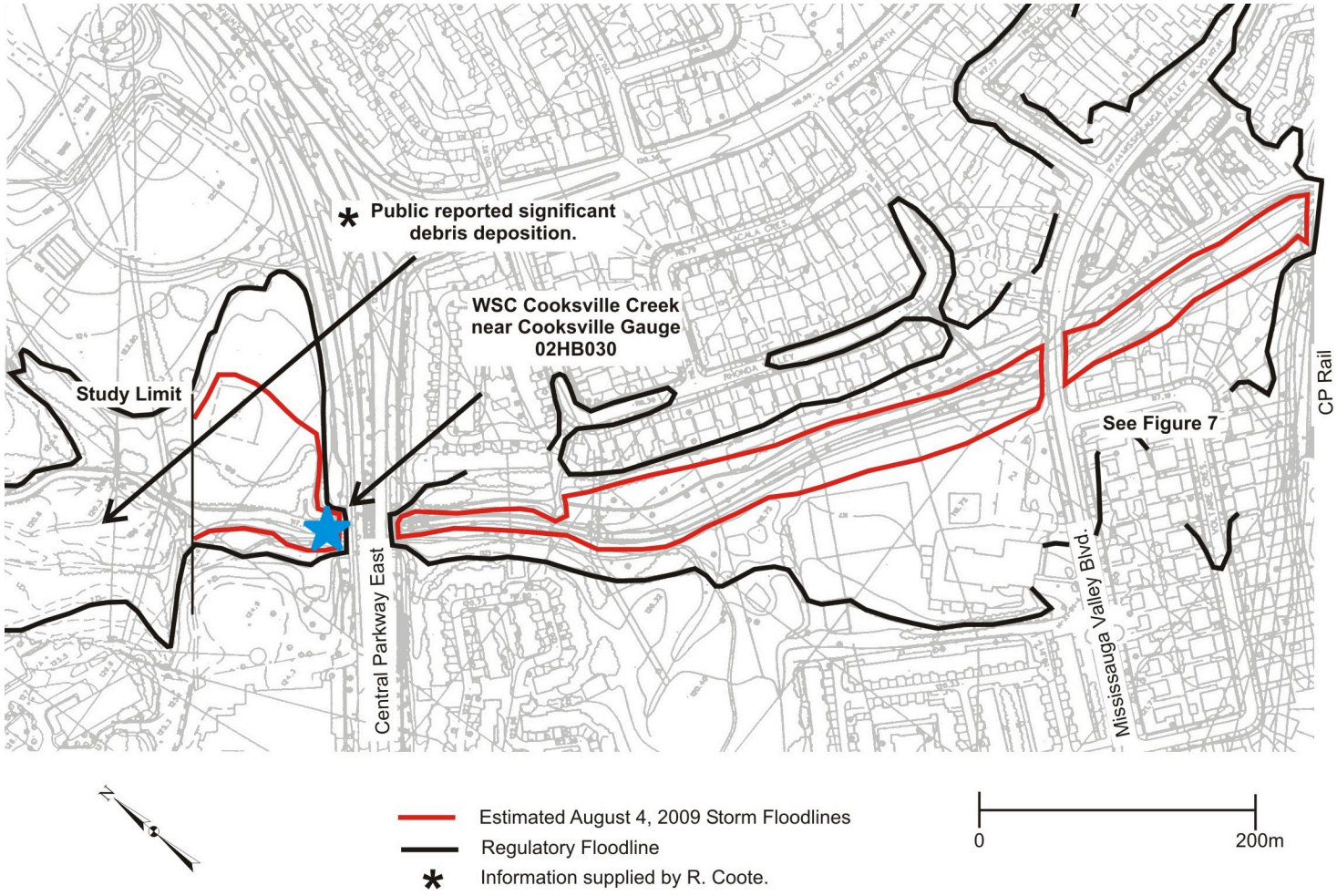

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Figure 10 **Rainfall Depth Contours - August 4, 2009**

