

Grand River Conservation Authority

Report number: GM-03-23-36

Date: March 24, 2023

To: Members of the Grand River Conservation Authority

Subject: April 2023 Flood Event

Recommendation:

THAT Report Number GM-04-23-36 – April 2023 Flood Event be received as information.

Summary

This report provides a detailed overview of the March 31 to April 2, 2023 weather event that resulted in minor flooding in a few communities in the Grand River Watershed.

A strong low-pressure system moved into the region on early hours of Friday, March 31 which resulted in 30 to 50 millimetres of rain throughout the Grand River watershed. Thunderstorms overnight resulted in periods of intense rainfall. The watershed received an additional 10 to 20 millimetres of rain through the day on Saturday. In addition to the rainfall, increased temperatures during this period resulted in a watershed wide snowmelt which consequently contributed to the loss of snowpack in most areas of the watershed. Runoff associated with this event resulted in minor flooding in several communities across the watershed including West Montrose, Drayton, New Hamburg, Ayr, and some low-lying areas in the lower part of the watershed. A brief Lake Erie surge event also accompanied this flood on April 1. GRCA's major reservoirs were used to reduce downstream flooding, reducing river flows downstream of these reservoirs by 20 to 60 percent.

Report

A strong weather system, originating in the southern United States, brought rain and warm temperatures to southern Ontario on Friday March 31, 2023. This event continued through the weekend before moving out of the watershed on April 2. Due to the three large snow storm events the watershed received in late February and March, the accumulated snowpack was significant, specifically upstream of Shand Dam as presented in Figure 1. The warm temperatures and rain resulted in melting of much of the remaining snowpack during this event. In addition to this snowmelt, the entire watershed received between 30 to 65 millimetres of rainfall with the highest volumes, in excess of 60 millimetres, falling in the lower-central portion of the watershed near Paris and the lower portion of the Nith River. Figure 2 presents a map of the rainfall totals across the watershed. Peak temperatures between 8 to 15 degrees were recorded across the watershed, as presented in Figure 3. It should be noted that the system brought some freezing rain in the early hours of Friday morning, which resulted in underestimation of rainfall measurement by rain gauges, specifically in the upper portion of the watershed.

The GRCA relies heavily on external weather information to forecast river flow conditions during events like this. Weather forecasts prior to this event featured a great deal of uncertainty around whether the watershed would be impacted by strong thunderstorms, which would lead to excessive rainfall in localized areas. That uncertainty continued

even as the event was unfolding across the watershed. Temperatures remained above freezing and precipitation fell mainly as rain in across the watershed. In addition to flooding based on snowmelt and rainfall, a Lake Erie Surge was also forecasted by the Ministry of Natural Resources and Forestry (MNRF) to occur on Saturday April 1, during late hours of the afternoon and early evening, resulting in Zone 1 Flooding along Lake Erie Shoreline. Fortunately, the observed lake levels did not reach flooding thresholds and peaked at 175.33 metres while Zone 1 flooding threshold is 175.50 metres.

Flood Warnings issued during flood

A total of 6 Flood Warnings were issued from April 1 to April 3 :

Flood Message Number 1 - Issued Saturday, April 1 , 2023 at 8:45 AM

Flood Message Number 2 - Issued Saturday, April 1 , 2023 at 10:30 AM

Flood Message Number 3 - Issued Saturday, April 1 , 2023 at 2:15 PM

Flood Message Number 4 - Issued Saturday, April 1 , 2023 at 4:30 PM

Flood Message Number 5 – Issued Monday, April 3 , 2023 at 3:30 PM

Flood Message Number 1 – High Lake Erie Level, Issued Saturday, April 1 , 2023 at 12:00 PM

Flood Warnings were issued by email, automated voice phone call, personal phone calls to specific flood co-ordinators in affected areas, posted to the GRCA website, GRCA social media feeds, and issued directly to the media. Flood message Number 5 was a flood warning termination message. A flood watch message was included with message Number 5 reminding residents of the risks around our local waterways as river flows would remain much higher than normal through the week following the event.

Role of GRCA website

The GRCA website played an important role delivering information to the public and emergency responders. During the period of March 31 and April 3, pages were viewed more than 71,000 times. This compares to 33,000 page views for the same period in previous week. Website statistics from the recent event are presented by Figure 4, which shows page view data over a 4-day period with the y-axis of the chart presenting the number of page views per hour.

