Flowlink
ENVIRONMENTAL

Real-Time Monitoring of Construction Site Effluents and Urban Streams:

Working Together to Protect the Water Quality of Our Watersheds

www.flowlink.ca

About Flowlink Environmental

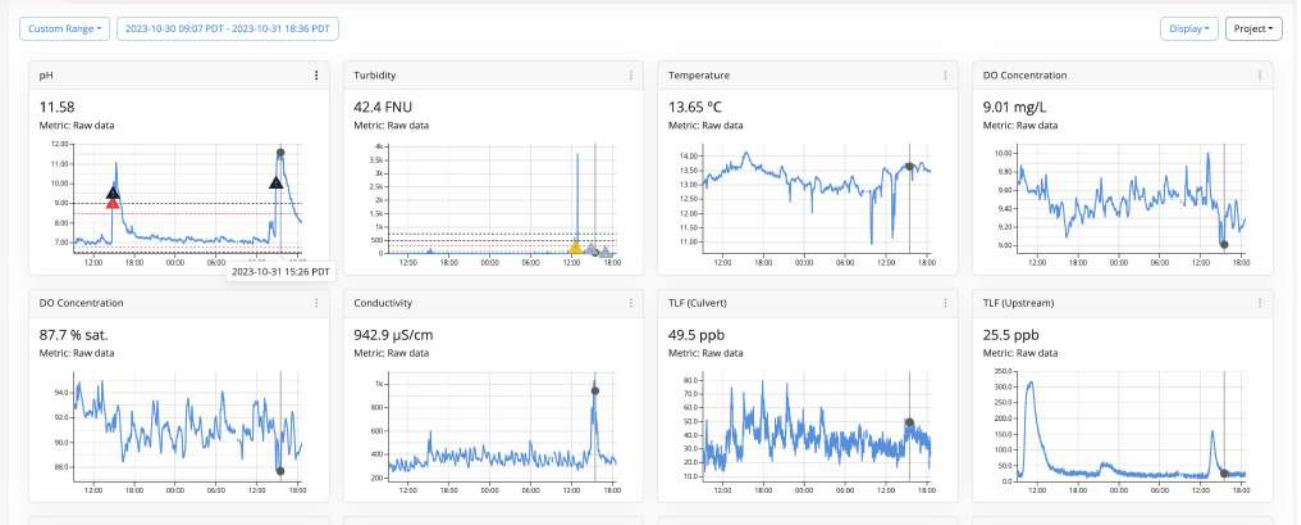
- Coquitlam, BC-based
- Founded in Oct 2018
- Areas of specialization:

- (A) Real-time monitoring and control of construction site effluents for pollution prevention

- (B) Real-time monitoring of urban streams for pollution detection

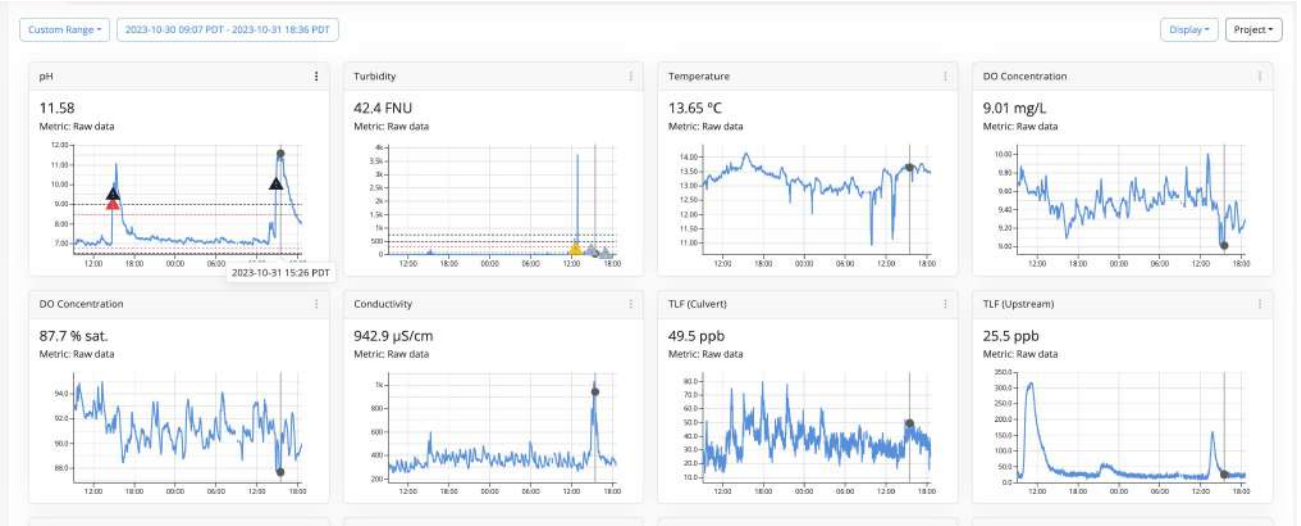
- Full-service company

The problem



Common construction-related sources of urban stream pollution

The problem



Common construction-related sources of urban stream pollution

HOME > LOCAL NEWS

Contractors' high pH spill killed West Vancouver fish: report

The Ministry of Transportation and Infrastructure says human error by one of its contractors is to blame for the near-extinction of a local population of cutthroat trout.

Jul 18, 2018 6:00 AM By: Brent Richter

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Metro Vancouver creek contamination kills at least 300 fish

A murky discharge found flowing out of a culvert from Coquitlam into a Burnaby creek has been linked to the death of hundreds of young salmon, according to a local stream-keeper group.

Aug 3, 2021 5:22 PM By: Stefan Labbé

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Toxic water kills hundreds of fish in Coquitlam creek

80% of Hoy Creek hatchery fry killed, hundreds of crayfish, trout and salmon in the creek also died when a plume of poisoned water passed through Wednesday

May 30, 2019 12:33 PM By: Diane Strandberg

West Van investigating fish kill in McDonald Creek

The District of West Vancouver and the province are investigating after dozens of fish were killed in McDonald Creek Monday, apparently by pollution. Residents spotted the carcasses near the mouth of the creek at the foot of 19th Street.

Sep 21, 2020 4:33 PM By: Brent Richter

Chemical spills wipe out fish three North Shore streams

Multiple agencies are investigating after three mass fish kills in North of which has likely resulted in the extinction of a local population of cu

May 3, 2018 3:38 PM By: Brent Richter

British Columbia

Hundreds of dead fish found in Vancou creek

Conservationist with Peninsula Streams Society says bleach likely p drain

CBC News · Posted: Jun 07, 2021 9:03 PM PT | Last Updated: June 11

Conservationists counted 318 cutthroat trout, 13 sculpins, 11 stickleback and three co

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Fish kill hits 30 daily at Noons Creek in Port Moody

Hatchery workers to try and freshen water by opening Cypress Lake dam

Aug 9, 2019 4:36 PM By: Grant Granger

Noons Creek Hatchery volunteer Dave Bennie holds a tray of dead coho he found in the water on Thursday, Aug. 8. | Grant Granger/The Tri-City News

HOME > LOCAL NEWS

Contractors' high pH spill killed West Vancouver fish: report

The Ministry of Transportation and Infrastructure says human error by one of its contractors is to blame for the near-extinction of a local population of cutthroat trout.

