ENGINEERING DEPARTMENT

DECEMBER 3, 2020

MAY 31 FAIRMONT DEBRIS FLOOD EVENT

Kara Zandbergen, RDEK Engineering Technician

Regional District of East Kootenay

1-888-478-7335 | www.rdek.bc.ca

INTRODUCTION

- Cause of the event
- Response
- Recovery
- Extent of the Damage
- Summary and Costs

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CAUSE AND RETURN PERIODS

- Assessed by NHC
- Very warm weather and high snow melt rate followed by intense rain
- 10 year return period rain event
- 10 to 20 year flood event
- 35 year return period debris flood on Fairmont Creek
- 5 year return period debris flood on Cold Spring Creek
- 2012 Fairmont Creek event return period now 165 years

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The debris floods occurred on the morning of May 31. There had been two or three days of unusually warm weather and rapid snowmelt followed by an intense rainfall event. These events combined to produce large volumes of runoff in a short period of time. Several debris flows occurred in the headwaters of Fairmont and Cold Spring Creek. As these events travelled downstream and the runoff increased, the flows transitioned to debris floods which filled our containment basins.

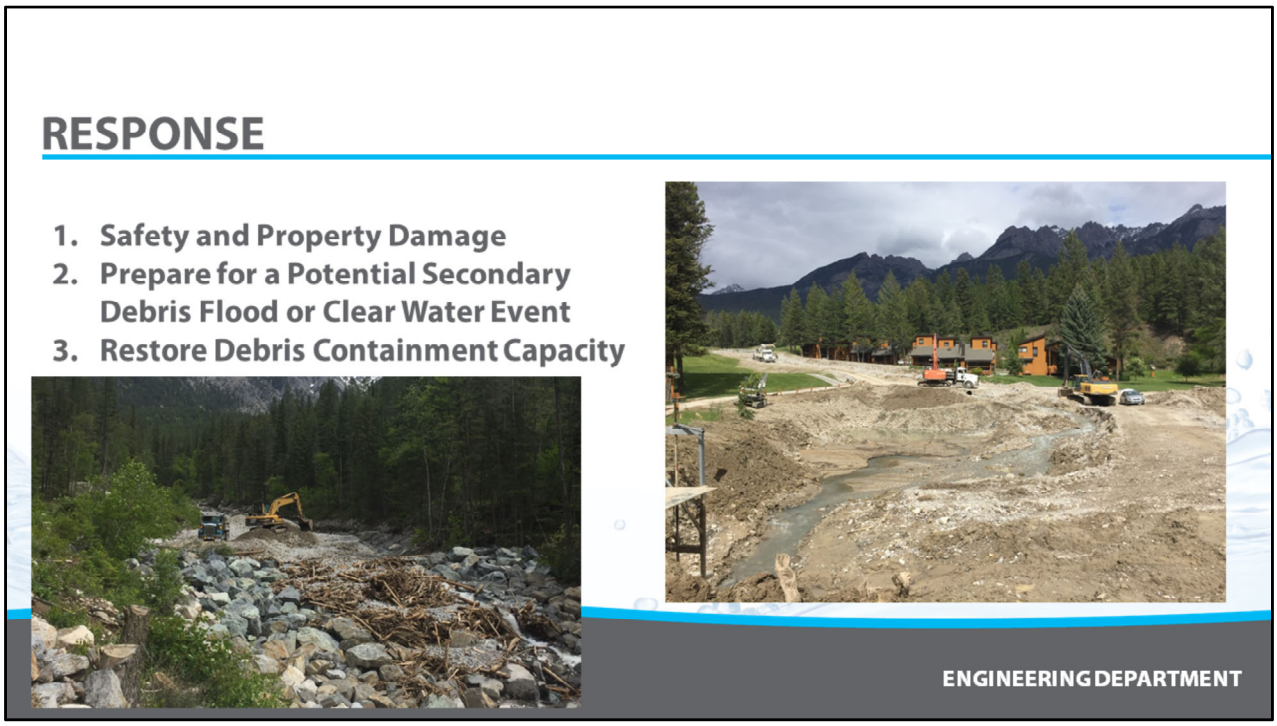
One of the first things we did was get NHC on site to assess the creeks. Their assessment included the following information:

