



Stantec

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

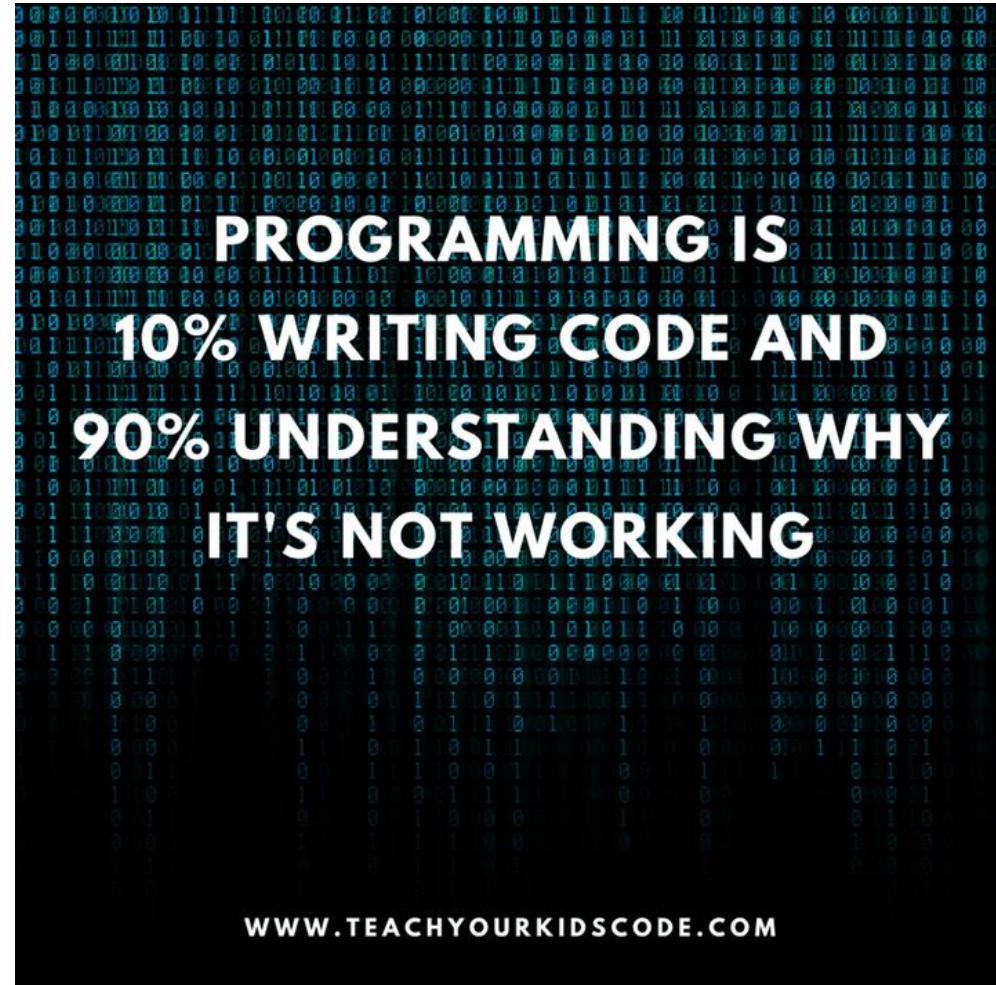


- Real-time data QA/QC
- Reduction of expensive field visits
- Hazard Mitigation
- Immediate access to site information
- Logic!