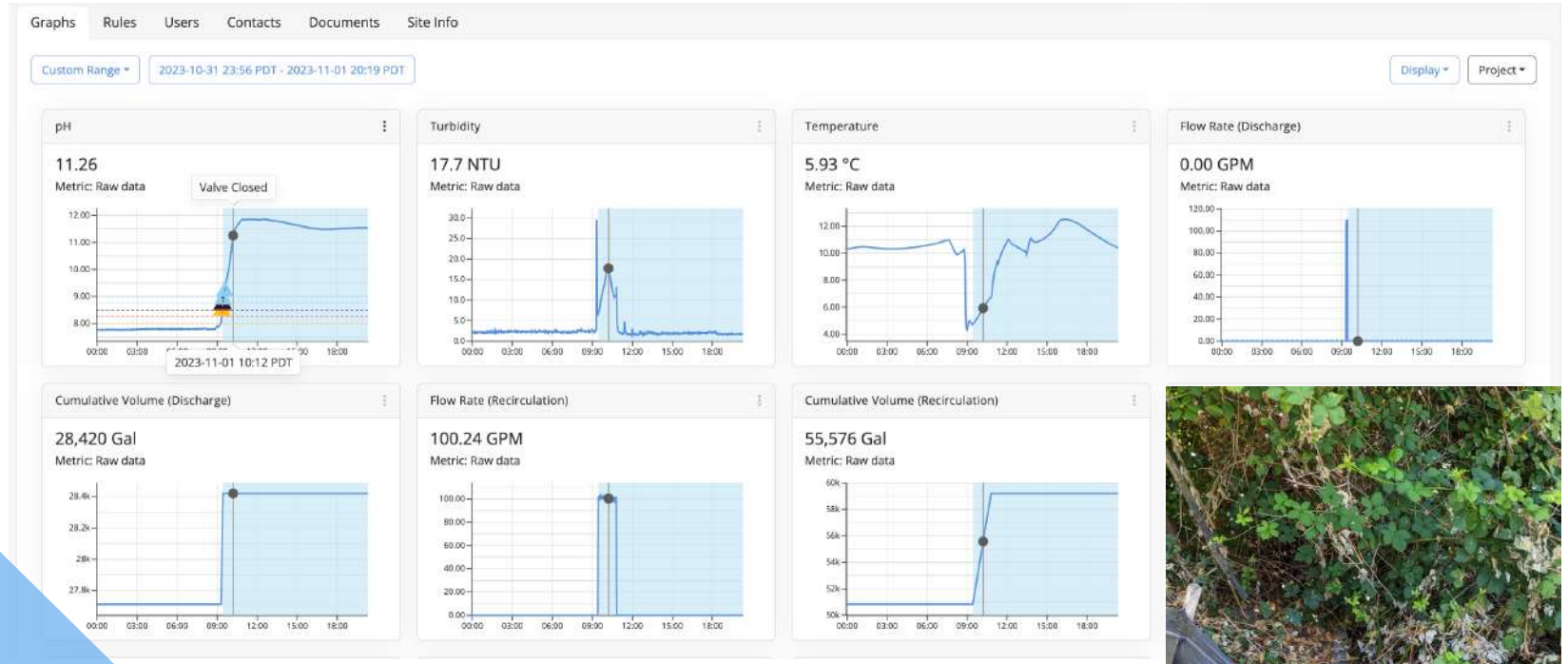
Jul 18, 2018 6:00 AM By: Brent Richter

"**Standing water tested at the site the next day, according to the report, had a pH level of 11.5** – about the same as household ammonia.

"**This thing was so lethal, it might have killed everything in its path**," said John Barker, president of the West Vancouver Streamkeeper Society."

https://www.nsnews.com/local-news/contractors-high-ph-spill-killed-west-vancouver-fish-report-3079639

Construction effluent – a project example

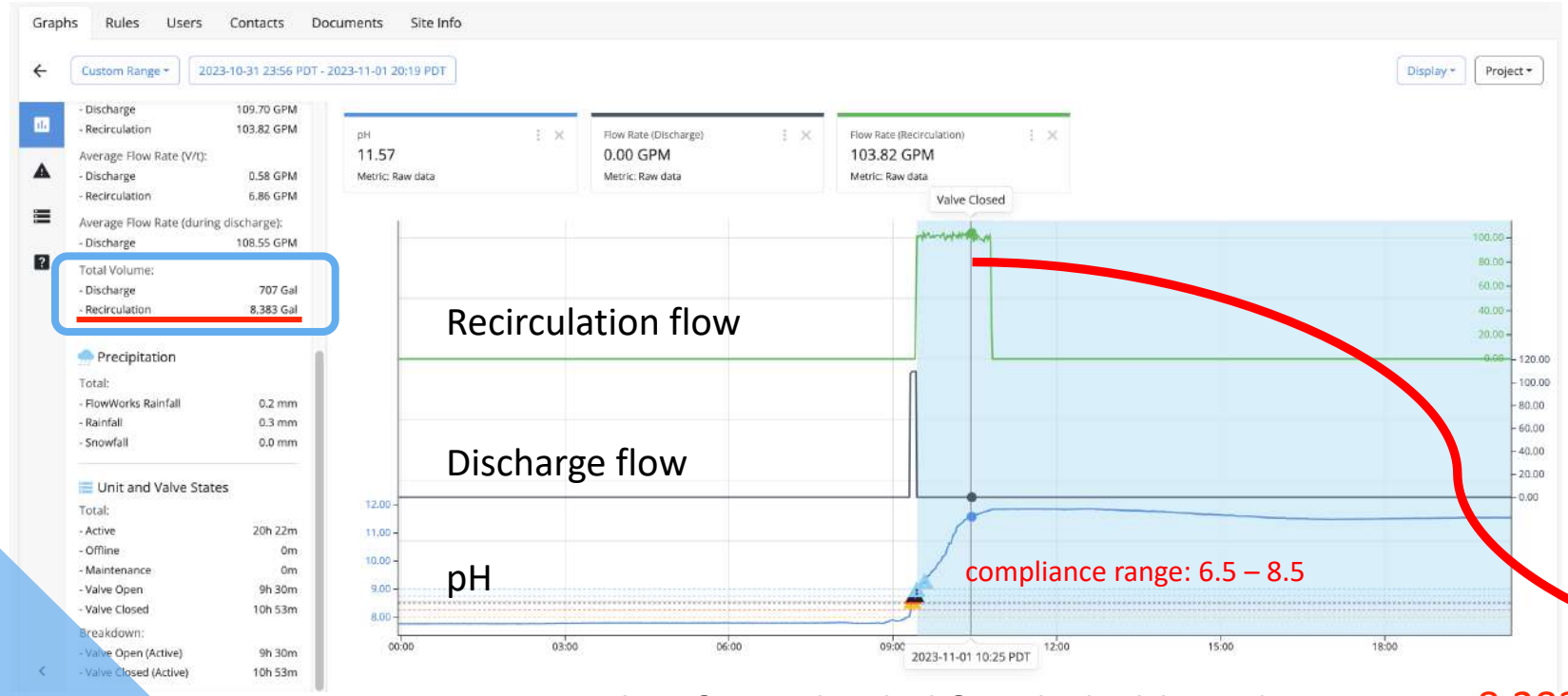


A screenshot from Flowlink® web dashboard

Discharge point

WTP w/ Flowlink® effluent monitoring & control system

Construction effluent – a project example



A screenshot from Flowlink® web dashboard

8,383 gallons
(32 m^3)

