

**DECEMBER 2022**  
**PERFORMANCE MEASURE INFORMATION SHEET**  
**DUNCAN: FLOODING**

**SUMMARY**

**Goal:** Minimize the flood damage to people and property on the Lower Duncan River.

**Recommended Performance Measure:**

Objective/ Location	Performance Measure	Units	Details	Description
Flooding/ Lower Duncan River	Initial flooding risk	# days per year	Median number of days per year across all years when flow levels are between 400 to <500 m <sup>3</sup> /sec. Less is better.	Seepage is starting and there is a risk of flooding from any increases such as rain events.
Flooding/ Lower Duncan River	Extensive flooding	# days per year	Total number of days when flow levels are equal to or above 500 m <sup>3</sup> /sec. Less is better.	Extensive flooding of low- lying areas, including hayfields and the former Cooper Creek Cedar industrial site.

Further consideration of the best statistics (e.g. median, mean and what years to include) is ongoing and may result in some revision to these measures.

Sub-measures of the number of days, number of years and flow levels above the thresholds will inform detailed scenario evaluation.

**Introduction**

The lower Duncan River from Duncan Dam to Kootenay Lake, including Meadow Creek and the former Cooper Creek Cedar industrial site and farmland (known collectively as the floodplain of the lower Duncan River) can be affected by high flow (flooding) events. Flooding impacts may include equipment damage, loss of employment, potential loss of agricultural production, and other water-caused impacts to private property.

The primary concern related to high flows in the Lower Duncan River and flooding of the Duncan River floodplain is when river discharge increases above 400 m<sup>3</sup>/sec several private properties are flooded. Flooding is most likely to occur during the late spring and summer months when the Lardeau River and Meadow Creek flows are high and the Duncan Reservoir is near or at full pool so that no more water can be stored.

The extent of inundation of the Duncan River floodplain has been reduced since the dam was constructed, however flooding on the lower Duncan River can and will occur regardless of the operations of the Duncan Dam. This is primarily the result of high flows on the Lardeau River, which enters the Duncan River below the Duncan dam, during the freshet, in combination with local rain events, groundwater influences, and other tributary influences. Operations of the Duncan Dam may, however, reduce both the likelihood and degree of flooding by reducing discharges at critical times by storing water in the Duncan Reservoir (depending on if there is available storage space). Flooding in the lower Duncan River can occur because of both groundwater infiltrations as well as overbank flow.

### Past Performance Measures

The [Duncan Dam Project Water Use Plan Consultative Committee Report](#) (2005)<sup>1</sup> used a flood risk performance measure to evaluate alternative dam operations (Table 1). This performance measure had several flow thresholds to estimate the impact of Duncan Dam discharges, combined with Lardeau River discharges on inundation of the floodplain of the lower Duncan River (below the confluence of the Lardeau River). The performance measure was relevant year round, though flooding is most likely to occur during the late spring and summer months. It is anticipated that discharges greater than one day in duration will allow water to seep/flow into low-lying areas and soil characteristics limit the ability of water to recede and affect access (due to soft ground) over the longer term.

**Table 1. Flood risk performance measures from the Duncan Dam Project Water Use Plan Consultative Committee Report (2005)**

Flow levels	Details	Description	Important dates
> 400 m <sup>3</sup> /sec:	Water level is “bankfull”	Seepage is starting, no surface water pooling, water backing up Meadow creek but not overtop banks. Risk of flooding from any increases (e.g., rain events)	N/A
> 450 m <sup>3</sup> /sec:	Water overtopping the banks at the former Cooper Creek Cedar industrial site*	Potential for wood chips, etc. to be washed into the stream. Low area flooding of private properties	8 August: flooding before this date creates risk of hay crop loss
> 500 m <sup>3</sup> /sec:	Extensive flooding of low-lying areas including hay fields	Water levels flow into the electrical shed at the former Cooper Creek Cedar industrial site and the site must shut down	8 August: flooding before this date creates risk of hay crop loss

*\*Although the Cooper Creek Cedar operation has closed, the land continues to be a valued economic development community asset.*

### New Information

BC Hydro’s flood risk management (FRM) performance measures that have been incorporated in the Columbia River Treaty Planning Model for Lower Duncan River flows below the confluence of the Lardeau River are equal to or above 400 m<sup>3</sup>/sec and 500 m<sup>3</sup>/sec; these are the same as the lowest and highest flow thresholds used in the Duncan Water Use Plan (WUP) flood risk performance measure.

In 2022, the CRT Socio-Economic Integration Team invited pictures from local residents of flood impacts to verify these levels but no photos were provided.

Members from the Columbia River Treaty Local Governments Committee and the Columbia Basin Regional Advisory Committee commented that Kootenay Lake levels can influence flooding along the Duncan River below the confluence of the Lardeau River. This is noted in the Duncan Dam Project Water Use Plan Consultative Committee Report<sup>2</sup> however it was not

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<sup>2</sup> Page 4-33

included in the WUP performance measure. BC Hydro does not have any information about this factor. It was beyond the scope of this process to explore this situation; however, this could be explored later if raised through further public input as a significant factor in local flooding.

