MUNICIPAL ALLIANCE FOR ADAPTIVE MANAGEMENT
MEETING OF THE MEMBERS
DRAFT MINUTES

Meeting Type: **Members Meeting**
Meeting Location: **Rochester DPW**
209 Chestnut Hill Road, Rochester NH

Meeting Date: **April 14, 2026**
Meeting Time: **2:00 pm**

A quorum of Members will be in person, but for those interested in participating remotely please register at the above link.

A full recording of this meeting is available to review for further detail.

1. Call to order

The Meeting was called to order at 2:00 pm.

Town/City	Representative	Present
Dover	Tim Puls (TP) John Storer (JS)	Yes Yes (by Zoom)
Portsmouth	Suzanne Woodland (SW)	Yes
Rochester	Gretchen Young (GY)	Yes
Exeter	Stephen Cronin (SC)	No
Newington	Aerial Write (AW)	Yes (by Zoom)
Newmarket	Sean Greig Lindsay Butler	Yes Yes
Milton	Richard Krauss	No
Epping	Jake Roger (JR)	Yes (by Zoom)
South Berwick	Denis Messier (DM)	Yes
Berwick	Jay Wheeler (JW) Mike Tibbets (MT)	Yes (by Zoom) Yes

Non-Members:
Kalle Matso, PREP
Chris Whitney, PREP
Stacy Villanueava, Brown and Caldwell
Clifton Bell, Brown and Caldwell
Atsushi Matsuoka, UNH
Mike Bobinsky, Somersworth
Sally Soule, NHDES
Danielle Gaito, EPA Region 1
Daniel MacAdam, UNHSC
Jamie McCarty, Portsmouth
Jud Kenworthy, PREP

Chiaki Motegi, PREP
Steve Couture, NHDES
Jim Steinkrauss, Rath, Young, and Pignatelli
Vyacheslav Lupeshich, Maryland Center for Environmental Science
Michelle Shattuck, UNH
William McDowell, UNH
Amber Hall, Somersworth
Ken Edwardson, NHDES

2. Approval of Meeting Minutes from February 5, 2026

a. GY lists minutes for the February 5, 2026 meeting.
b. No questions.
c. DM move to approve.
d. TP 2nd.
e. GY conducts roll call.
f. All vote yes to approve.

3. Agenda Items

a. Presentation from Bill McDowell and Michelle Shattuck
  i. Part 1 – Impacts of storms on Great Bay water quality presented by Bill McDowell
  ii. Part 2 – Estimating Discharge in Great Bay Tributaries: Runoff Comparison by Michelle Shattuck
  iii. Video presentation can be found at the following link:
    1. Video Conferencing, Web Conferencing, Webinars, Screen Sharing - Zoom
    2. Passcode: q=?V%bn9
  iv. Slides are attached to the end of these meeting minutes.

4. Other Business

a. Tier 1 Eel Grass Report is available.

5. Schedule Next Meeting

a. September 2026, Gretchen to email meeting options.

6. Adjourn

a. GY motion to adjourn, DM 2nd, all agree.

Impacts of storms on Great Bay water quality

Jody D. Potter, William H. McDowell, Michelle D. Shattuck, and Kalle Matso

April 14, 2026

University of New Hampshire
NH Agricultural Experiment Station

NEW HAMPSHIRE Water Quality Analysis Lab

NEW HAMPSHIRE WATER RESOURCES RESEARCH CENTER
NH WRRC

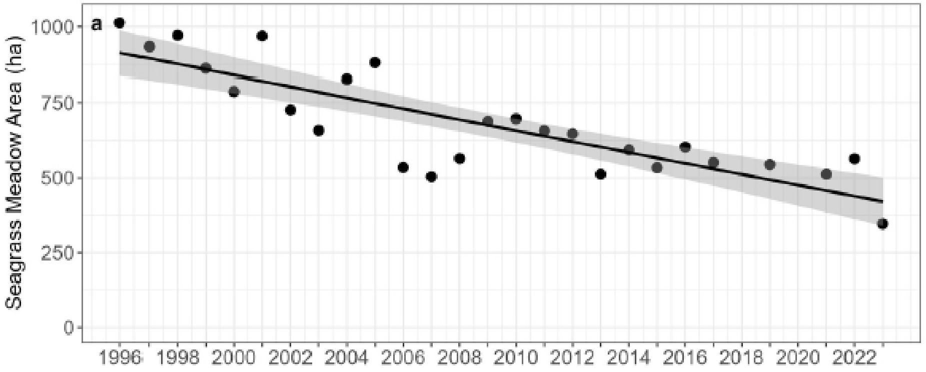
PREP Piscataqua Region Estuaries Partnership

Municipal Alliance for Adaptive Management (MAAM)

Eel Grass Decline

- Keystone species
- 65% loss from 1996-2023
- Sensitive to light availability – impacted by N, OM, Chl a, & sediments

Mikulis et al. 2026



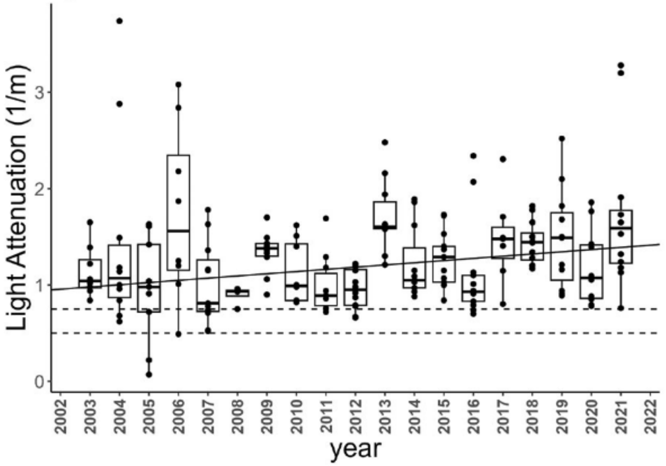


Figure 14.2: Light attenuation (Kd) data at Adams Point, 2003 through 2021. Data are log-transformed and include a mix of high and low tide samples, with all samples taken between April 1 and August 30 of the given year. Boxes encompass the middle 50% of the data points. The horizontal line in each box is the median and the vertical whiskers encompass the remaining data. "Outliers" are shown as individual points. Lines at 0.5/m and 0.75/m refer to suggested range of light attenuation values for the maintenance of existing eelgrass beds. The trend line indicates a statistically significant increasing relationship over time.
Data source: Jackson Estuarine Lab, UNH

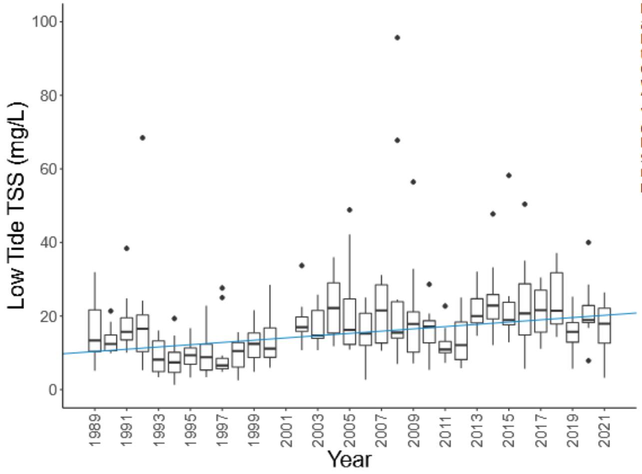


Figure 13.2: Total suspended solids (TSS) at Adams Point Station (low tide only). Boxes encompass the middle 50% of the data points. The horizontal line in each box is the median and the vertical whiskers encompass the remaining data. "Outliers" are shown as individual points. Year 2001 not included due to missing data. The linear regression represented by the blue line shows the statistically significant increasing trend in annual median TSS concentrations.
Data source: Jackson Estuarine Laboratory, UNH

State of Our Estuaries 2023

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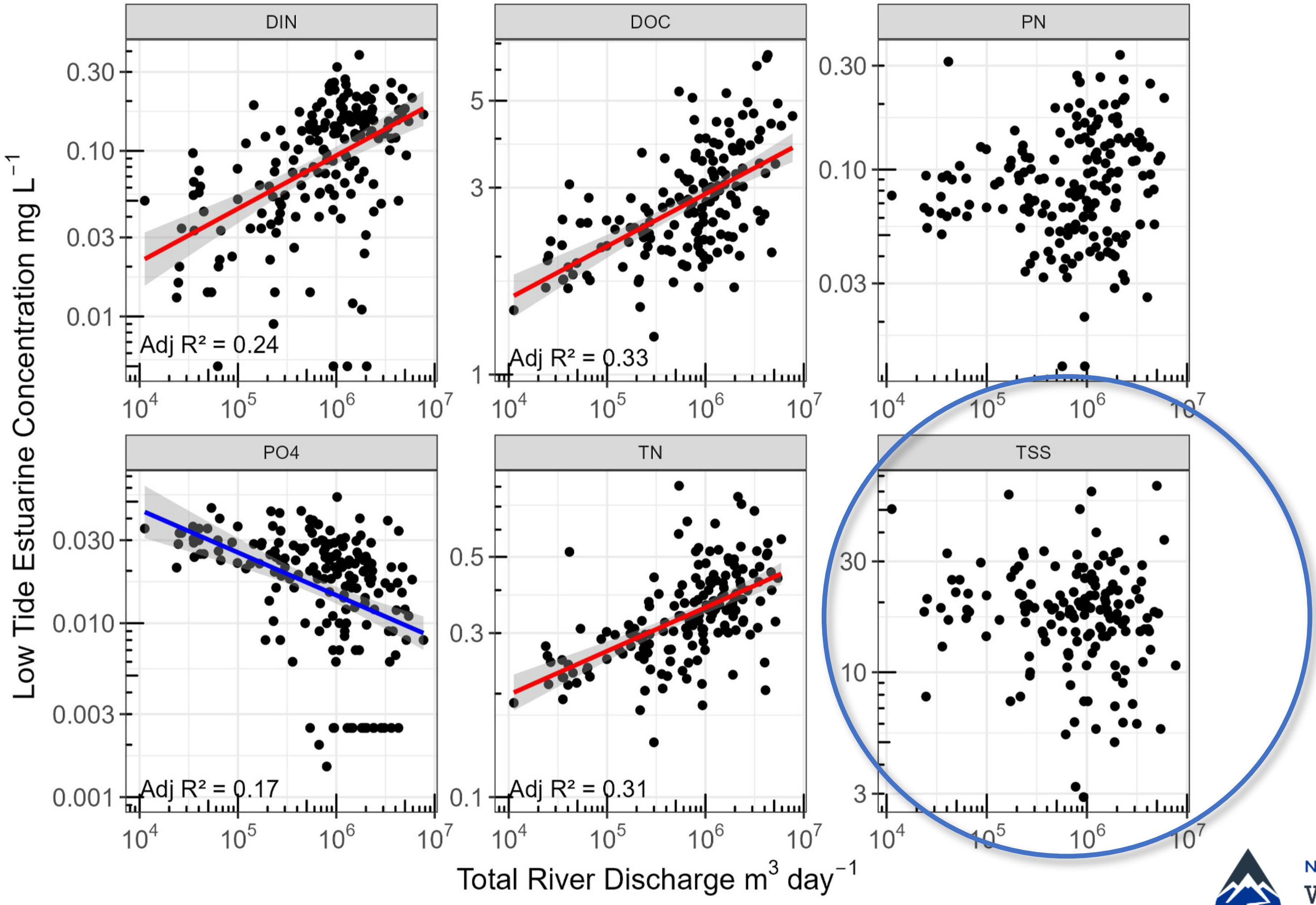
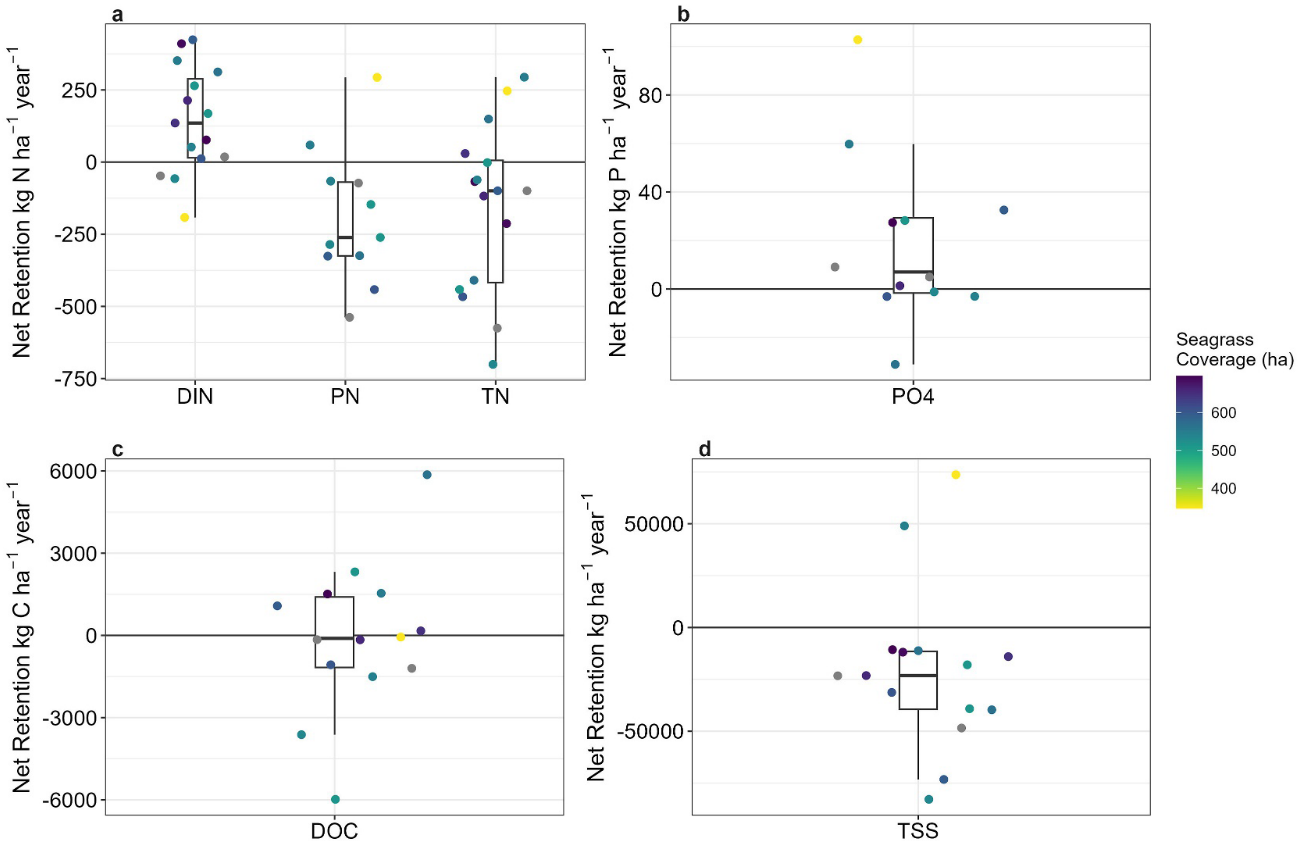
Mikulis et al. 2026 – Monthly Chemistry

