



Ohop Creek Stormwater Management Pilot Project

South Sound Science Symposium
Ashley Bagley, MMA
October 20, 2022



Long Live the Kings

Our mission is to restore wild salmon and steelhead and support sustainable fishing in the Pacific Northwest.

Our vision is a Northwest with a growing human population, a thriving economy, and strong and vibrant salmon runs.





Image: Seattle Times



Image: Associated Press



Nisqually Watershed

Ohop Creek

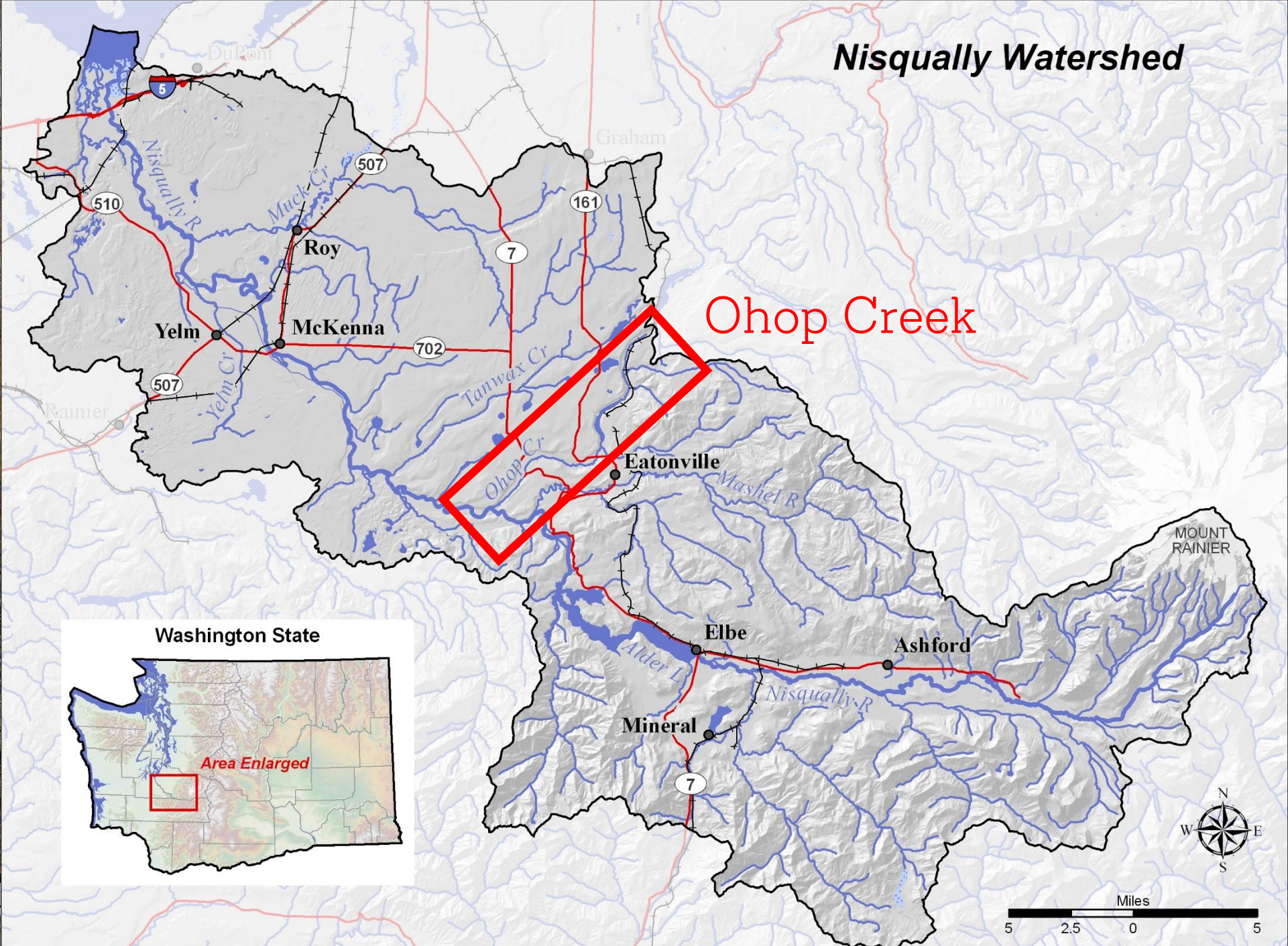




Image: Nisqually Land Trust



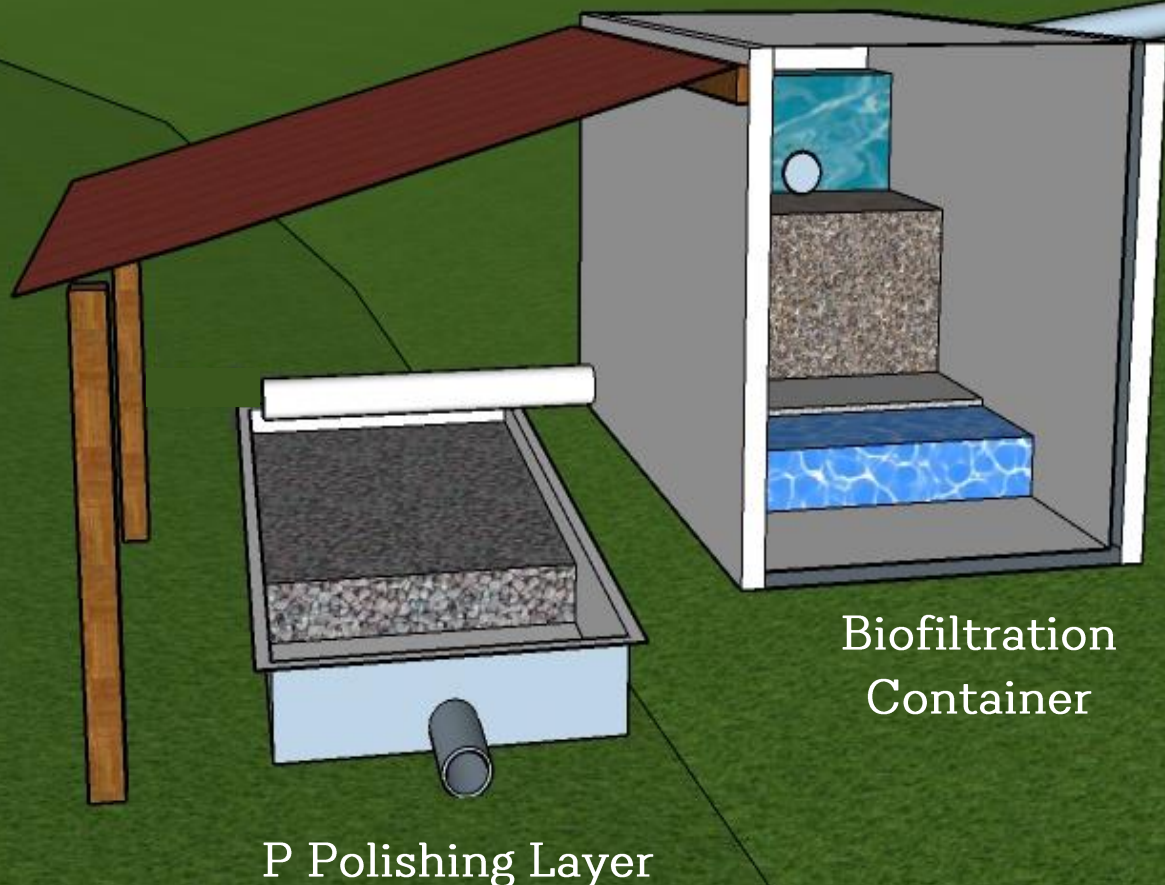


1. No existing stormwater management system

2. Ohop Creek is a salmon bearing stream

3. Above ground systems are more favorable in ecologically sensitive areas

RENDERING



- Test the effectiveness of
- Cedar Grove's biofiltration container at removing harmful contaminants; and
 - Secondary phosphorus polishing layer at removing excess nutrients.