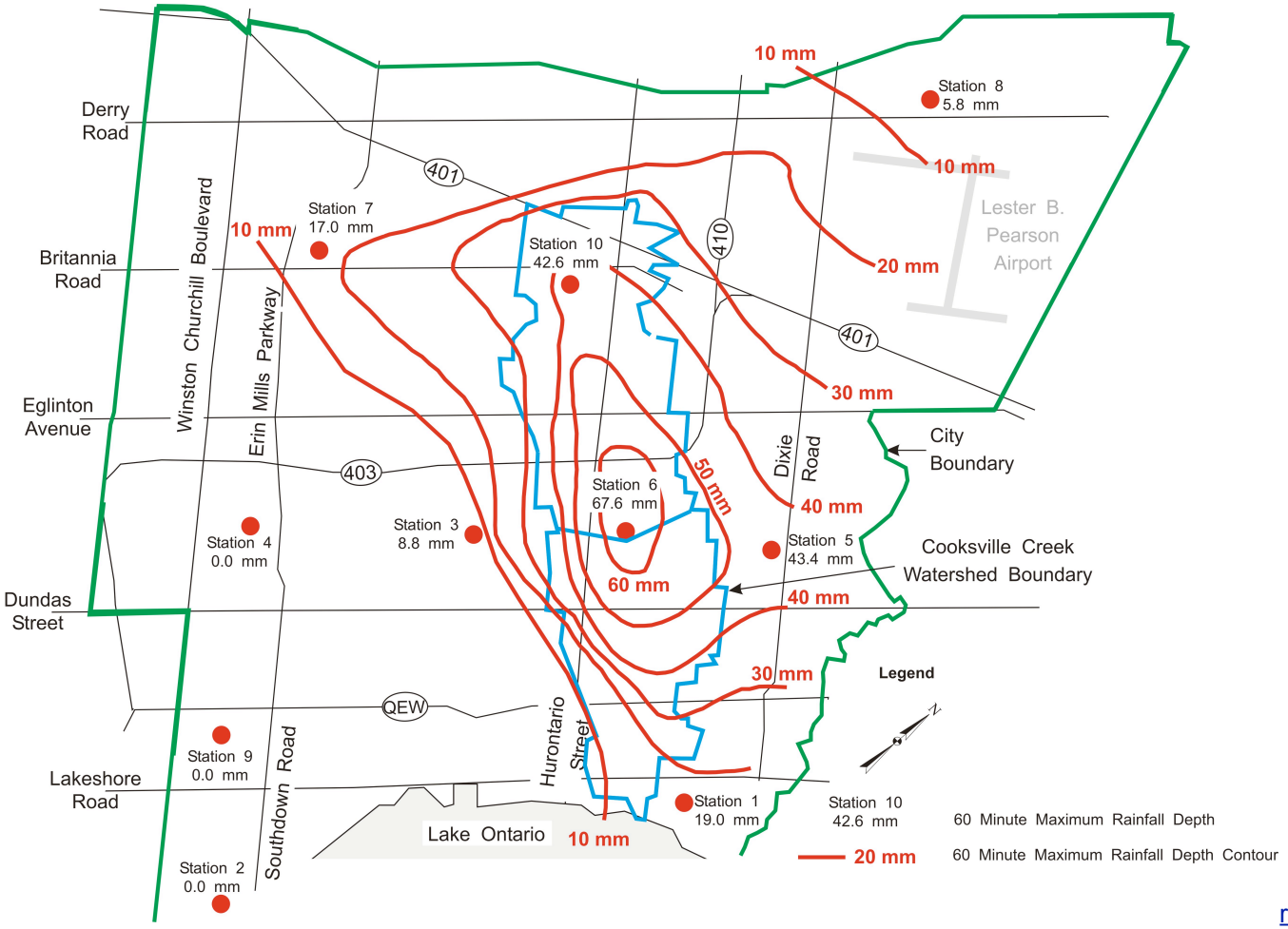

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Table 2 City of Mississauga Recorded Rainfall - August 4, 2009