- DIN,DOC, PO4, TN related to river discharge
- TSS and PN not related to river inputs, but inputs not well constrained by monthly samples



Mikulis et al. 2026 Annual box model from monthly chemistry data

- ***Net negative retention of TSS and PN -*** produced within the Bay, not significantly from rivers
- DOC, in contrast no net retention or production within Bay



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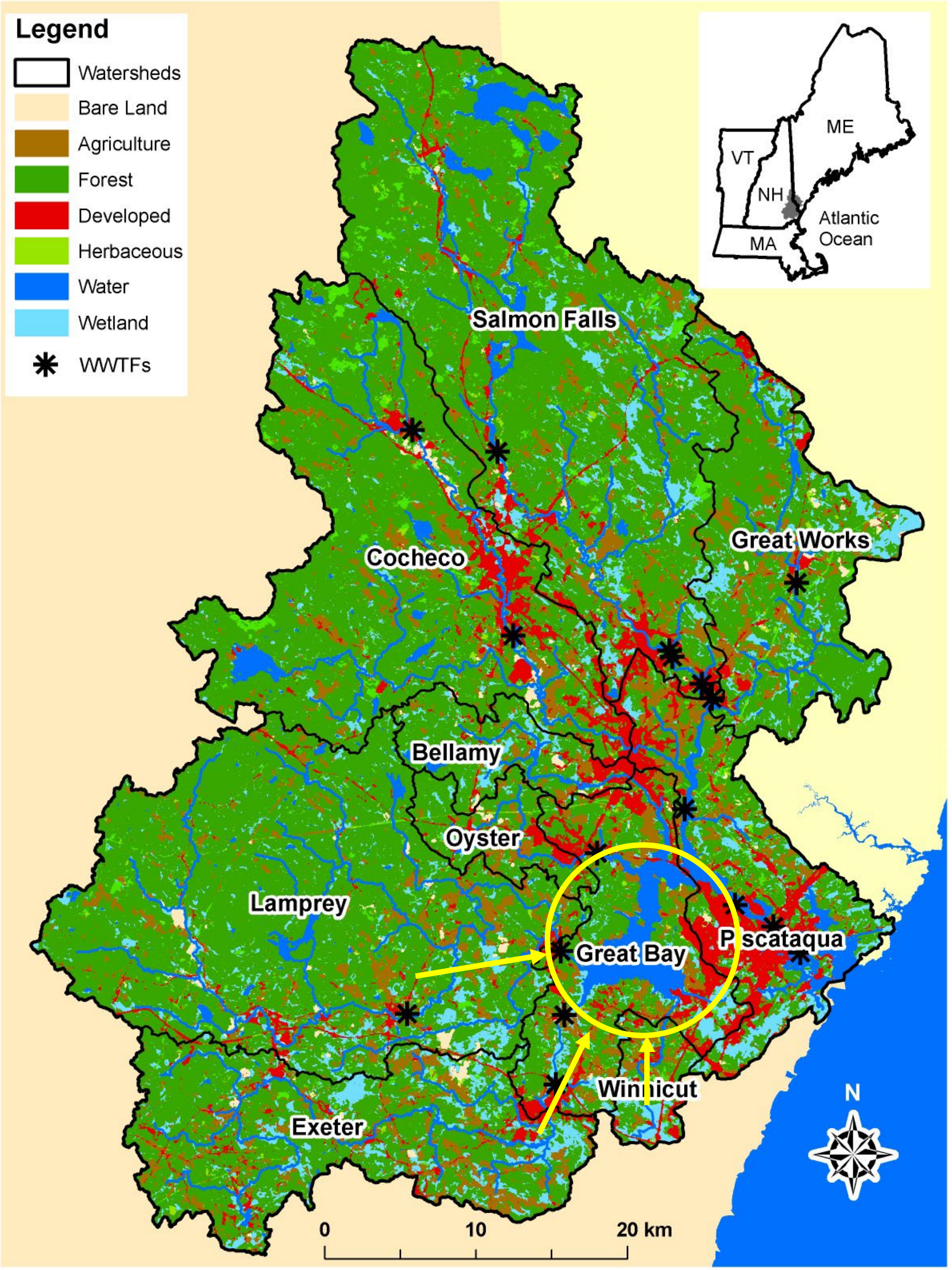
Freshwater Storm Impacts

- Sensors provide new insight into impacts of storms on the Bay
- Monthly Tidal Tributaries project does not target storms
- "Do storm inputs of N, TSS, and (CDOM) drive variability in the concentrations of these parameters in the Great Bay system?"



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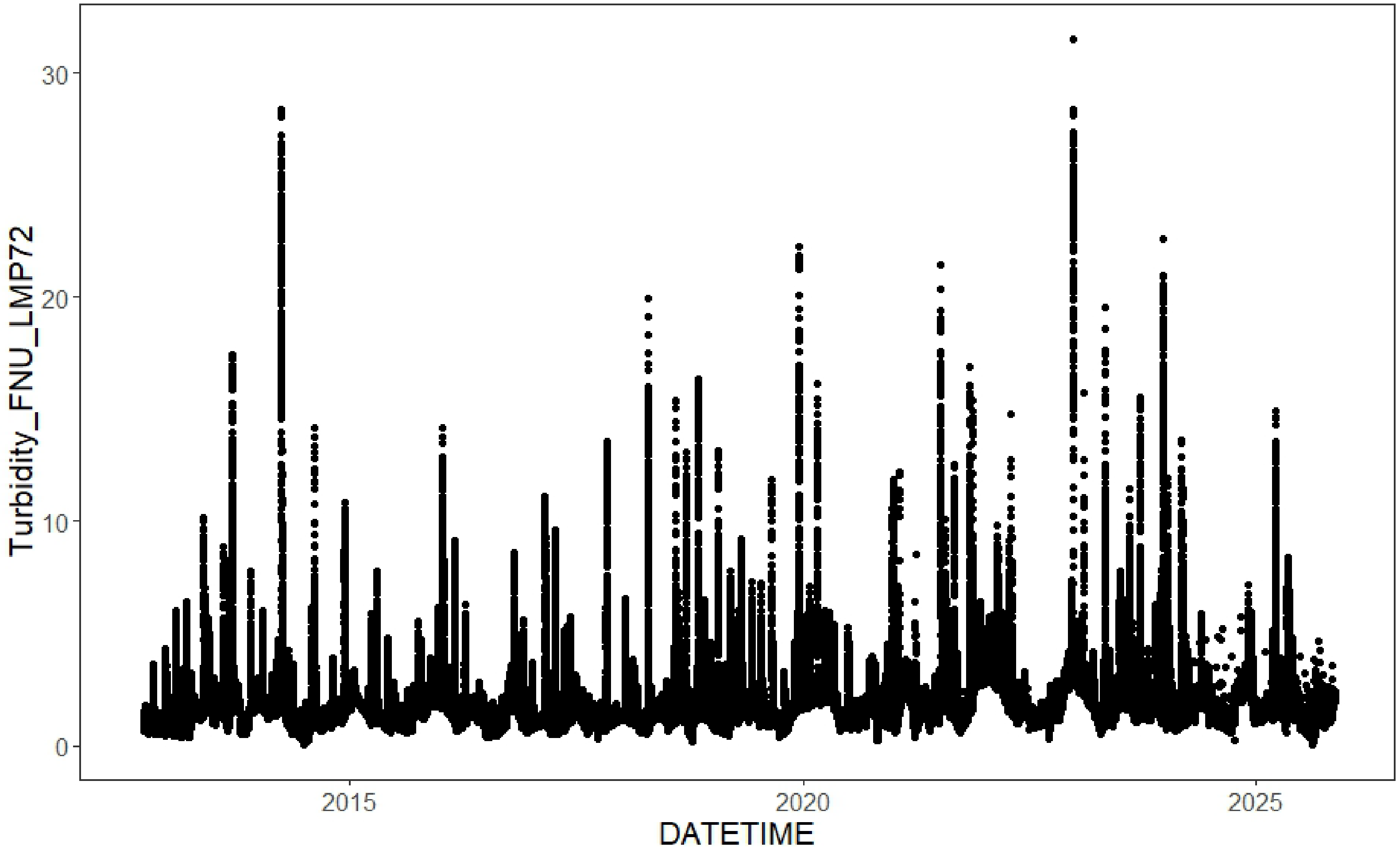
Approach

- Deploy EXO2 sondes at head of tide - each major tributary to Great Bay proper (the Lamprey, Exeter and Winnicut Rivers)
- Compare to what we see in the Bay - using the sensors already in place on the Great Bay buoy
- EXO2 - turbidity and fDOM (fluorescent dissolved organic matter)
- Paired autosampler to verify the proxies
  - fDOM = CDOM, proxy for Dissolved Organic Carbon (DOC) and DON (Nitrogen)
  - Turbidity = TSS, and Particulate C and N

Long-term sensor record from UNH WQAL at Wiswall Dam (6 km upstream of GB) for context

- Does Lamprey contribute much sediment?
- **Highest turbidity is 30 FNU** ~ about 25 mg/L TSS
- Susquehanna River (Chesapeake Bay) turbidity mean ~ 5-20 NTU (variable by year) **with max > 800 NTU**



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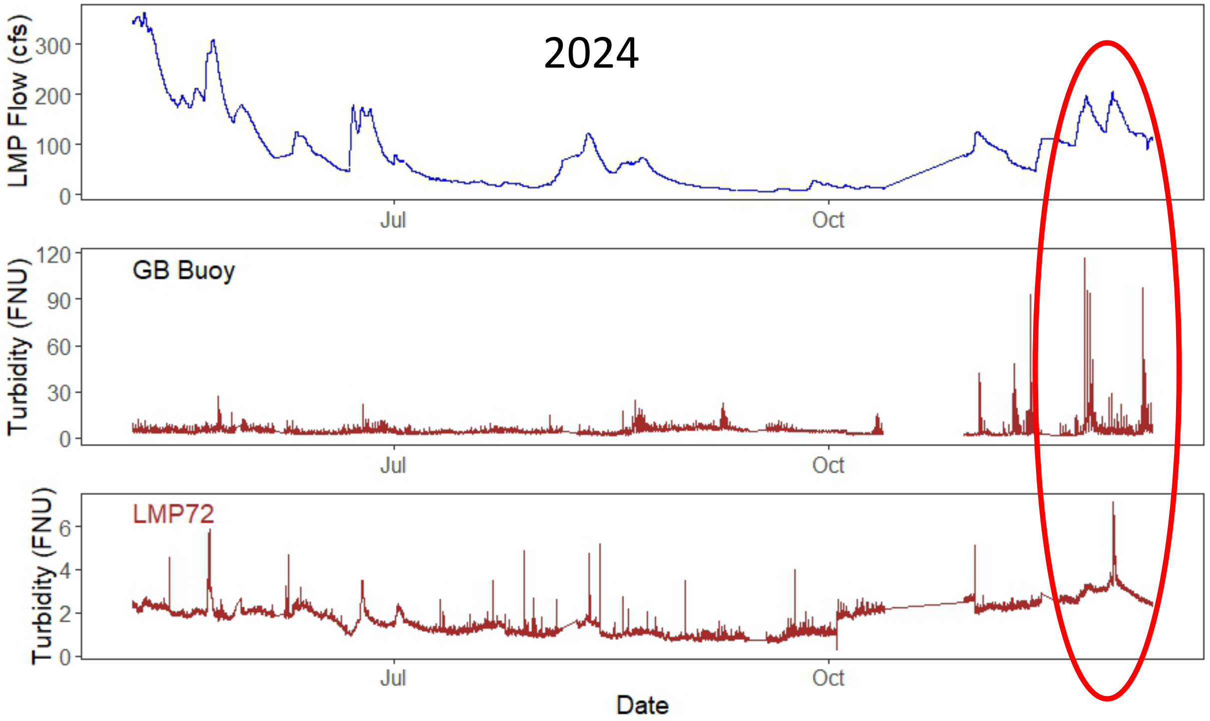
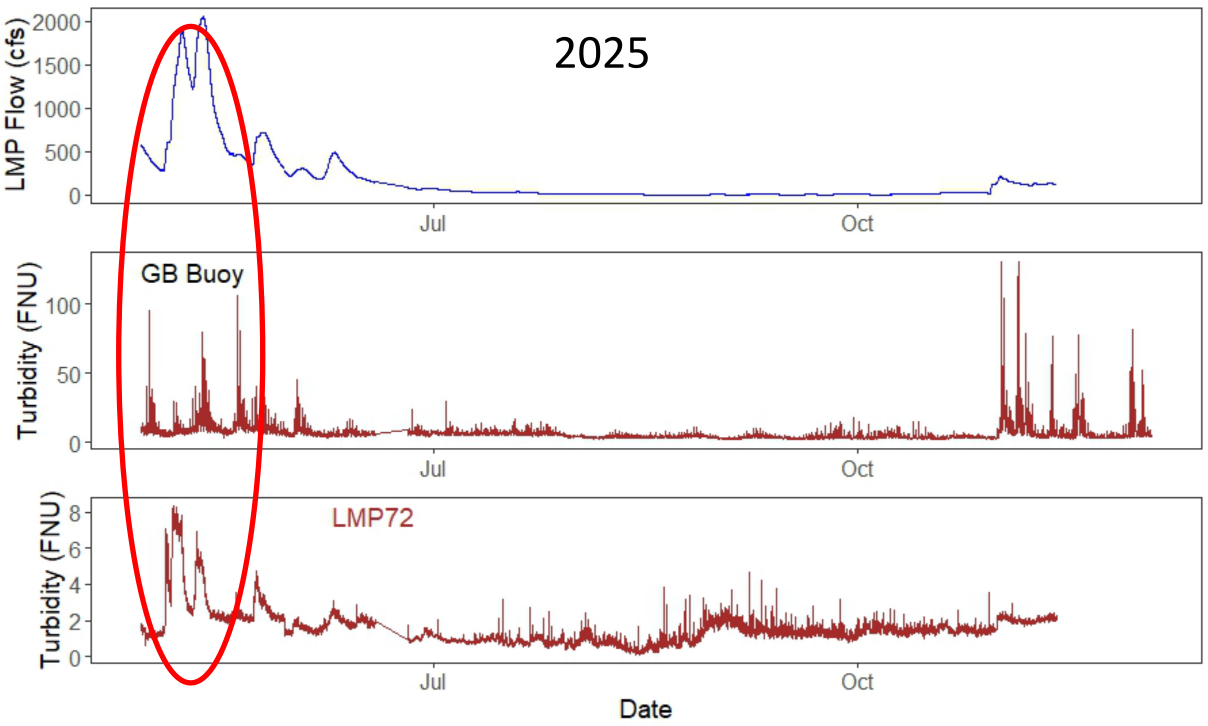
Full Turbidity Record during study period – Wiswall Dam and GB Buoy