**Recommended Performance Measure**

Given the information above, the research team recommends the following performance measure (Table 2) which:

- retains the lowest and highest flows from the Duncan WUP as these levels are from the most recent public engagement on this topic and no reasons were provided to the team to change them; they reflect the most significant changes in types of flood damage; and they are consistent with the FRM PMs;
- only counts days when Duncan Dam flows are greater than the minimum environmental flow because this eliminates the flooding events that are solely due to the unregulated Meadow Creek and Lardeau River flows; and
- for the higher flow threshold, focus on years with higher flow levels to increase the sensitivity of the measure to pick up the lower number of flooding events.

**Table 2: Duncan flooding recommended performance measure**

Objective/ Location	Performance Measure	Units	Details	Description
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The team recognizes that flooding impacts depend on how high river flows become, over how many days and how frequently within a year and over the years that the flooding thresholds are exceeded. The team will be exploring these factors when scenarios are evaluated and will be exploring ways to refine these performance measures to better reflect the influential factors.

**Comparison of Proposed Performance Measure with Historical Operations**

1963 – 2020 flows indicate a risk of initial flooding (over 400 m3/sec) in March, during the freshet from mid-May to mid-August and infrequently in September through December (Figure 1). Extensive flooding (over 500 m3/sec) has occurred in very high flow years in March, June through August, and less frequently in September and December.

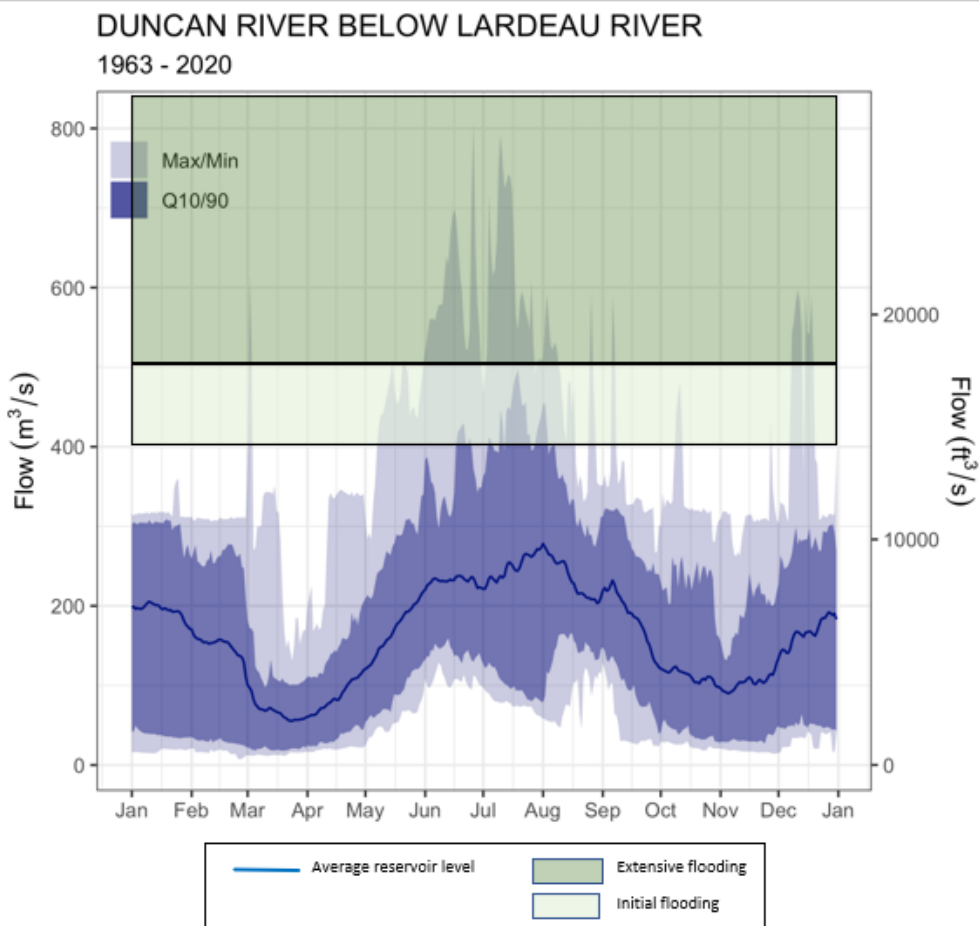


Figure 1. Comparison of proposed performance measures with historical flows

## Key Assumptions and Uncertainties

Flooding in the lower Duncan River floodplain will continue to occur as it is dependent on tributary inflows, local weather patterns, groundwater effects, and Kootenay Lake levels (in the lower reaches). The performance measure will provide an indication of the relative risk of flooding associated with different Duncan Dam operating alternatives.

- Maximum flows in the lower Duncan River are represented by the daily averages as generated in the Columbia River Treaty Planning Model. In reality, instantaneous flows may be measurably higher.
- The degree of impact associated with larger flow events in the lower Duncan River is not well documented.
- The PM assumes that changes in the riverbed do not occur. In reality, changes will occur in lower Duncan River channel morphology and sediment deposition; this may influence the discharge (positive or negative) at which flooding of private properties occur in the future.

- The PM assumes that local events or watershed issues do not increase local flooding or inundation risk. This includes logging practices, land development around the area, or even debris events like log jams clogging the river or channels in areas.

## References

The Consultative Committee for the Duncan Dam Water Use Plan (2005). Duncan Dam Water Use Plan: A Project of BC Hydro. <https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/environment-sustainability/water-use-planning/southern-interior/wup-duncan-consultative-committee-report.pdf>