- The precipitation event had approximately a 10 year return period. I'll be mentioning return periods a few times – a 10 year return period event means that every year, there is a one in ten chance of that event occurring.
- This produced a 10 to 20 year clearwater flood event on Fairmont Creek – this is just the water not debris
- And a 35 year return period debris flood even on Fairmont Creek.
- Every debris event that occurs gives us new data to look at the big picture and with this new data, NHC determined that the big 2012 event which was previously classified as a 1 in 500 year event was likely more in the order of a 1 in 165 year event. So instead of a 1 in 500 chance of occurrence each year, there is a 1 in 165 chance of occurrence.
- The Cold Spring Creek Debris flood was considered to be a 1 in 5 year event.

The Fairmont event had impacts throughout the community and the response was a true group effort.

The onsite Incident Command was lead by Engineering Services with valuable support onsite from the fire departments and the Resort. For the first week, Kara Zandbergen and Brian De Paoli were onsite, after that Kara stayed on at Fairmont and Brian moved over to the Windermere site, because as it often happens there was more than one event occurring at the same time. Brian Funke took over as needed as well as visiting other impacted sites in the area.

The EOC was activated immediately and was lead by Protective Services with support from finance, GIS, external consultants and personnel from other departments as needed.



There were several areas impacted on both Cold Spring Creek and Fairmont Creek and I will go through each of them but first I'll explain the response and recovery strategy.

The term "response" refers to actions taken in direct response to the emergency/disaster in order to manage the consequences. This phase of emergency management involves measures to limit loss of life, minimize suffering and reduce personal injury and property damage. It also includes initiation of plans and actions to support recovery.

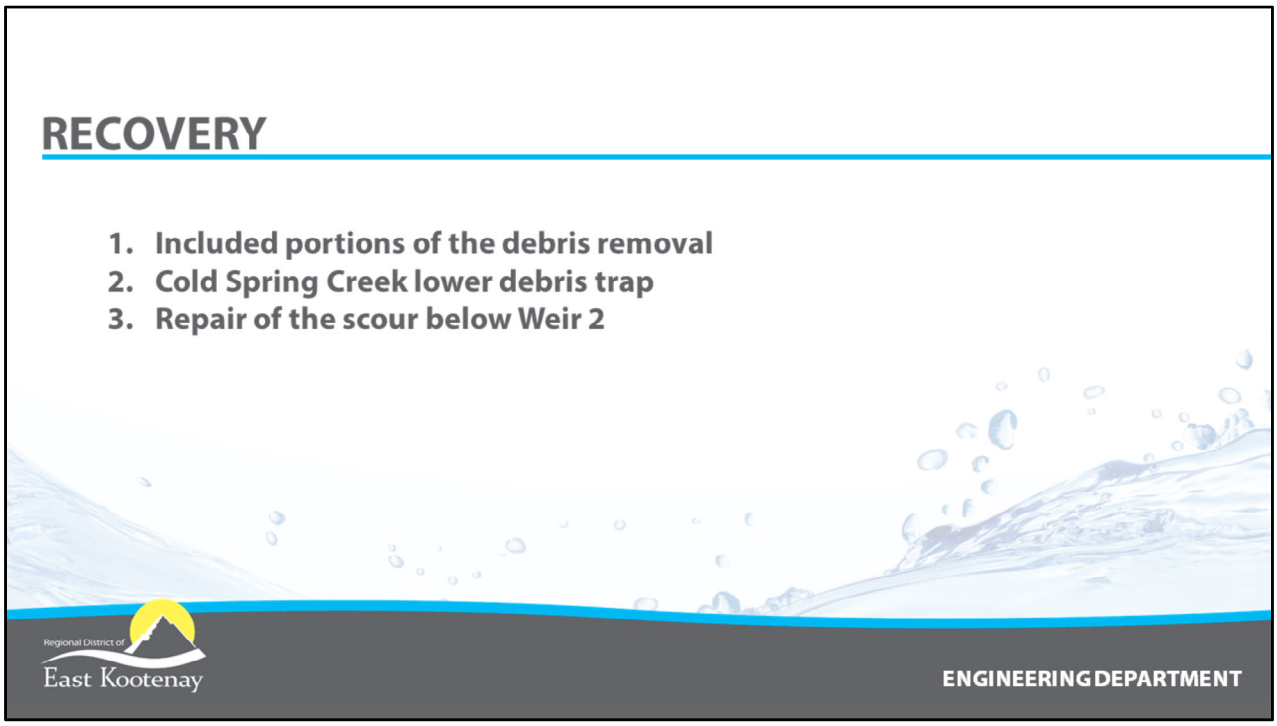
The actions taken had these guidelines in mind.

