



Puget Sound Freshwater Monitoring Network

Using supplemental funds, expand the continuous monitoring of water quality (WQ) in eight freshwater rivers flowing into Puget Sound.



DEPARTMENT OF
ECOLOGY
State of Washington

About the Puget Sound Freshwater Monitoring Network



About Ecology's statewide Ambient Freshwater Monitoring Network.



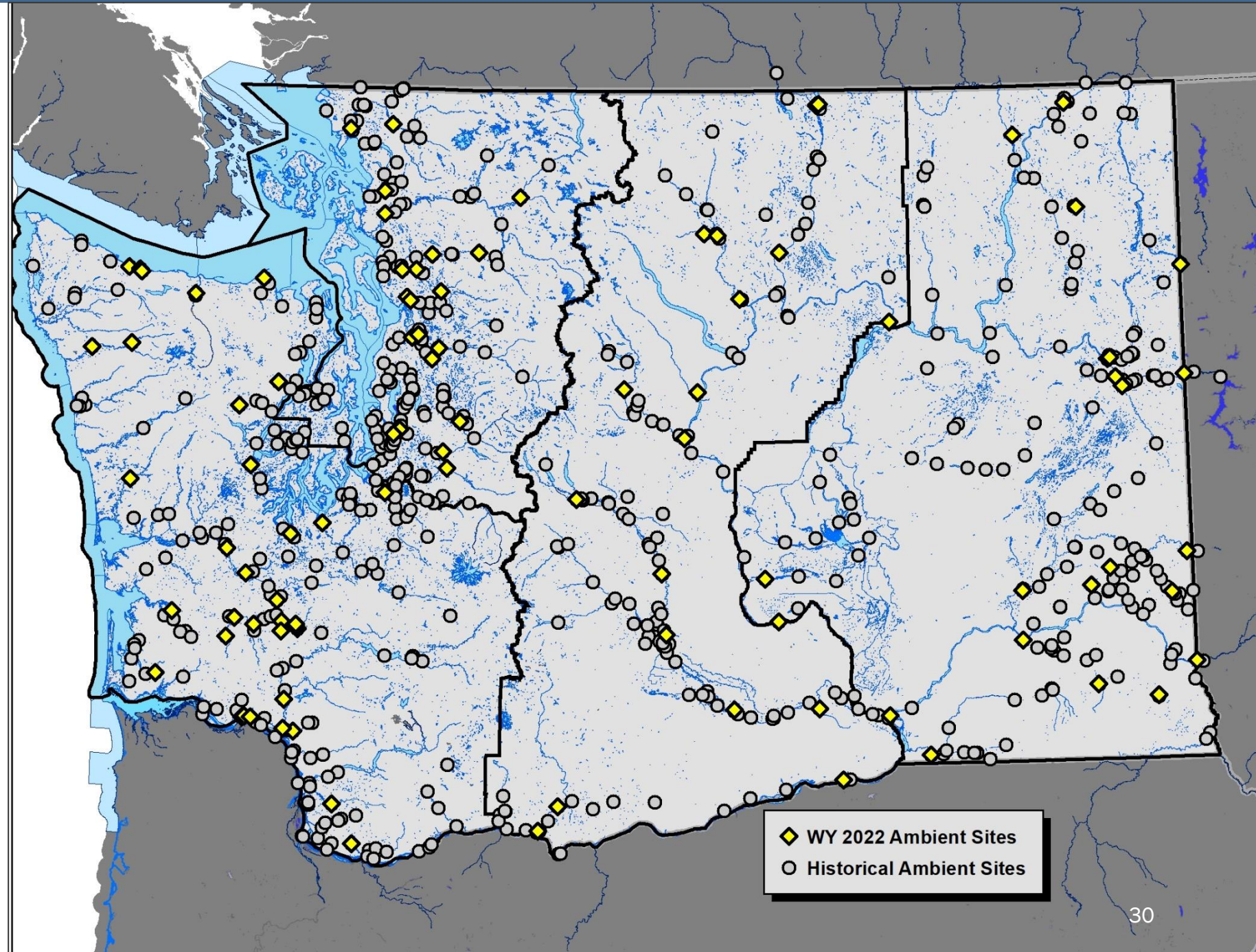
Why we need continuous water quality monitoring data for Puget Sound.



How we will collect this data.

Ambient FW monitoring

- Monthly freshwater (FW) WQ monitoring
- WQ data since the 1950s.
- Some continuous flow and WQ sites since 1996.



Ambient monthly discrete sampling

- Data used for TMDLs, modeling, and water quality assessments.
- The best available data for many parameters and sites.

Ambient technology updates

- Satellite telemetered stage and water quality monitoring.
- Compact temperature loggers
- Better meters for discrete and continuous monitoring



Continuous monitoring

- Flow and stage monitoring.
- Continuous water quality:
 - Temperature
 - Conductivity
 - pH
 - Dissolved oxygen
 - Turbidity
- Satellite telemetry for near real-time data.



