Tile drainage self-assessment: What can I evaluate?

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UW Discovery Farms

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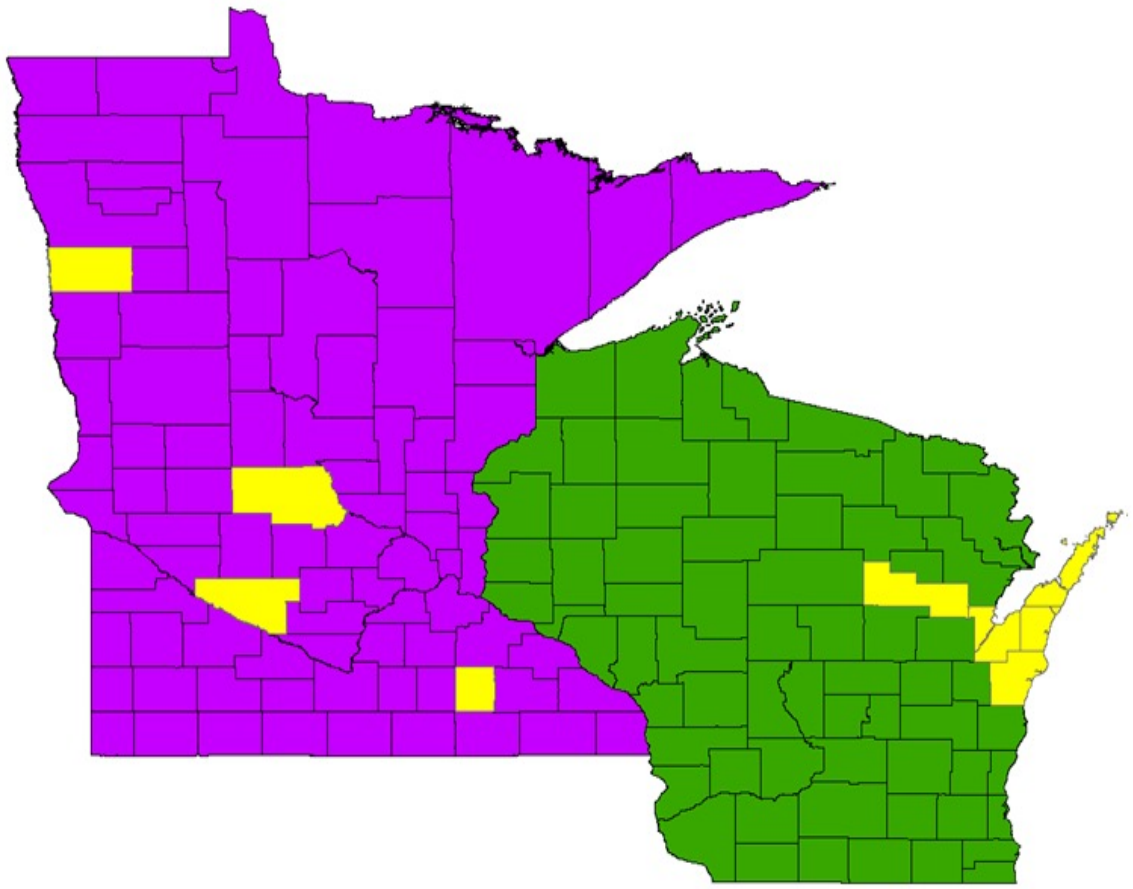
Discovery Farms CIG Tile Project in MN and WI (2018-2020)



- Provide tools for farmers and advisors to diagnose and treat fields with high nutrient loss through tile drains
- Intensively monitored tile sites surrounded by satellite locations
- Understand the link between soil health and tile drainage

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Study design: 3 monitoring styles

Site type	Intensive sites (8)	Intermediate sites (20)	Basic sites (20)
Flow monitoring	Constant	Constant	Bi-weekly
Water sampling	Constant and Bi-weekly	Bi-weekly	Bi-weekly

Water sampling: suspended sediment, TKN, ammonium, nitrate, total P, dissolved P, chlorine