1. The first priority was public Safety and property damage – evac orders and alerts, geotech assessment and culverts and sandbags
2. The very close second priority was to prepare for a potential secondary debris flood or clear water flood event – The weather forecast for the following weekend was quite ominous and we focussed on restoring capacity in key locations and repairing vulnerable areas where damage had occurred and could potentially progress:
    - Cold Spring Reservoir
    - Fairmont Ck Berm by the sheds – when a berm breaches there is the potential for it to progress very quickly and become a bigger problem
    - Fairmont Ck by Fairmont Ridge – channel infilling and erosion

- Fairmont Ck Channel through the golf course and the Hole 12 pond

1. Once that was achieved we continued to restore capacity in upstream locations
    - Upper Fairmont Creek Weirs
    - Hole 12
    - Some of this fell under recovery and some fell under response (NHC recommendations)

    Much of the work considered to be response had the cost 100% covered by EMBC.

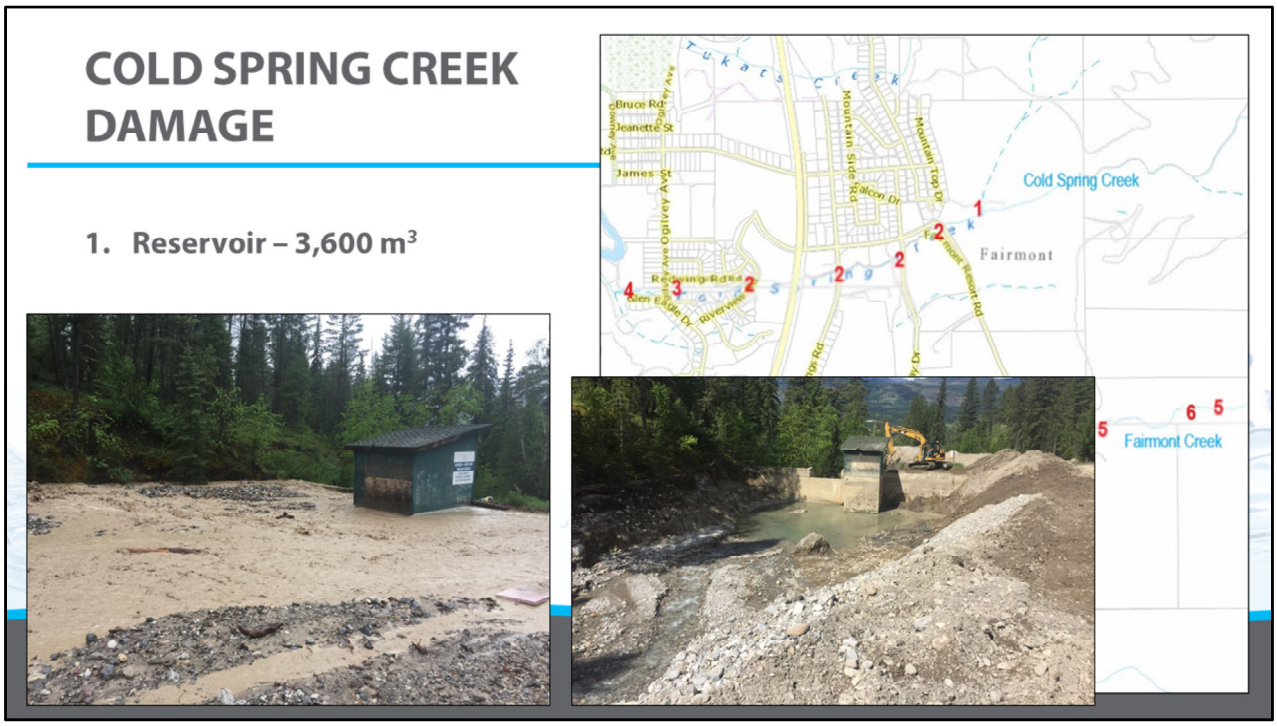


Recovery includes the steps and processes taken/implemented to repair communities affected by a disaster, restore conditions to acceptable levels and where feasible, improve them.

The lines between response and recovery are a little bit fuzzy but for this event, the work that NHC recommended be completed in order to remove the evacuation alerts was considered response and most of the remaining work was considered recovery.

