



# Real-time Hydrometric Monitoring for Environmental Compliance and Community Safety





## Jacob Bauer, P.Geo

- Six years experience working on complex systems in BC with Northwest Hydraulic Consultants Inc.
- Focus on hydrometrics, hydrology and geomorphology
- Bringing experience with real-time data collection to Atlantic Canada
- Water Resources group in the Environmental Services Business Center at Stantec Business







01

## Why I love Real-time

- Pro and Cons

02

## Environmental Compliance

- Coast Mountain Hydro

03

## Community Safety

- Pemberton Valley Diking District
- Resort Municipality of Whistler
- District of Stewart





# Pros



- Real-time data QA/QC
- Reduction of expensive field visits
- Hazard Mitigation
- Immediate access to site information
- Logic!

# Cons



- Expensive
- Complicated



**PROGRAMMING IS  
10% WRITING CODE AND  
90% UNDERSTANDING WHY  
IT'S NOT WORKING**

[WWW.TEACHYOURKIDSCODE.COM](http://WWW.TEACHYOURKIDSCODE.COM)

# The Most Powerful Pro for Real-Time Monitoring: **Logic**

Logic can play a crucial role in datalogger programming by enabling developers to create automated solutions to Environmental problems.

- Automated Monitoring
- Automatic Alerts and Notifications
- Real-time complex analysis
- Reduction of station downtime

Source: TeachYourKidsCode.com



Created on Fri Nov 3 08:39:16 2023

@author: jbauer

"""

#identify interested parties

email\_to\_address = '[johnsmith@municipality.com](mailto:johnsmith@municipality.com)'

#define thresholds

stage\_change\_stage\_change\_thresh = 0.1 'm/per min

dyke\_top = 30 'm'

sample\_period = 15

#Measure Wwaterlevel

wetted\_stage = SDI12Recorder (PT(),1,0,"M!",1,0)

#Calculations to determine Water Level

Water\_Level = Elevation\_of\_sensor + wetted\_stage

#check for overtopping condtions

if (Water\_Level > dyke\_top:

Alarm = True

else

#calculate rate of change

max\_stage = max(wetted\_stage)

min\_stage = min(wetted\_stage)

rise\_rate = max\_stage - min\_stage/sample\_period

#check if rate of change conditions

if rise\_rate >= stage\_change\_thresh:

Alarm = True

Cell\_On = True

else

Alarm = False

if Alarm:

Message = "Water level at the river indicates high stage or rapid change in stage."

EmailSend (email\_server,email\_to\_address,"[jacob.bauer@stantec.com](mailto:jacob.bauer@stantec.com)",

# Alarm Code

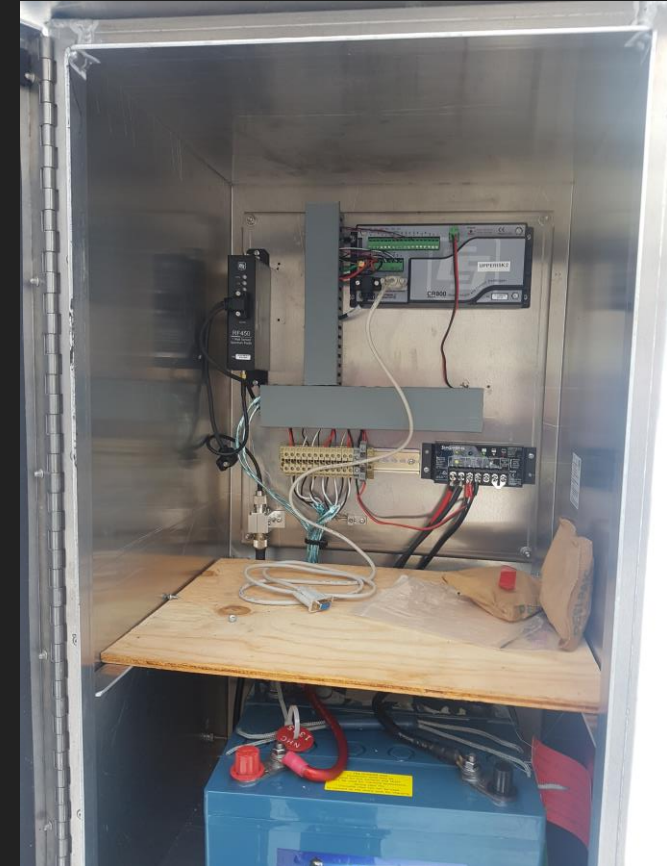
- Define recipients
- Set stage and rate of change thresholds
- Measure stage
- Check active stage against stage thresholds
- Calculate rate of change
- Check rate of change against threshold
- If alarm values are true send alert emails