Evenly split between states. 24 + 24 = 48

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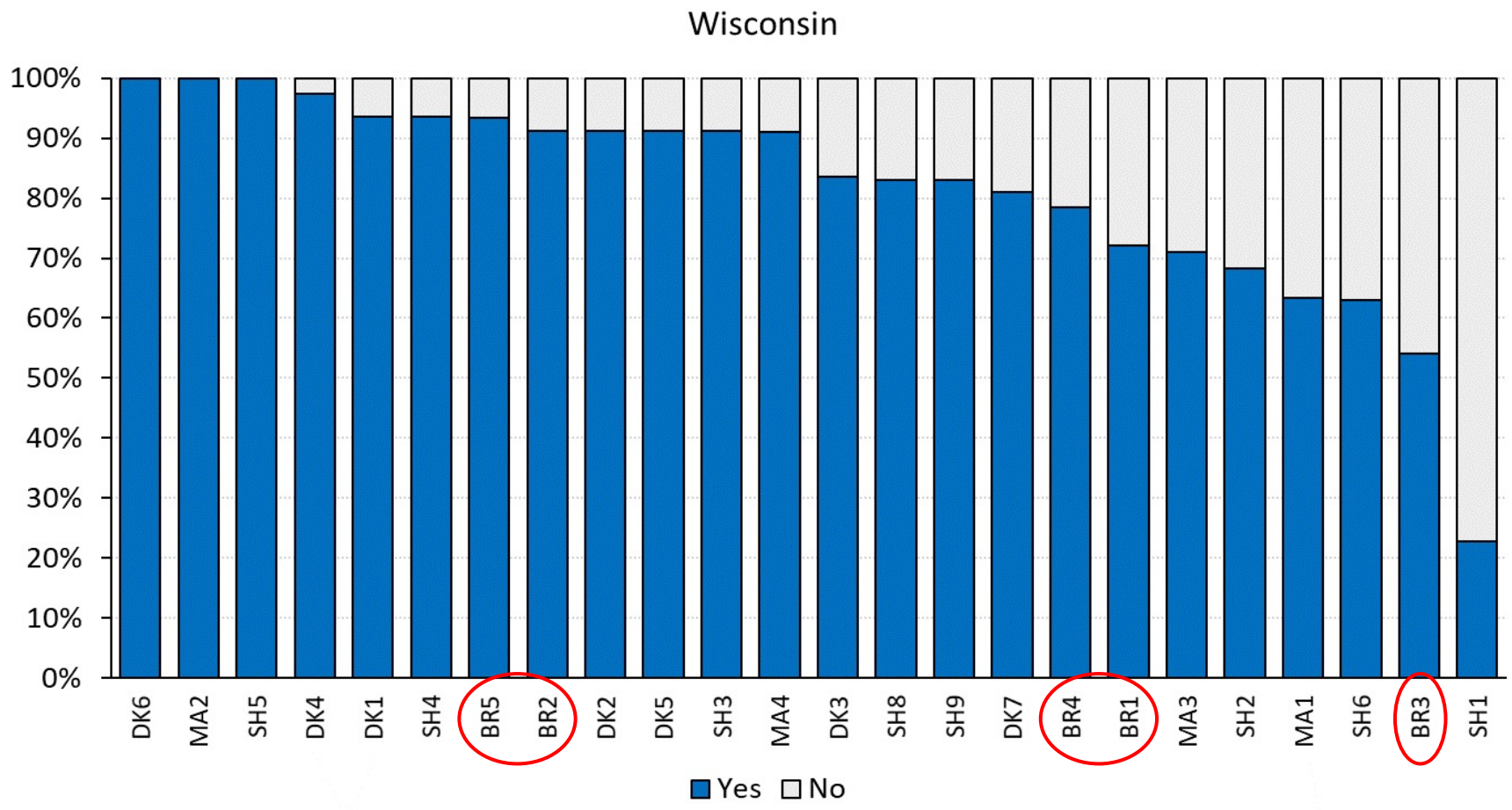
The average flow frequency for WI sites was 82%.



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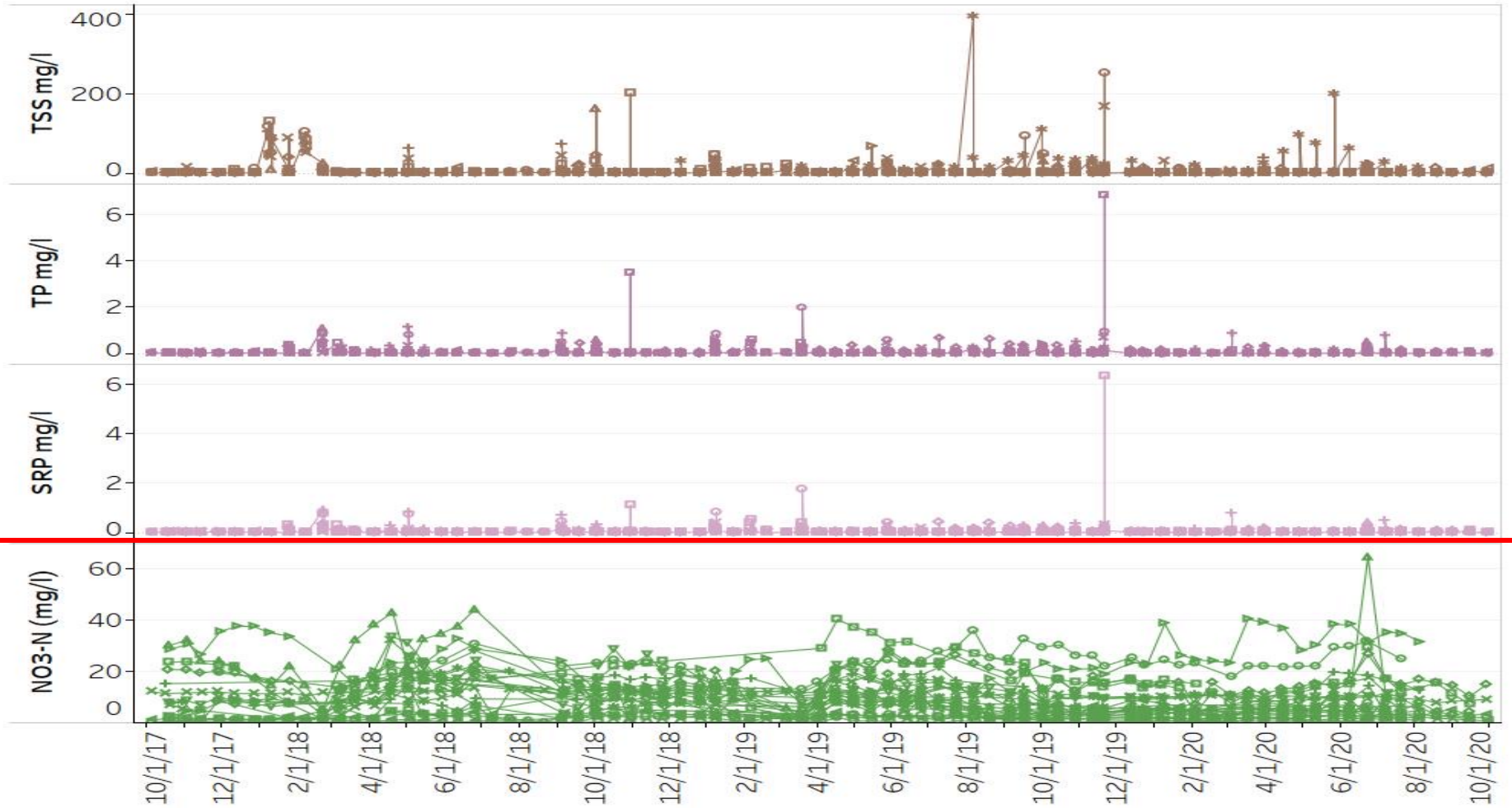
Typical tile concentration trends