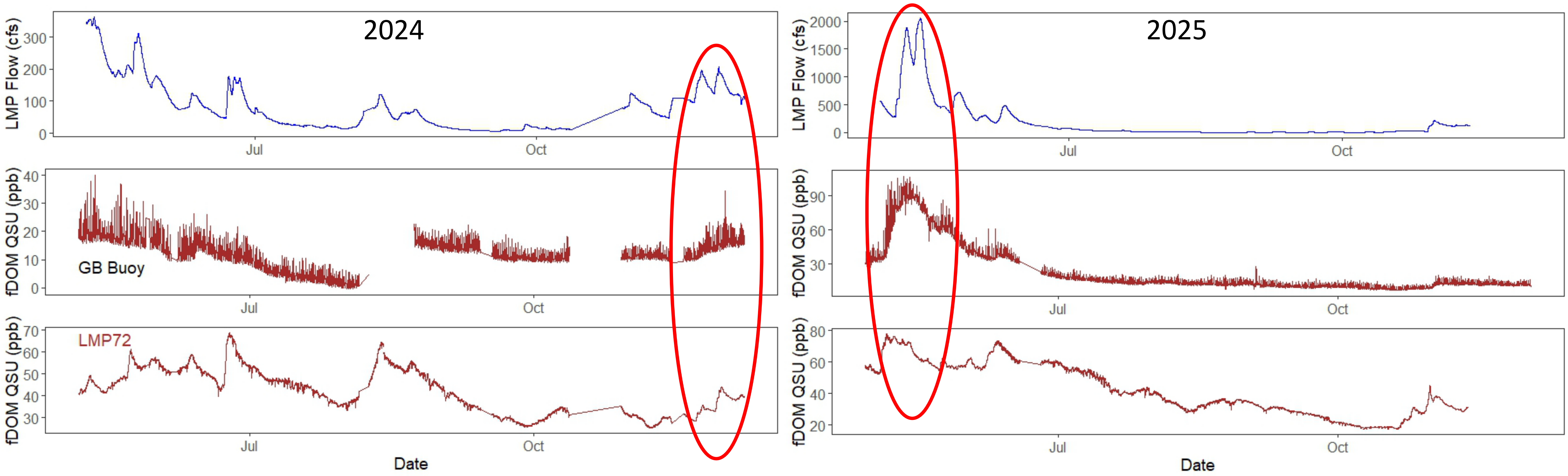
- Biggest storms **collected** used for analysis
- May 2025 storms much larger **(note scale for 2024 vs 2025)**
- GB Buoy turbidity range much greater than Lamprey; ***again note scales***





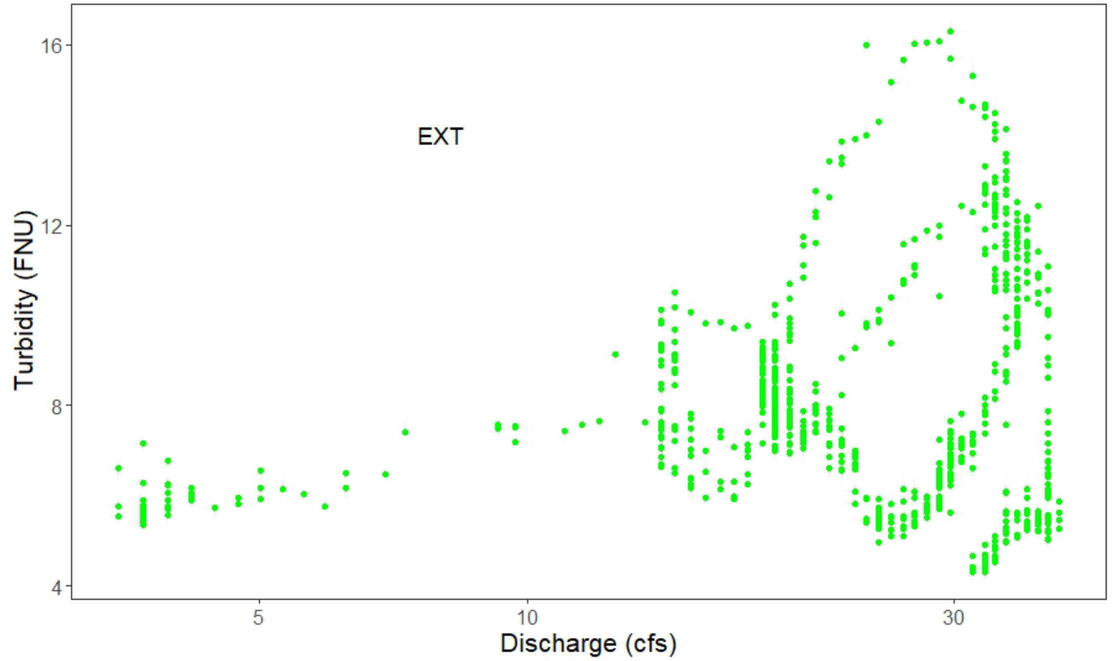
Full fDOM Record during study period– Wiswall Dam and GB Buoy

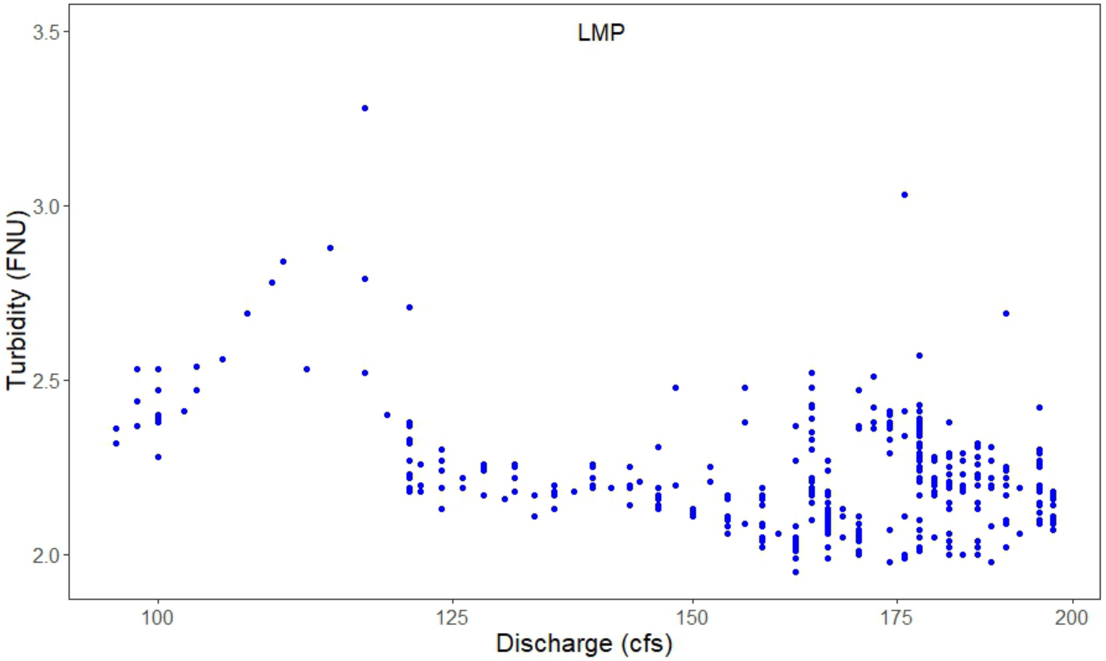
- River fDOM greater than GB Buoy 2024; similar in early 2025
- fDOM increases with river discharge; GB Buoy fDOM highest May 2025



Storm response: small change in turbidity at head of tide during Nov 2024 storm

- EXT (Exeter) increase in turbidity with discharge
- LMP (Lamprey) response is small

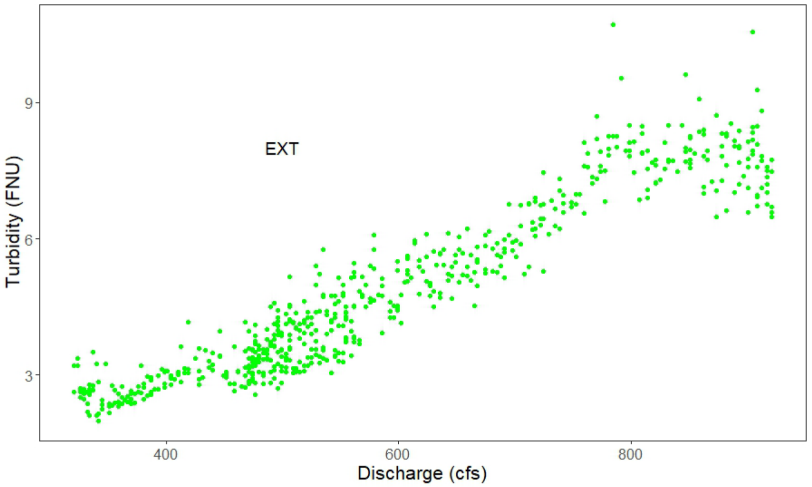


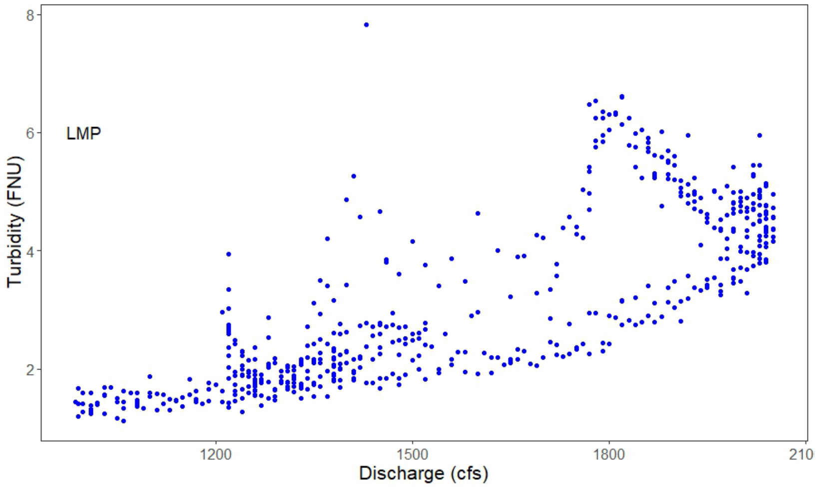


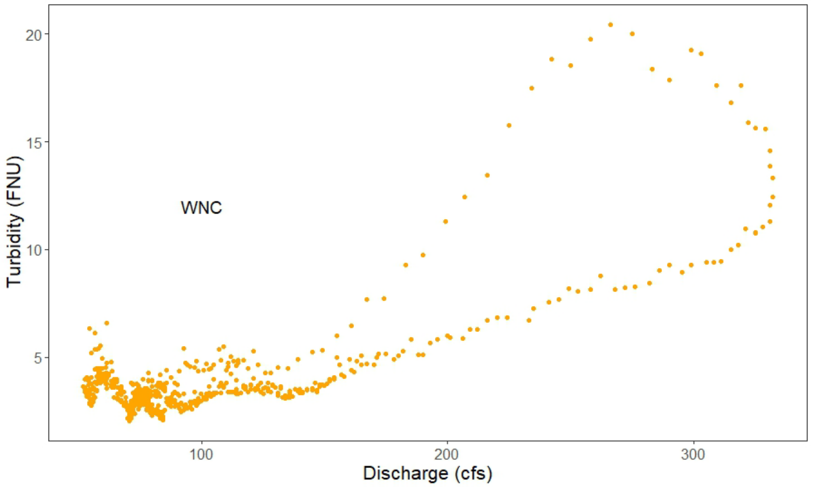
C-Q = concentration vs discharge

May 2025 storm does increase river turbidity

- All rivers turbidity increase with flow (unlike Nov 2024)
- LMP & WNC hysteresis – sediment peaks after peak discharge; coming from more distant sources