	Station 1 Rainfall mm	Station 2 Rainfall mm	Station 3 Rainfall mm	Station 4 Rainfall mm	Station 5 Rainfall mm	Station 6 Rainfall mm	Station 7 Rainfall mm	Station 8 Rainfall mm	Station 9 Rainfall mm	Station 10 Rainfall mm
12:30	--	--	--	--	--	--	--	--	--	--
12:35	--	--	--	--	--	--	--	0.6	--	--
12:40	--	--	--	--	--	--	--	--	--	--
12:45	--	--	--	--	--	--	--	--	--	--
12:50	--	--	--	--	--	--	--	1.6	--	--
12:55	--	--	--	--	0.4	--	--	1.6	--	1.0
13:00	--	--	--	--	0.2	--	--	--	--	--
13:05	--	--	--	--	--	--	--	--	--	--
13:10	--	--	--	--	--	--	--	--	--	--
13:15	--	--	--	--	--	--	--	--	--	--
13:20	--	--	--	--	--	--	--	--	--	--
13:25	--	--	--	--	--	--	--	--	--	--
13:30	--	--	--	--	--	--	--	--	--	--
13:35	--	--	--	--	--	--	--	--	--	--
13:40	--	--	--	--	--	--	--	--	--	--
13:45	--	--	--	--	--	--	0.4	0.4	--	--
13:50	--	--	--	--	--	--	0.8	0.2	--	--
13:55	--	--	--	--	--	--	0.6	0.8	--	--
14:00	--	--	--	--	--	--	1.0	2.0	--	--
14:05	--	--	--	--	--	--	1.4	1.2	--	--
14:10	--	--	--	--	0.2	--	0.4	0.4	--	0.4
14:15	--	--	--	--	0.2	0.6	2.0	0.6	--	1.2
14:20	--	--	--	--	0.6	0.8	0.8	--	--	0.4
14:25	--	--	0.4	--	0.4	3.6	4.8	--	--	1.8
14:30	--	--	0.6	--	1.8	3.0	2.2	--	--	2.6
14:35	--	--	0.2	--	3.4	6.0	2.2	--	--	11.2
14:40	--	--	--	--	5.0	5.2	0.4	0.4	--	6.2
14:45	--	--	--	--	10.2	11.8	--	--	--	6.4
14:50	--	--	2.8	--	10.2	11.6	--	--	--	1.6
14:55	--	--	0.8	--	2.4	5.6	0.4	--	--	4.4

Table 2 **City of Mississauga Recorded Rainfall – August 4, 2009** .... continued

	Station 1 Rainfall mm	Station 2 Rainfall mm	Station 3 Rainfall mm	Station 4 Rainfall mm	Station 5 Rainfall mm	Station 6 Rainfall mm	Station 7 Rainfall mm	Station 8 Rainfall mm	Station 9 Rainfall mm	Station 10 Rainfall mm
15:00	--	--	3.4	--	3.6	5.2	--	--	--	2.2
15:05	--	--	0.2	--	1.2	8.4	--	--	--	4.2
15:10	--	--	--	--	3.8	5.8	--	--	--	0.2
15:15	--	--	--	--	0.8	--	--	--	--	--
15:20	--	--	0.4	--	--	--	--	--	--	--
15:25	--	--	--	--	--	--	--	--	--	--
15:30	--	--	--	--	--	--	--	--	--	--
15:35	--	--	--	--	--	--	--	--	--	--
15:40	0.6	--	--	--	--	--	--	--	--	--
15:45	--	--	--	--	--	--	--	--	--	--
15:50	--	--	--	--	--	--	--	--	--	--
15:55	--	--	--	--	--	--	--	--	--	--
16:00	2.8	--	--	--	--	--	--	--	--	--
16:05	4.2	--	--	--	--	--	--	--	--	--
16:10	5.2	--	--	--	--	--	--	--	--	--
16:15	4.6	--	--	--	--	--	--	--	--	--
16:20	0.2	--	--	--	--	--	--	--	--	--
16:25	--	--	--	--	--	--	--	--	--	--
16:30	1.4	--	--	--	--	--	--	--	--	--
16:35	--	--	--	--	--	--	--	--	--	--
16:40	--	--	--	--	--	--	--	--	--	--
16:45	--	--	--	--	--	--	--	--	--	--
16:50	--	--	--	--	--	--	--	--	--	--
16:55	--	--	--	--	--	--	--	--	--	--
17:00	--	--	--	--	--	--	--	--	--	--
Total	**19.0**	**0.0**	**8.8**	**0.0**	**44.4**	**67.6**	**17.4**	**9.8**	**0.0**	**43.8**