Suspended Sediment

Total Phosphorus

Dissolved Phosphorus

Nitrate-N



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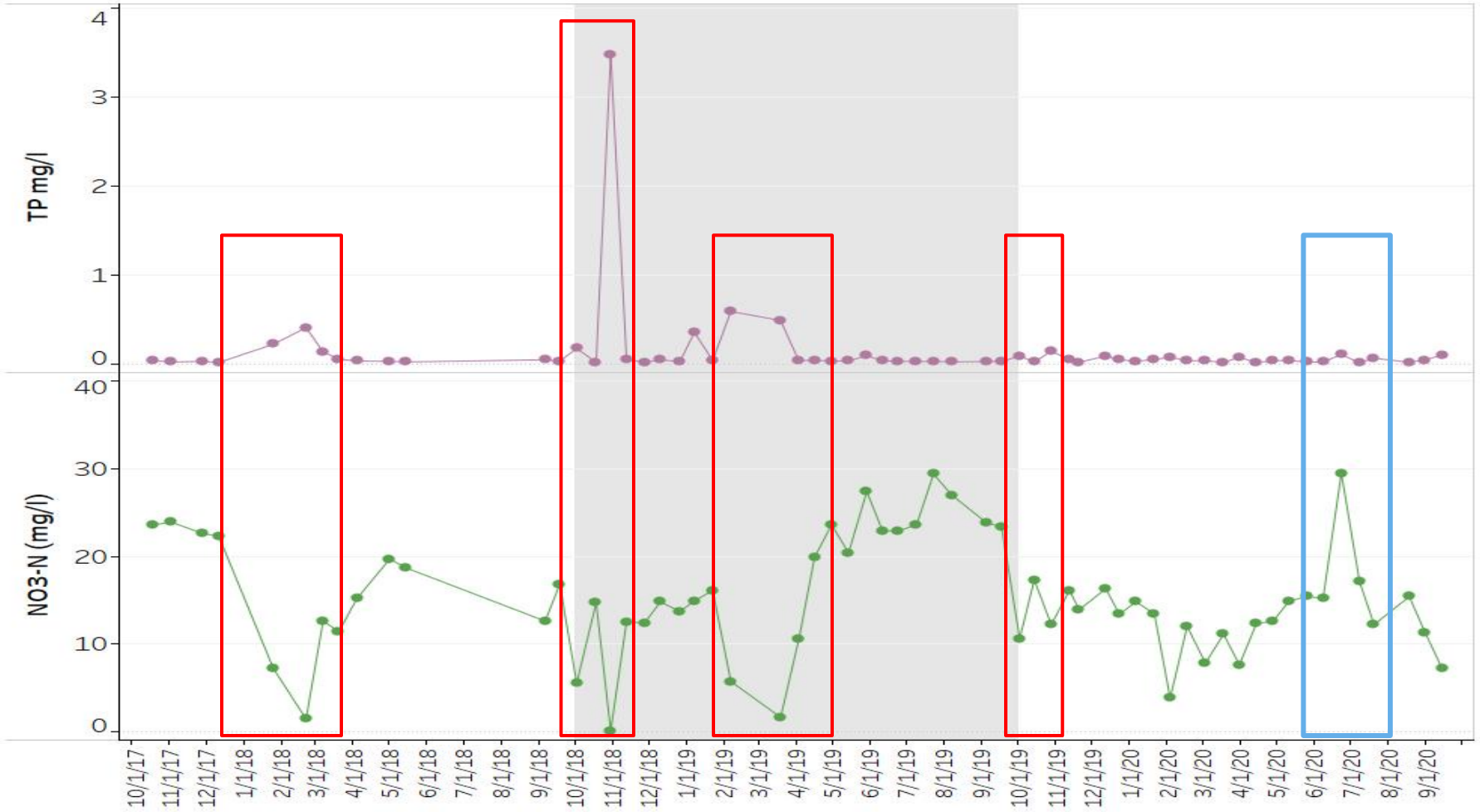
Phosphorus and nitrate respond differently to flow.