This highly alkaline water was prevented from entering the storm drain by the Flowlink® effluent monitoring and control system

Is dilution the solution?

pH 12

32 m^3

*How much water would it take to dilute it down to **pH 8** in the environment?**

- ❑ 320,000 m^3
- ❑ 32,000 m^3
- ❑ 3,200 m^3
- ❑ 320 m^3

** Assuming no buffering capacity of the creek*

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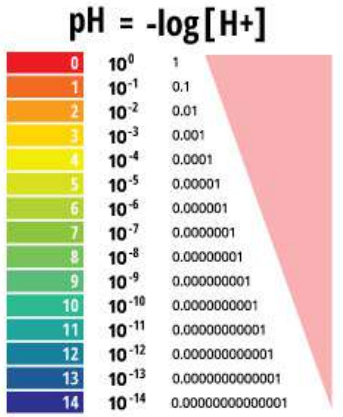

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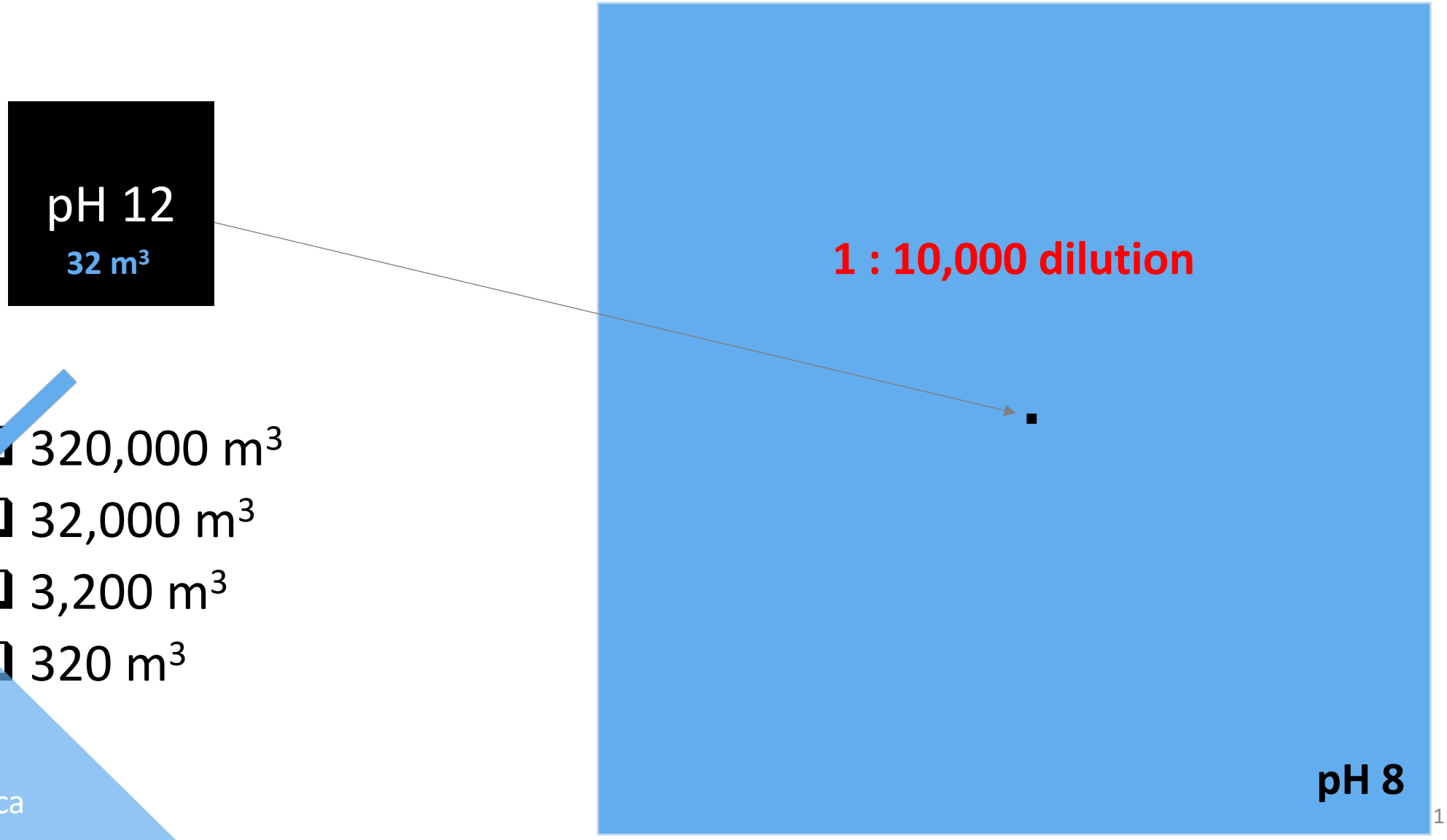

- ☑ 320,000 m³
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- ☐ 320 m³

Is dilution the solution?