Resultant flooding and flood reduction provided by major dams

Table 1 presents a summary of observed flows and natural flows that would result without the flood mitigation effect of the reservoirs.

Table 1: Peak river flows at selected locations during event

Location	Water Course	Natural Flow (m ³ /s)	Regulated Flow (m ³ /s)	Flood Frequency		Flow Reduction %
				Natural (yr)	Regulated (yr)	
Legatt-Grand Valley	Grand River	106	--	< 2yr		
Marsville	Grand River	136	--	< 2yr		
Shand Dam	Grand River	150	91	2 to 5 yr		39%
Elora	Grand River	150	91	2 to 5 yr	< 2yr	39%
Irvine Salem	Irvine River	68	--	< 2yr		
West Montrose	Grand River	227	170	< 2yr	< 2yr	25%
Bridgeport	Grand River	446	341	< 2yr	< 2yr	24%
Doon	Grand River	450	357	< 2yr	< 2yr	21%
Galt	Grand River	539	409	< 2yr	< 2yr	24%
Paris	Grand River	539	409	< 2yr	< 2yr	24%
Brantford	Grand River	714	567	< 2yr	< 2yr	21%
Caledonia	Grand River	797	688	< 2yr	2 to 5 yr	14%
York	Grand River	797	688	< 2yr	2 to 5 yr	14%
Above Drayton	Conestogo River	158	--	2 to 5 yr		
Drayton	Conestogo River	140	--	2 to 5 yr		
Moorefield	Moorefield Creek	27	--	< 2yr		
Conestogo Dam	Conestogo River	188	139	< 2yr		
Glen Allan	Conestogo River	188	139	< 2yr	2 to 5 yr	26%
St. Jacobs	Conestogo River	182	140	< 2yr	< 2yr	23%
Floradale	Canagagigue Creek	43	--		2 to 5 yr	
Woolwich Dam	Canagagigue Creek	46	20		2 to 5 yr	56%
Below Elmira	Canagagigue Creek	59	34		2 to 5 yr	42%
Armstrong Mills	Speed River	27	--	< 2yr		
Guelph Dam	Speed River	56	21	< 2yr		62%
Victoria Rd Gauge	Speed River	56	21	< 2yr	2 to 5 yr	62%
Eramosa River	Eramosa River	14	--	< 2yr		
Speed River Edinburgh	Speed River	77	41	< 2yr	< 2yr	47%
Speed River Beaverville	Speed River	108	52	2 to 5 yr	< 2yr	52%
Speed River Preston	Speed River	108	52	2 to 5 yr	< 2yr	52%
Nithburg	Nith River	95	--	< 2yr		
New Hamburg	Nith River	146	--	< 2yr		
Ayr	Nith River	156	--	< 2yr		
Canning	Nith River	150	--	< 2yr		
Whitemans Creek	Whitemans Creek	48	--	2 to 5 yr		
McKenzie Creek	McKenzie Creek	24	--	2 to 5 yr		
Note: Regulated Flow is with reservoir regulation						
Natural Flow is without reservoir regulation						

Results presented in Table 1 indicate that the reservoirs were successful in reducing the peak flows and consequent flooding across the watershed for a range of 20 to 60 percent. The combination of the snowmelt and rainfall resulted in the headwater community of Drayton to experience minor flooding with observed peak flows reaching the lower portion of Flood Warning Zone 1 for this community. Flooding in the upper portion of the Grand River was limited to the community of West Montrose where observed peak flows reached Flood Warning Zone 1.

Flows in the Conestogo River downstream of Conestogo Dam resulted in the need to close the low-level bridge upstream of St. Jacobs. The storage provided by the reservoirs resulted in a 25 percent flow reduction along the Grand River downstream of the confluence with the Conestogo River (Bridgeport); without the mitigating effect of the

reservoirs a few properties along Golf Course Road in the Village of Conestogo would have experienced some flooding.

Through the City of Cambridge, the municipal flood coordinator was advised to close the Black Bridge Road and walking trails in low-lying areas near the Speed River.

River flows through the City of Brantford peaked at 570 cubic metres per second, resulting in low-lying walking trails to be flooded. Gilkison Street in Brantford was not flooded. Minor flooding was experienced in the Grand River through Six Nations, Brant County and York, including Onondaga side roads around Six Nations and Grand Sports Road in York.