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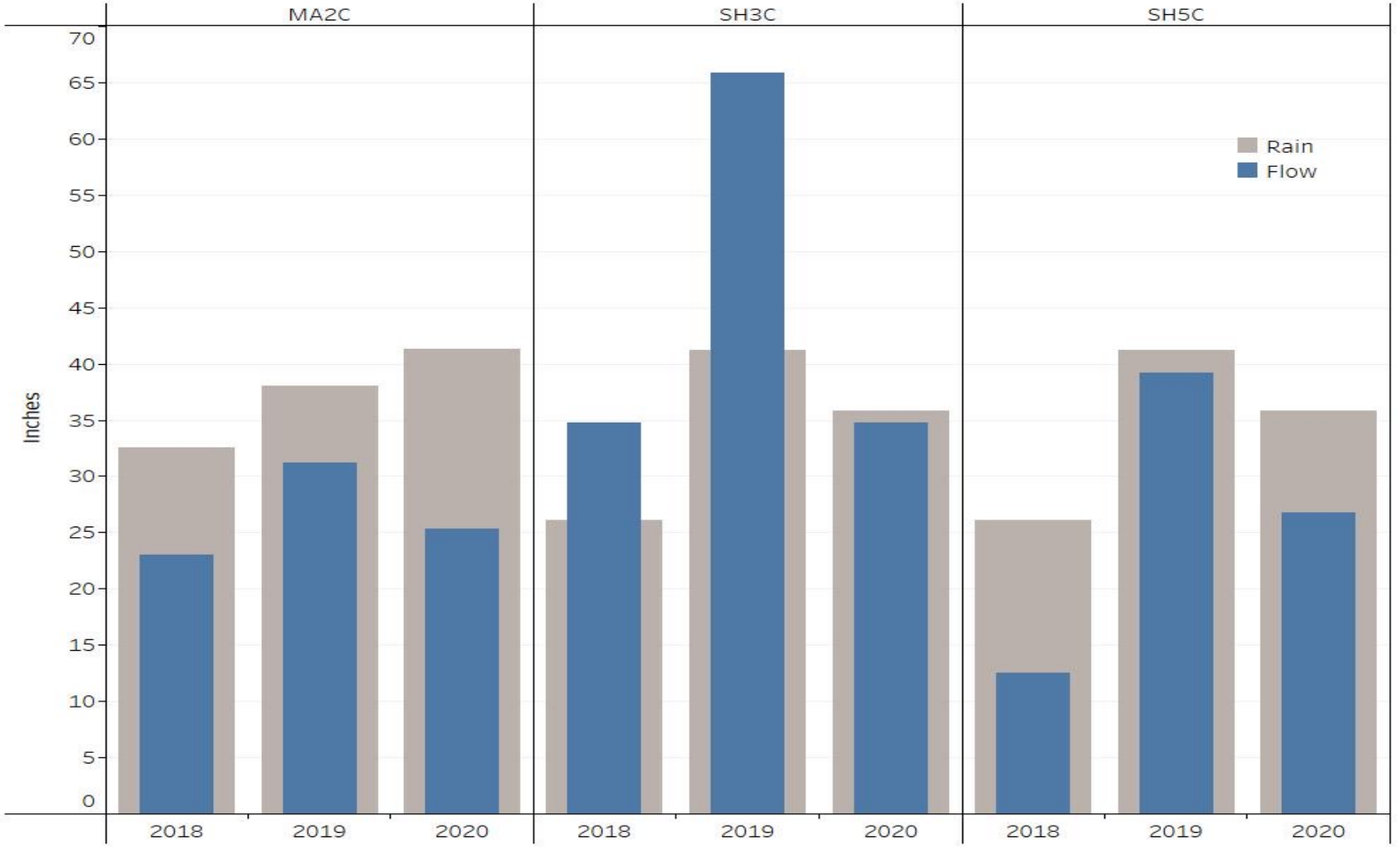
High annual flow volume compared to precipitation indicates interception of groundwater.



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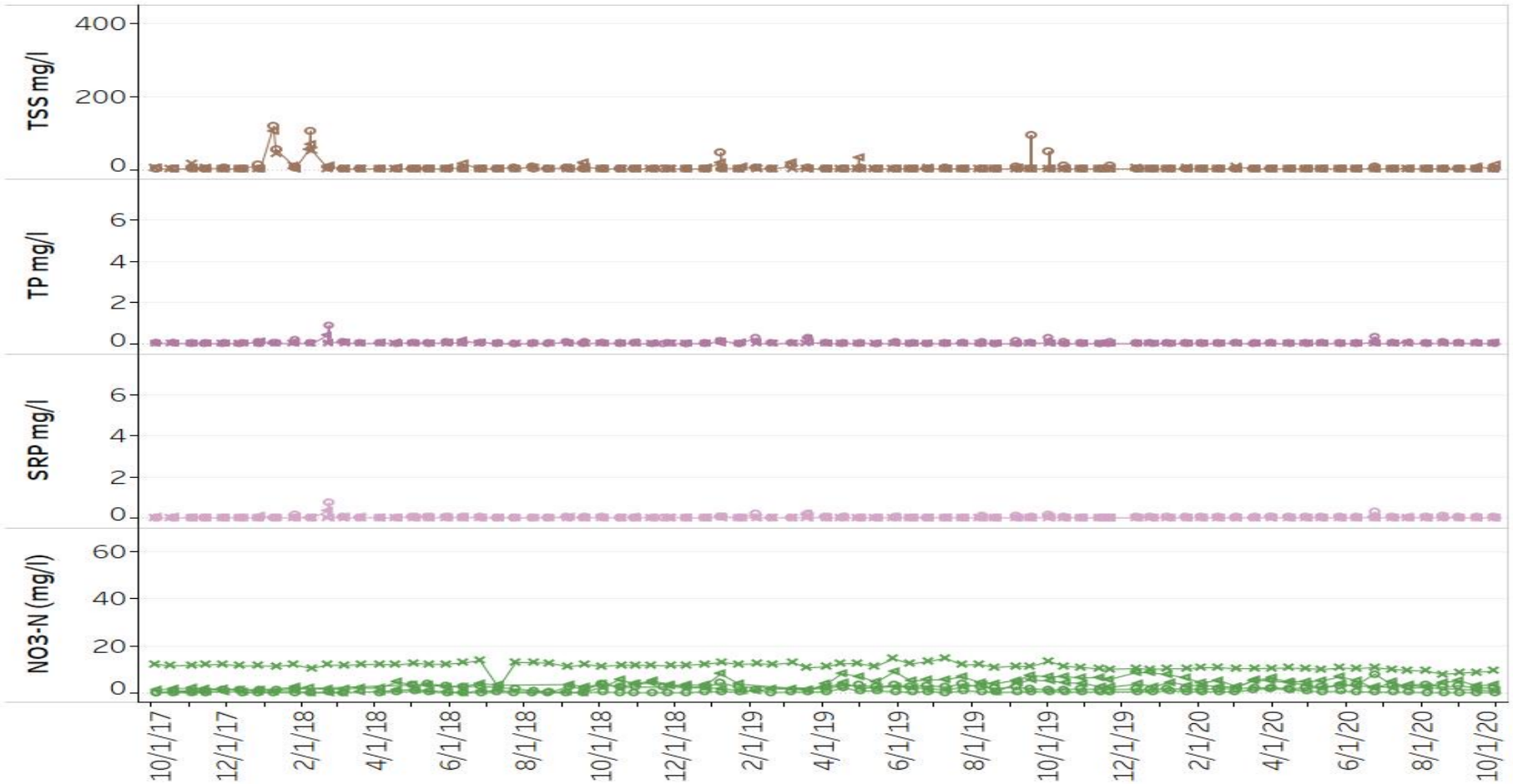
Groundwater dilutes concentrations making trend analysis difficult.



