Recovery and Funding Program
Disaster Financial Assistance Engineer
Engineer Tip Sheet

To request DFA Funding Approval with Local Government infrastructure recovery projects, you must send an engineer report along with the completed cost recovery plan. Engineer reports are required to provide detail on the more complex projects and to prove the damage was from the disaster with the least cost option to repair it back to functionality before the disaster occurred.

Purpose of Report:

- Confirm that the project is eligible for DFA
- Confirm that the all repair costs are eligible for DFA

Cover Page:

- Name of Event
- Name of Local Authority
- Project Name and Number
- Preliminary Report/Damage Assessment or Final Post Completion Report

Disaster Event Elements:

- What caused the damage?
    - The report needs to directly link the damage to the DFA event
    - If flood – dates of rainfall or river flooding
    - If landslide – provide evidence that the slide was a direct result of the DFA event and not caused by long term on-going slope instability

- What was the pre-disaster condition?
    - Describe condition of damaged infrastructure immediately before the disaster
    - Include supporting evidence – photos, reports, maintenance records, as built drawings etc.
    - Include infrastructure measurements or quantities of materials damaged by disaster.

- What is the least cost option to restore the damaged infrastructure to pre-event condition?
    - Cost breakdown estimate (choose 1 of the 3 options):

Do the same repair	The repairs represent only the minimum amount needed to return to the works to pre-disaster condition. In this case the engineers report needs to clearly state that the costs represent only the costs with measurements or quantities of materials of returning to pre-disaster condition.
Do more (build back better)	Additional work is undertaken beyond restoring to pre-disaster condition. In this case the engineers report needs to identify the minimum cost with measurements or quantities of materials to return the works to pre-disaster condition or functionality, and then separately identify the costs associated with any enhancements. These enhancements will not be DFA eligible unless supported with documentation to confirm they are required to meet mandatory standard, regulation, or code/by law.
Do different repair	An alternate solution is undertaken. The engineer report needs to identify the minimum cost to return the works to pre-disaster condition, and then separately identify and cost any alternate solutions. DFA eligible costs will be the lesser of the cost to return to pre-disaster condition or the alternate solution.

- What are the DFA eligible costs?
  - Refer to DFA legislation https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/124_95
  - If the work is NOT started – the engineers report will be preliminary and will provide estimated Class D costs (or a combination of actual and estimated costs if work has started)
  - If the work has been completed the report will be a final or post repair report and provide actual costs (these costs will match the invoices and claim summary being submitted to EMBC)

- What resources were used to prepare the engineer report?
  - Any reports or documents that were used to support conclusions for DFA eligibility must be appended to the report, such as:
    - Geotech reports
    - MFLRNORD and DFO requirements/approval letter
    - Archaeologic Study, Hydraulic Study and other engineers required for approval process

- Who prepared the Report?
  - Report must be signed by engineer with the engineering company name

CITY OF RIVERBEND

City of Riverbend

Cost Recovery Plan

Engineer Assessment

DFA Sample Report

Date: August 27, 2020

NAME OF LOCAL AUTHORITY: City of Riverbend

PROJECT TITLE: Recovery Repair Works

PROJECT LOCATION: 5 Project sites identified

File # 2021-05

NAME OF EVENT: **Spring Freshet Flood 2020**

DATE OF DAMAGE: May 31 - June 1, 2020

FUNDING REQUEST: ***$ 143,943***

DOCUMENTS INCLUDED:

- Map of effected area
- MFLNRORD Conditional Approval Letter (if required)
- Photos of damage pre and post event
- Cost Estimate

CEDAR ENGINEERING

August 27. 2020

City of Riverbend
Disaster Financial Assistance

The following is a summary of our engineering review of damage that occurred to the City of River Bend from the spring freshet at Carpenter Creek and Dike.

Applicant Information:

The City of Riverbend. Contact Kate Fern CFO and George Smith. Public Works.

Scope:

Chris Arbutus of Cedar Engineering. has reviewed flood damages sustained by the City of Riverbend during the May 31/June 1 2020 flood event. Cedar Engineering was asked to review the Disaster Financial Assistance (DFA) application and provide an opinion as to whether the site/damage was consistent with DFA eligibility criteria and to estimate the cost for repairs.

A field review was completed by Chris Arbutus and the undersigned on August 25, 2020 in the company of Kate Fern (CAO) and George Smith (Public Works) of the City of Riverbend. All sites identified were is reasonable working order before the event occurred.

Figure 1: City of Riverbend– **Site Location Map**
Damage Sites by flood

The following provides a description of the losses at each site. The City has identified 4 sites. Following the field inspection Cedar Engineering added the additional Site 3 to make a total of 5 Sites.