Much of the work considered recovery has had 80% of the cost covered by EMBC through Disaster Financial Assistance with the Fairmont service area being responsible for the remaining 20%.

I'm going to go through each site and will specify if the site was response or recovery.



I'll give you a quick tour through the various sites. For those of you that are not familiar with Fairmont, both creeks flow from east to west through the community. Cold Spring Creek is the creek to the north and Fairmont Creek is the creek to the south that flows close to the big public pools and through Mountainside Golf Course.

I'll start with Cold Spring Creek and discuss the sites starting at the most upstream site and working downstream.

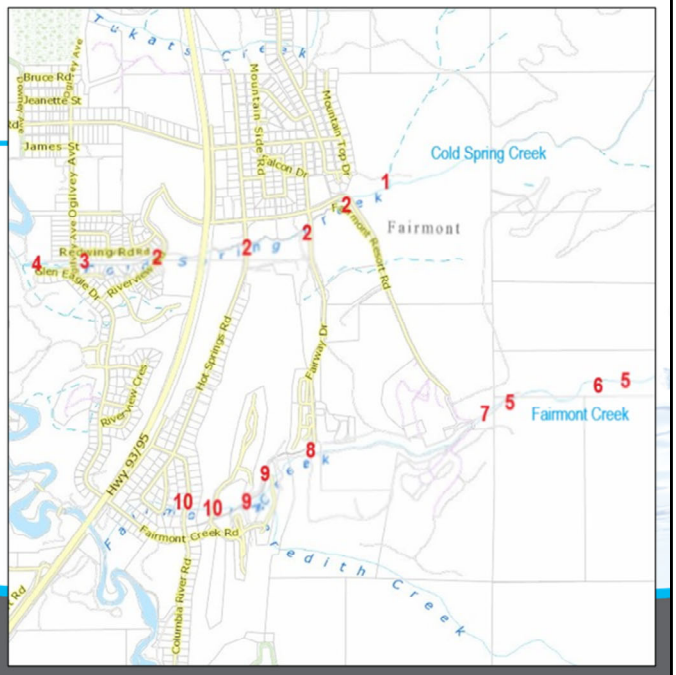
The reservoir site is the uppermost debris containment location on Cold Spring Creek and is currently the only containment site upstream of the community. It is marked on the map with a "1". Restoring capacity at this location was a high priority as it is the only debris containment location upstream of the community and this work was completed very early in the response. Approximately 3,600 cubic meters of material was removed from the reservoir. To make that volume more understandable, if we assume 9 cubic meters per truckload, that is 400 dump truck loads of material.

The picture on the left shows the full reservoir on May 31 and the picture on the right shows the cleaned reservoir.

This work was considered response.