Project Objective #1

Install the biofiltration system at the project site in winter 2021.

Completed



Project Objective #2

Collect flow-based, automated samples from the inlet, midpoint, & outlet for chemical analyses & toxicology screening from 3 qualifying storms.

Completed





DEPARTMENT OF
ECOLOGY
State of Washington

**Technical Guidance Manual for
Evaluating Emerging
Stormwater Treatment
Technologies**

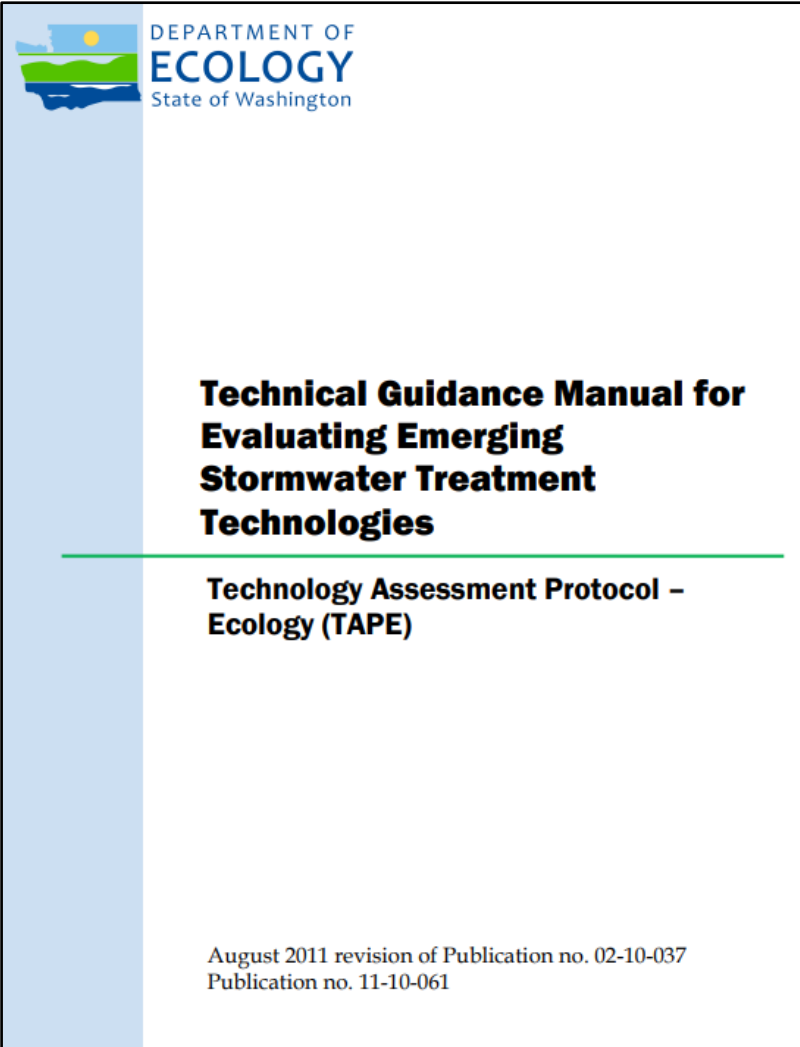
Technology Assessment Protocol -
Ecology (TAPE)

August 2011 revision of Publication no. 02-10-037
Publication no. 11-10-061

- Rainfall ≥ 0.15 inches
- Rainfall needs to last > 1 hour
- Storm start/end = 6-hours min w/ < 0.04 inches of rain



Sampling Criteria



- **Min 10 subsamples/station/event**
- **Need 75% coverage of storms < 24-hours**
- **Max sampling duration is 36 hours**



Sampled Storm Events

2022 Date	Rainfall (Inches)	Inlet Subsample Counts	Midpoint Subsample Counts	Outlet Subsample Counts
April 5	1.19	75	74	74
April 19				
May 9				

Sampled Storm Events

2022 Date	Rainfall (Inches)	Inlet Subsample Counts	Midpoint Subsample Counts	Outlet Subsample Counts
April 5	1.19	75	74	74
April 19	0.25	21	20	20
May 9				

Sampled Storm Events

2022 Date	Rainfall (Inches)	Inlet Subsample Counts	Midpoint Subsample Counts	Outlet Subsample Counts
April 5	1.19	75	74	74
April 19	0.25	21	20	20
May 9	0.78	101	80	81

Project Objective #3

Share lessons learned & preliminary findings to inform transportation redesign projects in ecologically sensitive areas.