Site 1 - Walkway: A large volume of bed load was deposited and was shifting in the main channel of Carpenter Creek during the event resulting in an avulsion at the downstream right bank and subsequent flooding and erosion of a 55 m long section of 1 meter wide gravel walkway as shown in Figure 2. The City does not have pre-event photo. The trail was in good working order before the spring flooding occurred.

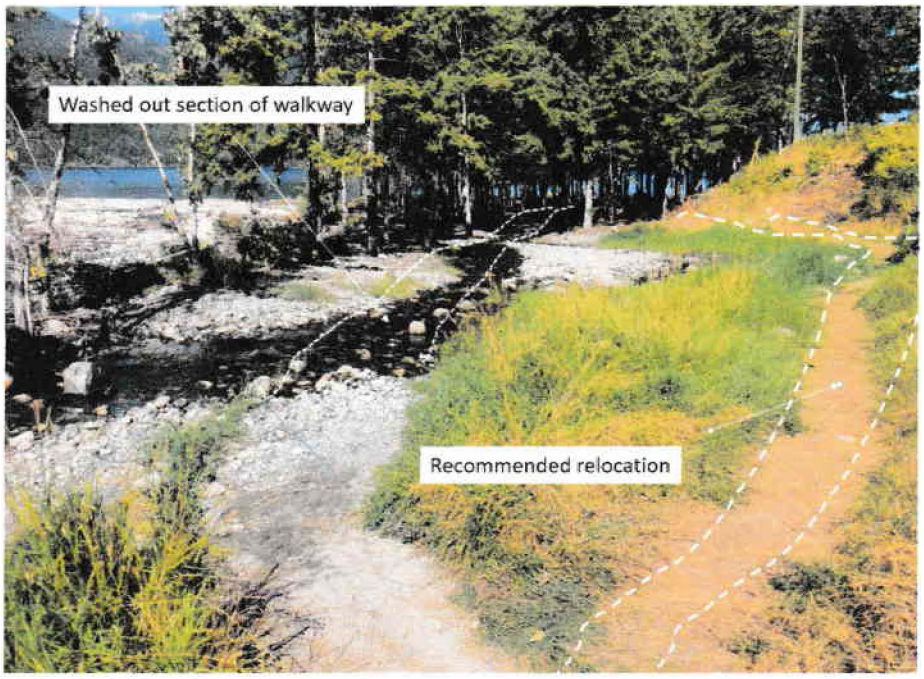


Figure 2: Site 1 – Walkway Flooding and Erosion August 25, 2020

The estimated cost to reconstruct the walkway is summarized in Table 1. The estimate is based on the relocation of the section of walkway approximately as shown in Figure 2. It is deemed impractical to reconstruct the washed out section of walkway in the location it existed prior to the flood. Firstly, it would require the excavation of the substrate of the main channel of Carpenter Creek to divert the water from the worksite. This work in and about a stream would require authorization from MFLNRORD increasing the project duration and cost substantially. It is questionable whether the ministry would authorize this work. Secondly, because of the elevated main creek bed adjacent to the entrance to the new channel that eroded the walkway and the continued deposition and shifting of gravel and accumulation of log jams there is a high probability that the area would flood again next freshet.

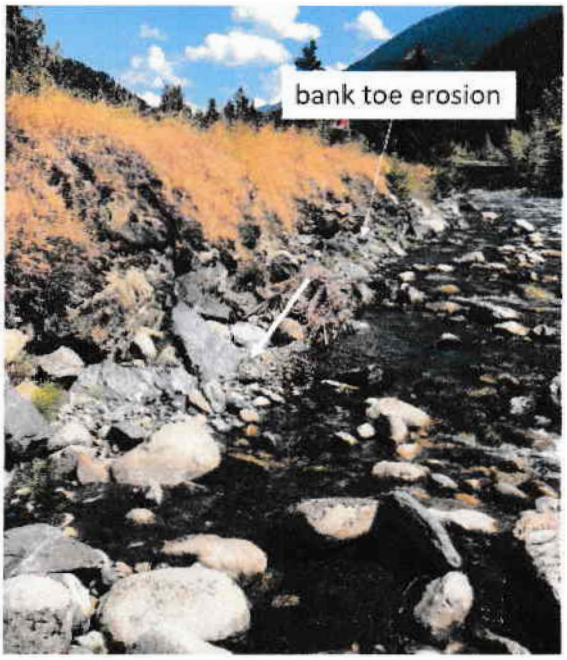
Site 2 – Log jam: The high creek flows resulted in development of several new log jams in the creek channel throughout the City. The City is concerned that the log jam shown in Figure 3 will increase the risk of erosion of the adjacent riprapped bank. The removal of the jam would reduce the likelihood of a bigger jam forming in subsequent freshet flows and would reduce the risk of damage to the adjacent riprap bank protection. However, there was no evidence of loss of riprap from the bank resulting from this event. The removal of the jam would require prior authorization from MFLNRORD. One alternative is to cut up and spread the logs in channel to reduce the likelihood of creek redirection.