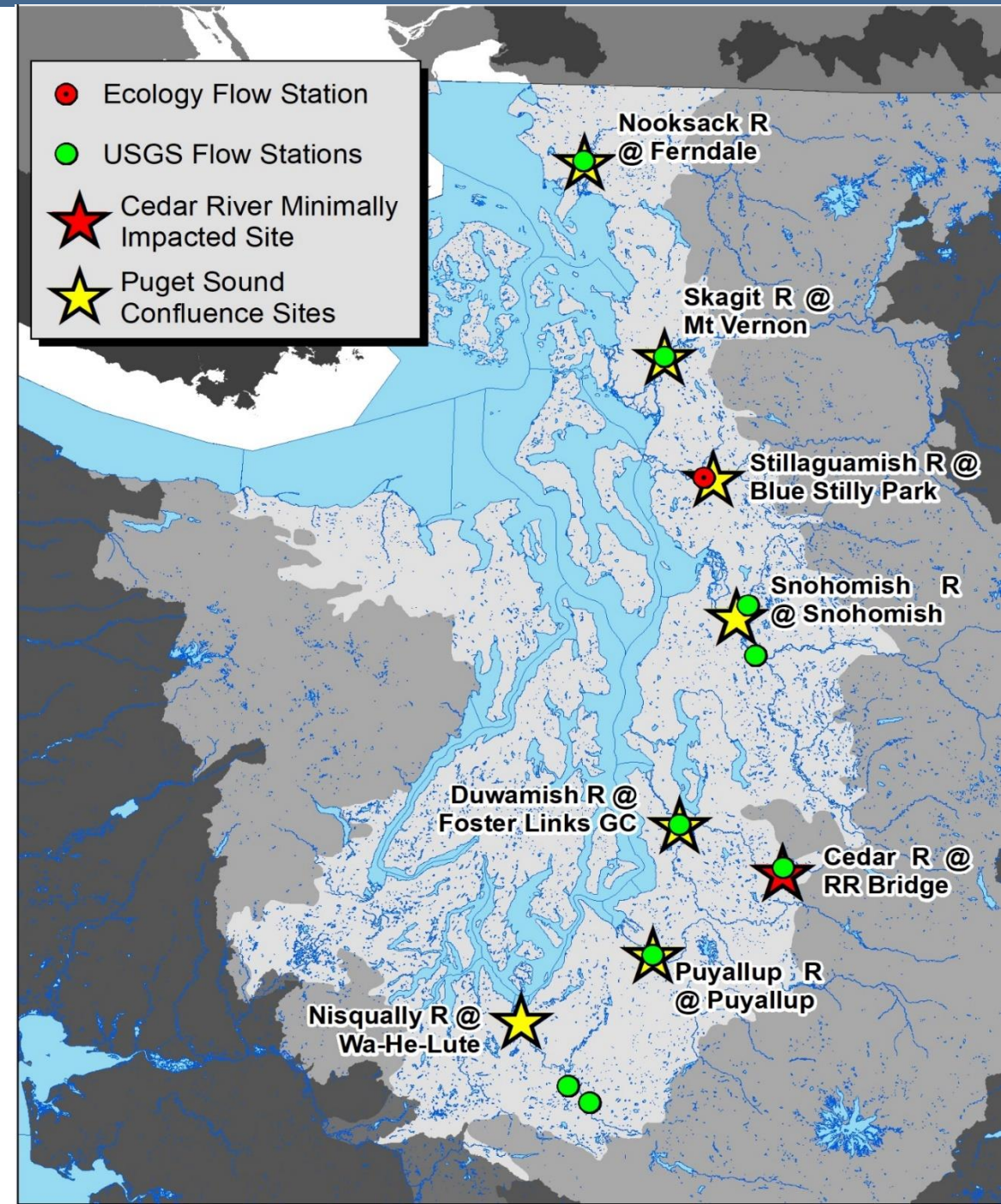
Continuous temperature

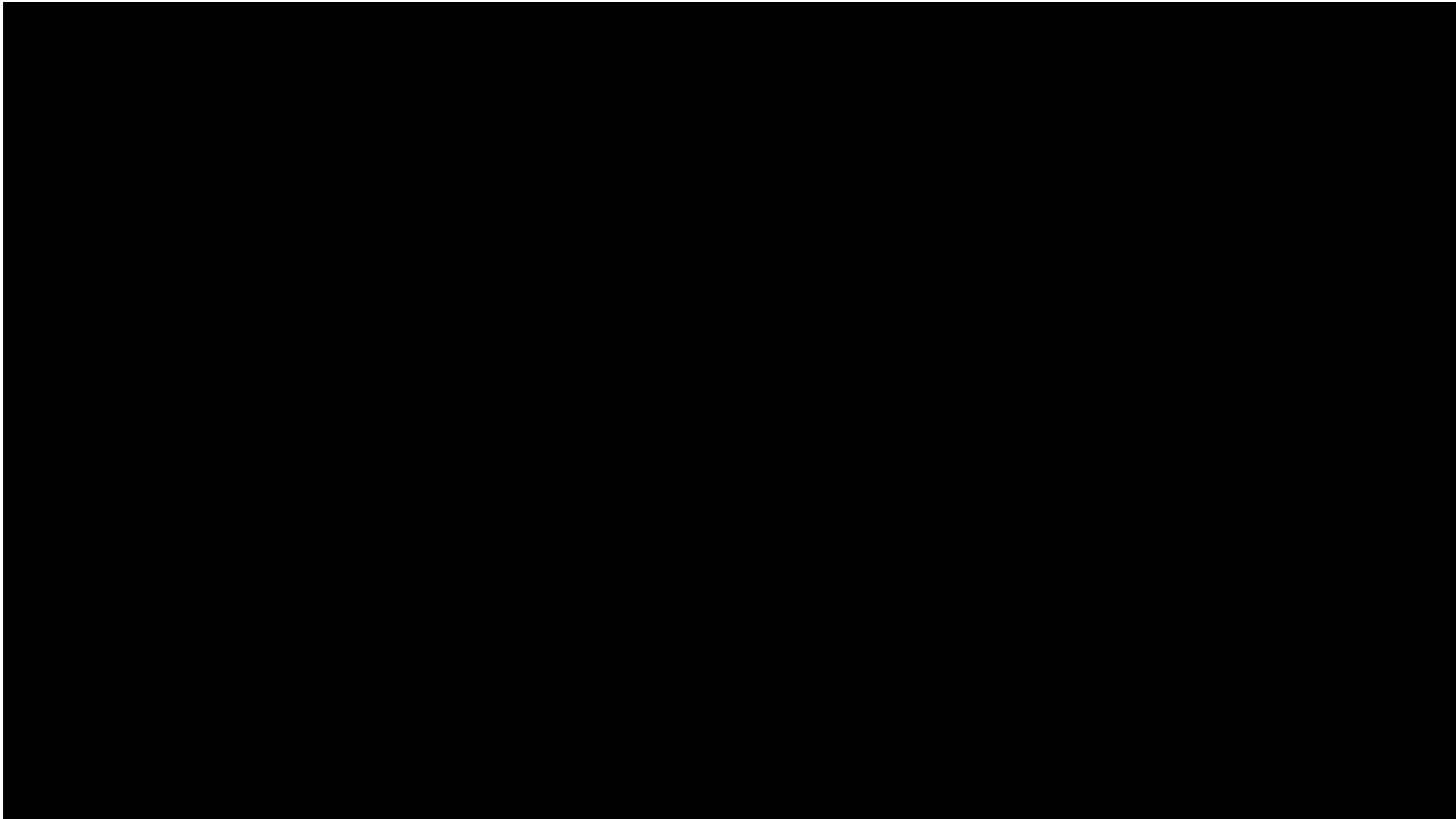
- Deploying small (<2 inch) temperature loggers
- Accurate to within ± 0.21 °C
- Record for years at 15 or 30 minute intervals



What we're doing

- Installing eight continuous nutrient sites
 - ★ Confluence sites for the seven largest rivers entering Puget Sound.
 - ★ One minimally impacted site on the Cedar River.
- Using the data to understand daily nutrient cycling in the rivers and Puget Sound.





Installing Puget Sound stations

For the Puget Sound monitoring sites, selection criteria included:

1. Near the mouth of the river for confluence sites
 - Plus, a minimally-impacted lowland river site.
2. Above the salt wedge (tidal influence ok, but not preferable)
3. Near a USGS or Ecology flow station
4. Near an Ambient station
5. Safety from vandalism
6. Accessibility



Water Year 2010 Pilot study on the Deschutes River

- Test new continuous nitrate measuring technology.
- Refine nitrate error estimates.



**Deschutes River
Continuous Nitrate Monitoring**



June 2011

Publication No. 11-03-030

Submersible Ultraviolet Nitrate Analyzer (SUNA)

- Spectrometer measures UV absorption to calculate dissolved nitrate concentrations.
- Logs readings and interfaces with satellite telemetry to send data.
- Low level sensitivity 0.035 mgN/L (2.5 μ M).
- Calibration uses a NIST standard.