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Figure 11

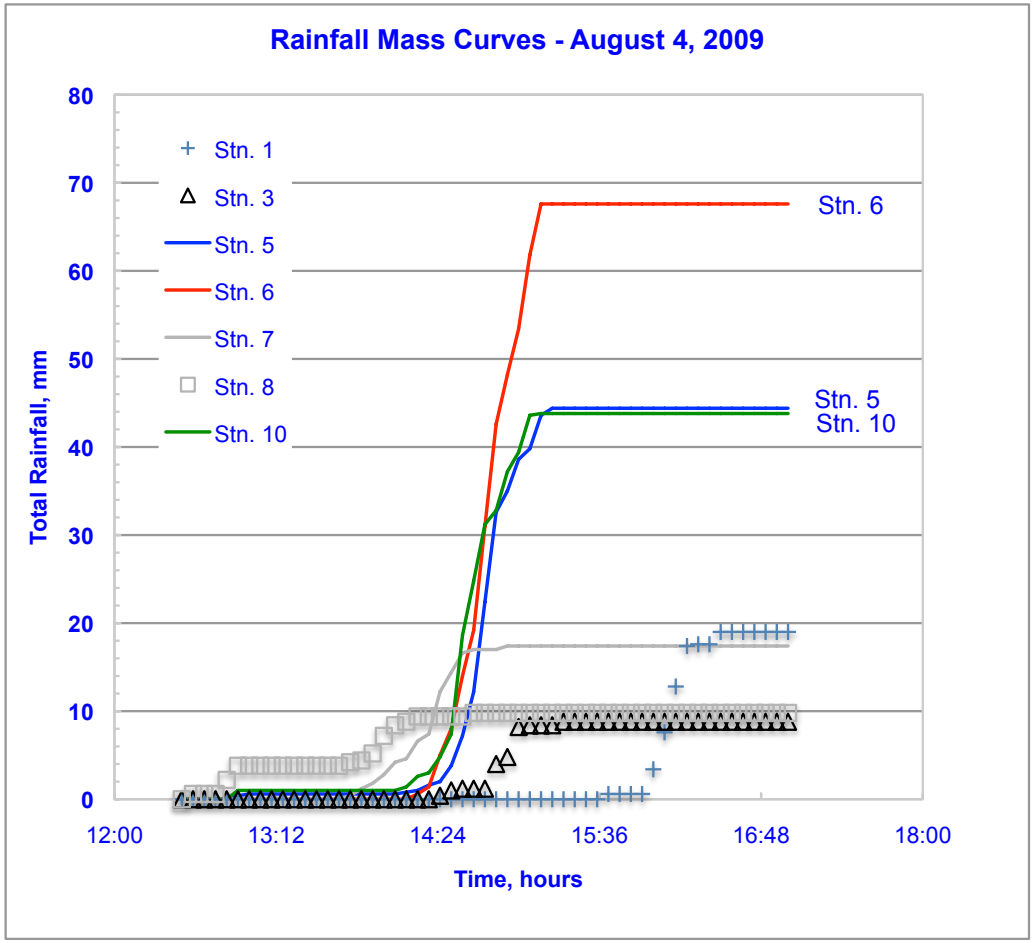

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Figure 12

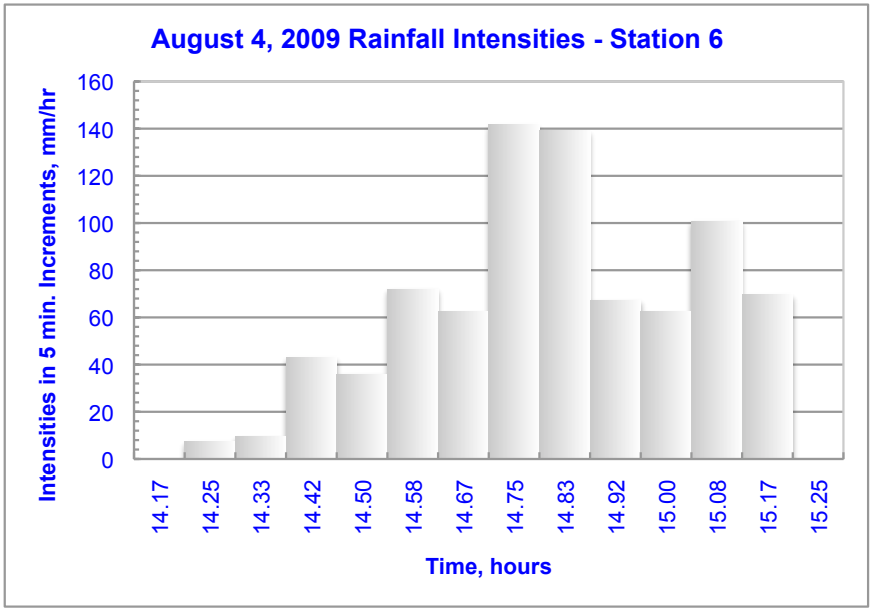

Figure 13