Figure 3: Site 2 Log Jam August 25, 2020

NOT ELIGIBLE FOR DFA FUNDING

The removal of the tree debris is considered mitigative as no Infrastructure is impacted

Site 3 Right Bank Erosion: A 15 m length of riprap bank protection, approximately 190 m downstream from the Highway 6 bridge (see Figure 1) was damaged as shown in Figure 4. Costs (Table 2) for riprap repairs to this site and Sites 4 and 5 are considered eligible.



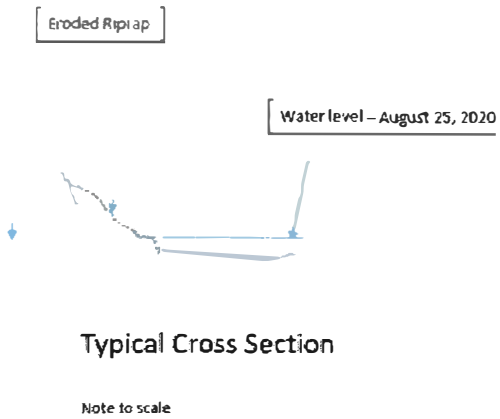
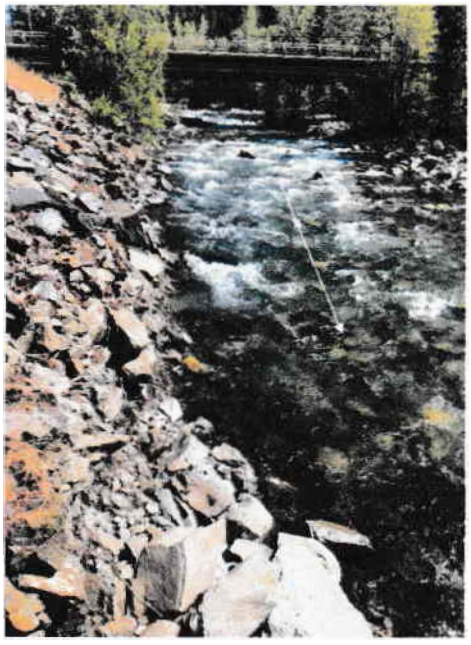


Figure 4: Site 3 Riprap Toe Erosion August 25, 2020

Site 4 -Riprap Replacement: Approximately 67 m of bank protection was damaged as shown in Figure 5.



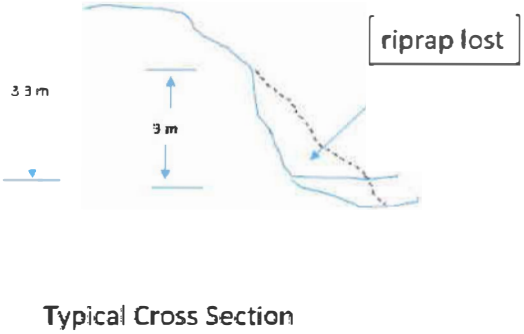
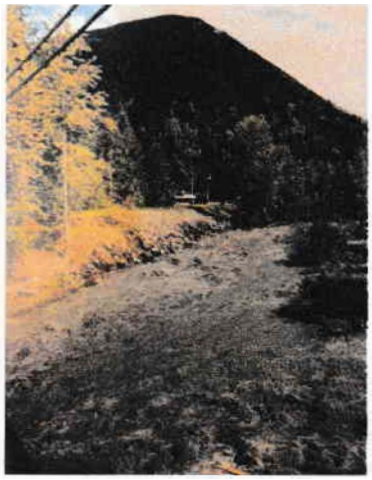


Figure 5: Site 4 Riprap Lost August 25, 2020

Site 5 Riprap Replacement: Riprap erosion protection on a 26 m section of dike upstream of the Highway 6 bridge was eroded as shown in Figures 6 to 8. A large gravel bar and trees in the

channel upstream of the bridge and ajacent to this site constricted the channel, caused log jams, and resulted in water being forced to impinge directly into the dike as shown in Figures 7 through 9.