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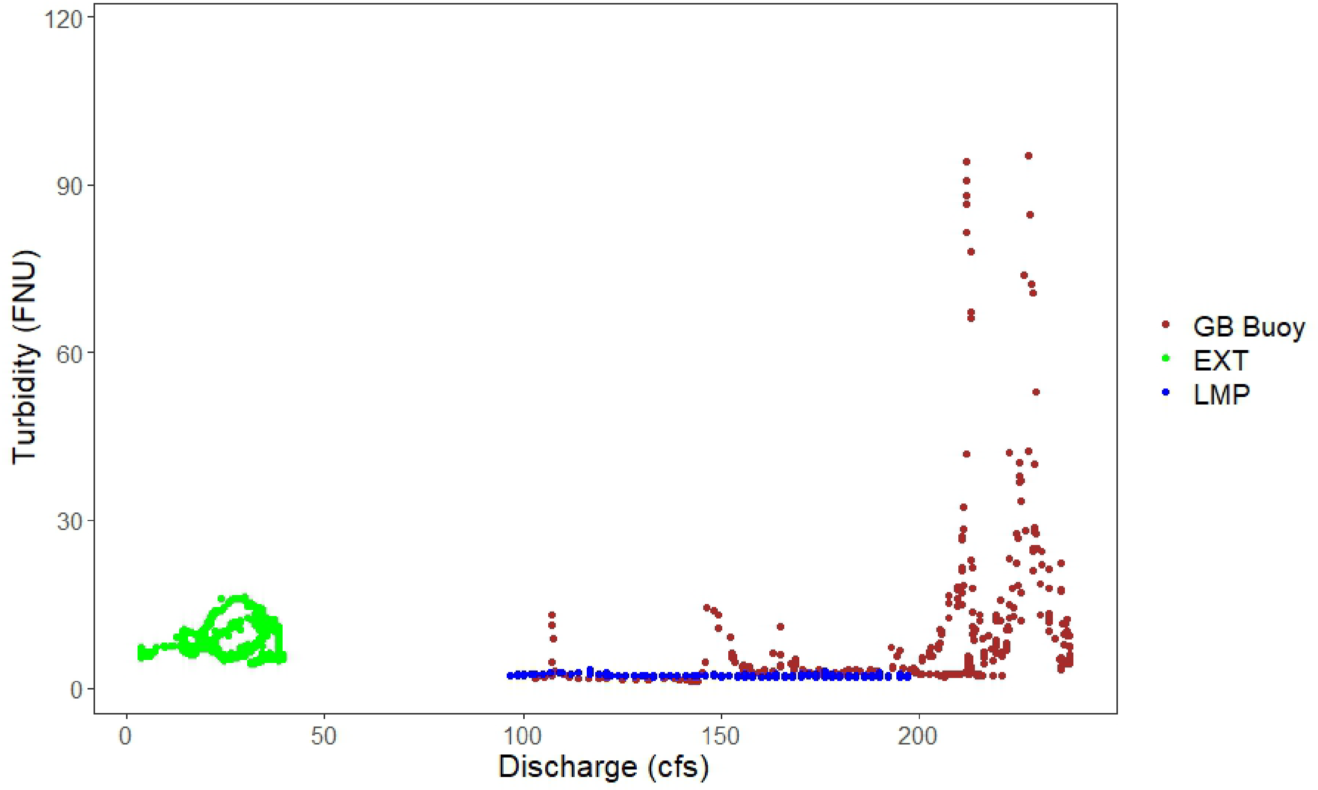
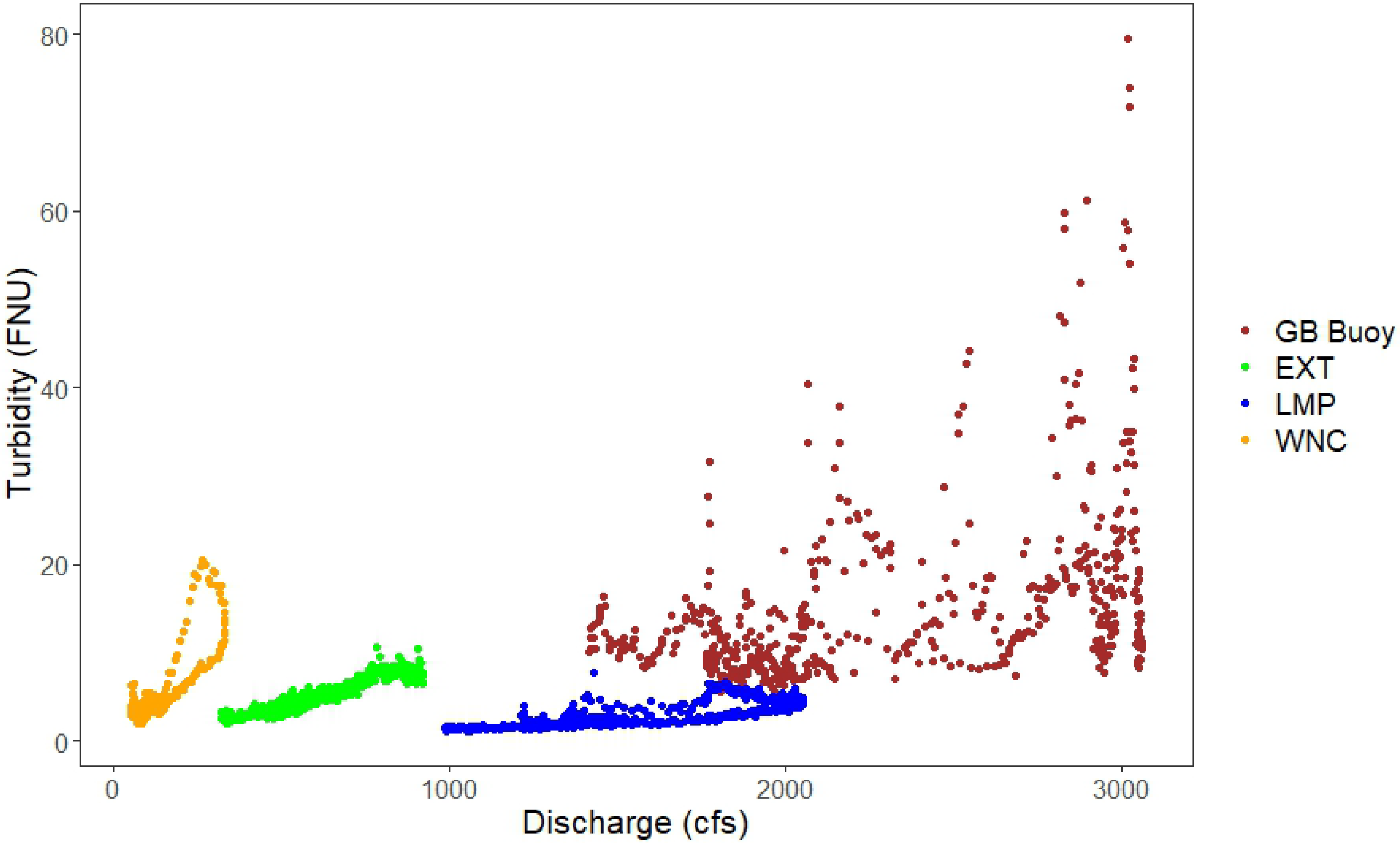
Great Bay Buoy, however, is much more responsive to storms than are the rivers

- Storm response of turbidity in GB Nov 2024
- Discharge for GB Buoy is sum of discharge from EXT, LMP, and WNC (Winnicut River)



Similar results for May 2025

- GB Buoy much higher turbidity during storm than rivers
- Largest river response in WNC, but smallest tributary



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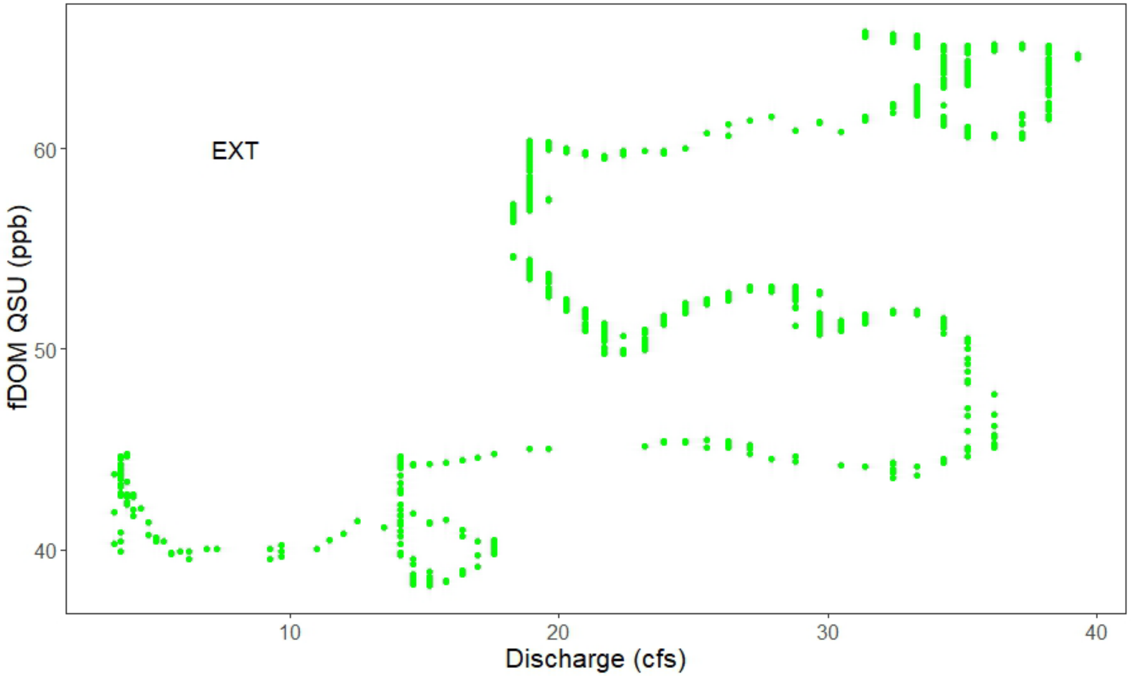
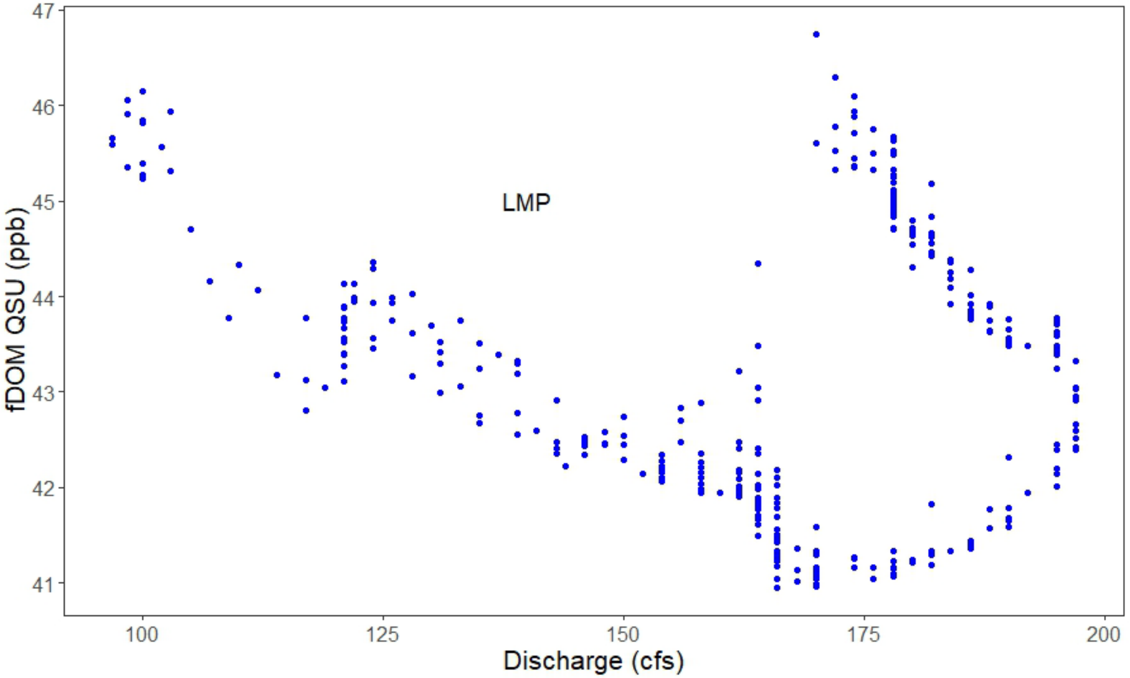
Storm response of fDOM

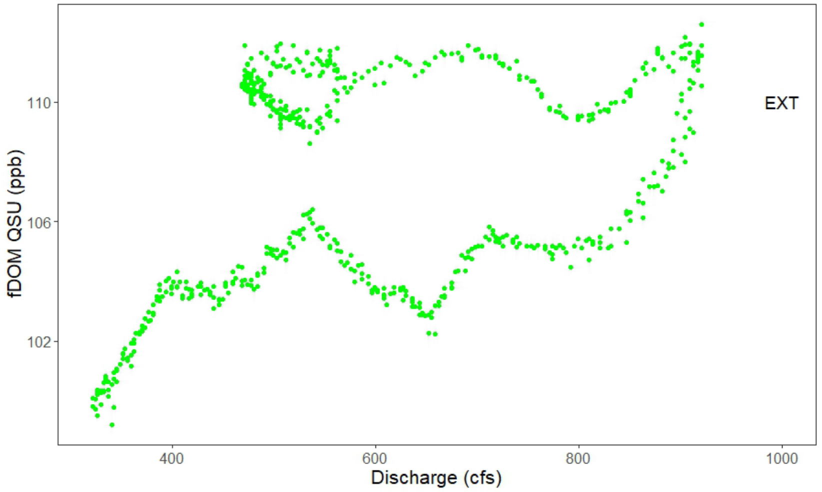
- EXT significant increase in fDOM with discharge (Nov 2024)
- LMP small decrease fDOM with discharge, late arriving DOM