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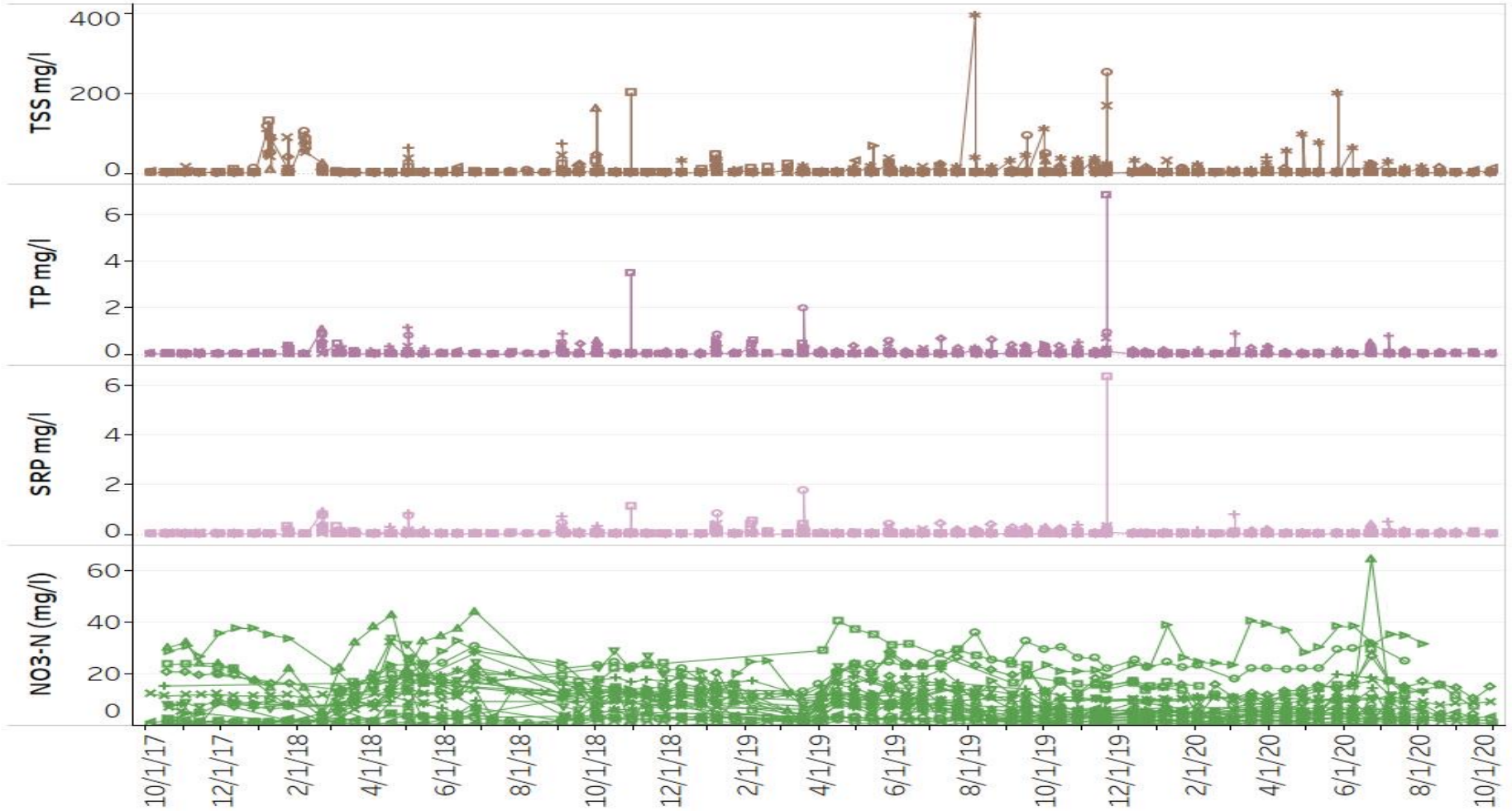
Typical tile concentration trends