Typical cross section

Figure 6: Site 5 Bank Erosion August 25, 2020

Figure 7: Site 5 Dike Erosion August 25, 2020

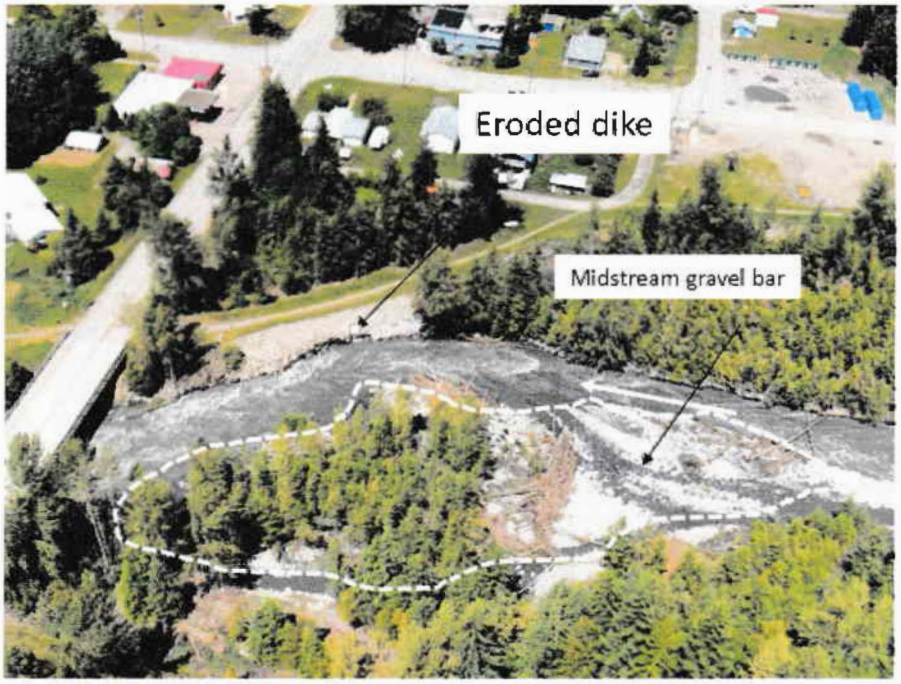


Figure 8a: Site 5 Gravel bar and trees mid stream upstream of Highway 6 bridge June 3, 2020

Figure 8b: View of midchannel bar and trees upstream of bridge June 3, 2020

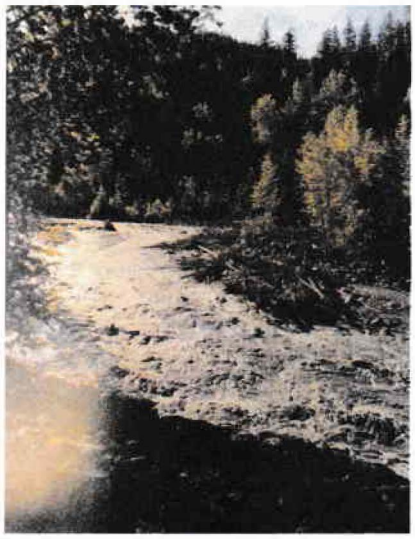


Figure 9: View of gravel bar and log jam forcing flood waters to impinge on dike May 31, 2020 (courtesy City of Riverbend)

The dike was intially constructed in the 1970's and upgraded in the 1990's. During the 2013 freshet the dike was damaged at this same location with loss of erosion protection and some of the dike prism as shown in Figure 10. The photo in Figure 10 was taken from CGT Engineeing letter report to the City dated September 11, 2013. In 2014 the dike slope was reconstructed and armoured with riprap, as shown in Figure 11, taken from CGT letter report to the City dated September 8, 2014. It is understood the repairs where funded partially by the Province.