# Coast Mountain Hydro

Coast Mountain Hydro Services` operates a collection of three run-of-river hydroelectric facilities — Forrest Kerr (195 MW), McLymont (66 MW), and Volcano (17 MW) Hydro Projects. Located in Northwest British Columbia, Canada.





# Environmental Compliance

## IFR

Real-time discharge to plant operators HMI

## River Ramping

Compliance monitoring for river stage rise and fall

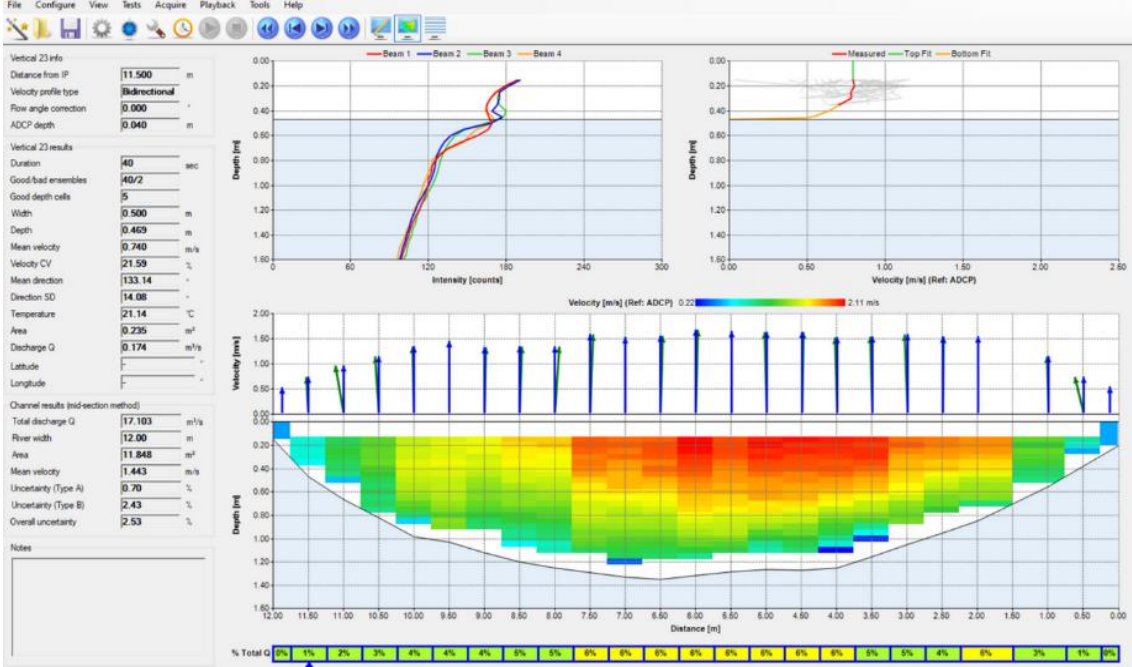
## Inflow Forecasting

A hydrologic model using forecasts of precipitation and temperature

## Water Quality

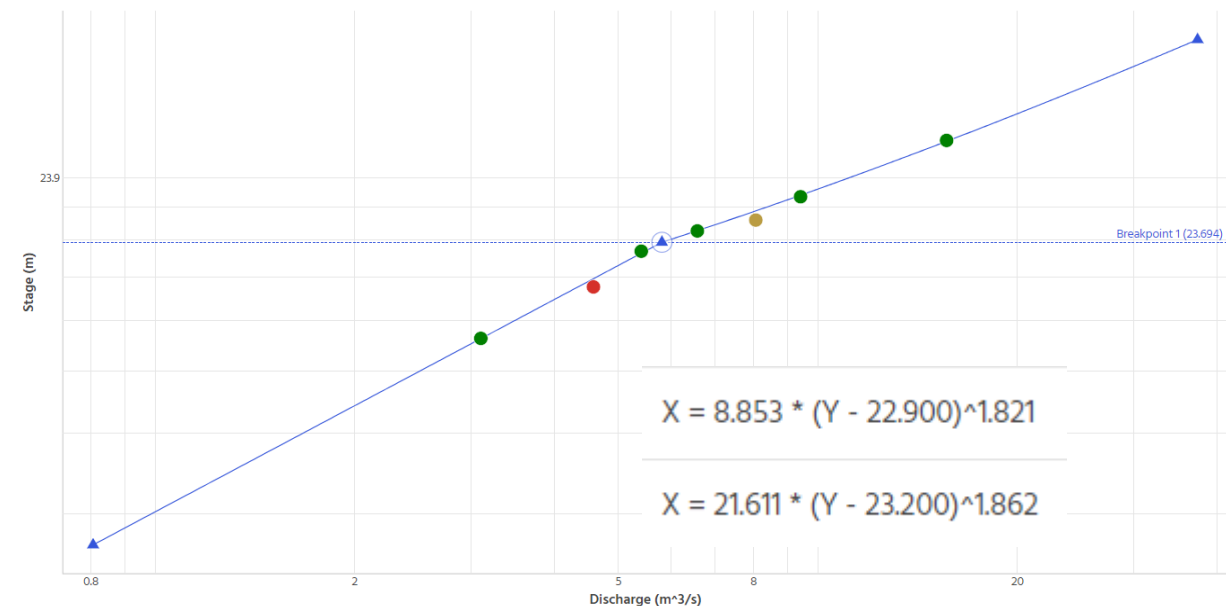
Turbidity monitoring during plant shutdowns