Suspended Sediment

Total Phosphorus

Dissolved Phosphorus

Nitrate-N



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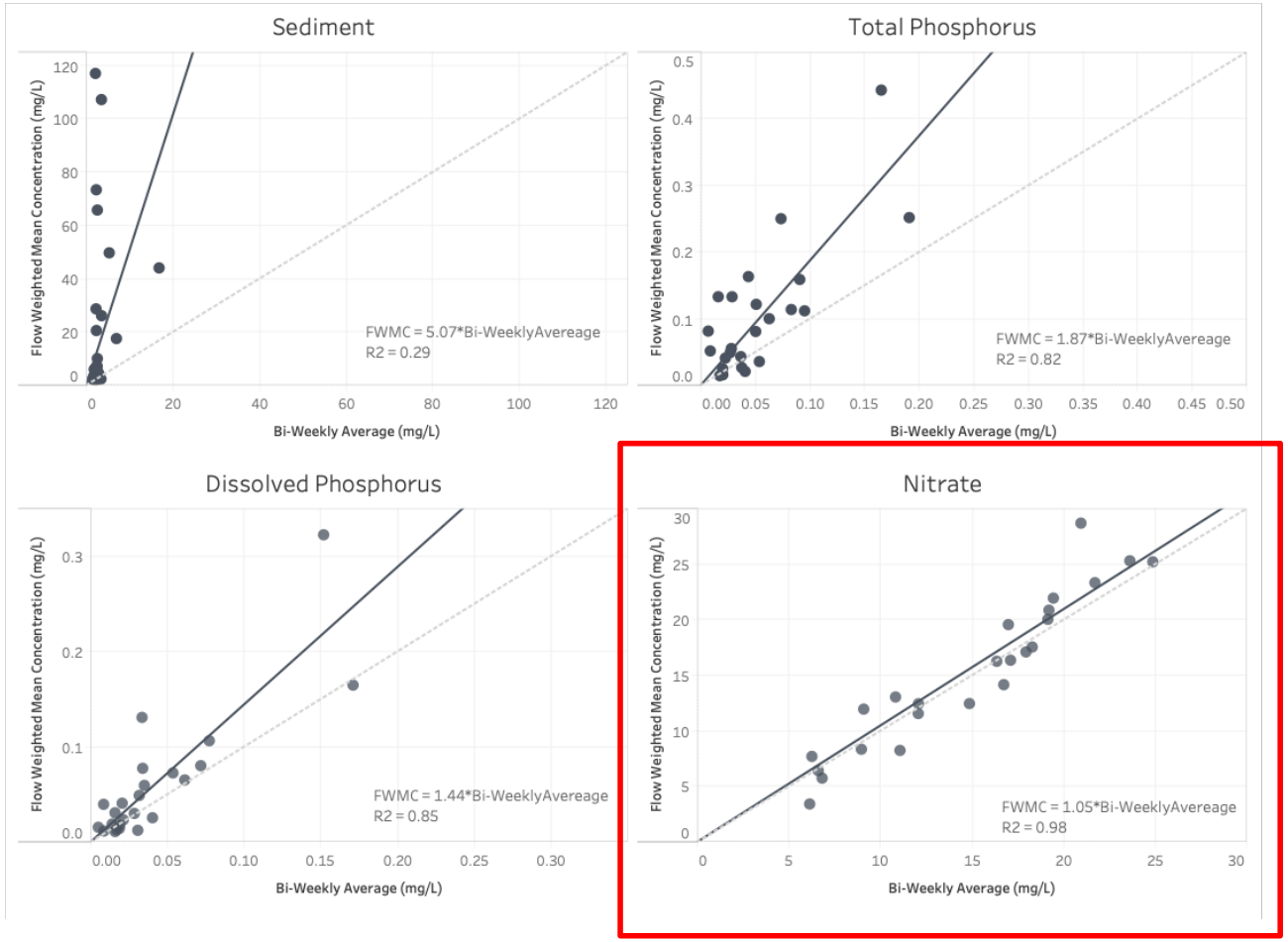
Annual average nitrate concentrations from bi-weekly sampling compares well with intensive monitoring.