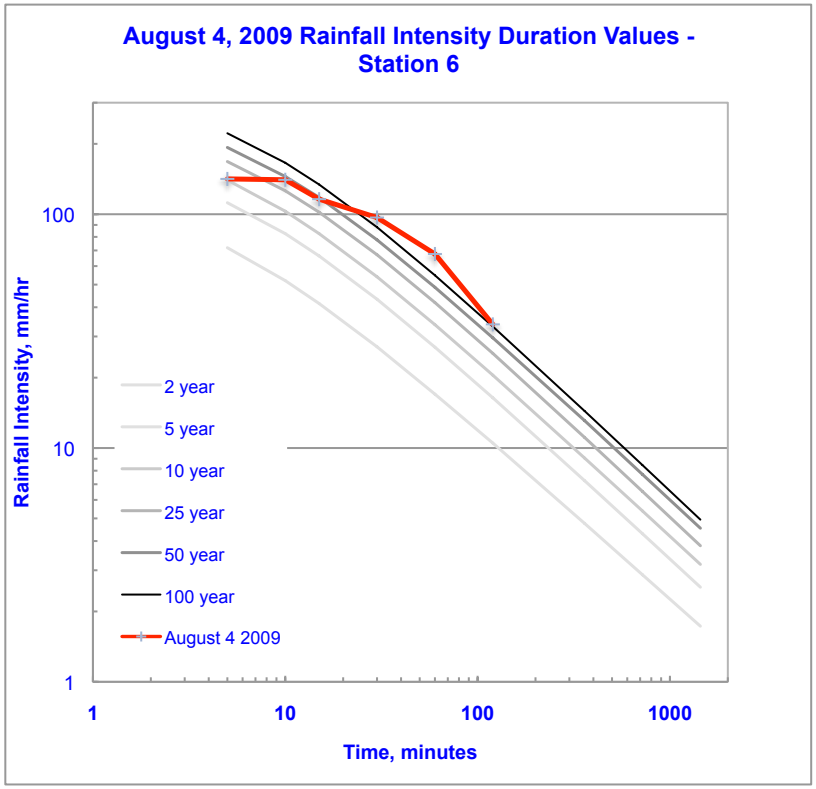

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Figure 14

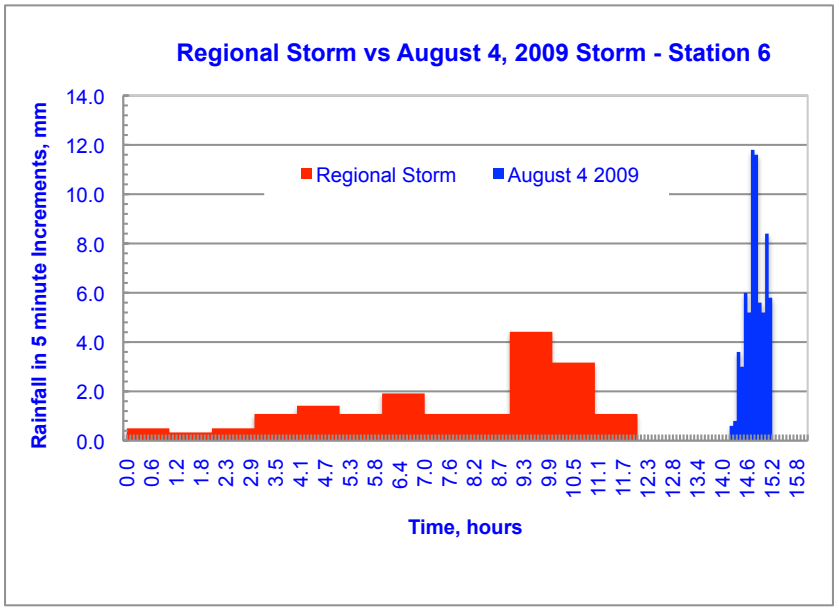

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Figure 15