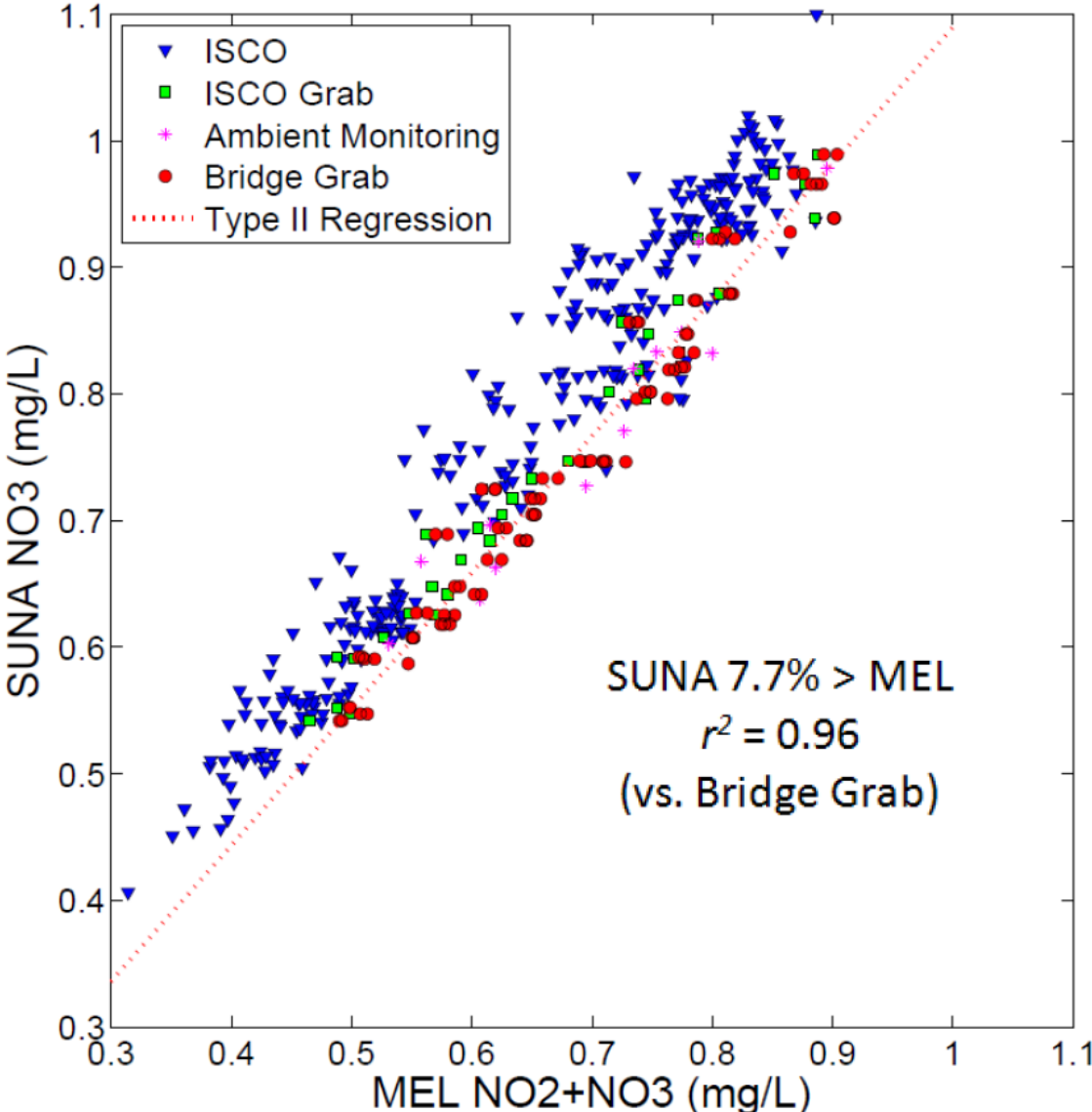


© Image Copyright 2022:
SeaBird Scientific
SUNA V2

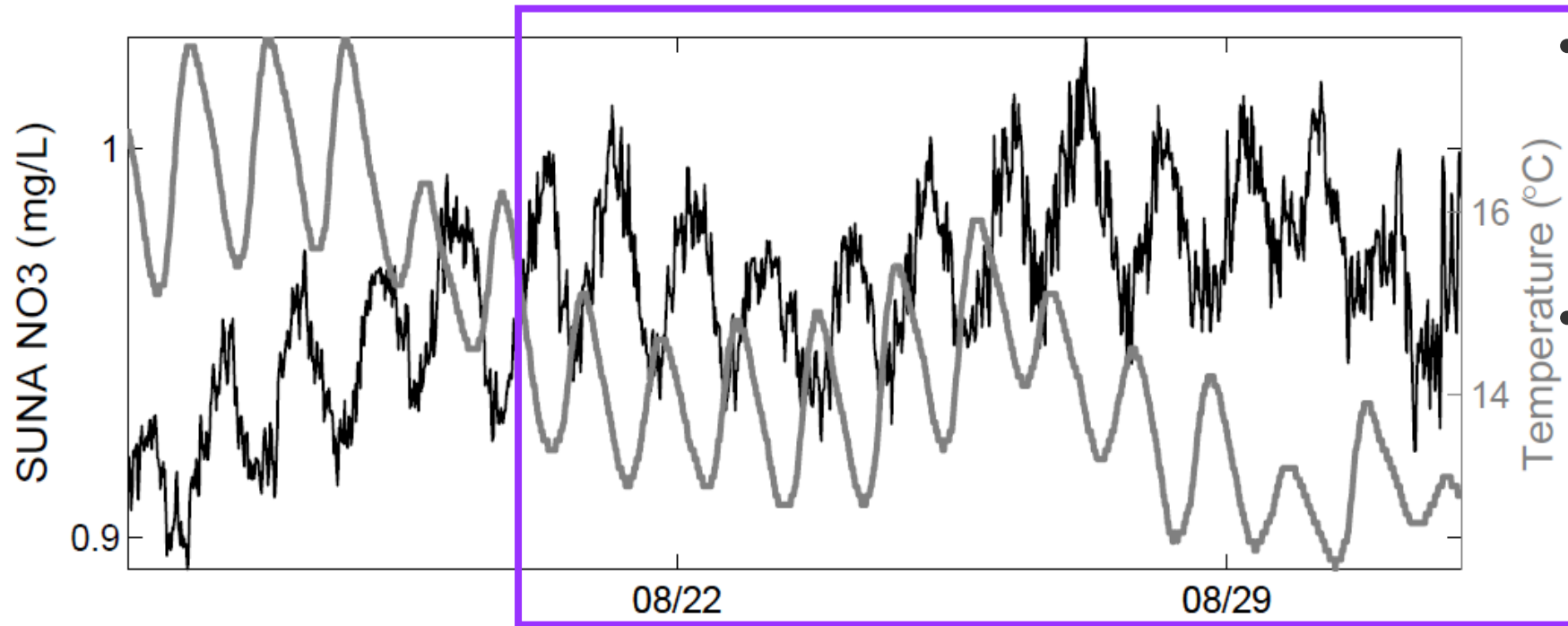
Deployment at the Deschutes River



Quality Assurance: Ambient monitoring grabs, the ISCO automated samples, and the SUNA nitrite & nitrate.



Implications for establishing Washington State nutrient criteria

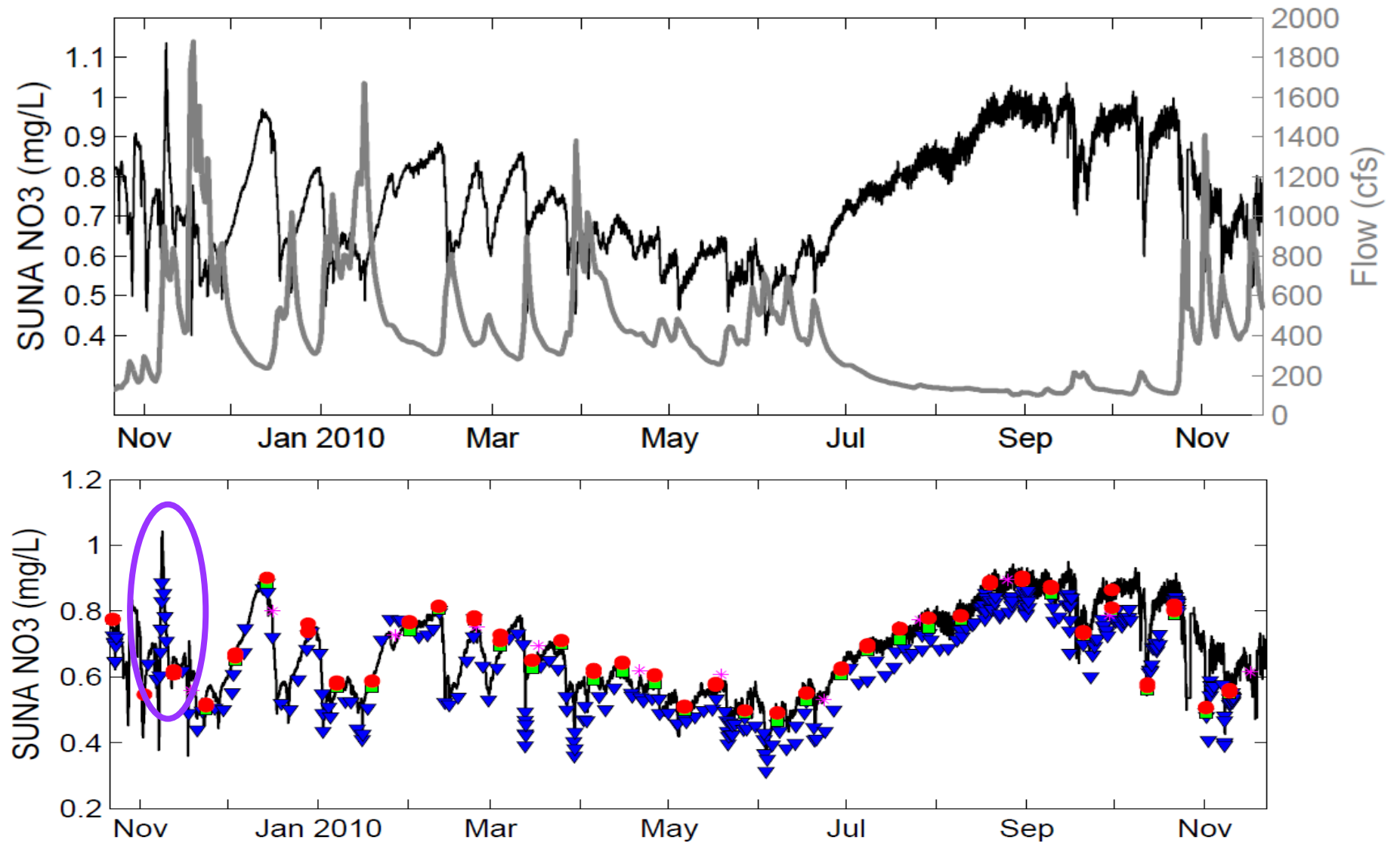


- Daily nitrate concentrations inversely correlate with temperature
- Both nitrate uptake and temperature rise are linked to solar exposure and ambient temperature.

Diurnal Variability and Relationships with Instream Processes

Example of diurnal nitrate variability from August 2010 showing a strong inverse relationship with water temperature.

Nitrate Concentrations vs. Flow Observations



15-minute unadjusted SUNA nitrate estimates from the E. Street Bridge site.