# Cons



- Expensive
- Complicated



# 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.

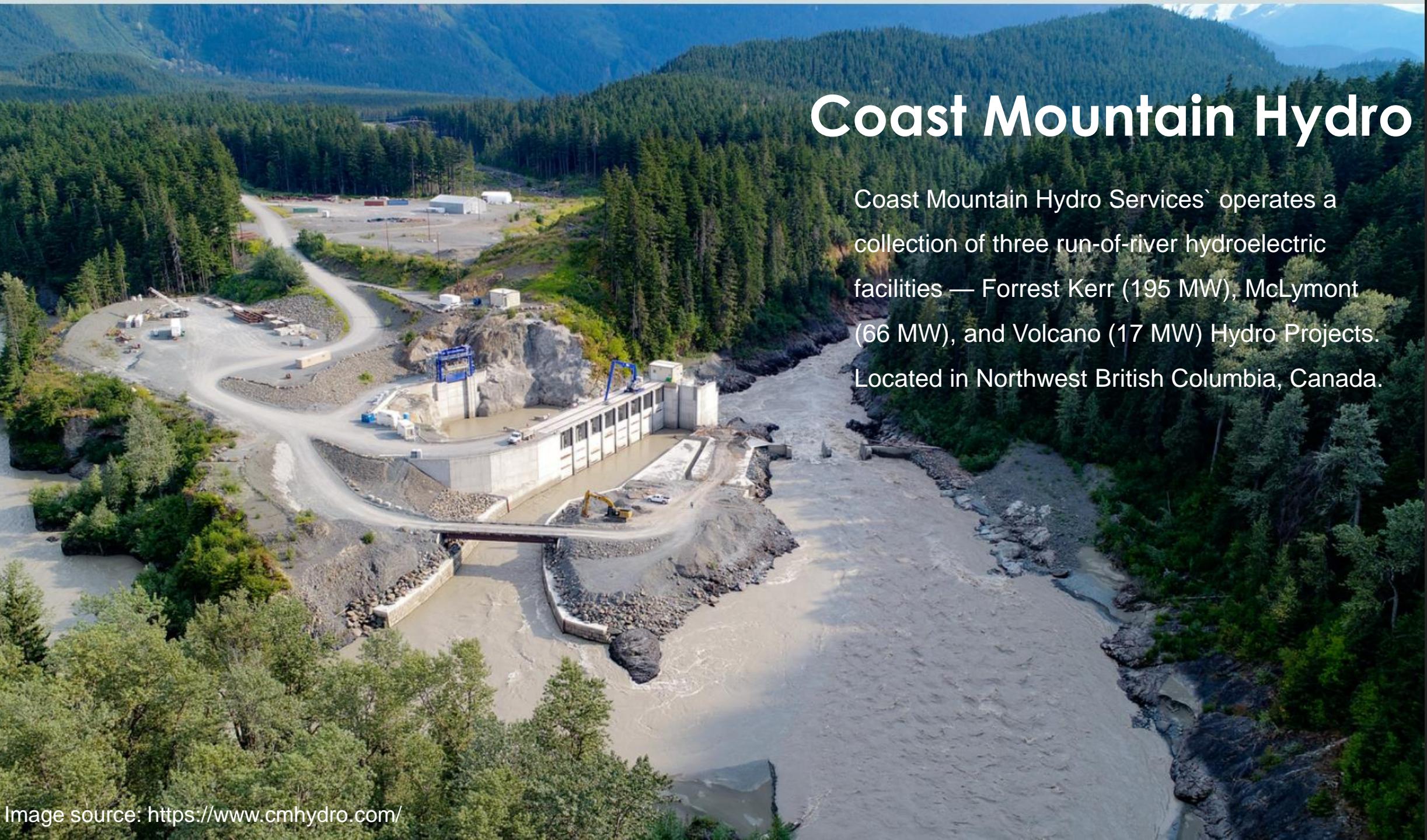
- Automated Monitoring
- Automatic Alerts and Notifications
- Real-time complex analysis
- Reduction of station downtime