Ongoing





High Detection Limits

- Total Phosphorus:
 - 0.25 mg/L
- Orthophosphate:
 - 0.525 mg/L



Lower Limits Preferred

- Total Phosphorus:
 - 0.01 mg/L
- Orthophosphate:
 - 0.01 mg/L

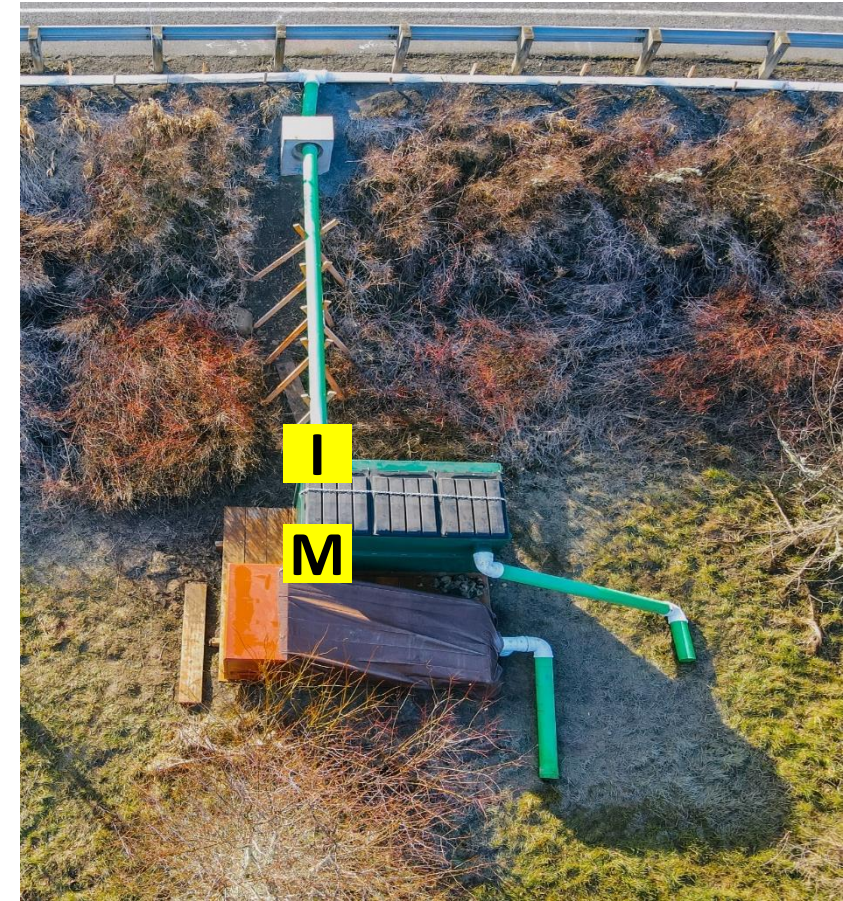
Water Quality *Preliminary* Results

Biofiltration Container – Average Removal Efficiency

**Changes in concentrations from inlet to midpoint*



- Zinc decreased 75%
- Dissolved Organic Carbon (DOC) increased 313%
- Copper increased 27%