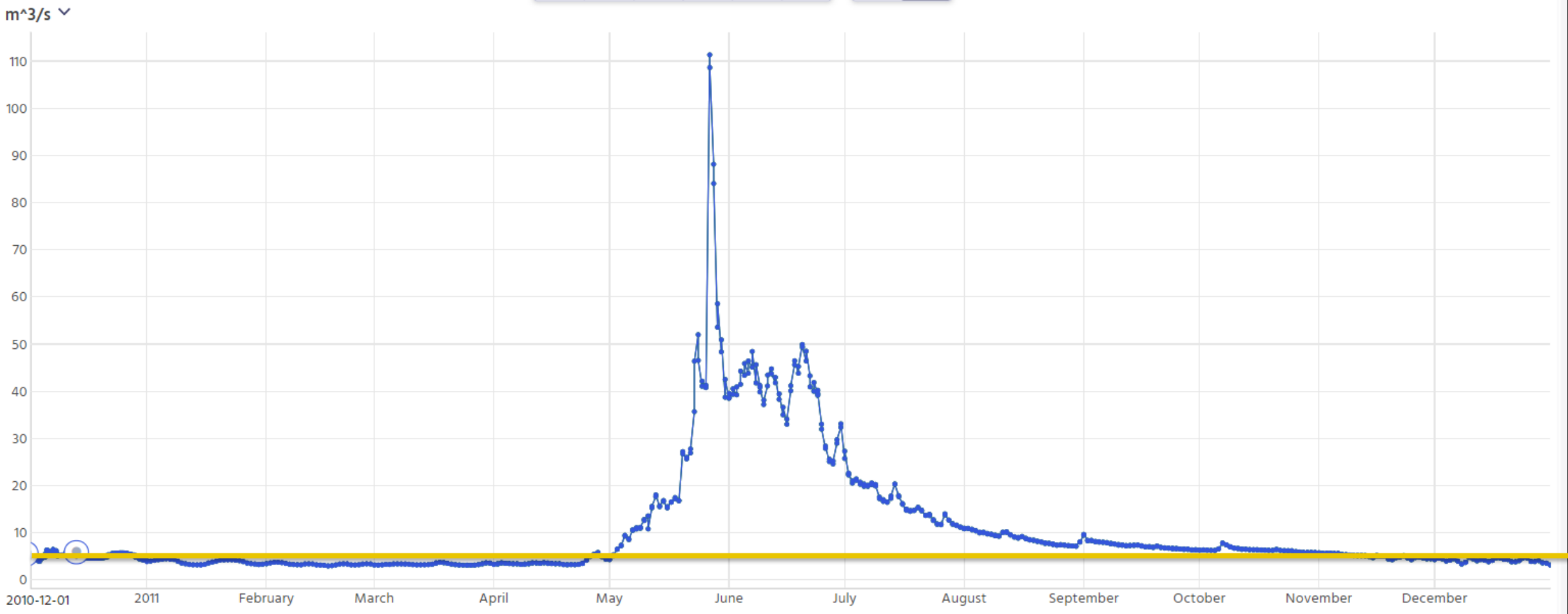


# Real-Time Discharge

- To develop rating curves, collect discharge and stage, and use statistical methods to construct a mathematical equation that can predict water flow based on levels.
- Put rating curve directly on the data logger and feed directly to plant operators through MODBUS