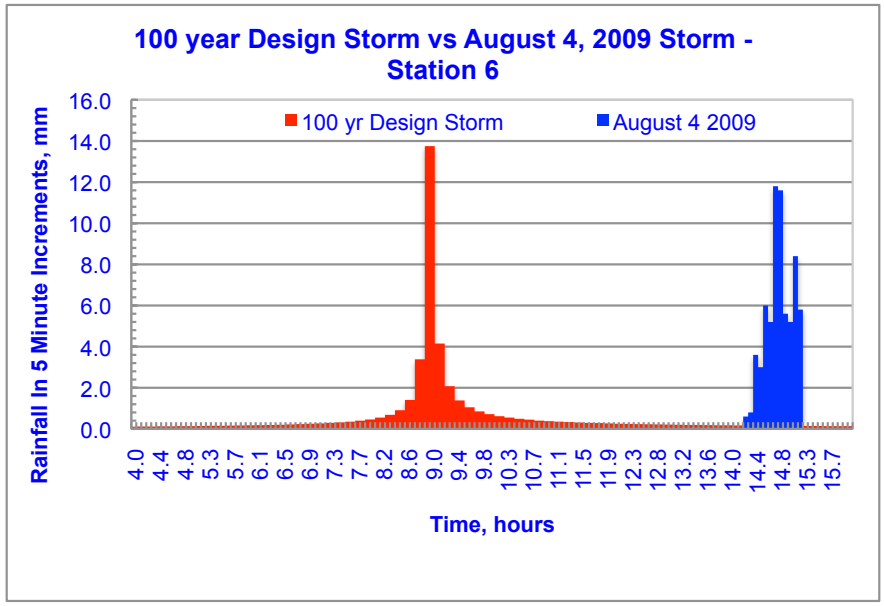

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Figure 16 **Recorded Gauge Heights August 2009**

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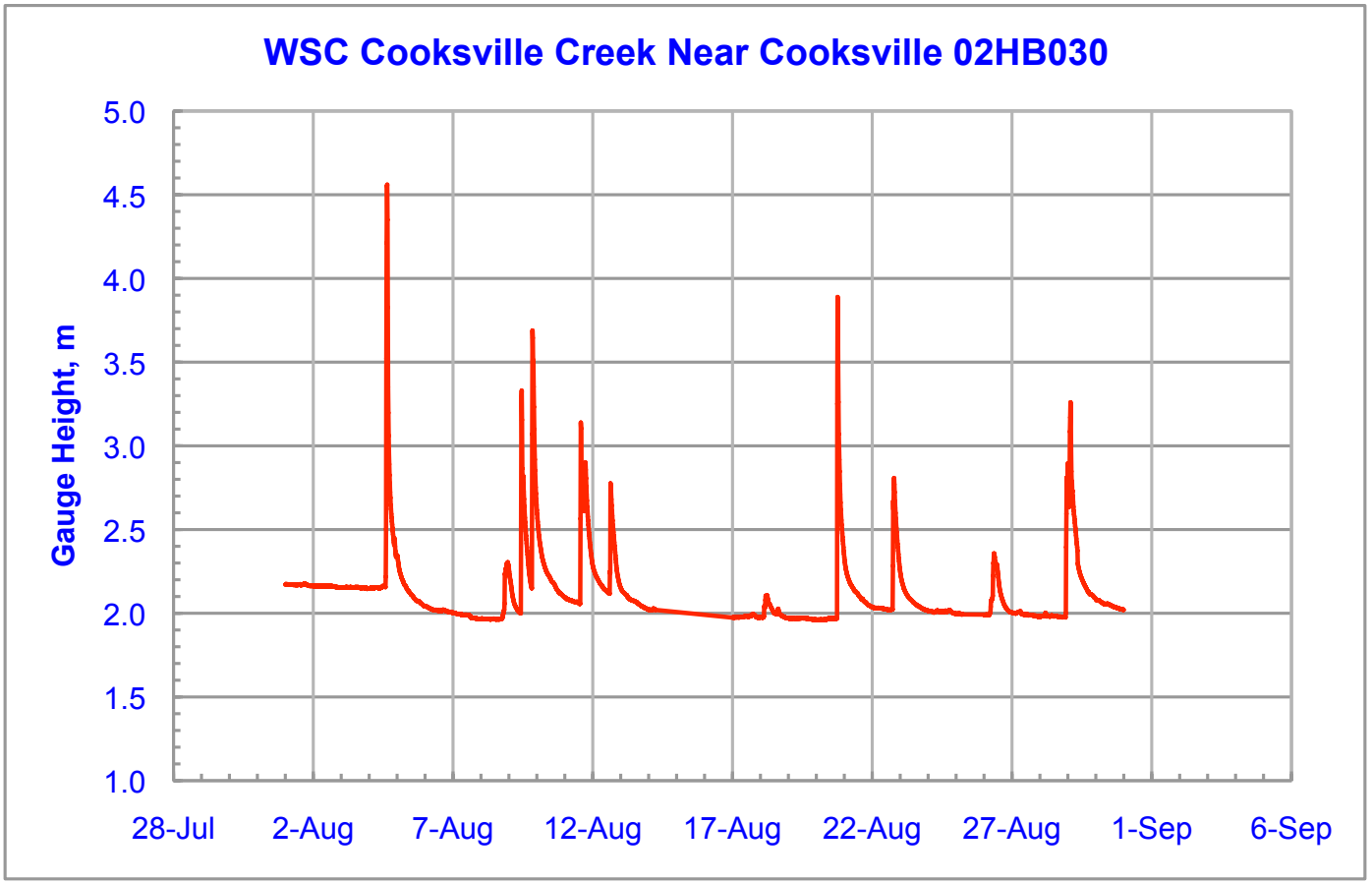