COLD SPRING CREEK DAMAGE

2. Culverts

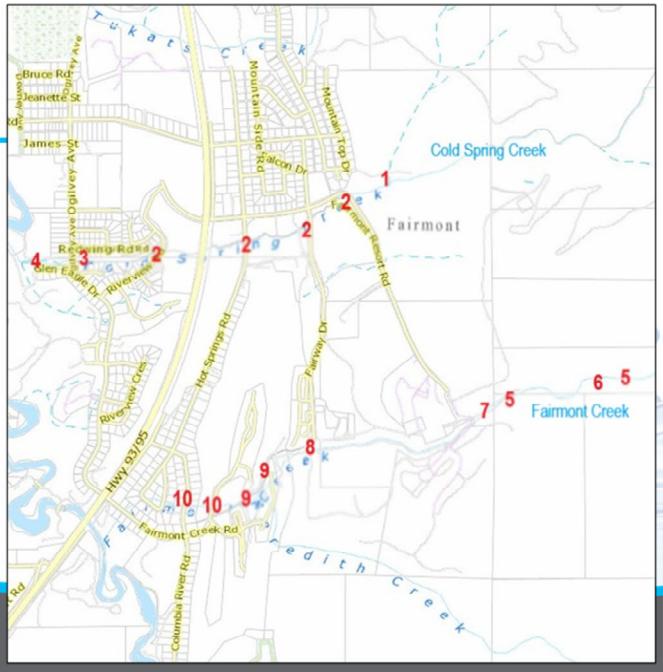


Because we were able to contain the debris so effectively, the biggest impact to the residents and community on both creeks were the culverts that were blocked, unable to pass the flows and overtopped the roads. There were four locations on Cold Spring creek represented by the “2” on the map where the creek overtopped the roads. The culverts were addressed immediately with assistance from local contractors and the Resort.

This was considered response.

COLD SPRING CREEK DAMAGE

3. Lower Channel
4. Lower Debris Trap – 2,500 m^3



The next sites on Cold Spring Creek were damage to the armouring on the lower channel and some infilling of small debris traps (3 on the map) and the lower debris trap (4 on the map) that was completely filled with material.

The repair of damage to the armouring in the channel was completed right away in anticipation of high flows and the material removal in the channel and pond was completed in late fall.

Both were considered recovery.

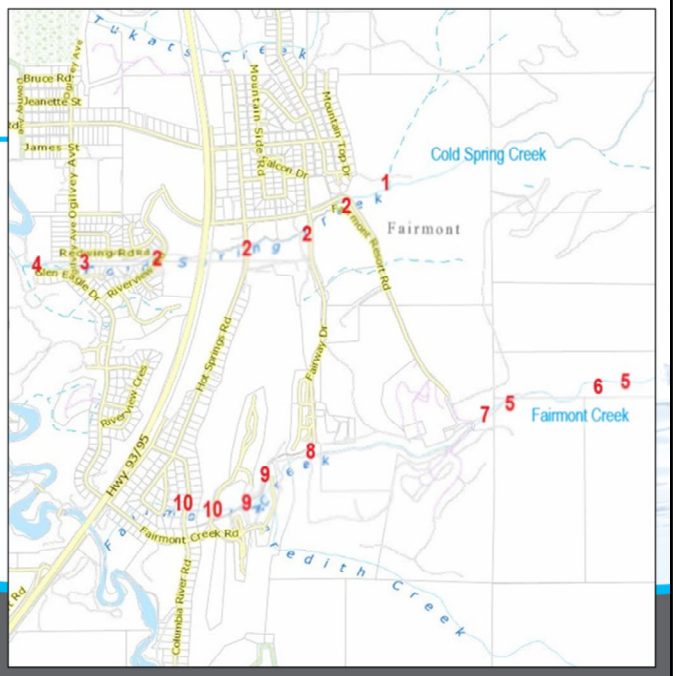
Moving over to Fairmont Creek, there are three large weirs and debris containment basins upstream of the resort and community. The three basins are marked by the 5's on the map (the right-hand "5" indicates basins 1 and 2) and contained a total debris volume of approximately 18,000 cubic meters, all of which has been removed.

The removal of 10,000 cubic meters of debris from the upper two basins was considered response and the remainder was considered recovery.

The picture on the left was taken upstream of the uppermost weir which is located roughly where you see the access road coming down. This weir was buried under about 2 meters of debris. The pic on the right is taken from weir 1 looking towards weir 2 in the distance and shows the cleaned basin. A tremendous amount of material was removed from this site.