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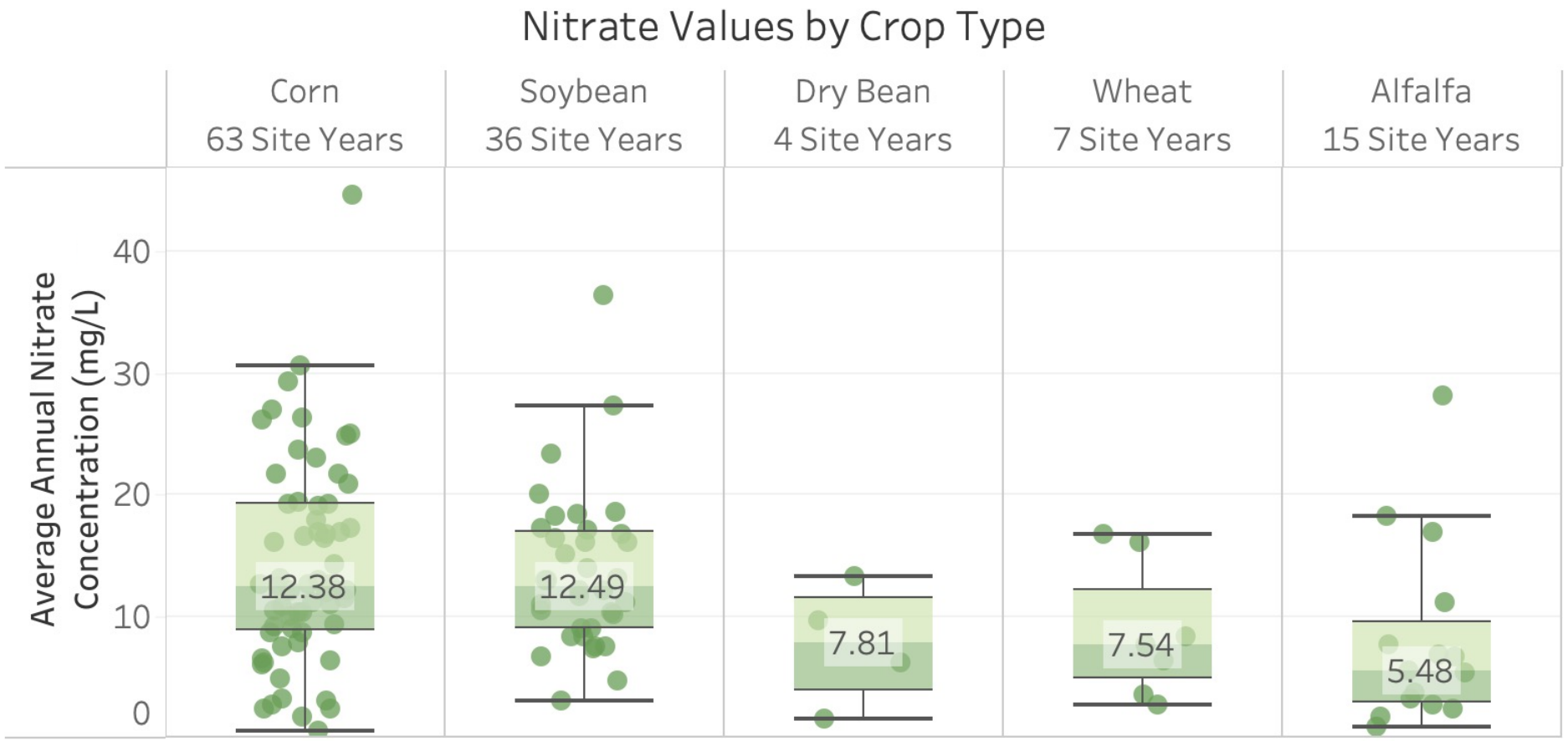
Crop type impacts nitrate concentrations in tile.



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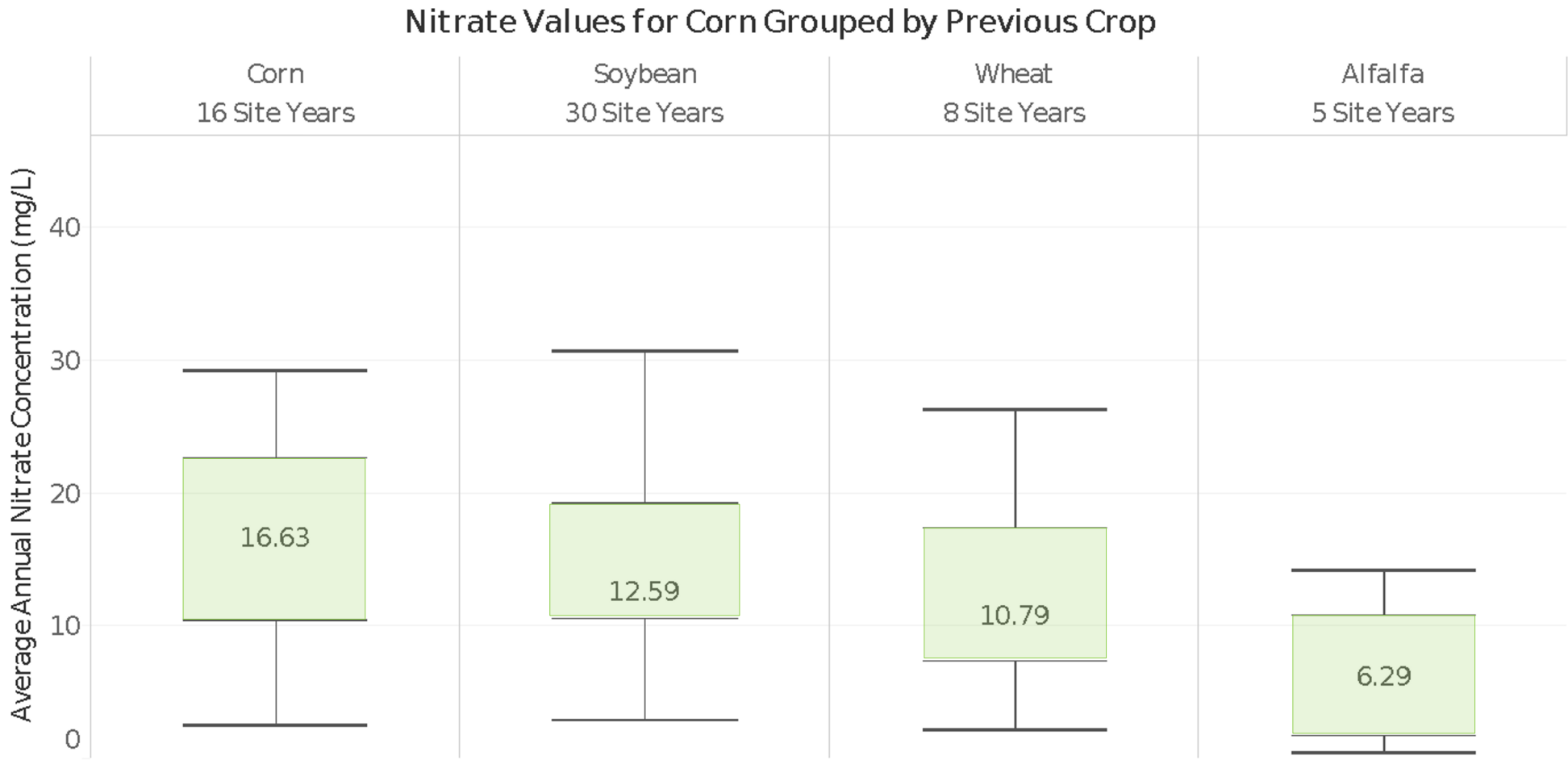
Previous crop impacts nitrate concentrations in tile.