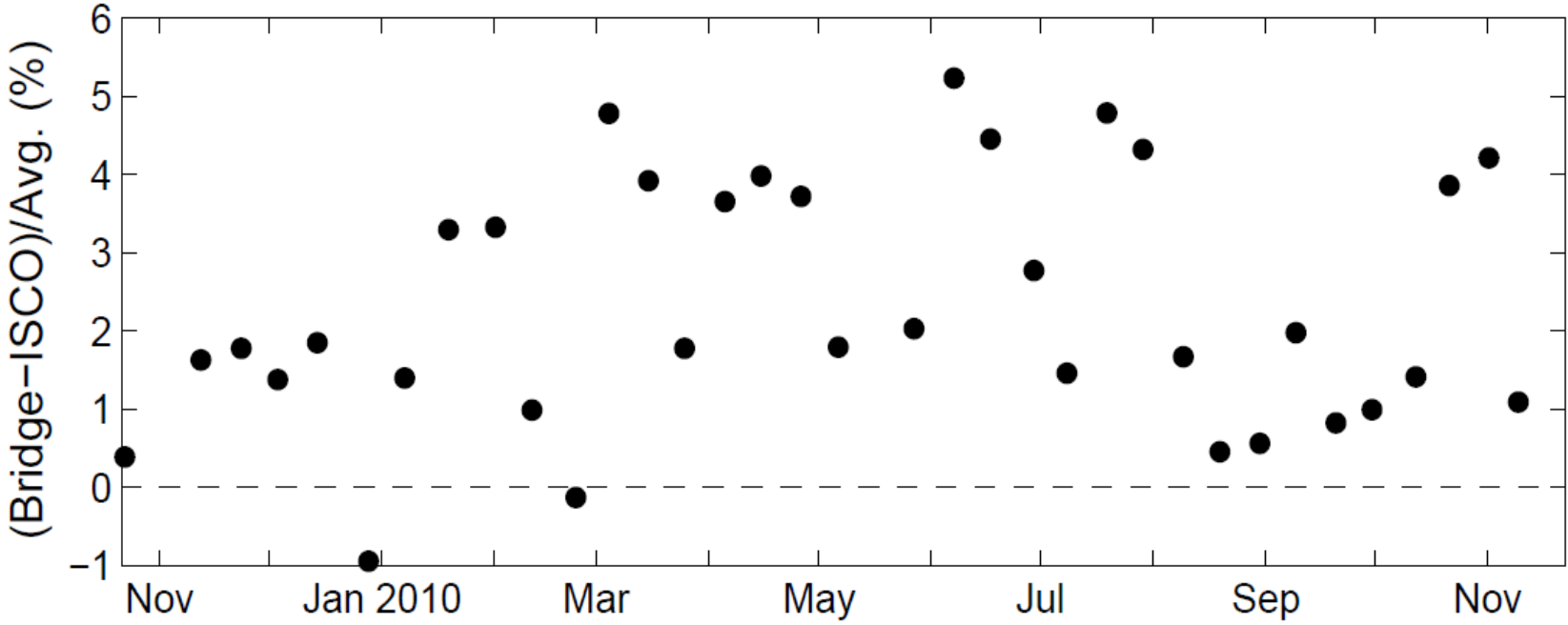
- Daily flow estimates were provided by the USGS and validated using Ecology's on-site stage height measurements.

Automated sampling

- Installing refrigerated automated pump samplers to collect rare event samples
- Capture and verify important, and unpredictable, water quality changes.



Percent error between discrete grab samples and automatic pumped samples (ISCO)



Time series of percent error between coincident discrete grab samples and automatic pumped samples (ISCO) analyzed for total nitrite+nitrate.

Average value was 1.82% (n = 36).









23B120: SF Newaukum @ Jorgensen St.



Period 14 Day 01/22/2018 to 02/05/2018

2018

— 23B120

SF Newaukum R 810.00 Line

Turbidity (Median)