FAIRMONT CREEK DAMAGE

6. Weir 2 Scour

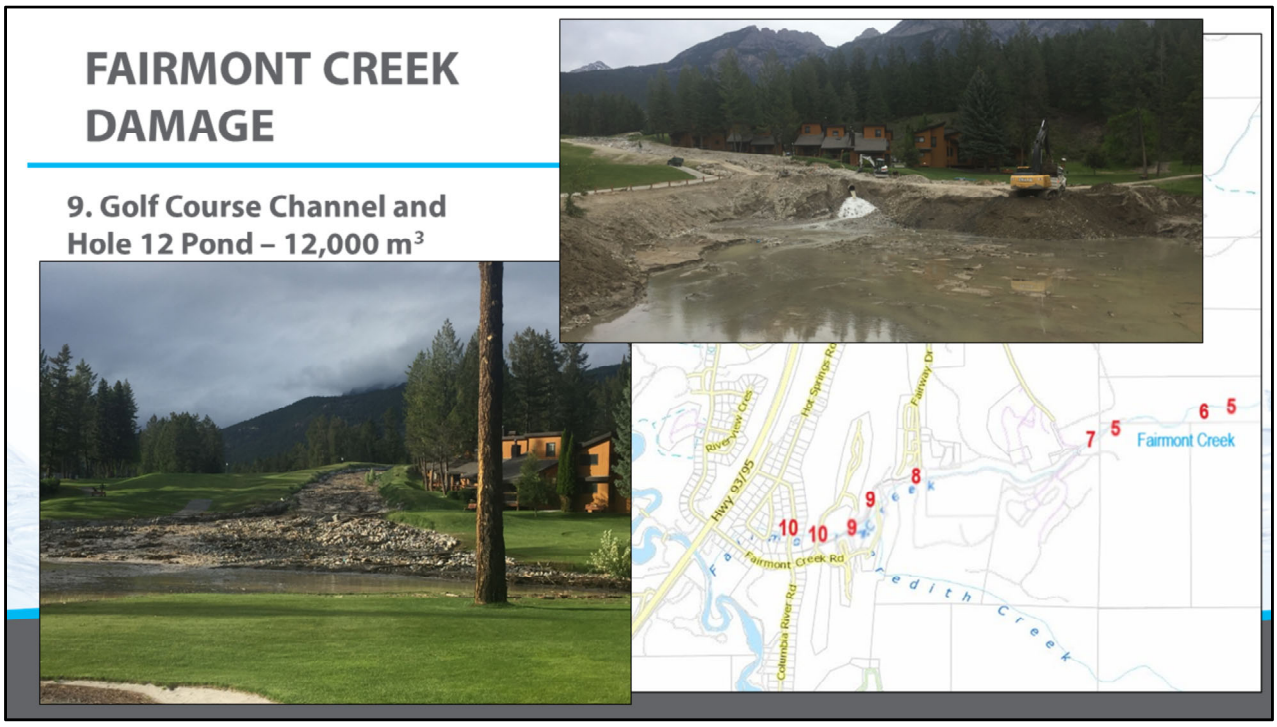


There was scour downstream of Weir 2 that needs to be repaired. This is shown in the lower picture and is marked by the 6 on the map.

This work will be completed in 2021 and will be considered recovery.

The berm marked with a 7 upstream of the resort and community was damaged as shown in the lower picture. This was a high priority site and was repaired very early in the response. The picture on the right shows the repaired bank. This was considered response.