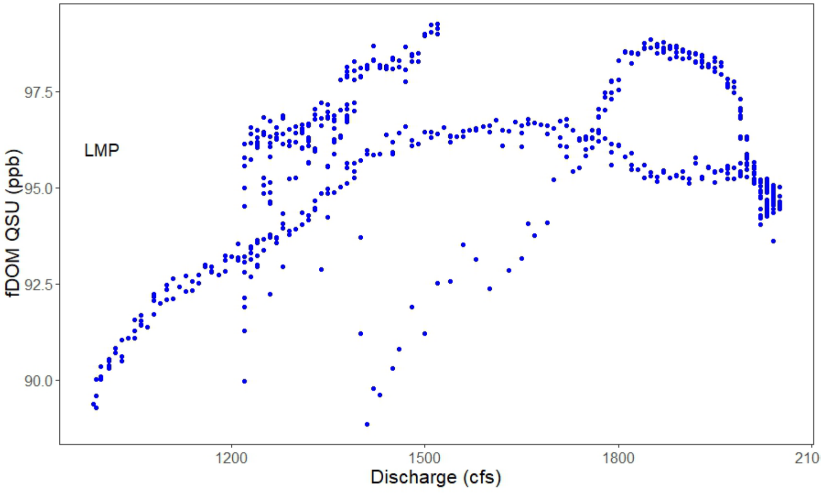


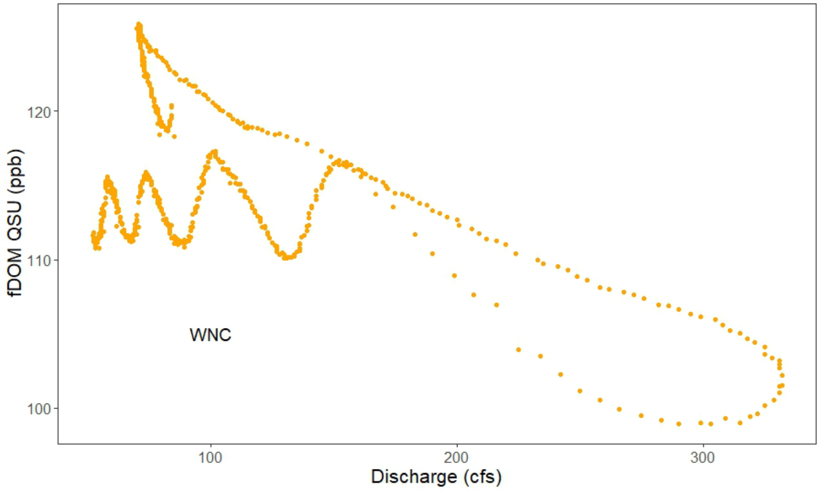


Storm response of fDOM May 2025

- River fDOM variable response to flow, EXT and LMP small increase
- EXT hysteresis – small change in fDOM; biggest increase with small change in flow. Could be wetland or groundwater flushing
- WNC hysteresis – fDOM is initially diluted, then increases with a distant source







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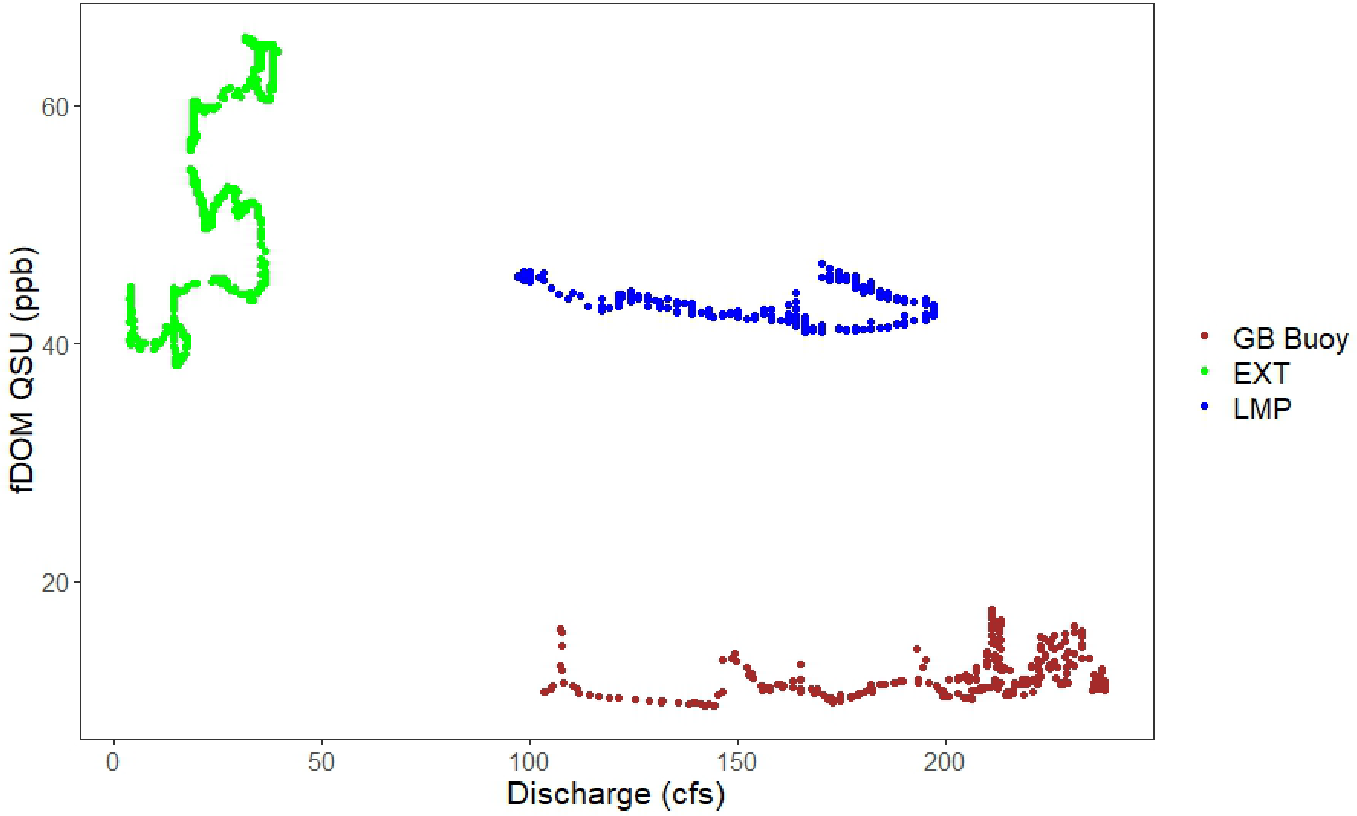
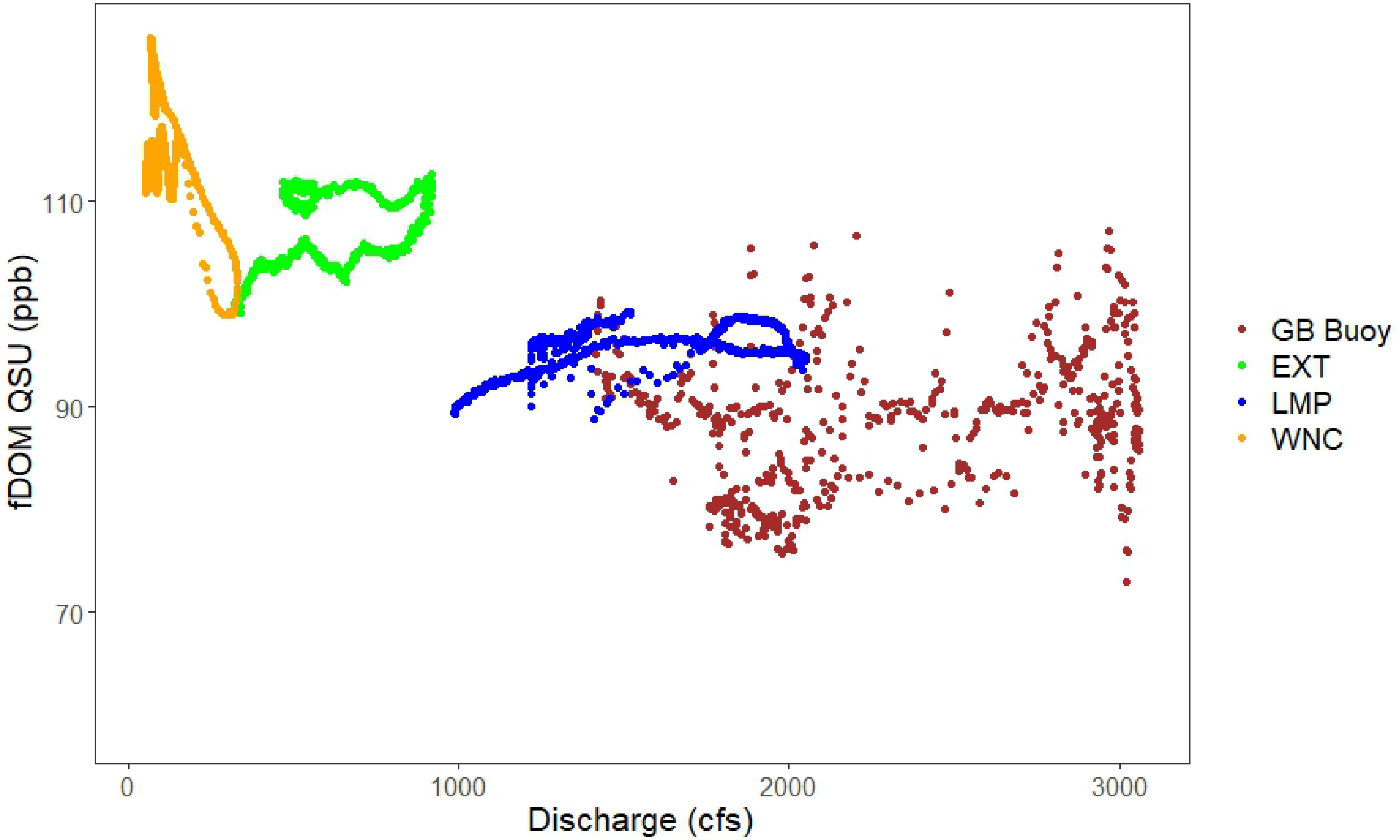
River fDOM can increase GB fDOM

- River fDOM much greater than GB Buoy (Nov 2024 storm)
- GB Buoy shows fDOM increase with river inputs



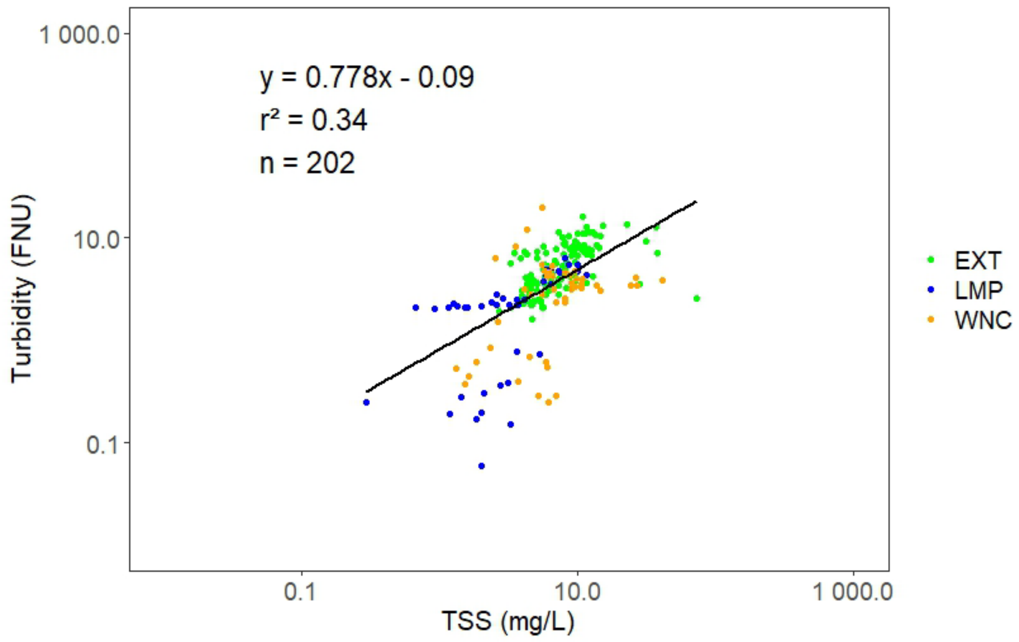
River fDOM can dominate GB fDOM (May 2025)

- fDOM in GB variable with increasing river flow
- fDOM in GB closer to river concentrations