Source: TeachYourKidsCode.com

```
1  Created on Fri Nov  3 08:39:16 2023
2
3  @author: jbauer
4  """
5
6  #identify interested parties
7  email_to_address = 'johnsmith@municipality.com'
8  #define thresholds
9  stage_change_stage_change_thresh = 0.1 'm/per min
10 dyke_top = 30 'm'
11 sample_period = 15
12
13 #Measure Waterlevel
14 wetted_stage = SDI12Recorder (PT(),1,0,"M!",1,0)
15
16 #Calculations to determine Water Level
17 Water_Level = Elevation_of_sensor + wetted_stage
18
19 #check for overtopping conditions
20 if (Water_Level > dyke_top:
21     Alarm = True
22     else
23
24 #calculate rate of change
25 max_stage = max(wetted_stage)
26 min_stage = min(wetted_stage)
27 rise_rate = max_stage - min_stage/sample_period
28
29 #check if rate of change conditions
30 if rise_rate >= stage_change_thresh:
31     Alarm = True
32     Cell_On = True
33     else
34     Alarm = False
35
36 if Alarm:
37     Message = "Water level at the river indicates high stage or rapid change in stage."
38     EmailSend (email_server,email_to_address,"jacob.bauer@stantec.com",
```

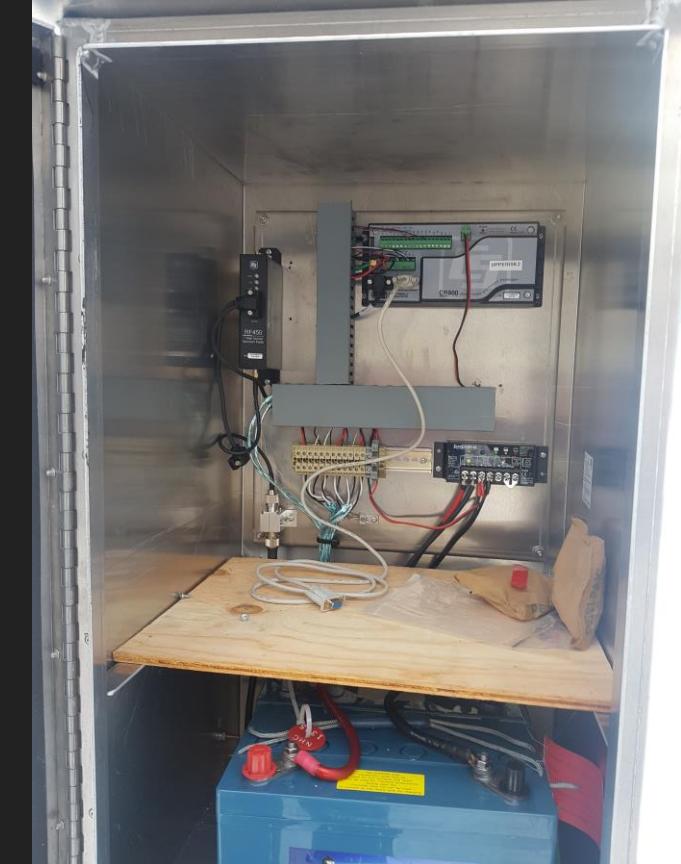
# Alarm Code

- 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

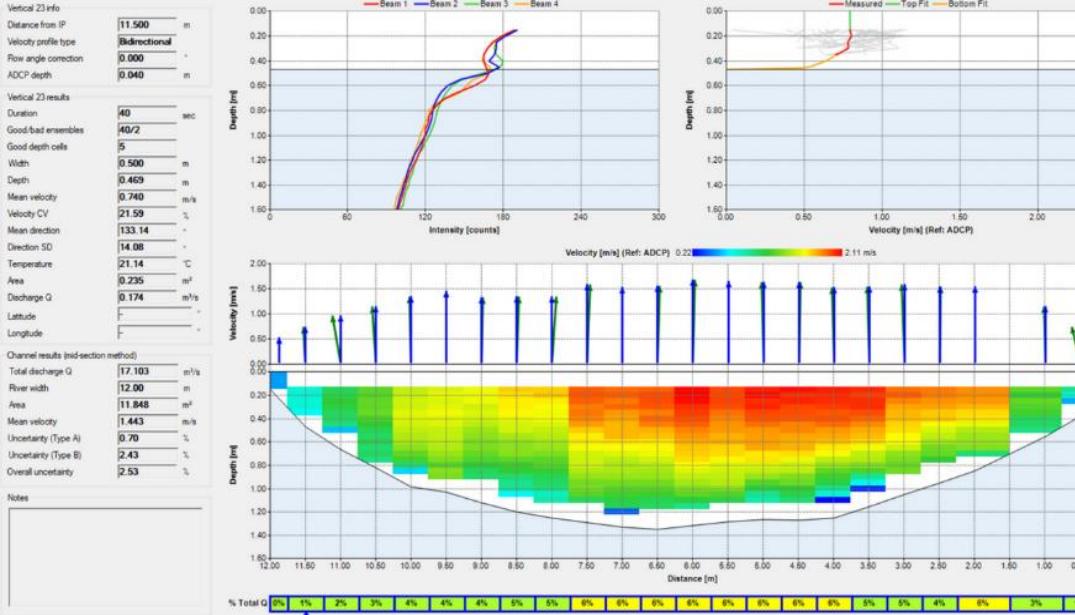
Compliance monitoring for river stage rise and fall