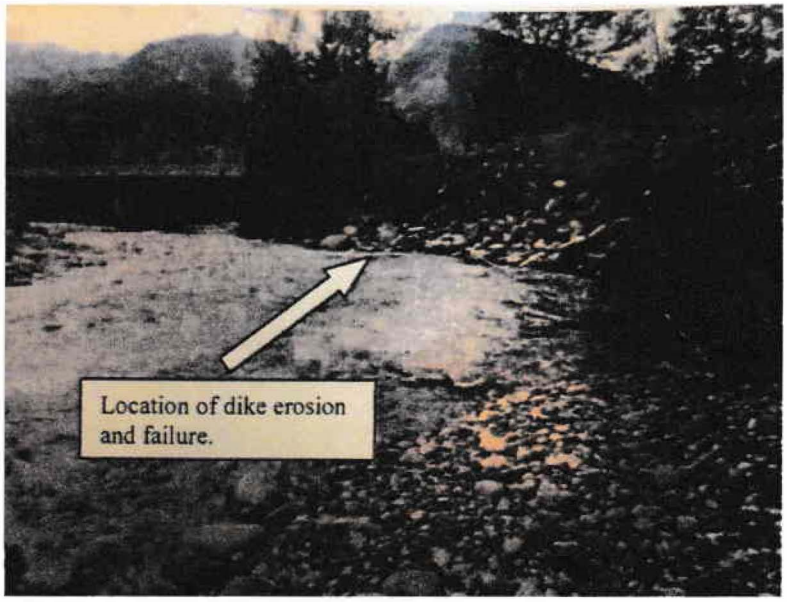


Figure 10: View of Erosion Resulting from June 2013 Flood (CGT 2013)

Figure 11: September 2014 photo of repaired dike (CGT 2014)

The estimated volume of riprap lost during the May 31/June 1 event is 143 m^3. Simply reconstructing to the pre-event configuration is not recommended as there would be a high likelihood of a repeat failure. Conceptual review indicates that the maximum riprap slope angle should be 1.5H:1V (which is consistent with the 2013 riprap design) and should include a toe trench (also part of the 2013 design). The riprap placed on the lower slope in 2013 had a lower slope angle of 1H:1V compensated by larger riprap sizing. In addition, it is recommended that the gravel bar, log jam and trees shown in Figures 7 and 8 be removed from the channel to realign flow under the highway bridge and reduce pressure on the dike. Once the channel is cleared the accumulation of gravel and log jams should be monitored and actions taken to prevent the re-establishment of the channel constriction. This can be facilitated with coordination between the City, MFLNRORD (Dike Inspection and habitat concerns), DFO and MOTI by updating of the Vegetion Management Plan. During the May 31/June 1 event the highway bridge sustained damage in the form of lost riprap that provides pile cap protection (piles now exposed).

The cost of repairs summary (Table 1) for Site 5 is based on the plan to reconstruct the bank with a flatter slope angle and scour protection described above. The construction will involve instream work. Consequently, authorization will be required from MFLNRORD. Most likely MFLNRORD will require an environmental assessment and oversight during construction. This cost is included in Table 1.

As noted above, Cedar Engineering recommends the removal and subsequent monitoring of the gravel bar build-up to reduce the risk of future damage to the dike and the highway bridge. This would include obtaining authourization from MFLNRORD and DFO to complete the intial gravel and

tree removal and re-grading and revising and updating the Vegetation Management Plan. As this work may not be elgible for DFA (to be confirmed) it is not included in Table 1.

Cost Summary: As stated, Table 1 provides a conceptual cost estimate to complete the works as the least cost option (not including channel works and debris removal upstream of the bridge – which may be eligible for DFA as it will assist in protecting the replacement riprap and highway bridge). The work at all sites will require authorization for work in and about a stream (Water Sustainability Act (WSA)). It is assumed that the work will be completed under one WSA authorization and that an RPBio report and site inspections will be required.

Table 1: Cost repair summary (conceptual design stage)

Site No	Item	Quantity	Unit Cost	Cost	Comment
1	Sand and gravel – haul to site	$20m^3$	$50	$1000	
	Machine time – strip, level, load and spread	10 hrs	$77.15	$771.50	Class 3 mini
2	Buck debris in channel	60 hrs	$50/hr	$3000	costs not eligible for DFA.
3	Riprap	10 m^3	$220	$2200	Unit price includes purchase, haulage & placement
4	Riprap	192 m^3	$220	$42,240	Unit price includes purchase, haulage & placement
5	Riprap	250 m^3	$220	$55,000	Unit price includes purchase, haulage & placement
	Excavator 30 tonne	30 hrs	$171.05	$5131.50	Required to reconfigure slope & instream work to dewater toe
	Site Survey			$2000	
	Geotextile			$2000	
All Sites	Engineering design, drawings, cnstruction specs			$15,000	Prepare drawings, Dike Act and WSA approvals, construction oversight and project completion report
	Hydrotechnical Report			$1,600	Hydrologic and hydraulic analysis to establish design perameters
	Riprap site inspections during construction – general confomance			$6,000	
	RPBio Report and Section 11 Application			$4,000	Field day, habitat assessment and prescriptions
	RPBio Site Monitoring			$4,000	On site monitoring and project completion report
Total				$143,943	**less costs $3000 associated with logjam.**

Any questions please call.

Sincerely,

Chris Arbutus

Chris Arbutus, Cedar Engineering.