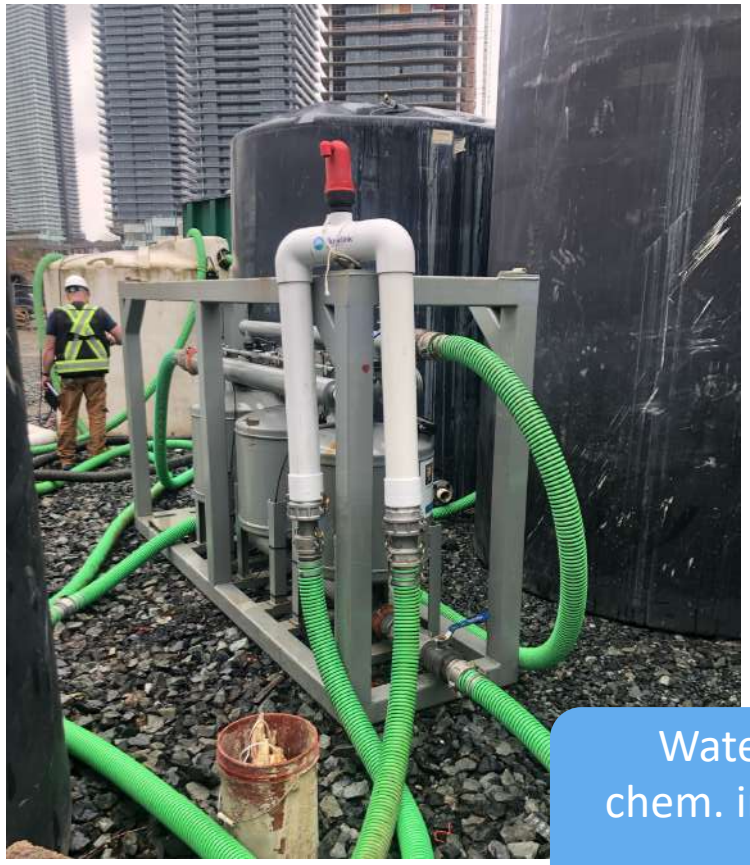
pH 12
32 m^3

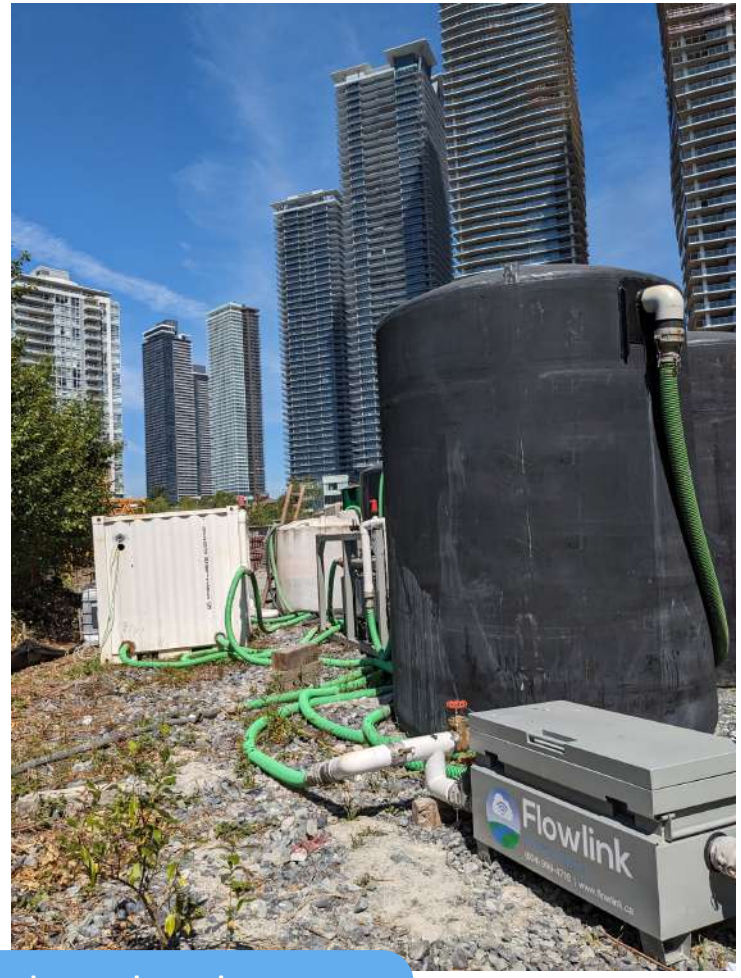
- ☑ 320,000 m^3
- ☐ 32,000 m^3
- ☐ 3,200 m^3
- ☐ 320 m^3

pH 8

The project example

- High-rise construction
- The site has a typical **water treatment system on site**





Water treatment system: chem. injection, settling tanks, sand filter

The evolution of regulatory policies

From Erosion & Sediment Control (ESC)* Permit Applications

Performance Standard

3.1.1. It is prohibited to discharge into the City's drainage system directly or indirectly any water that does not continuously and at all times meet or exceed the following water quality criteria:

– pH must be within 6.5 – 8.5; and
– turbidity must not exceed 50 NTU.

3.1.2 Compliance with the limits outlined in 3.1.1 must be monitored at all points of discharge.

https://www.burnaby.ca/sites/default/files/acquiadam/2022-12/Erosion-and-Sediment-Control-Permit-Applications.pdf

The evolution of regulatory policies

Performance Standard:

– pH must be within 6.5 – 8.5; and
– turbidity must not exceed 50 NTU.

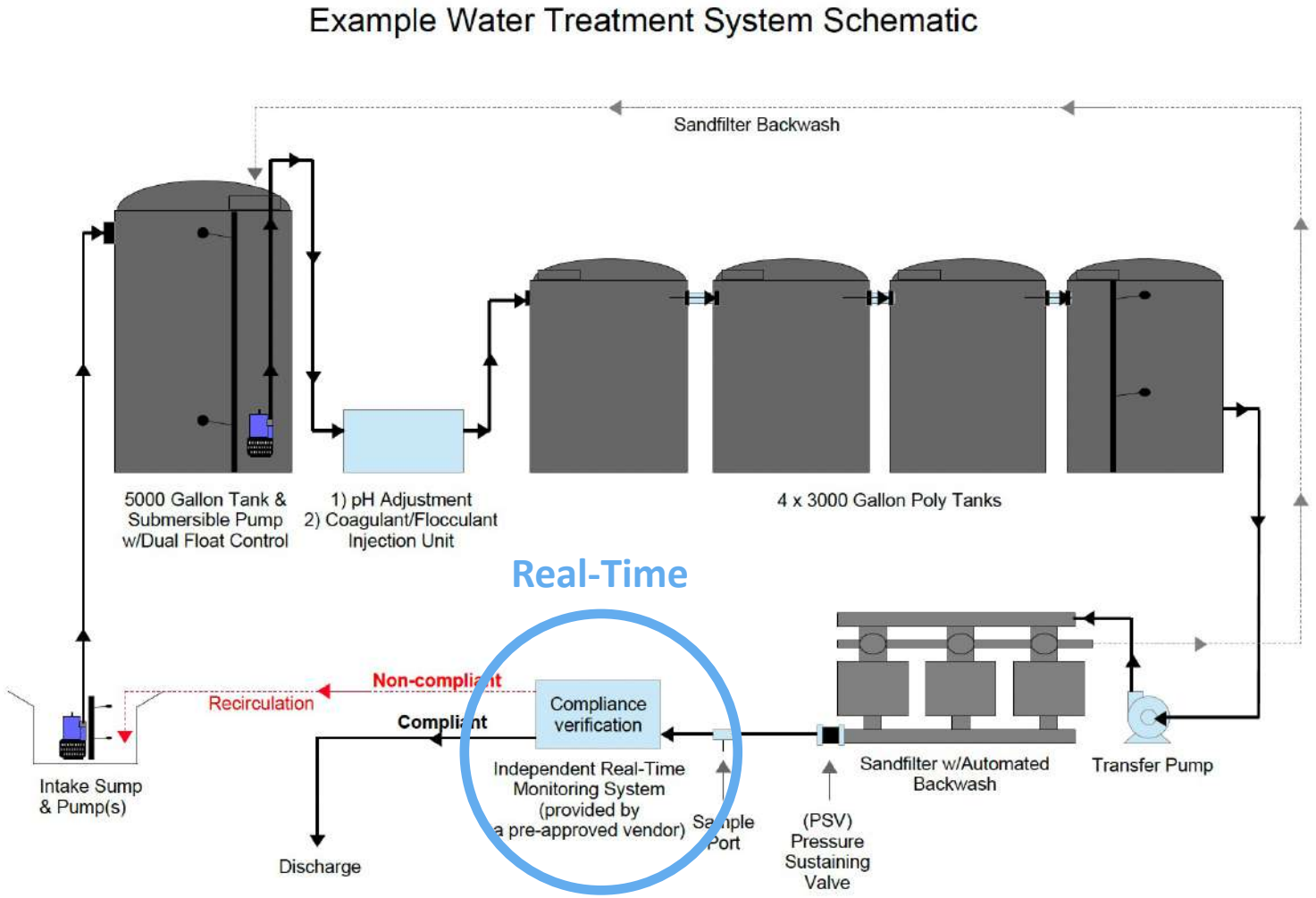
Traditional WQ compliance monitoring approach:

Weekly/bi-weekly frequency + after an SRE

The evolution of regulatory policies

Same Performance Standard,

NEW Monitoring Approach.



https://www.burnaby.ca/sites/default/files/acquiadam/2023-10/Example-Water-Treatment-Schematic.pdf

The evolution of regulatory policies

NEW Monitoring Approach.