Some minor flooding was also experienced along the lower portion of the Nith River with flooding occurring in Flood Warning Zone 1 in the communities of New Hamburg and Ayr.

GRCA's major reservoirs were used to reduce downstream flooding on the Grand, Conestogo and Speed Rivers. The Nith River flow is unregulated as there are no upstream reservoirs to help mitigate flooding on this river system. Prior to this event, reservoir levels were at their spring operating level when a small portion of the reservoir storage is available for flood attenuation. Highest flood reductions occurred through the City of Guelph where the Guelph Dam reduced flows by approximately 62 percent. Along the Grand River, flow reductions were in the 20 to 40 percent range.

Staffing of Flood Operations Centre

Beyond regular working hours, the Flood Operations staff at GRCA were actively operating through the weekend. A Duty Officer remained on-call throughout the duration of the event for after-hours emergency calls. A Senior Operator was available continuously during the event. Engineering and Communications staff monitored conditions and responded to public enquiries and media calls through the weekend.

Lessons learned and actions initiated

This particular flood event was relatively difficult to forecast given the uncertainty in the type of precipitation associated with the system, potential convective rainfall systems which resulted in thunder storms and severe rainfall over short periods of time, and also the uncertainties associated with snow melt.

The rain gauge network that provides rainfall data to the GRCA worked well however freezing conditions in a few locations affected the quality of data received. The ability to fortify our rain gauge network with devices better suited for mixed precipitation events will be investigated.

The GRCA began subscribing to the Hydromaster forecast system in 2020. This service provides a 3-hour Nowcast based on tracking the movement of weather systems via Radar and provides GRCA staff with direct warnings, as well as a long term hourly precipitation forecast. This service was particularly useful during this event as it provided both short-term and long-term rainfall forecast and assisted in providing an indication of the location where cellular thunderstorms would result in significant amount of rainfall over a short period of time.

Financial implications:

Not applicable. If requests that have budget implications result from the recent flood, these requests will be dealt with as budget forecast adjustments or as separate board reports brought back to the board.

Other department considerations:

Not applicable

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Figure 1: Snow Survey Results for the Grand River Watershed on April 3, 2023

