



## Fairmont Creek 2020 Annual Dike Inspection Report

### Background

#### 2012

Fairmont Creek experienced a significant debris flow event on July 15, 2012 which deposited approximately 65,000 m<sup>3</sup> of debris in the creek channel, over the debris fan and along subdivision roadways and drainage ditches. Disaster Financial Assistance funds were used to reconstruct the previously existing section of dike and protected bank just below Marble Canyon. This work was completed by April 2013. In addition to reconstructing the creek channel and protecting the bank, a series of nine grade controls were constructed along this section. The engineering consultant for this work was Kerr Wood Leidal and the contractor was Max Helmer Construction.

After the 2012 debris flow, Emergency Management BC (EMBC) funds were obtained to have a debris flow hazard and risk assessment completed on Fairmont Creek. Clarke Geoscience was retained for the assessment. It was completed in January 2013 and included a series of recommendations that could be implemented to help mitigate debris flow risk.

#### 2013

On June 20, 2013, Fairmont Creek experienced another debris flow event caused by a significant rain event on saturated soils. The magnitude of this event was approximately 6,000 m<sup>3</sup> and the material was mostly contained in the channel and the golf course pond. The golf course pond, a few sites along the creek channel and material impacting the time share condominiums were cleaned out and repaired through EMBC Emergency Response funding. The newly constructed bank protection was not damaged in the event but six of the nine grade controls were significantly damaged or completely destroyed.

The RDEK commissioned an overview inspection of Fairmont Creek following the 2013 event. The inspection and report were funded through EMBC, and completed by Clarke Geoscience. The inspection occurred on July 29, 2013 and confirmed the findings of the January 2013 Debris Flow Hazard and Risk Assessment, which states that unlimited material available for mobilization exists in the Fairmont Creek watershed and can mobilize given the right conditions.

#### 2014 - 2015

In 2014, the RDEK was awarded funding through the Building Canada Fund Flood Protection Program for Phase 1 of the Fairmont Creek Debris Flow Mitigation Project. Engineering for this work was completed in Fall of 2014 and construction was completed in early May 2015. The project included widening the

creek through the golf course to the pond in order to increase storage capacity. The banks were sloped appropriately and armoured and berms were constructed on both sides of the creek to further contain material in the event of a debris flow. The engineering consultant for this work was Urban Systems and the contractor was Max Helmer Construction.

## **2016**

In 2016, the RDEK was awarded additional funding through the EMBC Flood Protection Program in order to complete Phases 2 and 3 of the Fairmont Creek Debris Flow Mitigation Project. Phase 3 consists of the installation of a weather station at the ski hill and was completed in November 2016. The weather station will be used to develop an early warning system for the community.

## **2017-2018**

On May 12, 2017, a small amount of debris came down Fairmont Creek to the debris trap pond. An estimated 1,200 m<sup>3</sup> of debris material was deposited in the pond and additional debris was deposited upstream along the creek bed. Removal of the debris was planned for 2019 following completion of the Fairmont Creek Debris Flow Project Phase 2 works. This was not completed because of the costs associated with the August 12, 2019 event (see below). It will be completed when funding permits. The extensive debris storage that was constructed upstream on Fairmont Creek makes this work less urgent.

Phase 2 of the Fairmont Creek Debris Flow Mitigation Project involved the construction of two large sediment basins containing three large riprap weirs upstream of the Fairmont Hot Springs Resort. Construction was started in September 2017 and was completed Fall 2018 and has added approximately 17,000 cubic metres of debris capture and storage capacity.

## **2019**

On August 10-12, 2019, a significant weather event (isolated heavy rain) occurred in the Fairmont area. As a result, a debris flood occurred on Fairmont Creek and the uppermost of the three newly constructed debris traps was filled to capacity (1,225 cubic metres). Minor erosion between the first and second weir deposited a small amount of material in front of weir #2. There was moderate erosion in the channel below the second weir with material being deposited between the area of erosion and the third weir. The weirs successfully contained the debris flood material originating from above the project area and prevented it from being transported downstream.

## **2020**

On May 20, 2020 there was a small debris flood event that filled the Wier 1 basin with material. On May 31, 2020 there was a significant debris flood event in response to heavy precipitation on snow following a few days of very warm weather. This event filled the upper three containment basins to capacity, deposited a significant amount of material in the channel through the golf course and filled the pond on Hole 12 to capacity. There was damage in a few locations along the infrastructure that will be described in detail and two of the downstream culverts were blocked causing the water to flow over the roads and outside of the channel causing minor property damage. The precipitation event had a 10 year return period, the clear water flood event had a 10 to 20 year return period and the debris flood had a 35 year return period. Upon review and with the information from this event, the 2012 event was reclassified from a 500 year event to a 165 year event.