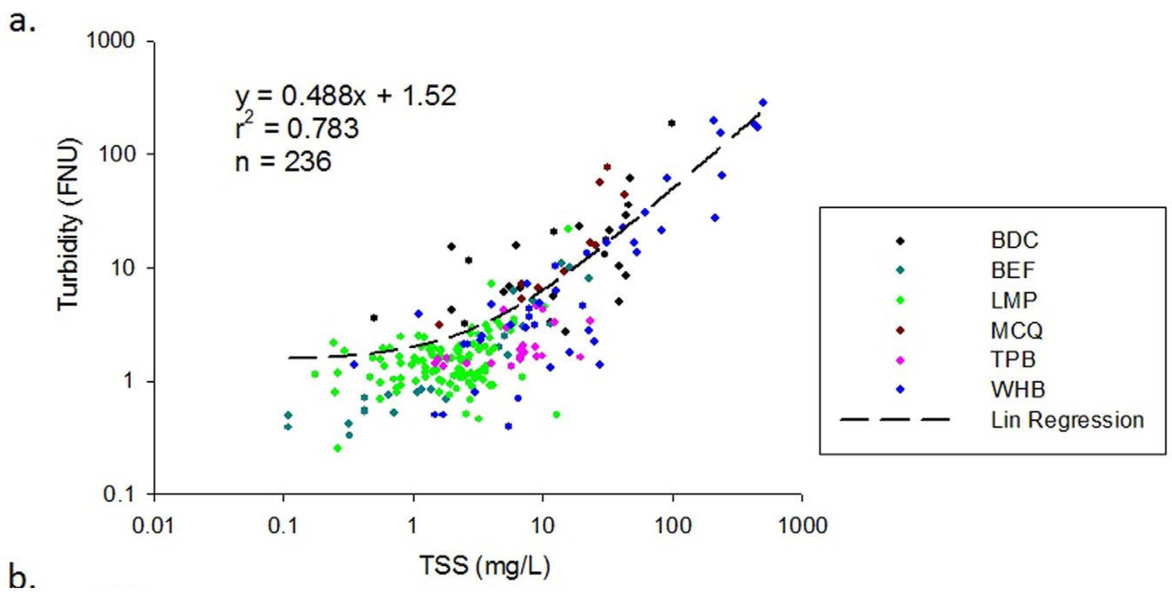


Turbidity – TSS Loads

- Turbidity is a good proxy for TSS loading to GB



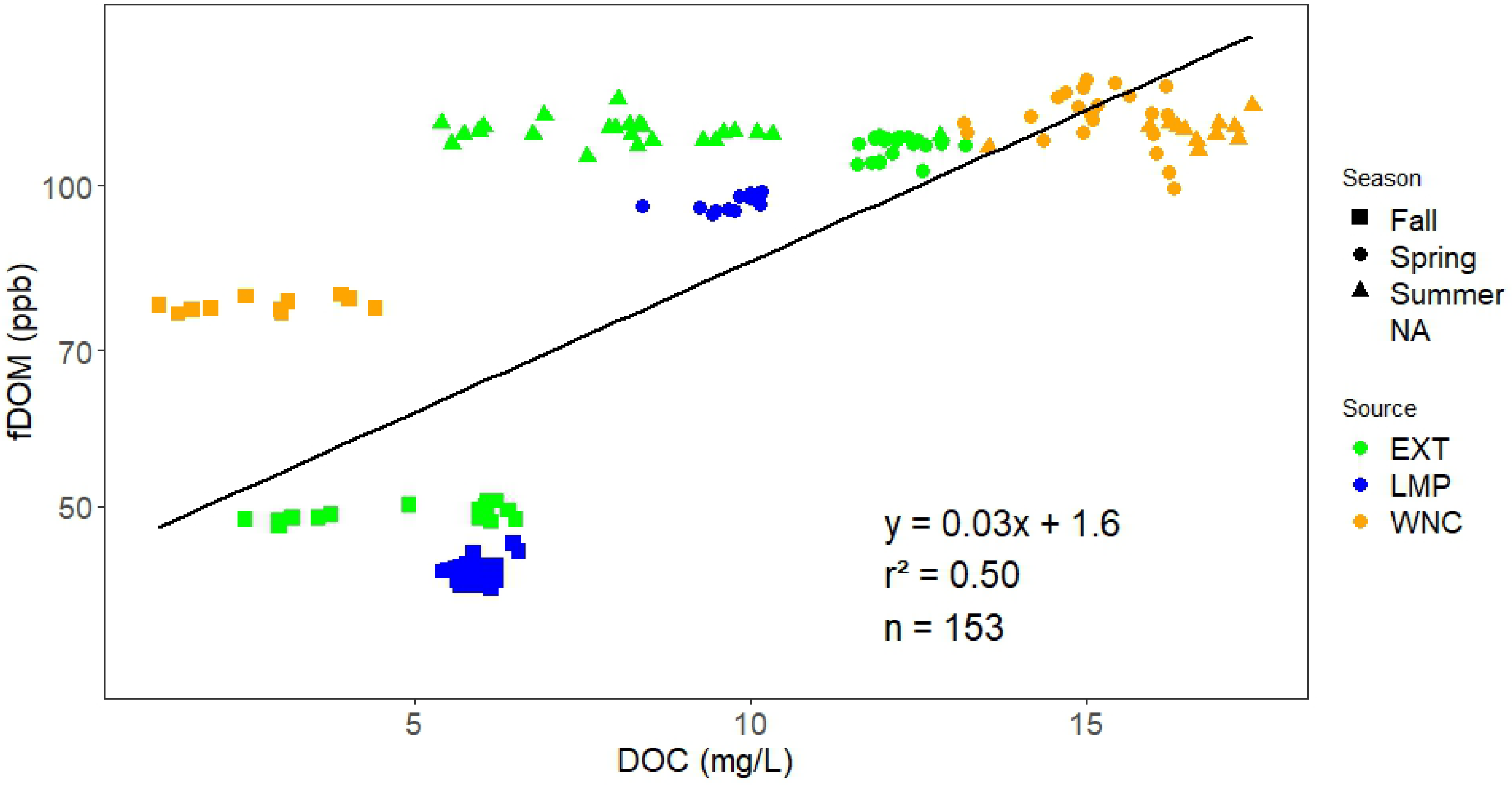
This study



Previous Lamprey work with small tributaries with urbanized land use

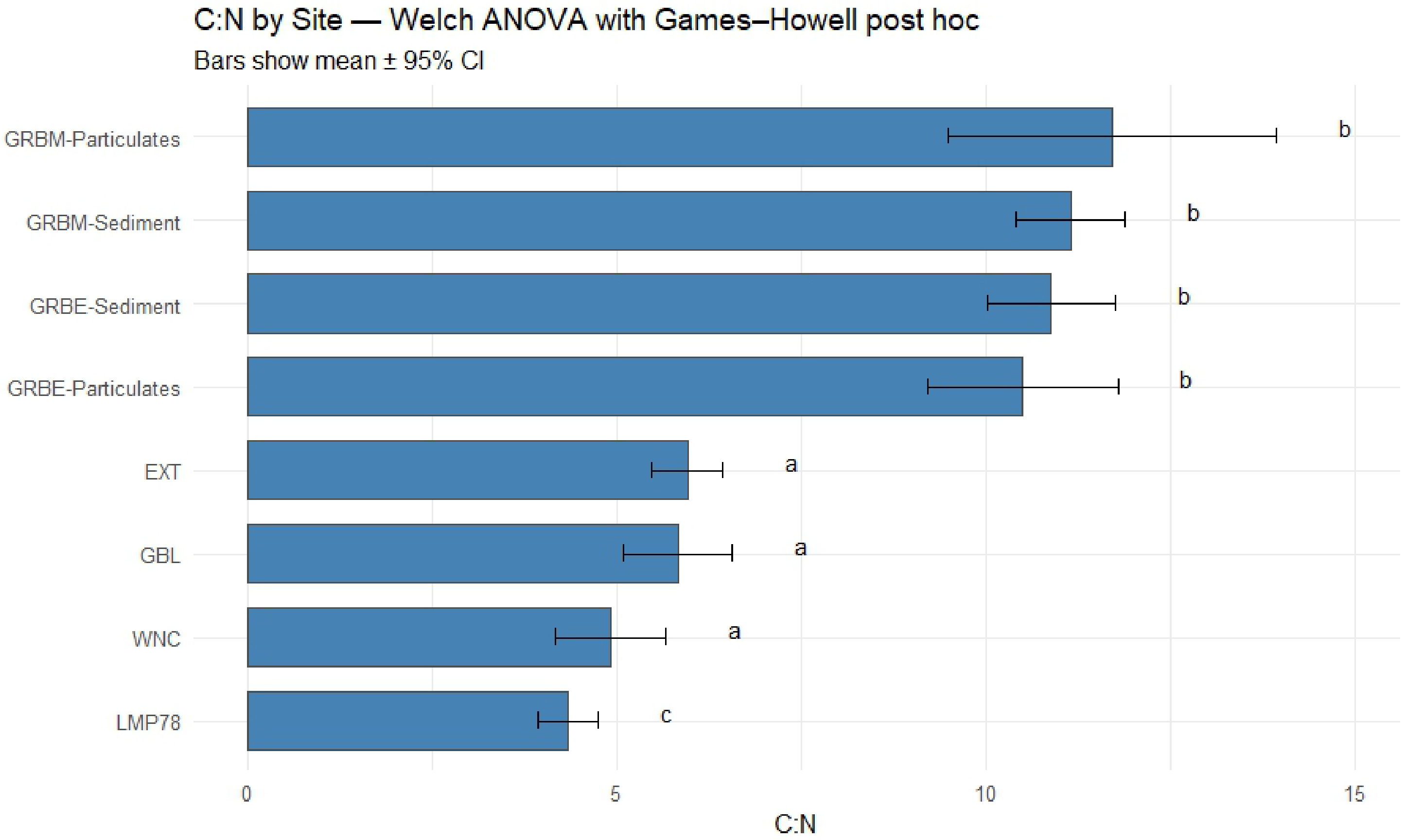
FDOM – DOC loads

- fDOM good proxy for DOC as well
- Relationship varies by season and site



C:N Sediments & Particulates

- Lower C:N in river particulates than in sediments & particulates in GB
- Similar C:N at Adam's Point - GBL



- WNC, EXT LMP78 suspended particulates from this study
- GBL suspended particulates from SWMP long-term monitoring program (2024-2025)
- GRB Sites from Mikulis et al 2026
    - M = Mudflats sites
    - E = Eelgrass sites
    - Sediment = from bottom sediments
    - Particulates = suspended in water column

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Conclusions

- Turbidity increases in freshwater rivers during storms, but the increase is small
- Turbidity within Great Bay during storms is 10x higher than river inputs
- C:N of particulate matter in GB is similar to Bay sediment, not river particulate matter
- GB turbidity thus is driven by internal sources
- In contrast, rivers drive GB DOM, especially during large storms

Estimating Discharge in Great Bay Tributaries: Runoff Comparison

Michelle D. Shattuck, William H. McDowell, Jody D. Potter and Kalle Matso

April 14, 2026

University of New Hampshire

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NEW HAMPSHIRE WATER RESOURCES RESEARCH CENTER

PREP Piscataqua Region Estuaries Partnership

Municipal Alliance for Adaptive Management (MAAM)

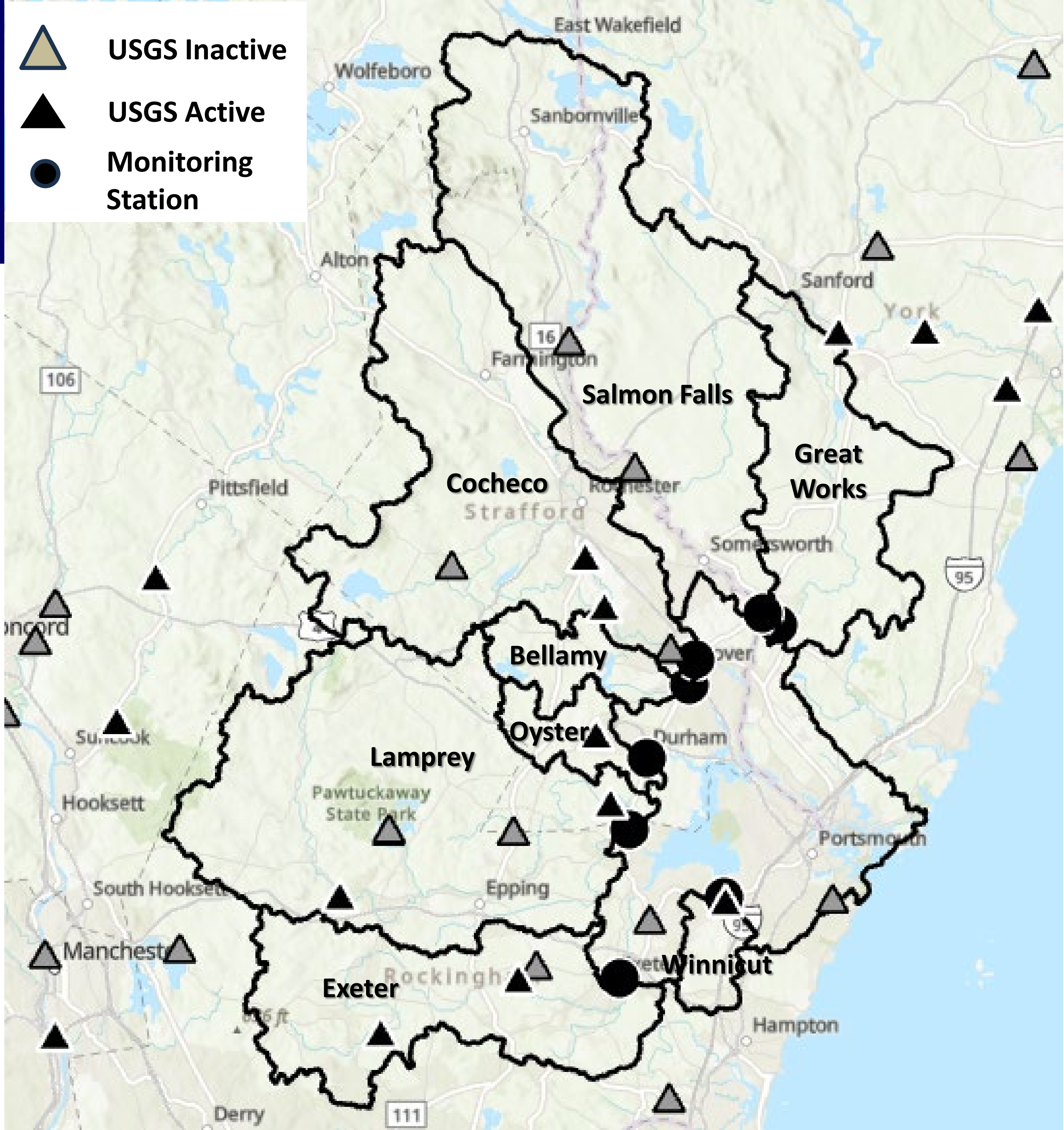
Great Bay Tributaries and USGS Sites

<u>Gauged</u>

1. Winnicut
2. Exeter
3. Lamprey
4. Oyster
5. Cocheco

<u>Ungauged</u>

6. Salmon Falls
7. Great Works
8. Bellamy



Municipal Alliance for Adaptive Management (MAAM) Tasks

- Review methods used to estimate discharge at monitoring sites on the five gauged tributaries and on the three ungauged tributaries to assess whether methods are appropriate
- If necessary, determine where appropriate discharge measurements could be collected on the three ungauged tributaries (Salmon Falls, Great Works and Bellamy Rivers)

Sites and Watershed Area

Co-located

Estimated from:

Upstream USGS station

Nearby USGS station; 40% of total tributary watershed area (SFR 27%)

Monitored Tributary River	Watershed Area at Monitoring Station (sq miles)	Previous PREP State of Our Estuaries Reports: USGS Site	Previous PREP State of Our Estuaries Reports: Watershed Area at USGS Site (sq miles)	Previous PREP State of Our Estuaries Reports: Multiplier to Estimate Streamflow at Monitoring Station
Winnicut	14.2	Winnicut 1073785	14.1	1.0
Exeter	106.9	Exeter 01073587	63.5	1.68
Lamprey	211.9	Lamprey 01073500	185	1.15
Oyster	19.9	Oyster 01073000	12.1	1.64
Cocheco	175.3	Cocheco 01072800	79.9	2.19
Bellamy	27.3	Ave. Cocheco 01072800 and Oyster 01073000	Cocheco 79.9 and Oyster 12.1	Cocheco 0.34 and Oyster 2.25
Salmon Falls	235.0	Lamprey 01073500	185	1.27
Great Works	86.7	Cocheco 01072800	79.9	1.08

Area Normalized Discharge or “Runoff”

