Transport of Suspended Sediment and Phosphorus During Experimental Restoration of Everglades High Flows

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Feedbacks: slough clearing increases flow/sediment transport…more flow

DPM has operated 4 times between 2013 and 2017
What was the fate of suspended sediment and phosphorus that were mobilized?

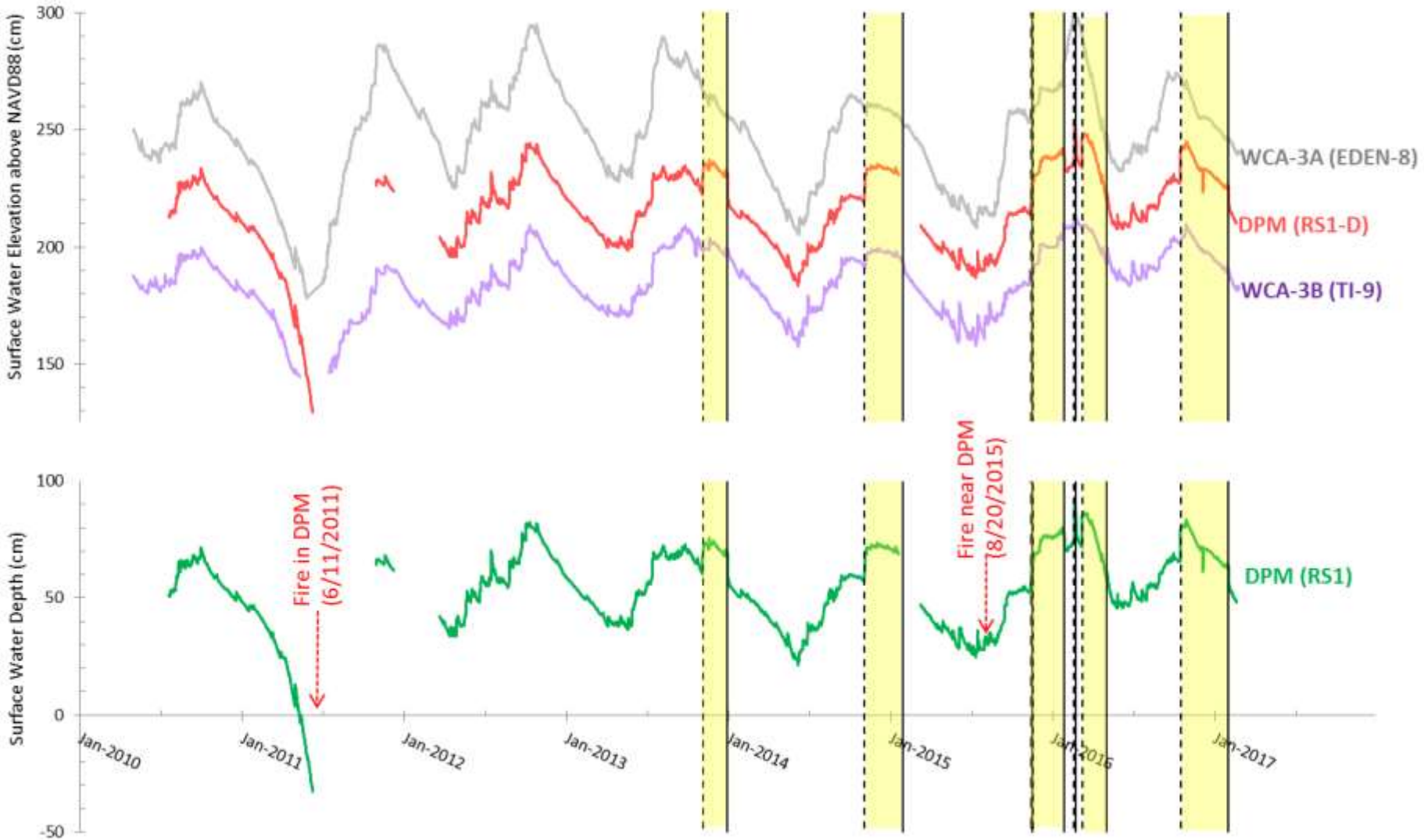
1) Have the experimental flow events increased storage of phosphorus in DPM, or is P transported farther downstream?