## Fairmont Creek Dike Inspections

An inspection was completed on April 23, 2020 and was conducted by Kara Zandbergen, RDEK Engineering Technician. All sections of the dike were found to be in good condition at that time and ready for freshet. Subsequent inspections were completed after each event and as the cleanup progressed.

The infrastructure will be described from upstream to downstream and will include photos for each site showing the condition of the infrastructure pre-freshet, post-event and after clean up (where appropriate).

### Weir 1 and Debris Basin 1



Photo 1: The uppermost weir in the system, Weir #1. April 23, 2020.





Photo 2: Weir 1, filled with debris material from the May 20 event. May 28, 2020.



Photo 3: Weir 1 was completely covered with material from the May 31 event. The weir is located near the small access road as marked by the arrow. June 2, 2020.





Photo 4: Weir 1 with debris flood material was removed. October 15, 2020.

Weir 2 and Debris Basin 2



Photo 5: Weir 2 in good condition looking downstream. April 23, 2020.





Photo 6: Weir 2 looking upstream. The basin is completely filled with debris flood material from Weir 2 continuing above Weir 1 which was buried by material. June 2, 2020.



Photo 7: Weir 2 basin with debris flood material removed. October 15, 2020.



Weir 2 Downstream Scour



Photo 8: Weir 2 downstream face and channel in good condition. May 28, 2020.



Photo 9: Weir 2 downstream face and scour after the May 31 event. This will be repaired in 2021. The armouring on the right bank was not damaged. June 4, 2020.



Weir 3 and Debris Basin 3



Photo 10: Weir 3 and basin in good condition. There was a very small amount of material captured behind the weir in August 2019. April 23, 2020.



Photo 11: Weir 3 and basin after the May 31 event. There was minor scour downstream of the weir that did not require repairs. June 1, 2020.





Photo 12: Weir 3 and basin after the debris material was removed. October 15, 2020.

Water Shed Berm Upstream of the Campground Road



Photo 13: Erosion of the berm above the FHSR water mixing sheds. May 31, 2020.





Photo 14: The berm was repaired immediately. July 7, 2020.



Photo 15: There was some minor seepage on the downstream face of the berm. Seepage was clear and stopped once the repair of the erosion was completed. The arrow shows the location of the erosion in the previous pictures. June 1, 2020.



Channel Through the Golf Course



Photo 16: Golf course channel looking downstream from the cart path bridge. Channel is in good condition with some minor infilling from the August 2019 event. The dike on the right hand side of the channel (red arrow) is in good condition. April 23, 2020.



Photo 17: The left hand dike is in good condition. April 23, 2020.





Photo 18: Golf course channel looking downstream from the cart path bridge on May 31, 2020. The debris and water were contained in the channel and the dikes were not impacted.



Photo 19: Golf course channel with debris material removed. June 23, 2020.





Photo 20: Lower portion of the golf course channel looking upstream from the pedestrian bridge near the Hole 12 pond. The channel and dikes were in good condition. April 23, 2020.



Photo 21: Hole 12 Pond has some material deposition at the inlet but is in good condition with lots of capacity. April 23, 2020.





Photo 22: This photo shows the Hole 12 pond inlet and the lower channel. The lower channel was filled with debris and there was minor damage to the right hand dike. The pedestrian bridge that Photo 20 was taken from was destroyed. The pond was filled with debris. May 31, 2020.



Photo 23: The flood flow exceeded the capacity of the spillway and the pond overtopped and water flowed between the condos on the downstream end of the pond. May 31, 2020.





Photo 24: Lower portion of the golf course channel with debris material removed. December 4, 2020.



Photo 25: Hole 12 pond with debris material removed. December 4, 2020.





Photo 26: Pond outlet and channel in good condition. April 24, 2020.



Photo 27: Pond outlet and channel during the May 31, 2020 event. The channel was not damaged and contained the flow. May 31, 2020.



### Culverts Downstream of the Pond



Photo 28: The culvert immediately downstream of the pond was blocked and could not contain the flood flow. Water flowed over the golf course and through residential properties before returning to the channel. May 31, 2020.

The Columbia River Road culvert was also blocked temporarily.

## **2020 Maintenance**

A significant amount of maintenance was completed in 2020 as response and recovery to the May 31, 2020 debris flood event. To summarize:

- 18,000 cubic meters of debris were removed from Debris Basins 1, 2 and 3.
- Repairs were made to the berm near the FHSR water mixing sheds.
- 12,000 cubic meters of debris were removed from the golf course channel and Hole 12 Pond.

This work was paid for with a combination of EMBC emergency funding, Disaster Financial Assistance funds and Fairmont Flood and Landslide Service area reserves.

## **Maintenance Planned for 2021**

At this time, the RDEK intends to repair the scour downstream of Weir 2 as early as possible in 2021.

In 2021, the RDEK will be working with the Fairmont Hot Spring Resort to establish statutory rights of ways for all of the works that have been constructed over the last several years. Discussions have already been initiated and this work has been included in the 2021 budget.