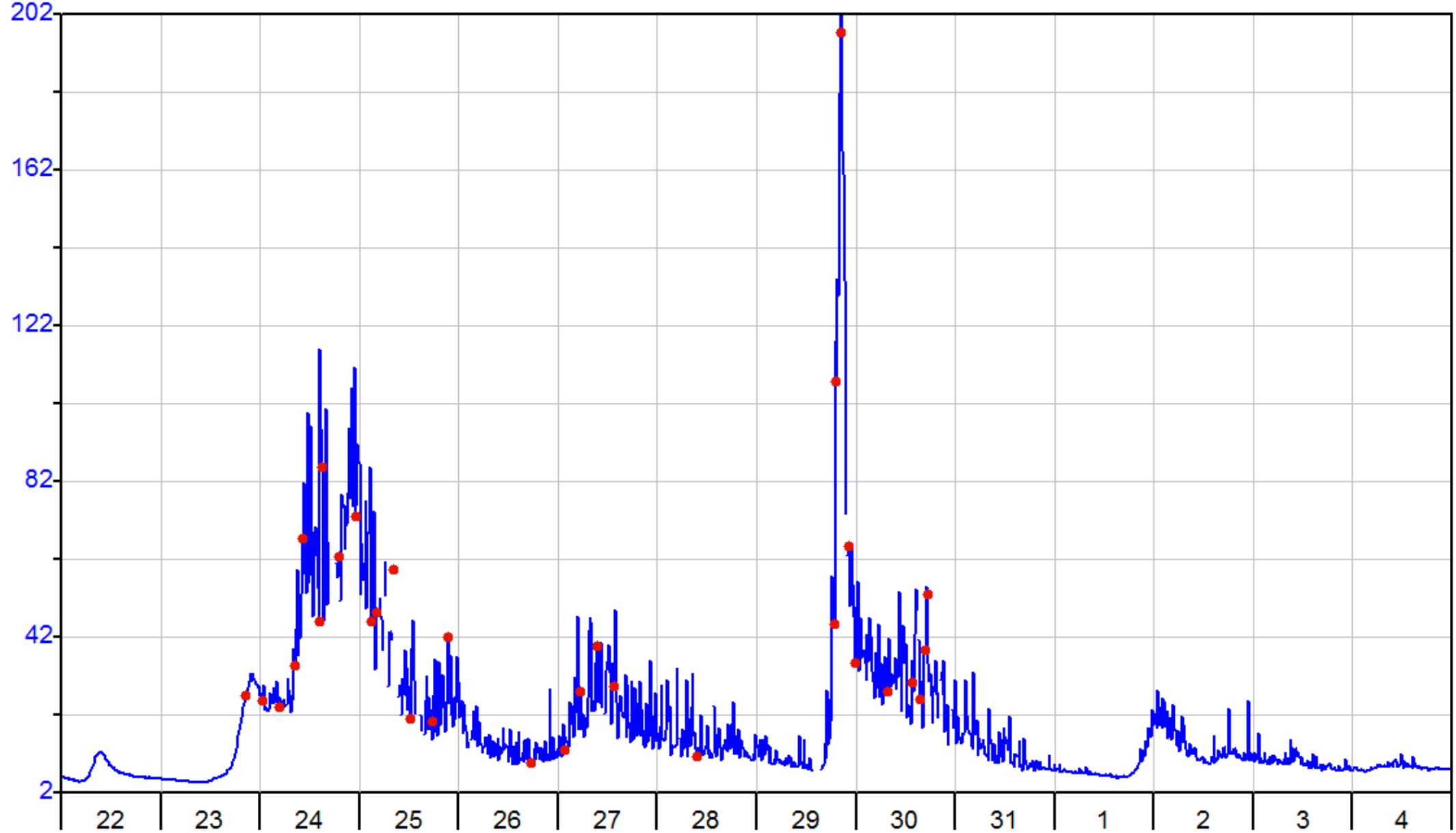
WATERQLA

■ 23B120

SF Newaukum R 352.00 Point

Bottle No.