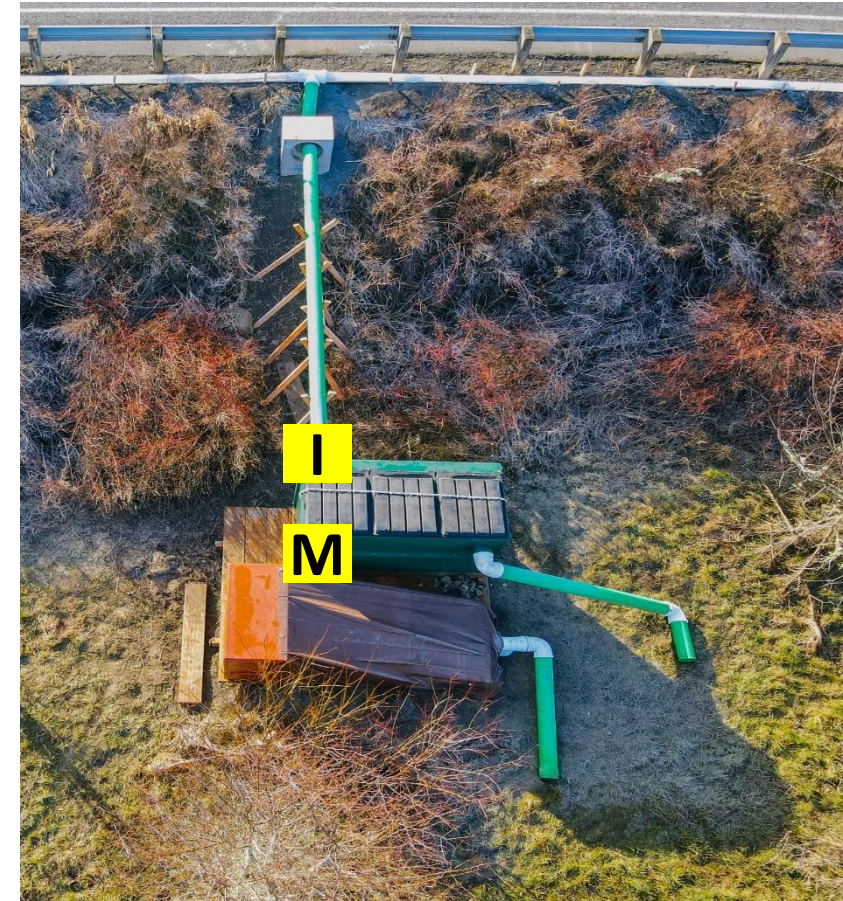
Water Quality *Preliminary* Results

Biofiltration Container – Average Removal Efficiency

**Changes in concentrations from inlet to midpoint*



- Total Phosphorus increased 162%
($0.25 \text{ mg/L} \rightarrow 0.66 \text{ mg/L}$)
- Orthophosphate increased 113%
($0.25 \text{ mg/L} \rightarrow 0.72 \text{ mg/L}$)
- Nitrate + Nitrite (N+N) increased 2,022%
($0.1 \text{ mg/L} \rightarrow 2.12 \text{ mg/L}$)