## Inflow Forecasting

A hydrologic model using forecasts of precipitation and temperature

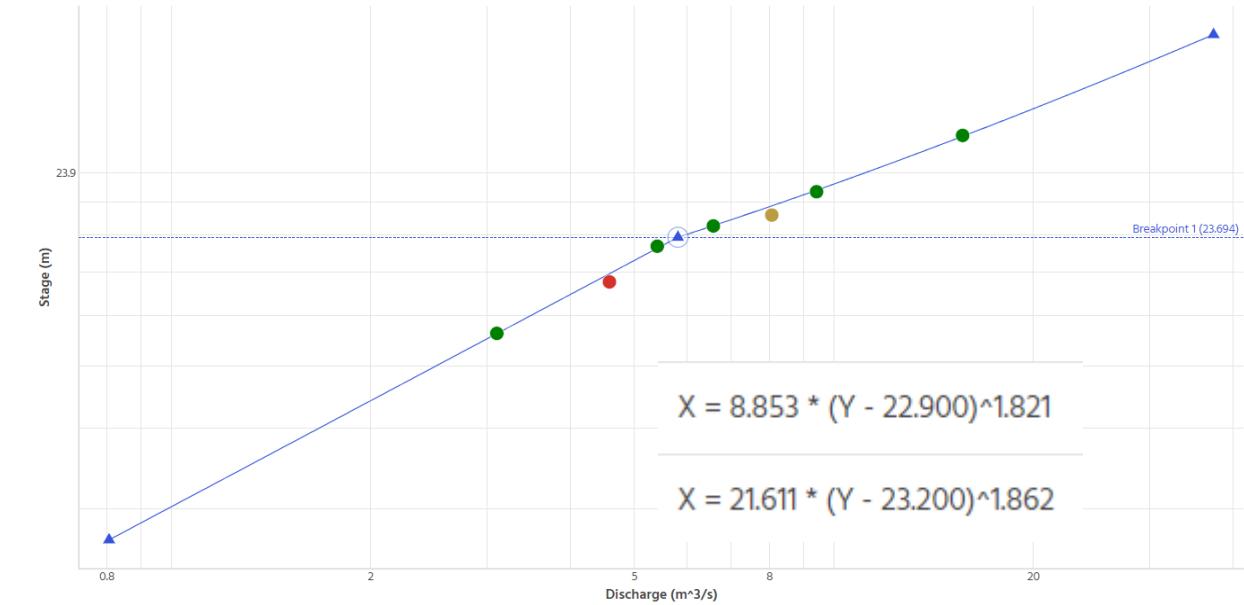