From Erosion & Sediment Control (ESC) Permit Applications

3.4 Post-Treatment Qualifications

3.4.1 **All discharge points from the site including discharges from the water treatment system(s) must be monitored continuously, in real-time**. It is prohibited to pump out or otherwise discharge untreated water from the work site to the City's storm sewer system, watercourse, or other drainage system in such a manner as to bypass the independent real-time water monitoring system...

https://www.burnaby.ca/sites/default/files/acquiadam/2022-12/Erosion-and-Sediment-Control-Permit-Applications.pdf

The evolution of regulatory policies

Another Performance Standard

From Stream & Drainage System Protection Bylaw

3 Prohibition of Discharge

….

3.3 No person shall cause or permit to be released, directly or indirectly into the Drainage System any Waste or Deleterious Substance.

3.4 Without limiting the generality of s.3.3, no person shall cause or permit to be released, directly or indirectly into the Drainage System any sediment, earth, Construction or excavation wastes, cement, concrete, or other substances, which when mixed with water, will result in:

3.4.1 a pH value outside the range of 6.5 to 8.0; or

3.4.2 a discharge exceeding a Turbidity level of 25 NTU, except during and for 24 hours following a Significant Rainfall Event a discharge exceeding 100 NTU.

https://publicdocs.coquitlam.ca/coquitlamdoc/getdocIF.asp?doc=4685890

The evolution of regulatory policies

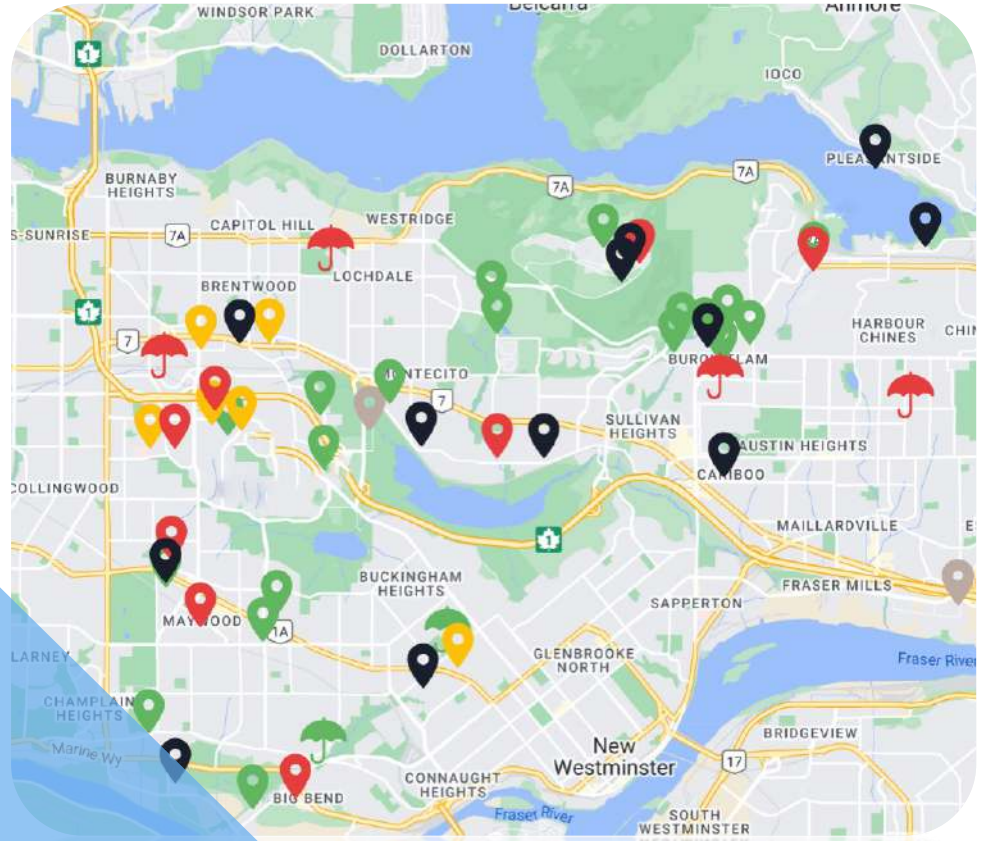
NEW Monitoring Approach.

Real-Time Monitoring Facilities for Construction Site Discharge Water Quality

Where this Schedule "D" applies, **the ESC Plan must include all Real-Time Monitoring Facilities** required by this Schedule "D" including but not limited to the following:
The location of all Real-Time Monitoring Facilities on site;
Drawings and schematics detailing all Real-Time Monitoring Facilities;
Any Notification Limits or Shut Off Limits required in addition to the minimum requirements listed in …

Schedule "D
2.4. Water Quality Parameters
2.4.1. **Real-Time Monitoring Facilities must provide monitoring of at least the following water quality parameters:** pH; turbidity measured in NTU or FNU; temperature measured in ^{o}C; discharge flow rate measured in cubic metres per second or litres per second; cumulative discharge volume measured in m^3 or L; and recirculation flow rate measured in m^3/s or L/s.
….The water quality parameters listed in Section 2.4.1 will be sampled no less frequently than once every 45 seconds.

Real-time monitoring on construction sites



Real-time monitoring of construction site effluents

Monitored Parameters:

- pH, turbidity, temperature, discharge flow rate and volumes, rainfall

Discharge Shutoff when Performance Standard is not met

Real-time monitoring on construction sites: Discharge Shutoff rules

Level	Conditions Summary	Action
Discharge Shutoff	Turbidity > 60.0 NTU for 2 min (with flow)	
Discharge Shutoff	pH < 6.00 for 5 min	
Discharge Shutoff	pH > 8.75 for 2 min (with flow)	
Discharge Shutoff	pH < 6.25 for 2 min (with flow)	
Discharge Shutoff	Turbidity > 80.0 NTU for 5 min	
Discharge Shutoff	pH > 9.00 for 5 min	
Critical	pH < 6.50 for 2 min (with flow)	
Critical	pH > 8.50 for 2 min (with flow)	
Critical	Turbidity > 50.0 NTU for 2 min (with flow)	
Critical	Valve state is CLOSED for 3 hr	
Critical	No data transmission for one or more sensors for 15 min	
Danger	pH < 6.75 for 2 min (with flow)	
Danger	Turbidity > 40.0 NTU for 2 min (with flow)	
Danger	pH > 8.25 for 2 min (with flow)	
Danger	Valve state is CLOSED for 60 min	
Danger	Module state is OFFLINE for 60 min	
Warning	pH < 7.00 for 2 min (with flow)	
Warning	pH > 8.00 for 2 min (with flow)	
Warning	Turbidity > 35.0 NTU for 2 min (with flow)	