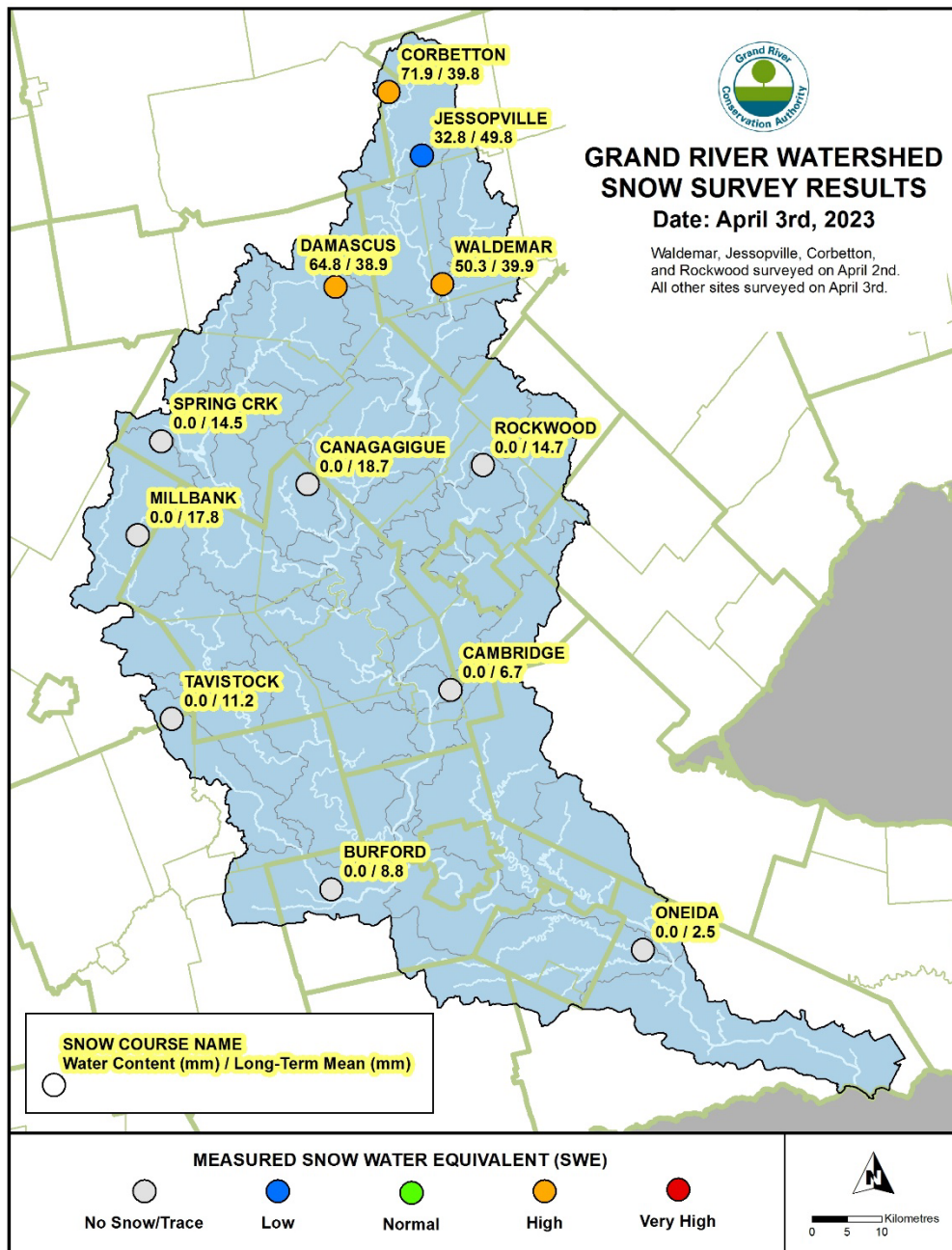


Figure 2 Watershed Rainfall Map for March 31-April 2 2023 Event

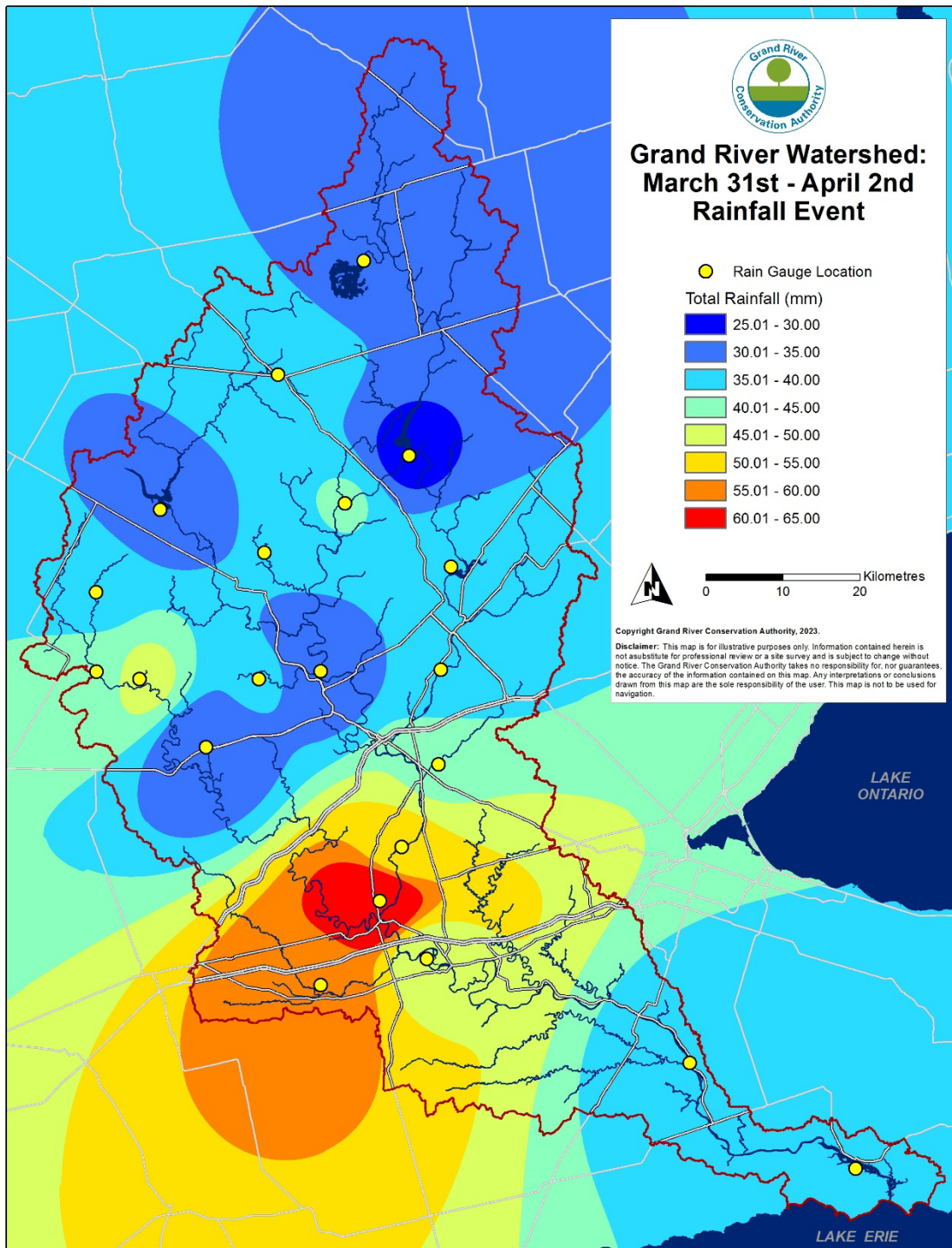