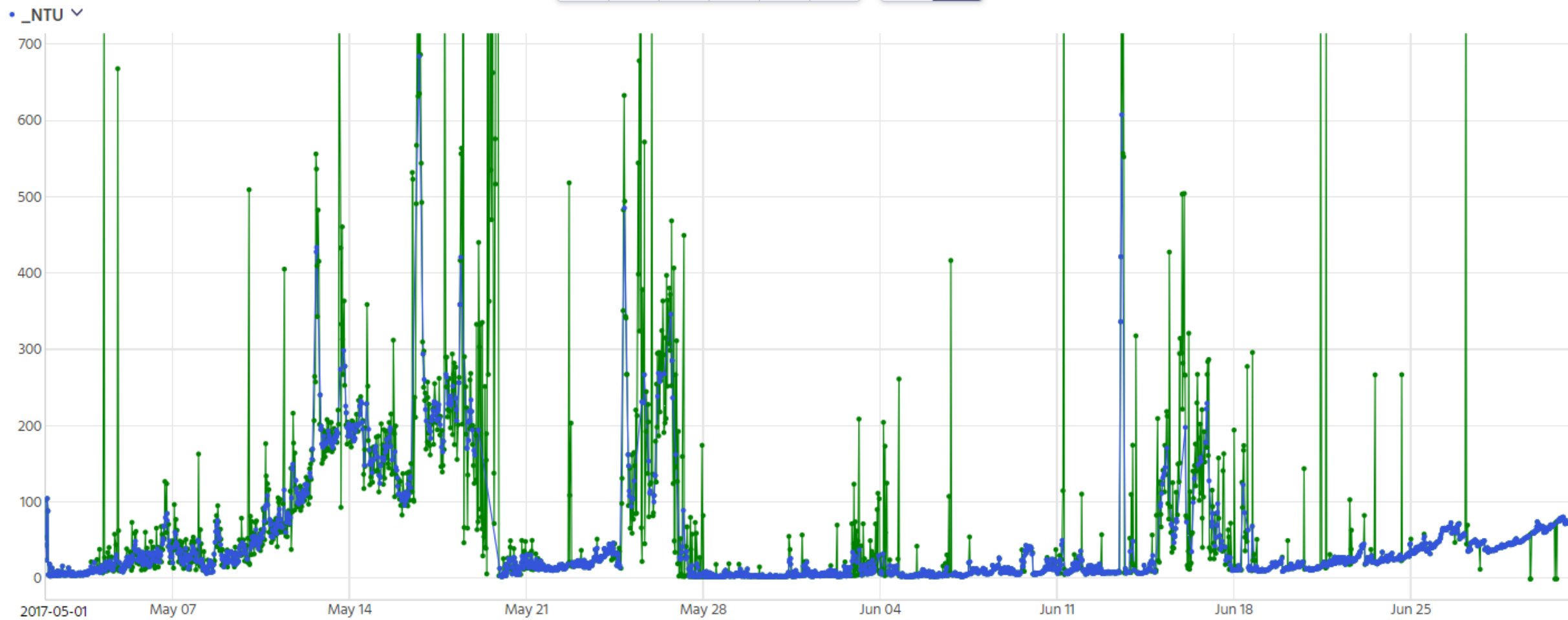




# Threshold Alarms

An automated threshold alarm system for river discharge can alert operators when discharge, stage, turbidity, ramping etc. is out of compliance.





# Automated Data QAQC

Automated filters for data spikes on turbidity data.





- Debris flow barrier
- Real-time water monitoring station on upstream side
- Pressure transducers on upstream side
- Camera to get visual confirmation

# Fitzsimmons River in Whistler BC





# Municipality of Stewart

- 70 years of river confinement from dykes
- Bed aggradation to the point where riverbed is above the township
- Two stations using radar water level sensors to watch for sudden changes in stage