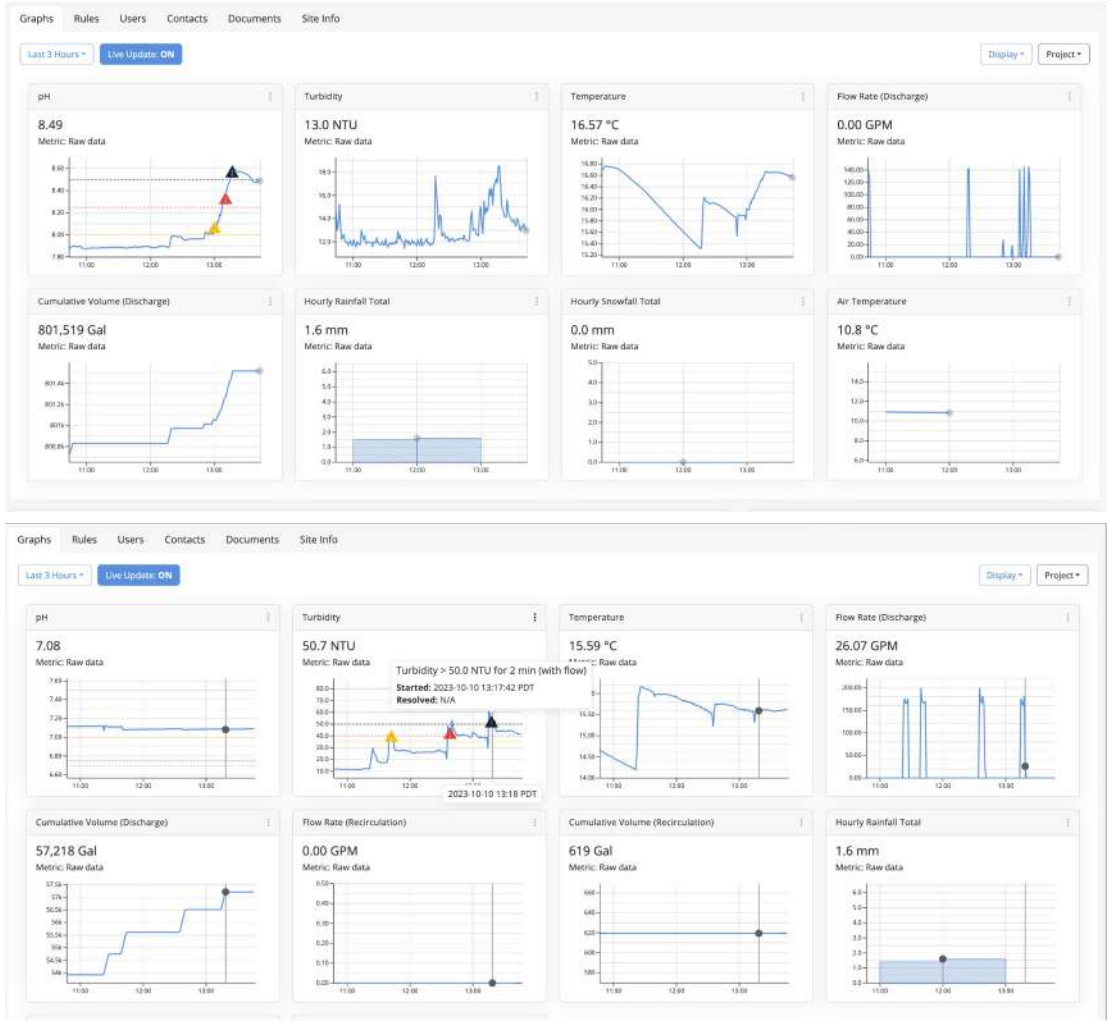
A set of rules designed to capture non-compliant discharges. Several rules can be activated at the same time. Only when all shutoff rules are resolved, the discharge may resume.

Municipality can require more stringent criteria to be met and/or require shorter activation duration.

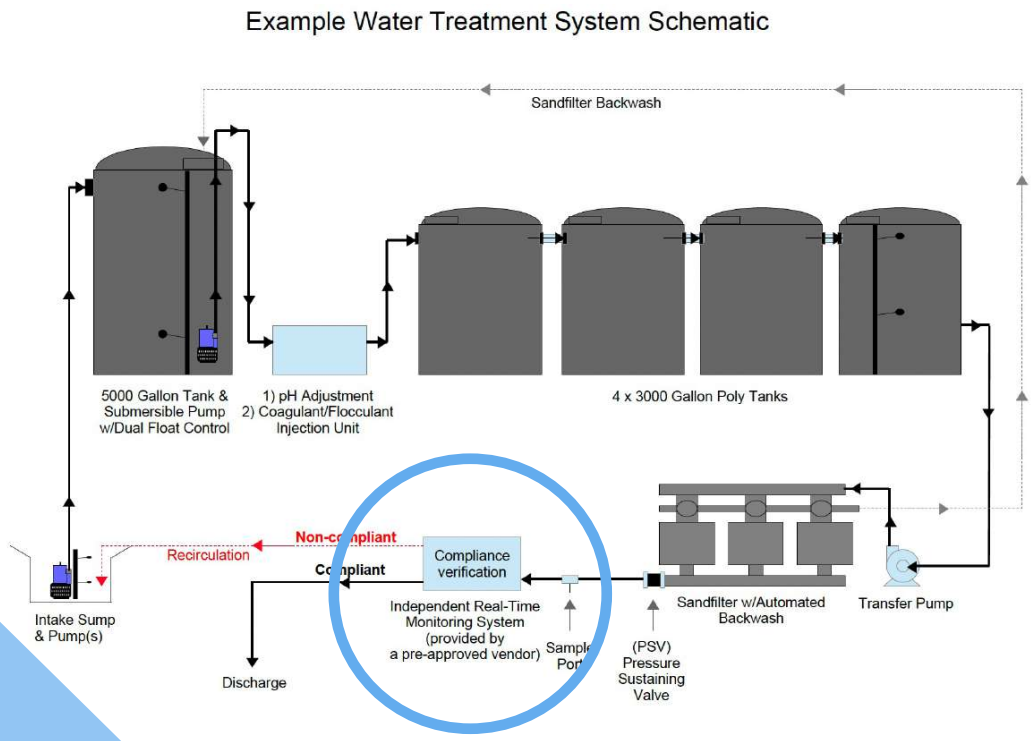
Last Updated	Level	Conditions Summary	Actions
2023-03-01 17:22:47 PST	Discharge Shutoff	pH < 6.25 for 2 min (with flow)	
2022-12-05 14:04:26 PST	Discharge Shutoff	pH < 5.80 for 2 min (with flow)	

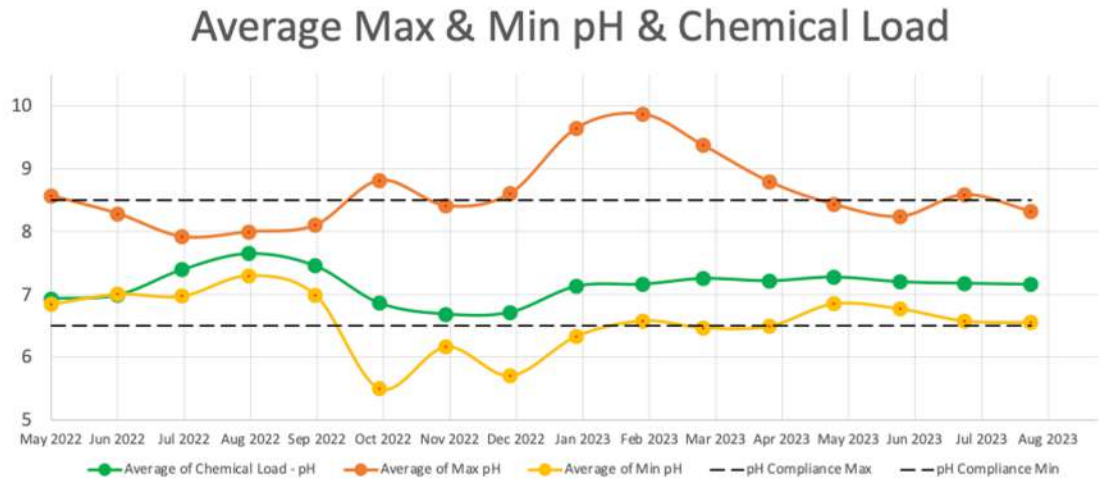
Real-time monitoring on construction sites: Notification rules