Table 3 **WSC Cooksville Creek Near Cooksville 02HB030 - Rating Table**

Gauge Height m	Streamflow Rate m^3/s	Gauge Height m	Streamflow Rate m^3/s
1.80	0.001	2.75	8.450
2.08	0.026	2.80	10.450
2.09	0.032	2.85	12.490
2.10	0.038	2.90	14.600
2.12	0.051	2.95	16.800
2.14	0.068	3.00	19.000
2.16	0.090	3.05	21.200
2.18	0.116	3.10	23.400
2.20	0.150	3.15	25.600
2.22	0.190	3.20	27.800
2.24	0.245	3.25	30.100
2.26	0.312	3.30	32.400
2.28	0.398		
2.30	0.500		
2.32	0.620		
2.34	0.750		
2.36	0.900		
2.38	1.070		
2.40	1.250		
2.45	1.770		
2.50	2.380		
2.55	3.090		
2.60	4.000		
2.65	5.150		
2.70	6.700		

Figure 17

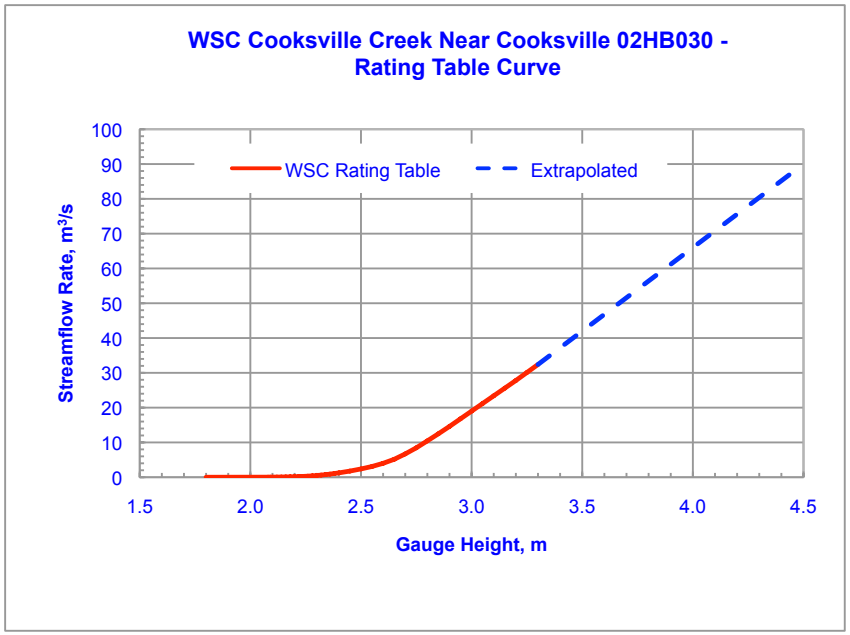

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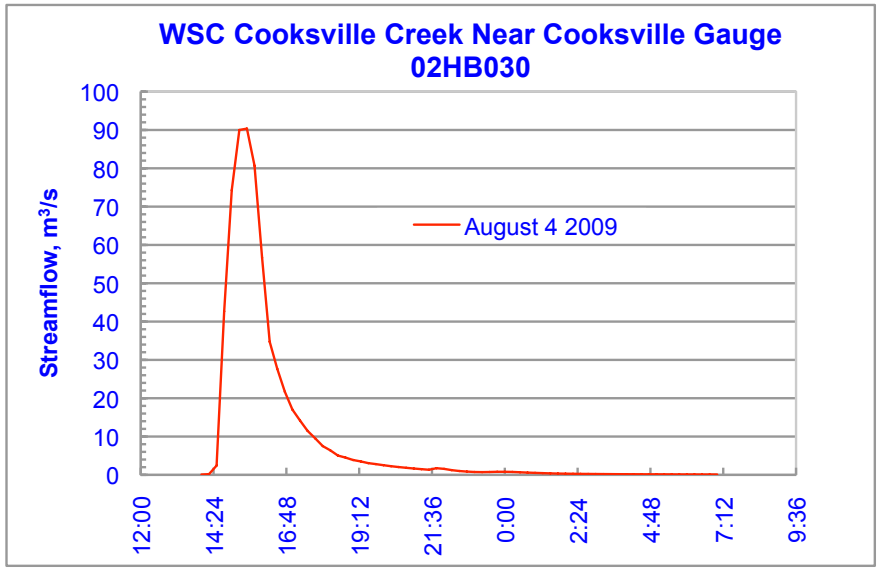
Table 4 **WSC Cooksville Creek Near Cooksville Gauge 02HB030 - Measured Streamflow Rates**