Figure 3 Temperature across the watershed during the March 31 – April 2 Flood Event

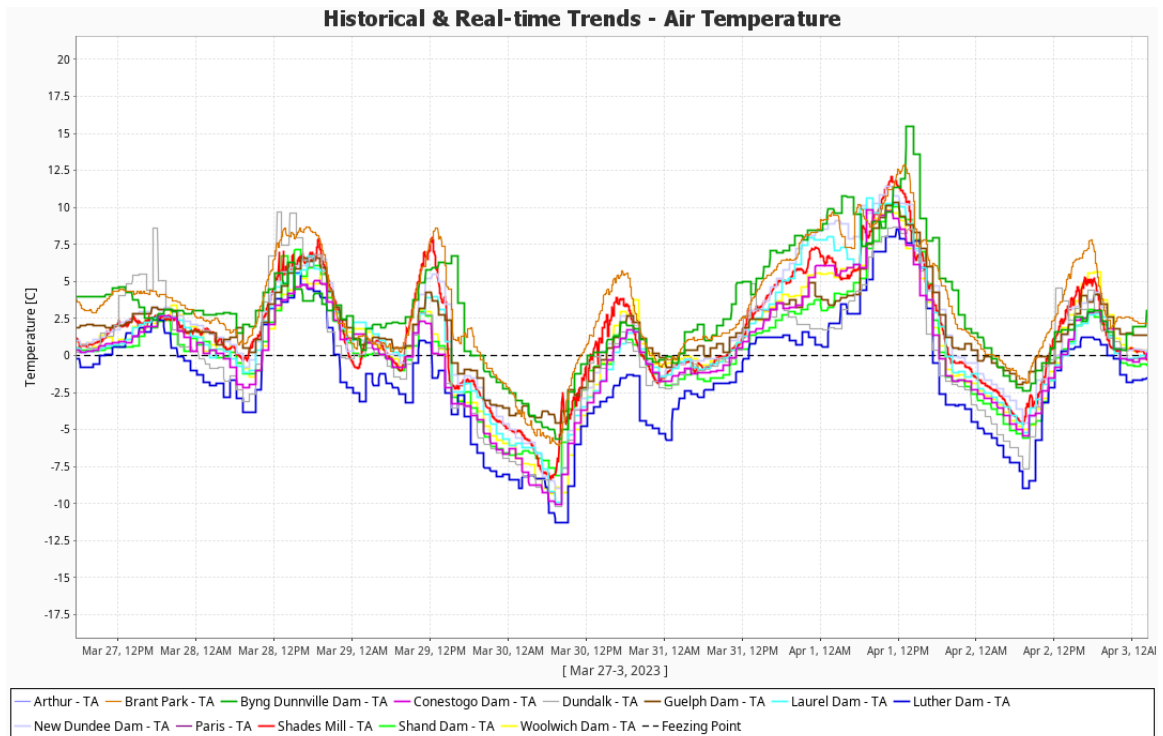


Figure 4 GRCA Website Statistics During March 31 – April 2 Flood Event