Discharge × **Normalize by watershed area** = ... **Convert units to:**

$$\frac{ft^3}{second} \times \frac{1}{sq.\ ft} = \frac{ft}{second}$$

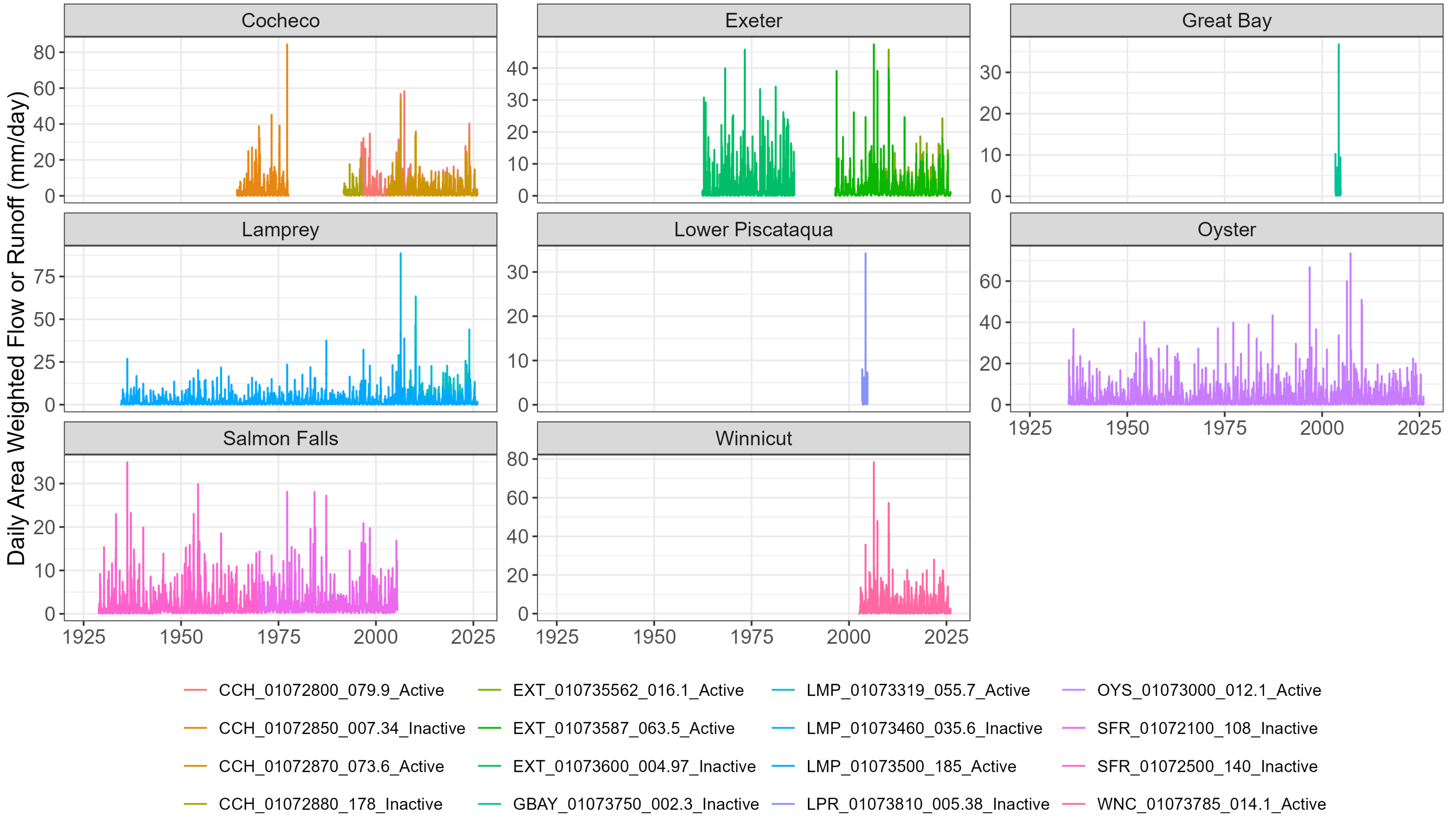
Convert units to: $\frac{mm}{day}$

Discharge × **Normalize by watershed area**

$$\frac{ft^3}{second} \times \frac{1}{sq.\ miles} = \frac{ft^3}{Second * sq.\ mile}$$

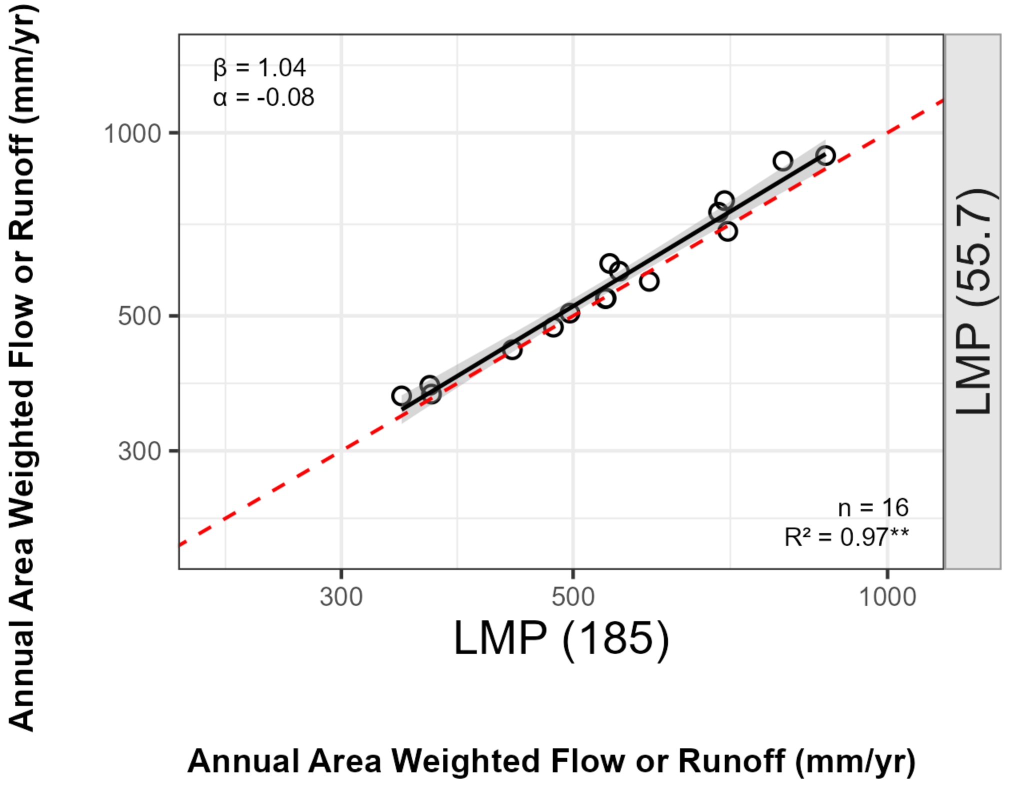
Note this is not just stormwater runoff

Daily Runoff in Great Bay Tributaries

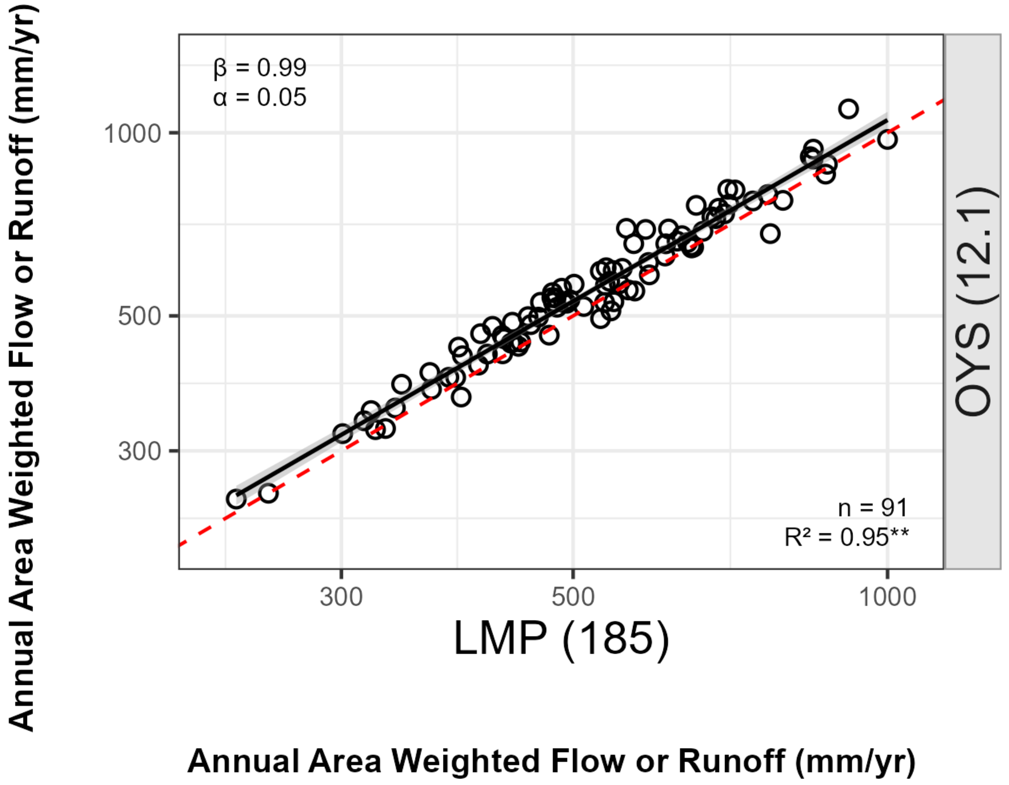


Approach: Compare USGS sites within and between watersheds

Does upstream predict downstream?

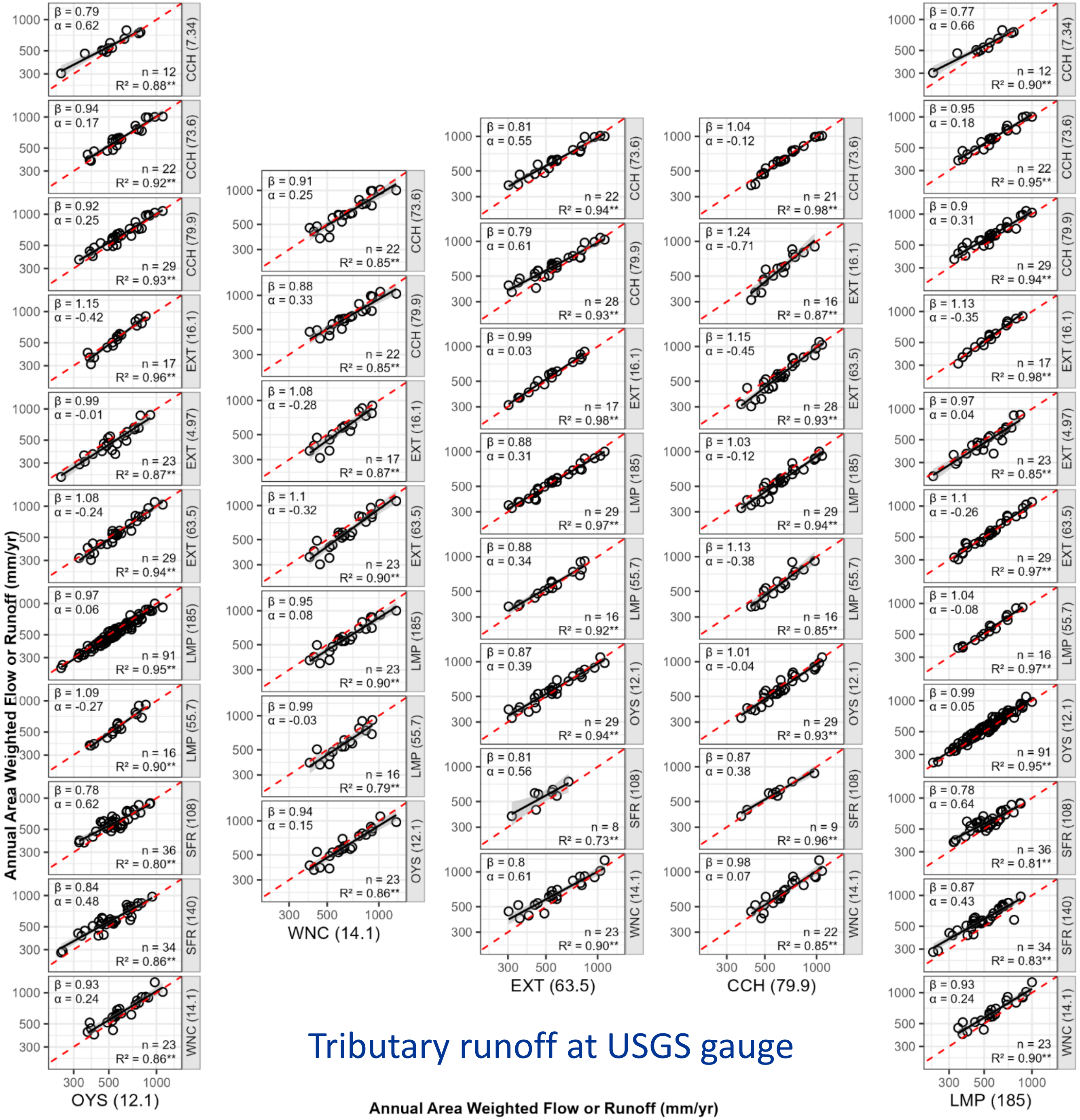


Does one watershed predict a nearby watershed?