Water Quality *Preliminary* Results

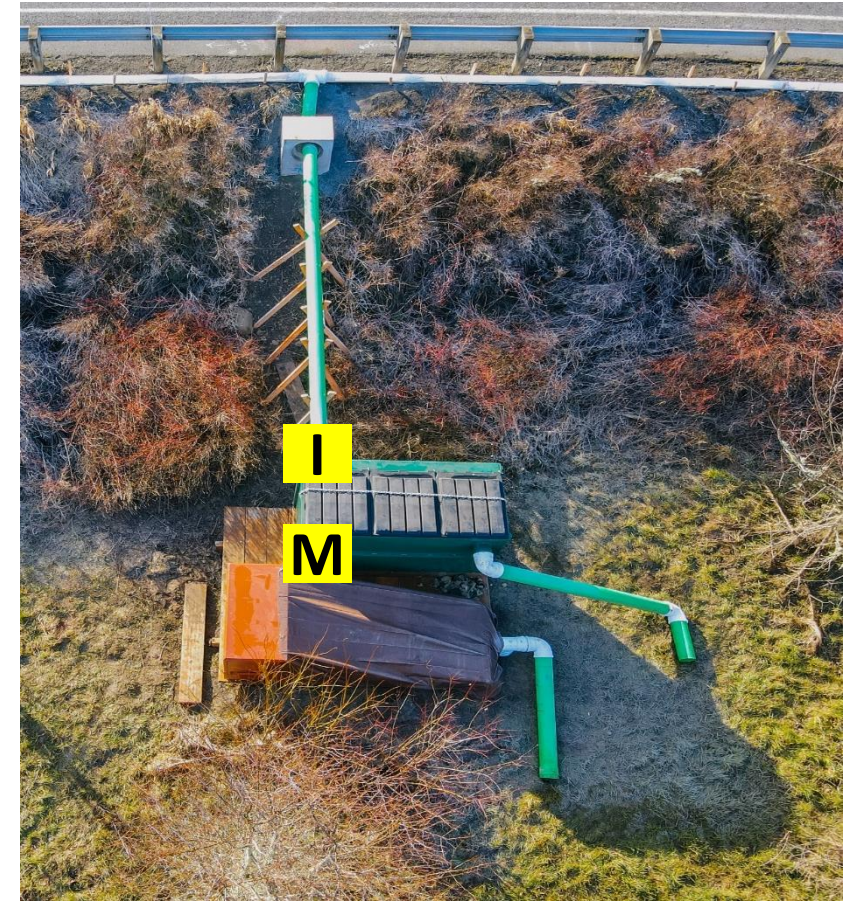
Biofiltration Container – Average Removal Efficiency

**Changes in concentrations from inlet to midpoint*



- 6PPD-Quinone decreased 92.5%

**Only first two storm events*



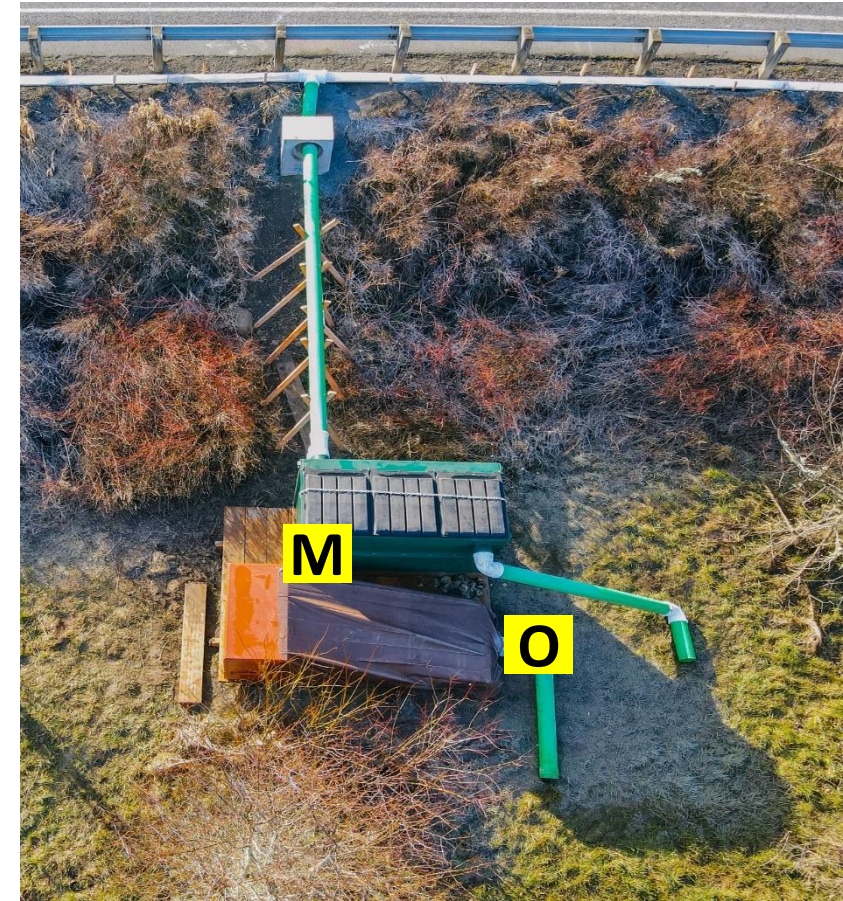
Water Quality *Preliminary* Results

Phosphorus Polishing Layer – Average Removal Efficiency

**Changes in concentrations from midpoint to the outlet*



- Total Phosphorus decreased 8%
(0.66 mg/L → 0.60 mg/L)
- Orthophosphate decreased 15.8%
(0.72 mg/L → 0.60 mg/L)
- N+N increased an additional 21.4%
(2.12 mg/L → 2.58 mg/L)