Date	Gauge Height m	Measured Streamflow Rate m^3/s	Flow Area m^2	Flow Top Width m	Average Flow Velocity m/s
09.09.16	1.974	0.046	0.156	2.70	0.29
09.08.25	2.000	0.066	1.180	6.90	0.06
09.08.06	2.019	0.167	1.830	7.55	0.09
08.11.07	2.104	0.041	0.114	2.30	0.36
09.07.09	2.120	0.050	0.163	2.55	0.31
09.07.09	2.120	0.050	0.163	2.55	0.31
09.05.15	2.169	0.076	0.190	3.00	0.40
09.08.12	2.174	0.392	2.740	7.90	0.14
09.03.31	2.213	0.142	0.768	5.80	0.18
09.02.09	2.258	0.382	0.547	5.20	0.70
09.08.11	2.791	11.400	5.160	7.90	2.21

Figure 18



Note: Streamflow rates are preliminary.

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Table 5 **WSC Cooksville Creek Near Cooksville Gauge 02HB030 - Gauge Height**

Date & Time mm/dd/yy hr:min	Gauge Height m	Date & Time hours	Gauge Height m	Date & Time mm/dd/yy hr:min	Gauge Height m
08/04/09 14:00	2.156	08/04/09 21:00	2.439	08/05/09 4:00	2.209
08/04/09 14:15	2.218	08/04/09 21:15	2.423	08/05/09 4:15	2.204
08/04/09 14:30	2.503	08/04/09 21:30	2.408	08/05/09 4:30	2.200
08/04/09 14:45	3.523	08/04/09 21:45	2.447	08/05/09 4:45	2.196
08/04/09 15:00	4.211	08/04/09 22:00	2.430	08/05/09 5:00	2.193
08/04/09 15:15	4.552	08/04/09 22:15	2.398	08/05/09 5:15	2.189
08/04/09 15:30	4.560	08/04/09 22:30	2.372	08/05/09 5:30	2.185
08/04/09 15:45	4.350	08/04/09 22:45	2.354	08/05/09 5:45	2.178
08/04/09 16:00	3.827	08/04/09 23:00	2.340	08/05/09 6:00	2.176
08/04/09 16:15	3.351	08/04/09 23:15	2.335	08/05/09 6:15	2.171
08/04/09 16:30	3.197	08/04/09 23:30	2.340	08/05/09 6:30	2.167
08/04/09 16:45	3.061	08/04/09 23:45	2.347	08/05/09 6:45	2.167
08/04/09 17:00	2.955	08/05/09 0:00	2.347	08/05/09 7:00	2.165
08/04/09 17:15	2.890	08/05/09 0:15	2.342	08/05/09 7:15	2.164
08/04/09 17:30	2.825	08/05/09 0:30	2.329	08/05/09 7:30	2.162
08/04/09 17:45	2.777	08/05/09 0:45	2.315	08/05/09 7:45	2.153
08/04/09 18:00	2.723	08/05/09 1:00	2.303	08/05/09 8:00	2.151
08/04/09 18:15	2.690	08/05/09 1:15	2.291		
08/04/09 18:30	2.645	08/05/09 1:30	2.277		
08/04/09 18:45	2.622	08/05/09 1:45	2.266		
08/04/09 19:00	2.593	08/05/09 2:00	2.259		
08/04/09 19:15	2.573	08/05/09 2:15	2.250		
08/04/09 19:30	2.548	08/05/09 2:30	2.243		
08/04/09 19:45	2.530	08/05/09 2:45	2.238		
08/04/09 20:00	2.510	08/05/09 3:00	2.232		
08/04/09 20:15	2.490	08/05/09 3:15	2.226		
08/04/09 20:30	2.472	08/05/09 3:30	2.221		
08/04/09 20:45	2.456	08/05/09 3:45	2.214		

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REPORT LIMITATIONS

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