## Water Quality

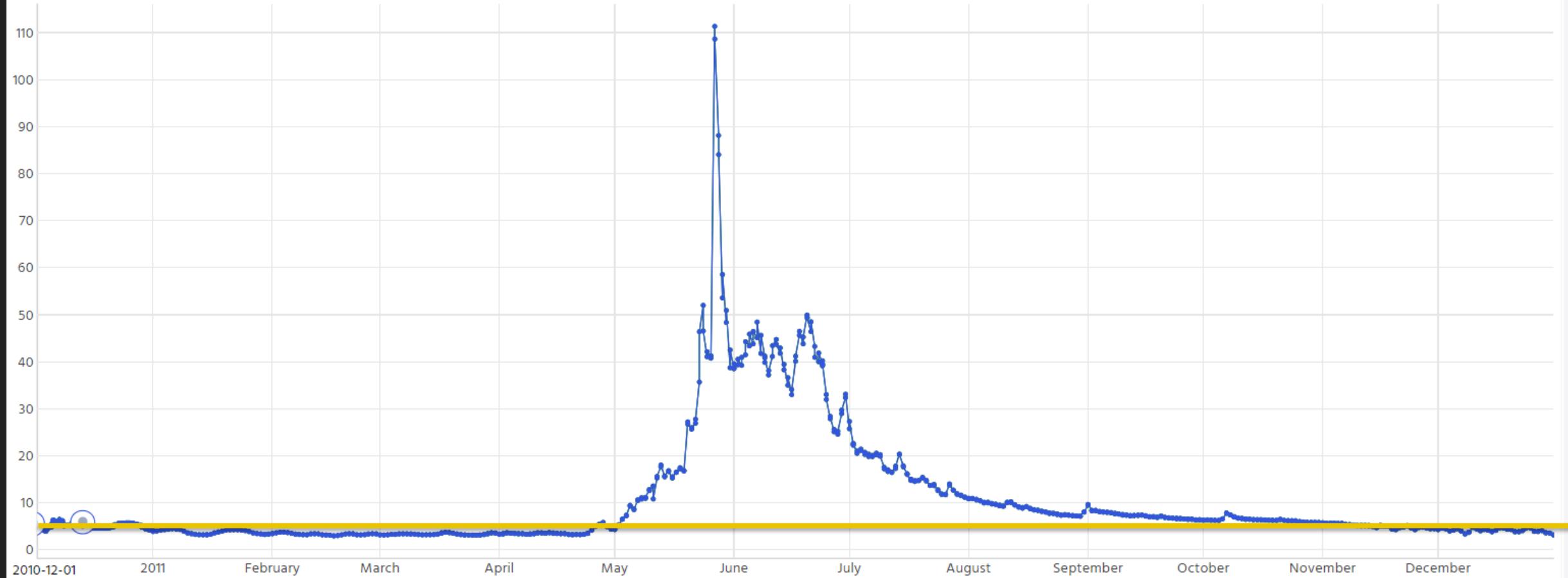
Turbidity monitoring during plant shutdowns