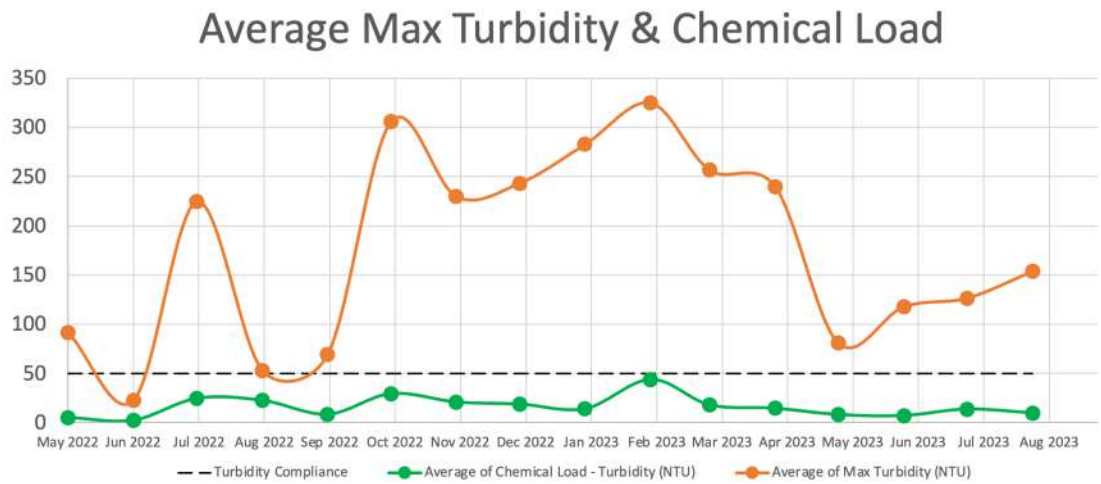
Level	Conditions Summary	Action
Discharge Shutoff	Turbidity > 60.0 NTU for 2 min (with flow)	
Discharge Shutoff	pH < 6.00 for 5 min	
Discharge Shutoff	pH > 8.75 for 2 min (with flow)	
Discharge Shutoff	pH < 6.25 for 2 min (with flow)	
Discharge Shutoff	Turbidity > 80.0 NTU for 5 min	
Discharge Shutoff	pH > 9.00 for 5 min	
Critical	pH < 6.50 for 2 min (with flow)	
Critical	pH > 8.50 for 2 min (with flow)	
Critical	Turbidity > 50.0 NTU for 2 min (with flow)	
Critical	Valve state is CLOSED for 3 hr	
Critical	No data transmission for one or more sensors for 15 min	
Danger	pH < 6.75 for 2 min (with flow)	
Danger	Turbidity > 40.0 NTU for 2 min (with flow)	
Danger	pH > 8.25 for 2 min (with flow)	
Danger	Valve state is CLOSED for 60 min	
Danger	Module state is OFFLINE for 60 min	
Warning	pH < 7.00 for 2 min (with flow)	
Warning	pH > 8.00 for 2 min (with flow)	
Warning	Turbidity > 35.0 NTU for 2 min (with flow)	



Real-time monitoring on construction sites







Chemical Load is a volume-weighted WQ average, calculated using high-frequency time-series data.

Real-time monitoring on construction sites

Benefits to the Municipalities

Implementing IoT technology on construction sites to enforce compliance with the Performance Standard

a. Requires less demand on City resources while still protecting City infrastructure and the Environment
b. Transparent & Reliable WQ data

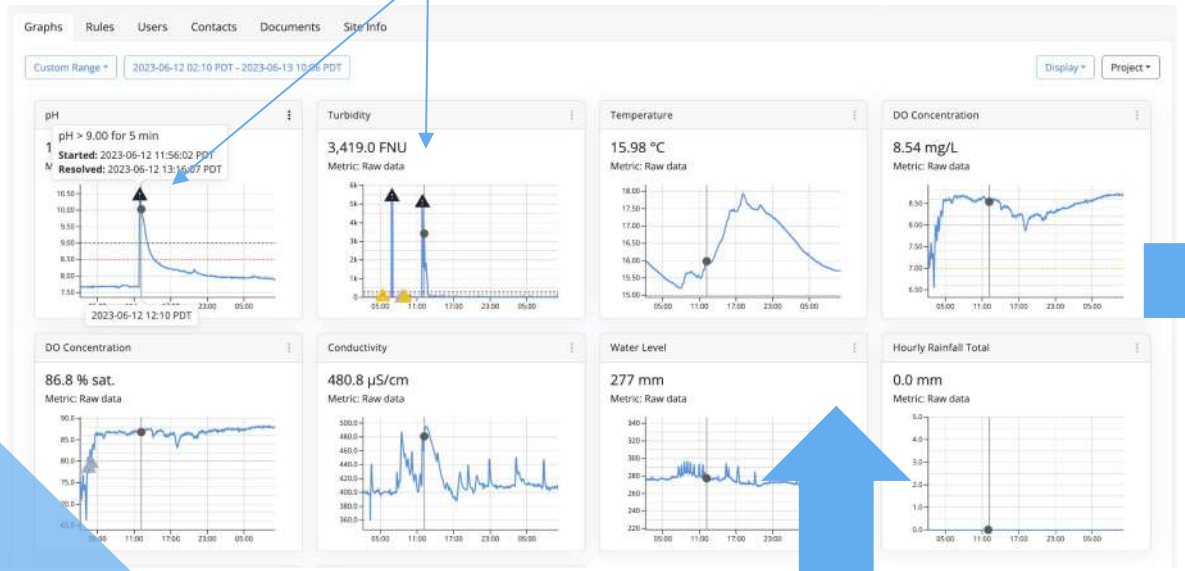
Presented by Mikayla Rafuse, P.Eng. (City of Burnaby) and Elena Ranyuk, PhD MBA (Flowlink Environmental) at ESCA BC 2023 Conference

Real-time monitoring on construction sites & creeks: Working together

pH, turbidity, DO, conductivity, temperature, water level, hydrocarbons, bacterial contaminants, rainfall