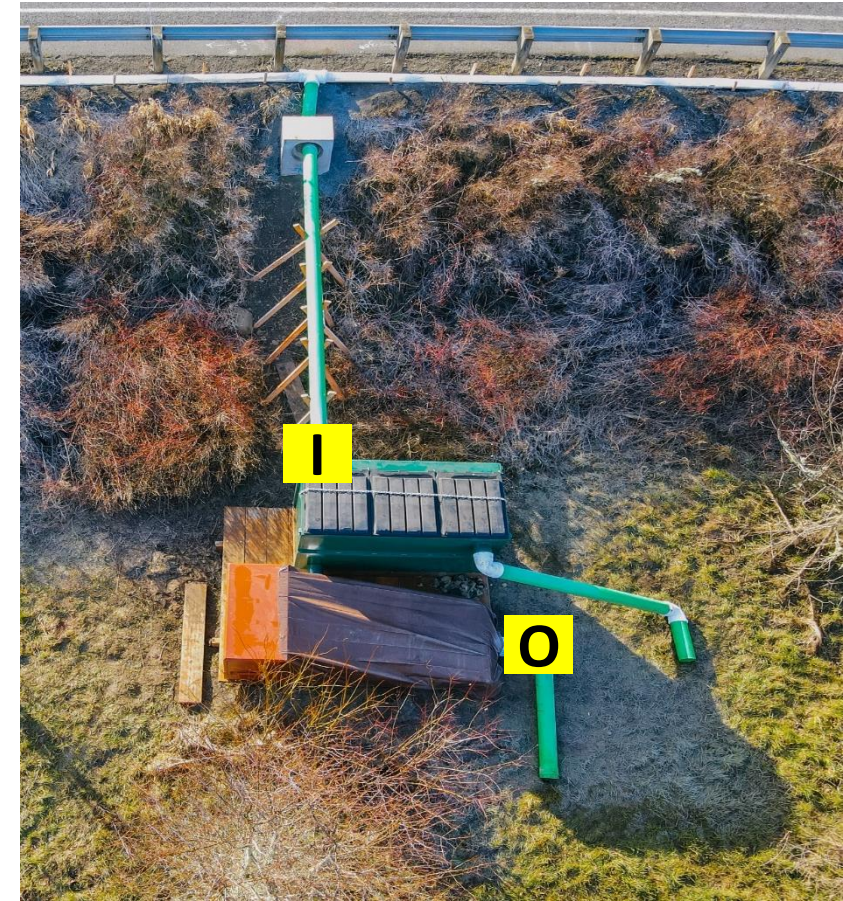
Toxicology Testing – Results Forthcoming

Stormwater Management System

**Changes in concentrations from inlet to the outlet*



- Will expose fertilized zebrafish embryos to test waters for 48–96 hours
- Endpoints include (1) morphometrics & (2) transcriptional responses of genes



- **Nutrients may not be a concern at project site**

Biofiltration Container

- **Increases nutrient concentrations (P & N)**
- **Reduces zinc, metals toxicity in water, & 6ppd-q**

Polishing Layer

- **Reduces P, but not as much as expected**
- **Increases N+N**

Anticipated Next Steps

- **Season 2 Sampling – 10 storm events (winter 2022)**
 - *New laboratory for lower detection limits*
- **Season 3 Sampling – 10 storm events (winter 2023)**
- **Ecology's TAPE Designation (2024)**



Nisqually Indian Tribe



**CEDAR
GROVE**[®]



W
UNIVERSITY of
WASHINGTON
TACOMA



WASHINGTON STATE
UNIVERSITY

SUSTAINABLE PATH
FOUNDATION





Thank you!

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