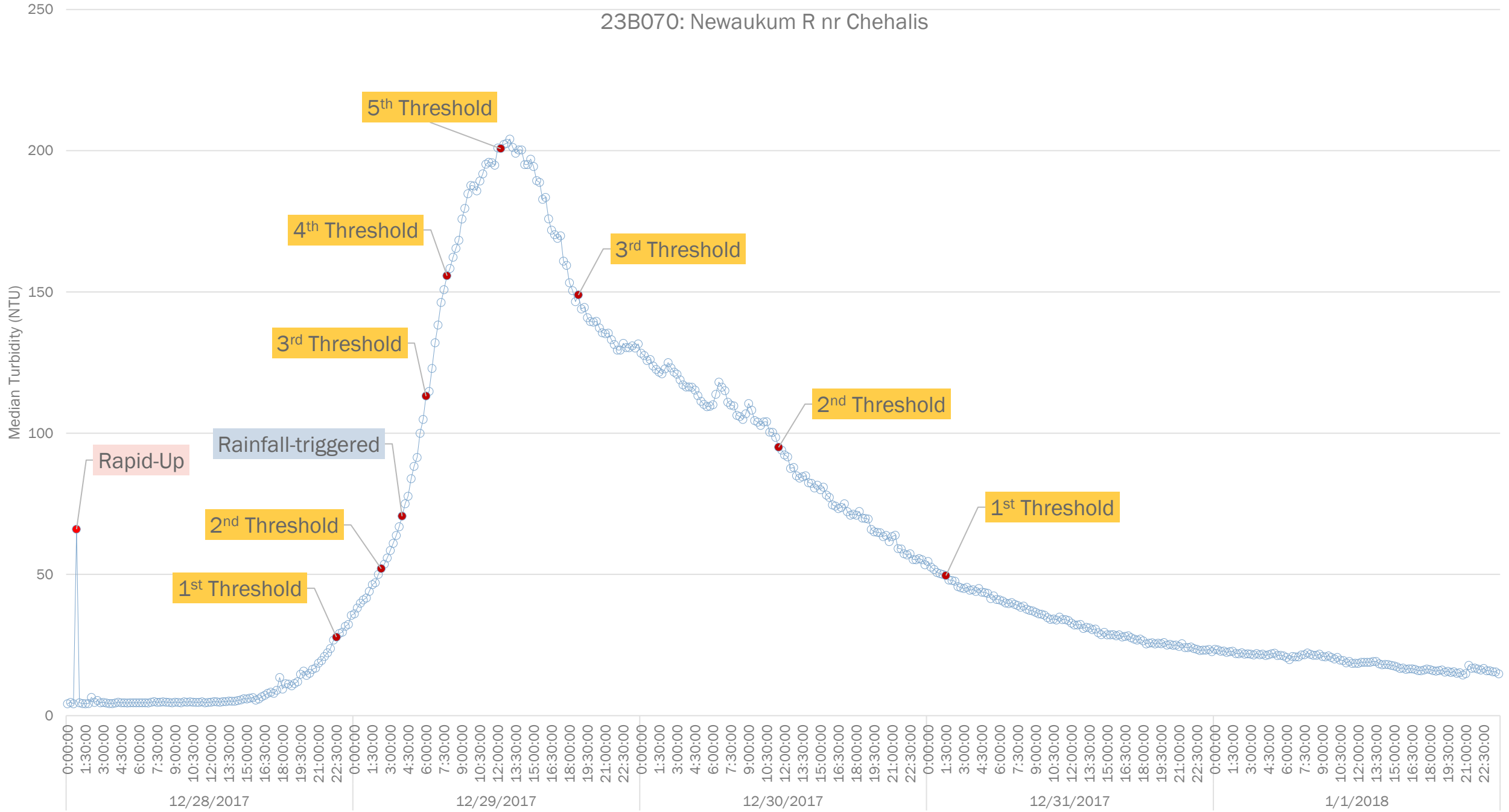
QC





25 LB MAXIMUM LOAD
ON TOP OF ENCLOSURE
- DO NOT EXCEED -

23B070: Newaukum R nr Chehalis



Chehalis pilot study results

- ISCO sampling worked to verify turbidity over storm threshold points.
- Automated threshold sampling was easy to configure and implement.
- Demonstrated we can implement automated sampling at other stations, including for Puget Sound Nutrient monitoring.



What the new Puget Sound stations will do

- Continuous nitrate monitoring added to other continuous parameters:
 - Turbidity, pH, DO, Conductivity, Temperature
- Monthly discrete parameters including:
 - Dissolved and total nutrients (ammonia, nitrates-nitrites, organic carbon, phosphorus), chloride, sulfates, alkalinity, suspended solids)
- Address the relationships between nutrients, and pH and DO state criteria.
- Continuous data will provide a finer resolution showing nutrient cycling.



Next steps

- Install continuous monitoring stations
- Develop deployment technology
 - I-beam and shuttle to adjust probe elevations instream
- Other tasks
 - Auto-sample testing
 - Data management and reporting in Ecology's Freshwater DataStream
<https://apps.ecology.wa.gov/continuousflowandwq/>



Next steps for Puget Sound stations.

- Site access permission
 - Permitting:
 - Federal, state, county, city, and tribal government review
 - Shoreline Management Act
 - Hydraulics permits
 - Cultural heritage review
- Installations
 - Supply chain (affected by COVID)
 - New hires accelerating installations
- Deployment testing
 - Can we get the data?



Monitoring Program Automation (MPA)



EAP Monitoring Program Automation

- Home
- Fieldwork
- Data
- Quality Control
- Manage

Welcome, Markus

+ Add MPA to home screen

Home

MPA Home

Fieldwork

Field Entry

[Field Data Entry](#)

Pick a field entry and collect data based on your trip plan

Trip Plans

[Create New Trip Run Plan](#)

Tie activities and data to locations

[View/Edit Trip Runs or field reports](#)

View finalized or edit un-finalized Trip Runs Plans or view field reports

Equipment

[Chassis List](#)

View or manage chassis

[Equipment List](#)

View or manage equipment

[Correction Factors](#)

View or manage correction factors

Data

Imported Data

[Load Data File](#)

Import data from files

[Manage Files](#)

View and remove files loaded to the system

Enter/Edit

[Add Discrete Result](#)

Enter Discrete Result data points

[View/Edit Discrete Results](#)

View & Edit Discrete Result data

[Edit Continuous](#)

Edit Continuous data results

Quality Control

Time Series Data

[Create New QC Session](#)

[Continue or Finalize Existing QC Session](#)

Discrete Data

[Discrete QC Evaluation](#)

[Discrete EIM Export](#)

[Review or Calculate Sum Stats](#)

[View/Finalize Batches from LIMS](#)

Field Parameters Validation

[Field Parameters Validation](#)

Datamart Reporting

[Water Year Samples Summary](#)

View/export RS2 data and reports

Management

Management Tools

[Manage Parameters](#)

Add/remove parameters

[Manage Units of Measure](#)

Add/remove units of measure

[Manage Methods](#)

Add/remove methods

[Manage Studies](#)

View EIM study information

[Manage Staff](#)

Add/remove staff

[Manage Stations](#)

Add/remove stations

[Manage Lab Bottles](#)

Add/remove lab bottles

[Manage Object Type Reference](#)

Add, edit, remove object type references like chassis type, instrument type, etc.

[Manage Qualities](#)

Add, edit, remove qualities.

Puget Sound Freshwater Monitoring Network

- Establish new monitoring tools at long-term stations
- Continuous and automated data will increase the accuracy of our nutrient model.



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