# Real-Time Discharge

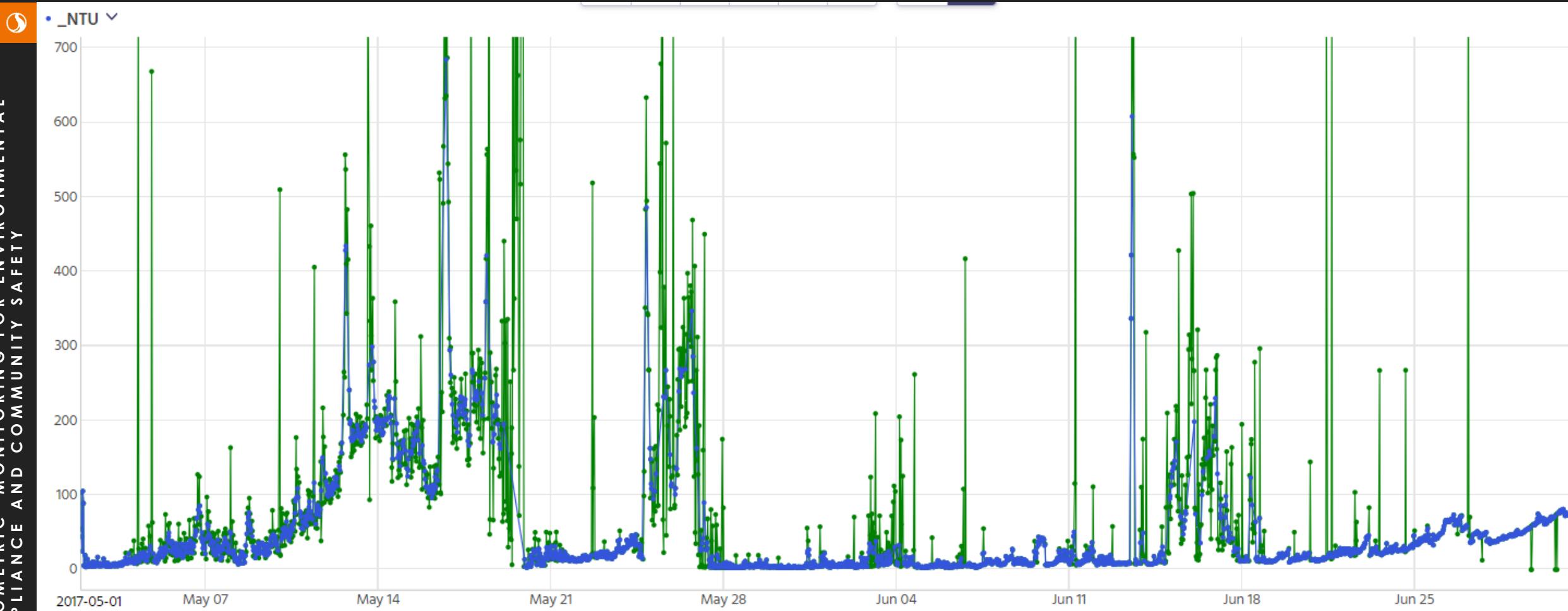
- To develop rating curves, collect discharge and stage, and use statistical methods to construct a mathematical equation that can predict water flow based on levels.
- Put rating curve directly on the data logger and feed directly to plant operators through MODBUS



m<sup>3</sup>/s ▾

# 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

# Fitzimmons 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

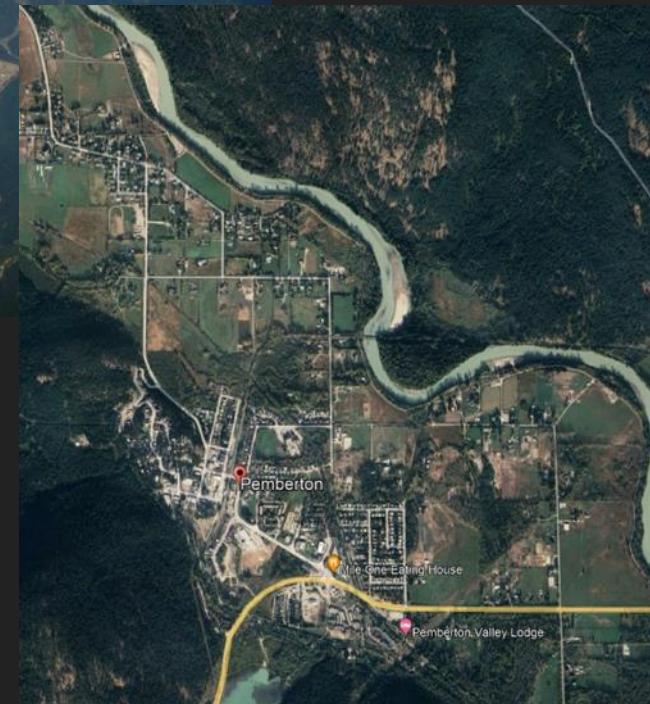
Jokulhlaup is a glacial outburst flood caused by the sudden release of water from a glacier or ice cap. These floods can cause significant damage to nearby infrastructure and communities.



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



# Pemberton Valley Dyking District



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)

- 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



# Thank You!