# Jökulhlaup

Jökulhlaup is a glacial outburst flood caused by the sudden release of water from a glacier or ice cap. These floods can cause significant damage to nearby infrastructure and communities.



Source <https://en.wikipedia.org/wiki/J%C3%B6kulhlaup>

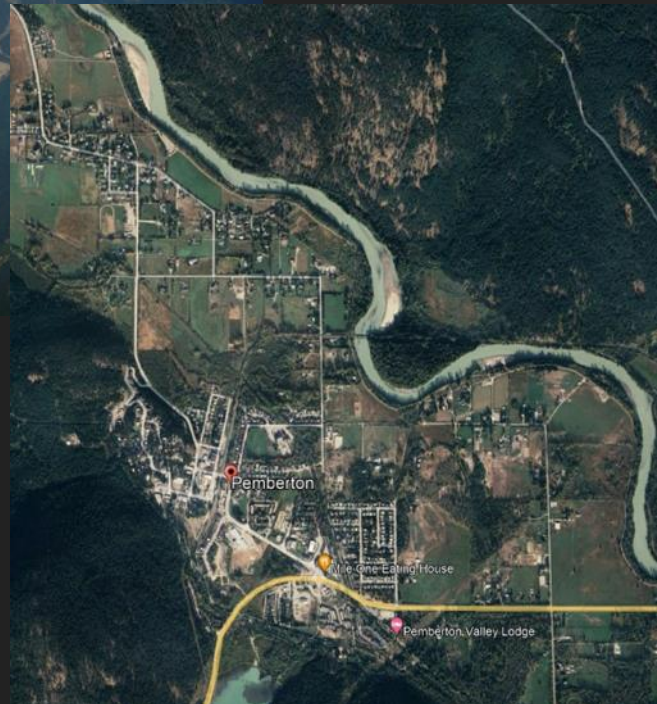




# Pemberton Valley Dyking District



- One of Canada largest landslides destroyed bridges and temporarily blocked Lillooet River on August 6, 2010



- Fear of river impoundment leading to the catastrophic collapse of temporary debris flow damned lake

Source:  
[https://en.wikipedia.org/wiki/2010\\_Mount\\_Meager\\_landslide#/media/File:2010\\_Mount\\_Meager\\_landslide.jpg](https://en.wikipedia.org/wiki/2010_Mount_Meager_landslide#/media/File:2010_Mount_Meager_landslide.jpg)





# Thank You!