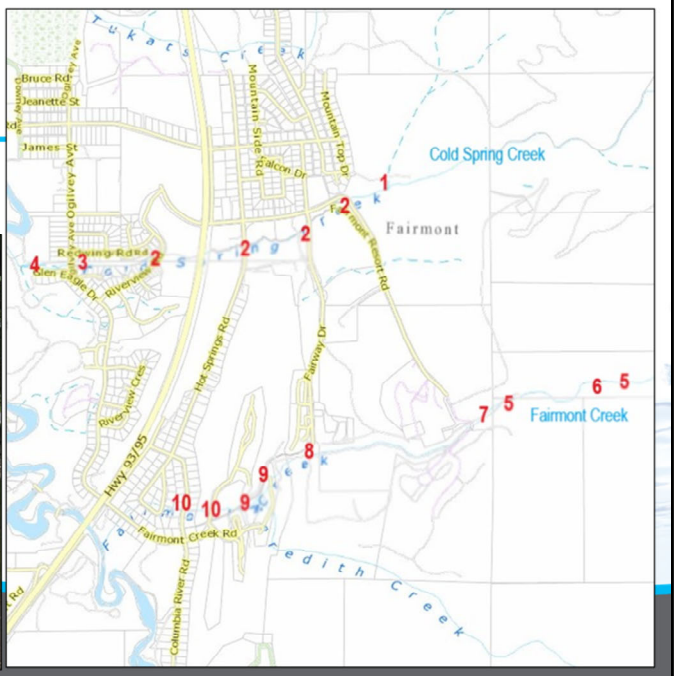
The Fairmont Ridge site is marked by an 8. There was bank erosion and channel infilling and the site was considered high priority as a second highwater event could have forced the creek out of the channel. Approximately 1,200 cubic meters was removed and the bank was repaired. This was considered response.



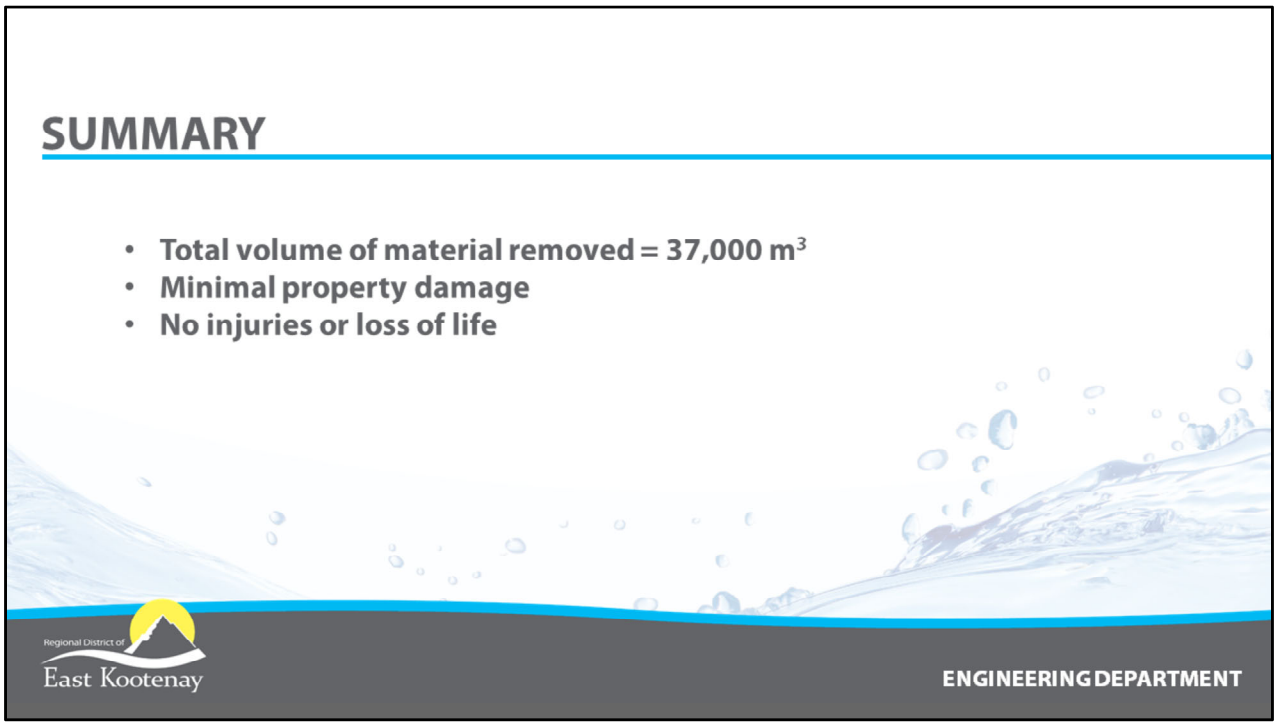
The armoured and bermed channel through the golf course and the pond (marked with 9's) captured approximately 12,000 cubic meters of debris. This was a high priority site and was actioned very early in the response. The removal of the debris from the channel and part of the pond excavation was covered under response and the remainder is considered recovery.