Annual runoff comparisons among all USGS sites vs. 5 most downstream active USGS sites

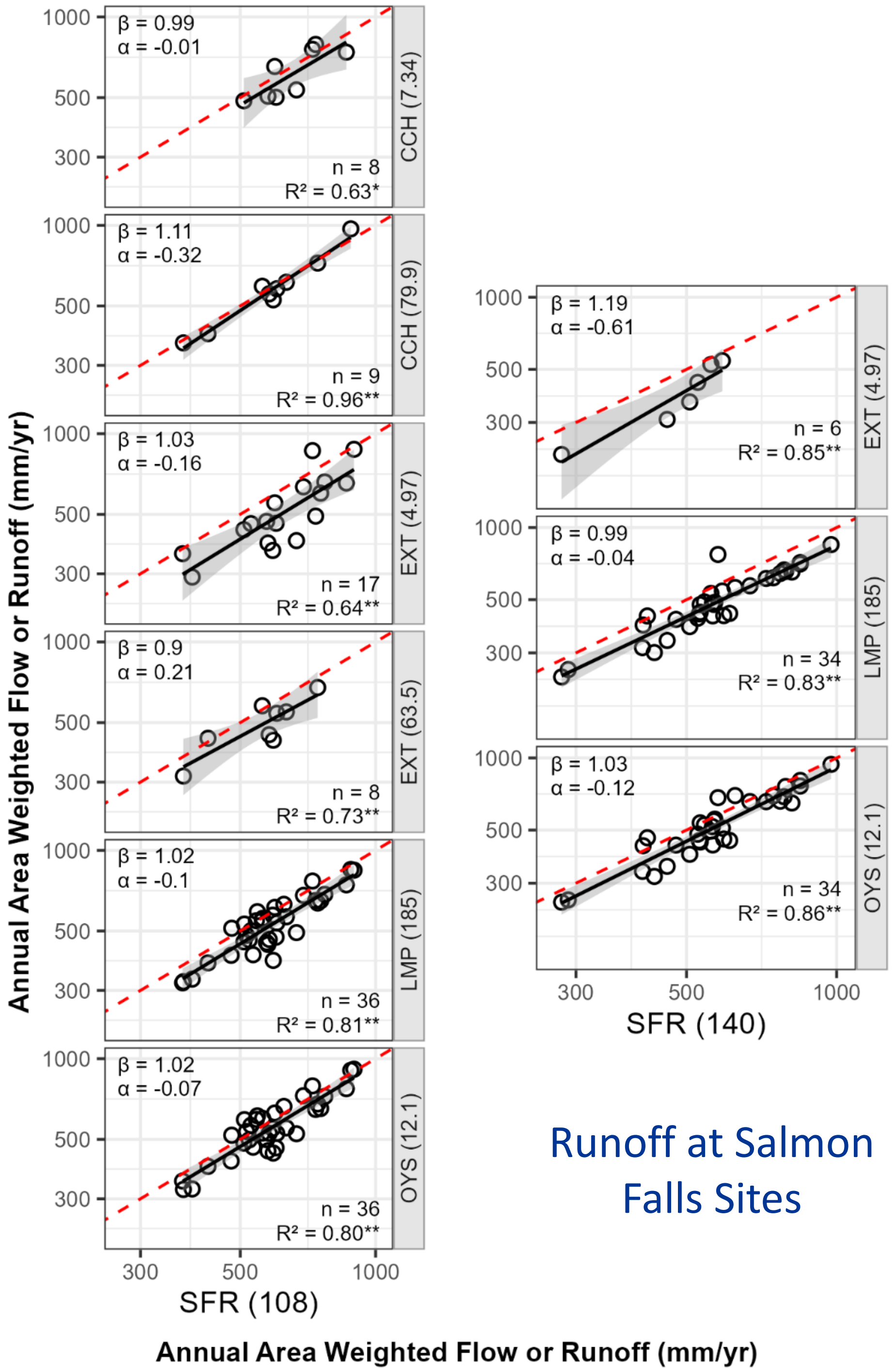
Runoff from other USGS sites



Tributary runoff at USGS gauge

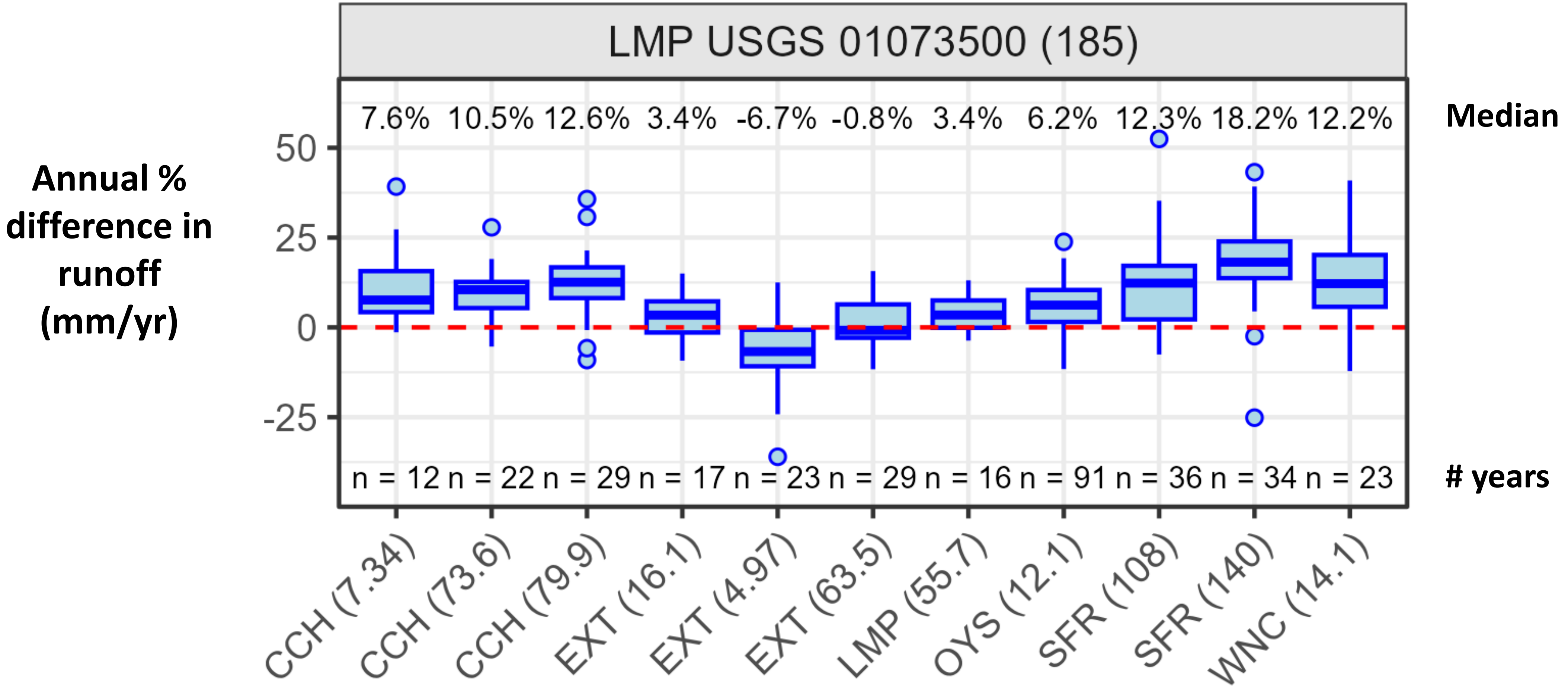
Understanding Salmon Falls Runoff

Runoff from other USGS sites



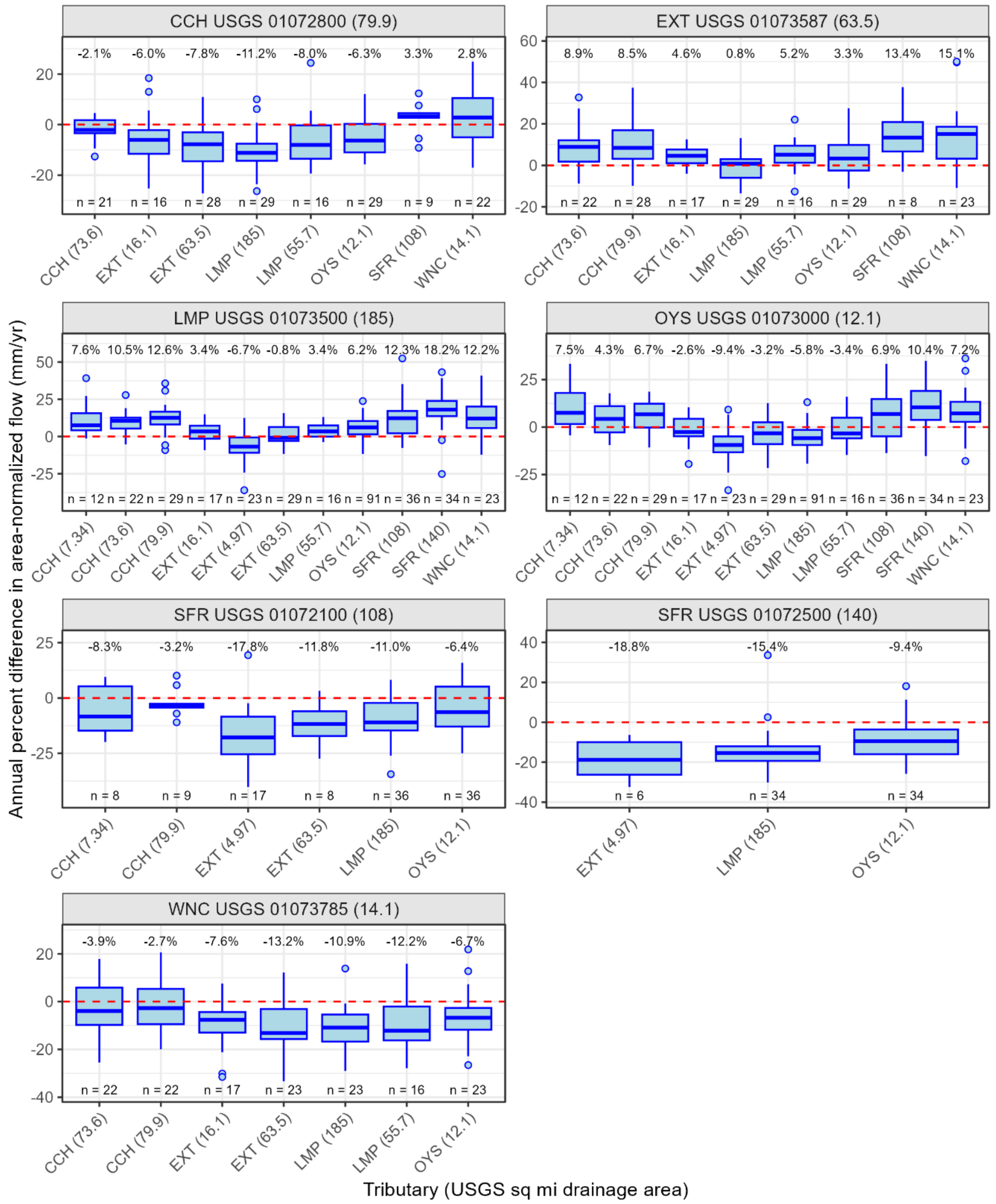
Runoff at Salmon Falls Sites

Percent difference within and between watersheds (example)

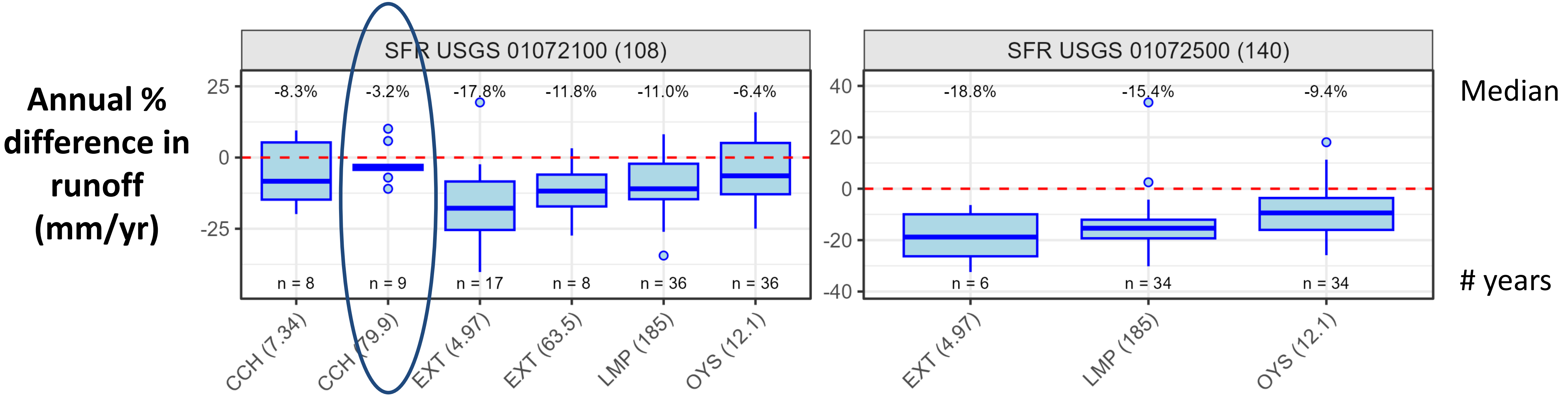


Annual % difference between other USGS gauges vs. a Great Bay tributary USGS site

- Within watersheds:
  - Mean: -1.7 to 4.1%
  - Range: -12.6 to 13.1%
- Across all watersheds:
  - Mean: -18.7 to 18.6%
  - Range: -40.2 to 52.5%



Annual % difference between other USGS gauges vs. the Salmon Falls River sites



Salmon Falls vs. all Watersheds:

– Mean: -18.7 to -2.1%

– Range: -40.2 to 33.6%

Salmon Falls vs. Cocheco (79.9 mi^2):

– Mean: -2.1%

– Range: -11.0 to 10.1%

Previously used USGS Sites and Recommended Sites

Monitored Tributary River	Watershed Area at Monitoring Station (sq miles)	USGS Site Used in Previous PREP SOOE Reports	USGS Site used in NH DES Assessment Process	Recommended USGS Site to use in Future PREP SOOE Reports
Winnicut	14.2	Winnicut 01073785	Winnicut 01073785	Winnicut 01073785
Exeter	106.9	Exeter 01073587	Exeter 01073587	Exeter 01073587
Lamprey	211.9	Lamprey 01073500	Lamprey 01073500	Lamprey 01073500
Oyster	19.9	Oyster 01073000	Oyster 01073000	Oyster 01073000
Cocheco	175.3	Cocheco 01072800	Cocheco 01072800	Cocheco 01072800
Bellamy	27.3	Ave. Cocheco 01072800 and Oyster 01073000	Oyster 01073000	Oyster 01073000
Salmon Falls	235.0	Lamprey 01073500	Cocheco 01072800	Cocheco 01072800 or Reinstate Salmon Falls 01072500 or 01072100
Great Works	86.7	Cocheco 01072800		Cocheco 01072800

Colors:
Same as previous PREP SOOE approach
Modification to previous PREP SOOE approach

Questions?

Contact information:

- Bill.McDowell@unh.edu
- Michelle.Shattuck@unh.edu
- Jody.Potter@unh.edu

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