Real-time monitoring on construction sites & creeks: Working together

High pH & turbidity detected by in-stream system

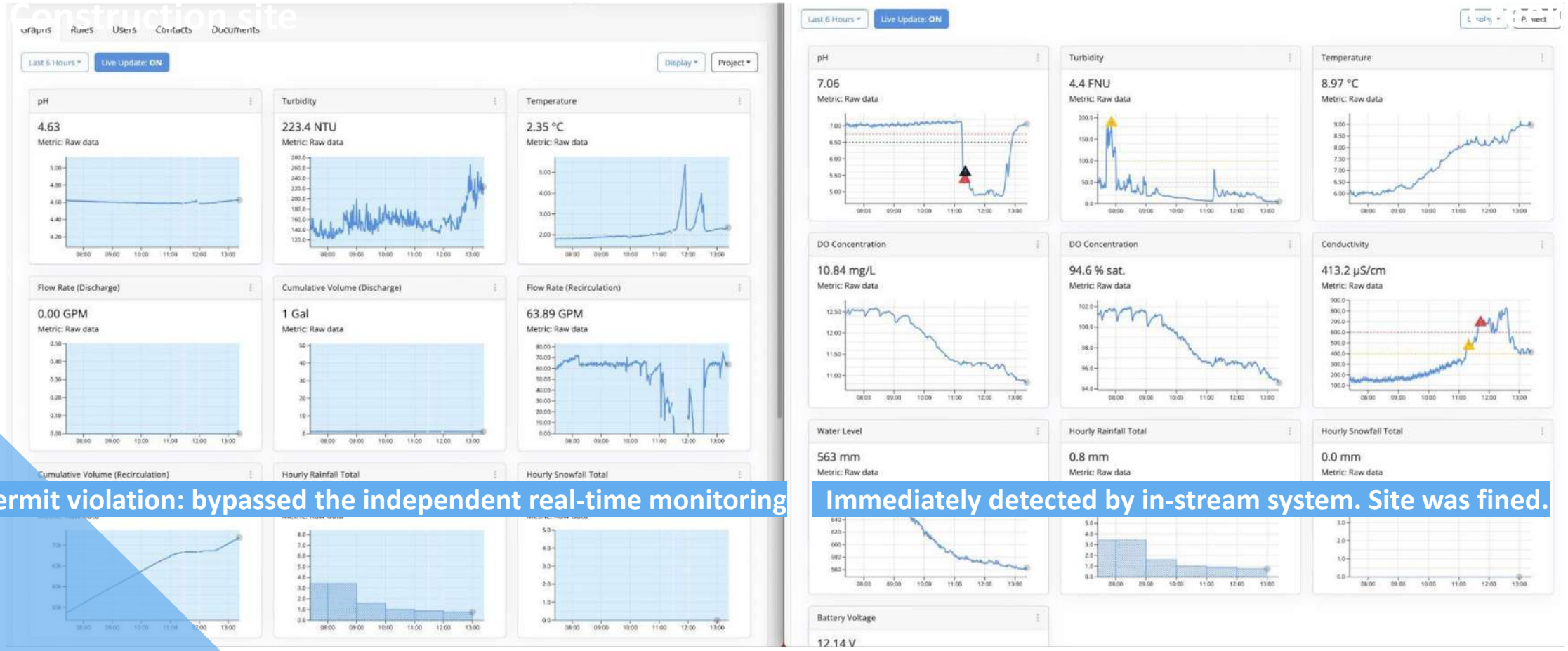


Tracking the source down

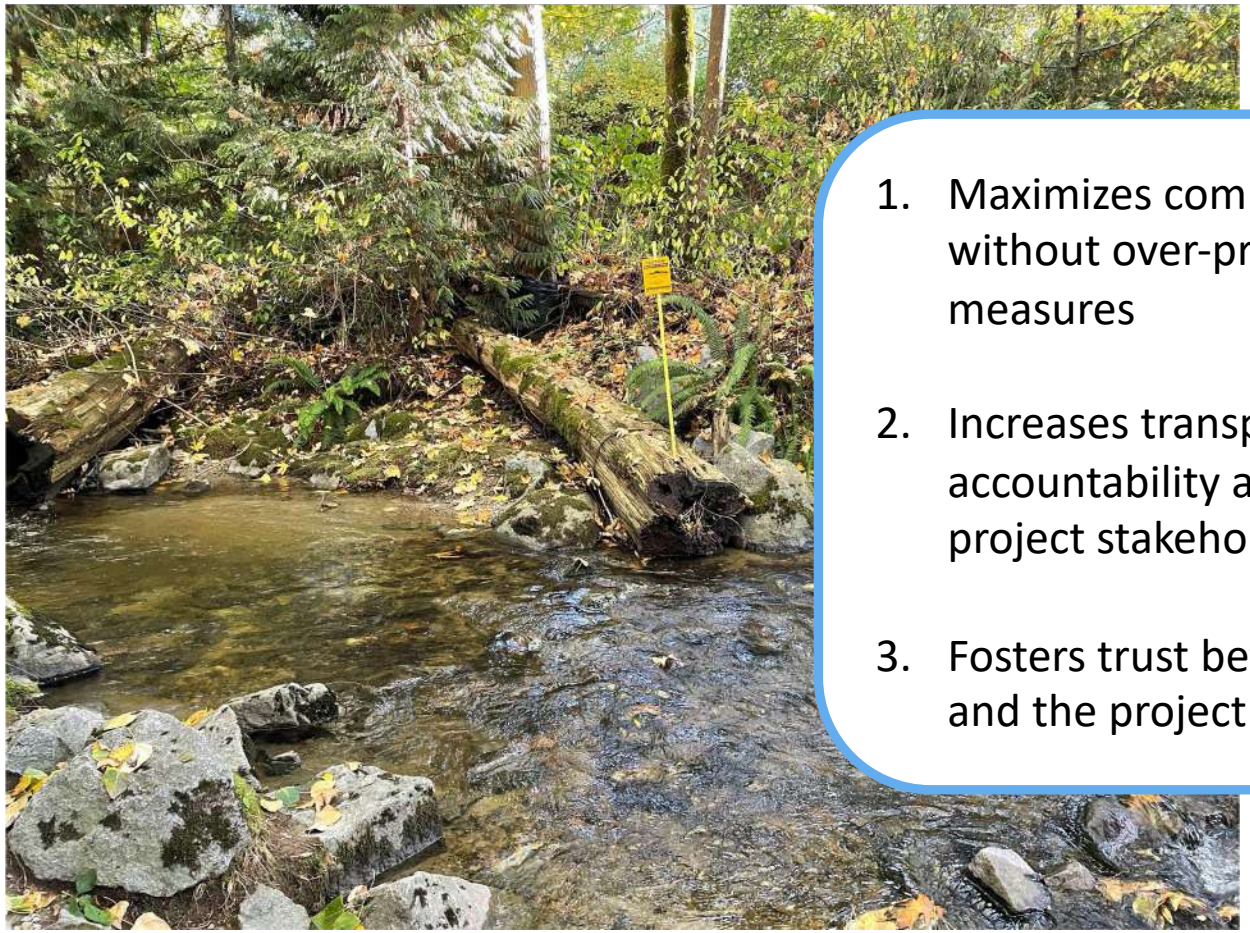
Identified the source!

Presented by Mikayla Rafuse, P.Eng. (City of Burnaby) and Elena Ranyuk, PhD MBA (Flowlink Environmental) at ESCA BC 2023 Conference

Real-time monitoring on construction sites & creeks: Working together



Benefits: healthier watersheds & maximized compliance



1. Maximizes compliance without over-prescriptive measures
2. Increases transparency & accountability amongst the project stakeholders
3. Fosters trust between the City and the project team

Conclusion

- Regulations are gradually evolving, leveraging IoT technologies to enforce compliance and protect our watersheds.
- On-site real-time monitoring stops non-compliant water at source.
- In-stream real-time monitoring captures the impact from sites that discharge non-compliant water.

We all need to work together to protect, maintain and improve watershed health.

www.flowlink.ca

Presented by Mikayla Rafuse, P.Eng. (City of Burnaby) and
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Questions?

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