FAIRMONT CREEK DAMAGE

10. Culverts



The two trouble culvert locations on Fairmont Creek are marked with 10's. Similar to the culverts on Cold Spring, the culverts were addressed immediately with assistance from local contractors, the Resort and the Mountainside Villas. There were properties impacted by these overflowing culverts – mostly yards but there was damage to a garage foundation.



Along with the other repairs, a total volume of 37,000 cubic meters of material was removed from the containment basins on both creeks. That's approximately 4,300 dump truck loads.

It's really important to note that the mitigation work that has been constructed so far worked. The material was contained where it was supposed to be contained. As a result, there was minimal property damage and no injuries or loss of life.

COST SUMMARY

- Much of the work that was considered "response" was funded by EMBC
- The work considered to be "recovery" is largely covered by DFA funding at 80% funded

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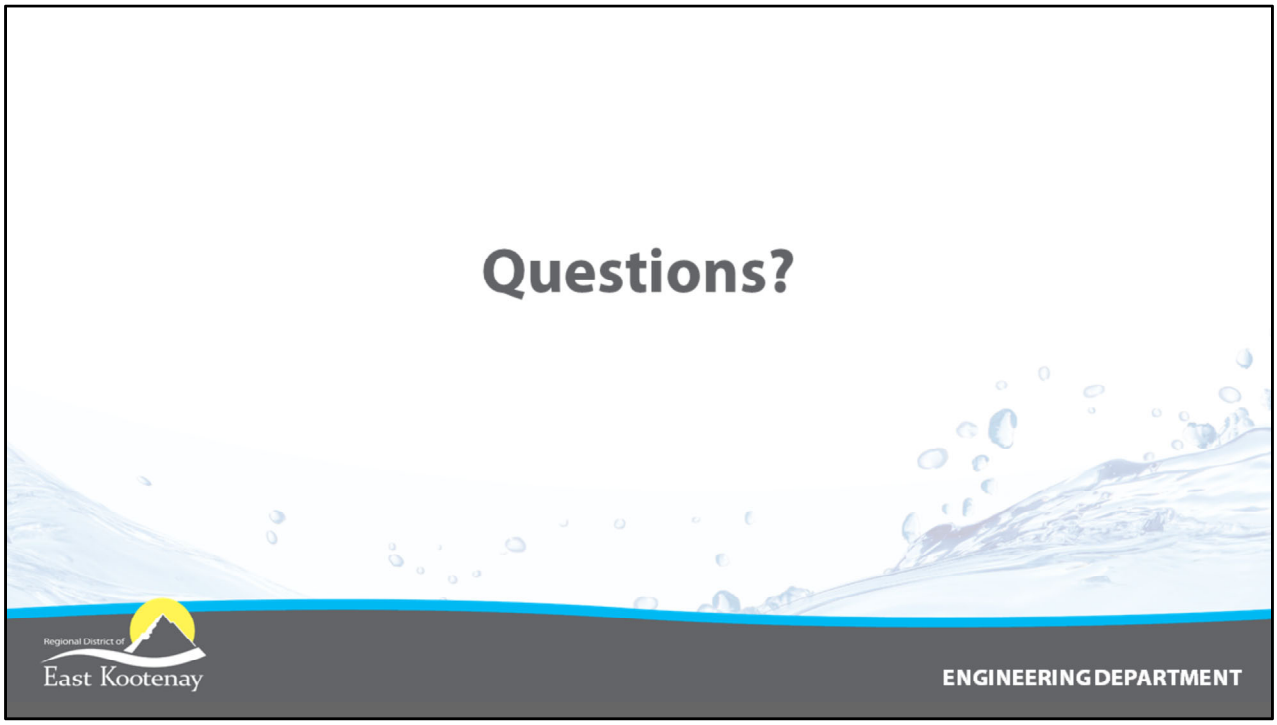
Questions?



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