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Nitrogen application rates impact nitrate concentrations in tile.

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Interpreting tile nitrate concentrations

NO_3-N Concentration (ppm)	Interpretation
≤ 5	Native grassland, CRP land, alfalfa, managed pastures
5 – 10	Row crop production on a mineral soil without N fertilizer Row crop production with N applied at 45 lbs./acre below the economically optimum N rate† Row crop production with successful winter crop to "trap" N
10 - 20	Row crop production with N applied at optimum N rate Soybeans
≥ 20	Row crop production where: • N applied exceeds crop need • N applied not synchronized with crop need • Environmental conditions limit crop production and N fertilizer use efficiency • Environmental conditions favor greater than normal mineralization of soil organic matter

Source: Interpreting Nitrate Concentration in Tile Drainage Water, Purdue Extension, Purdue University

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Self evaluation of tile nitrate concentrations

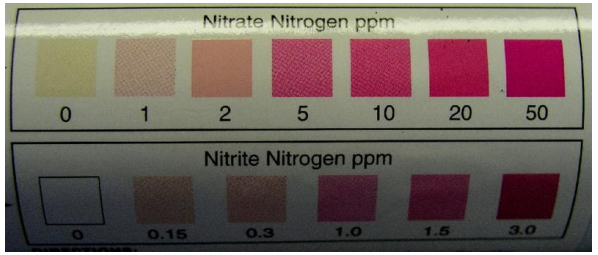
Laboratory analysis: $20/sample
(Stevens Point Water & Environmental Analysis Laboratory 7/21)

Nitrate test strips: $0.40 - $2/strip

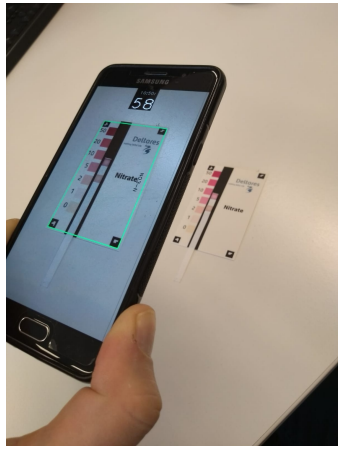
* For either method: record date, concentration and approximate tile flow for assessment

If using nitrate test strips for evaluation

- Ensure you look at scales of nitrate concentration to target optimal testing range (0-50 vs 0-500 ppm)
- Know if measuring in nitrate or nitrate nitrogen
  - 100 ppm nitrate = 23 ppm nitrate-N
- Read directions for proper waiting time before reading (30-60 seconds)
- Make sure you read nitrate not nitrite values (most test strips have both)
- Apps are available to aid in measurement and data storage
  - deltares.nl/en/software/nitrate-app/
  - MQuant® StripScan



Credit: reefs.com



Credit: deltares.nl

When to test tile systems for nitrate concentration assessment

- **Not** during periods of excessive flow (snowmelt)
- For most consistent soil nitrate values (May – September)
- After a precipitation event following manure or N fertilizer application
- Right before freeze-up for fall manure applications

When applying manure… don’t forget

Tiles should be monitored before, during and after liquid manure applications for potential discharge of manure (discolored or foamy).

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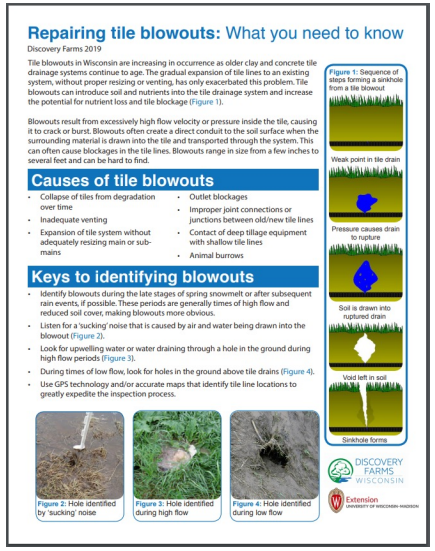
For more information:

uwdiscoveryfarms.org/on-farm-projects/tile

fyi.extension.wisc.edu/drainage/



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