2) What controls how far is phosphorus transported before being removed from suspension?

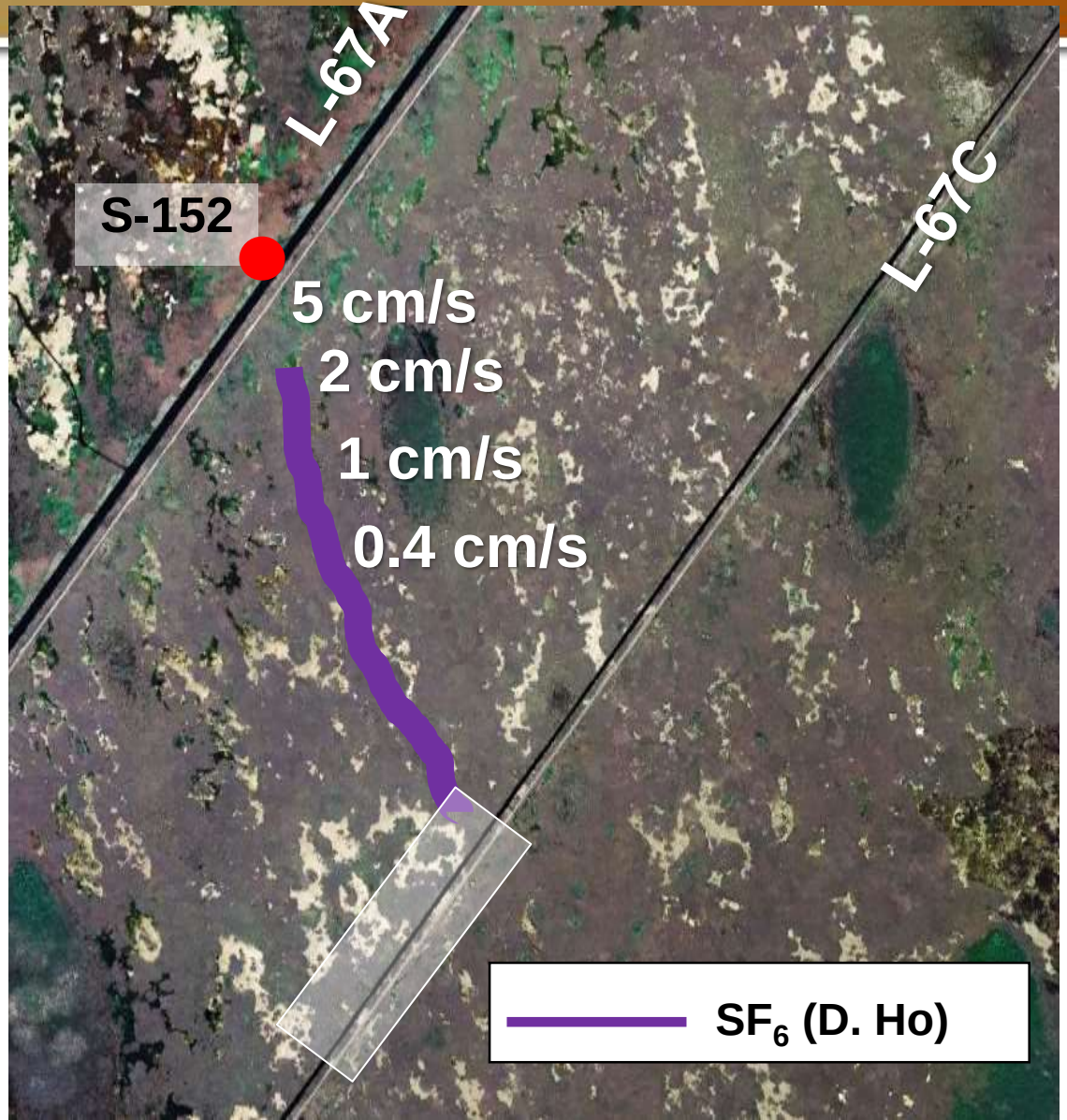
3) Where is phosphorus stored, i.e., attached to plants with epiphyton or in bed floc? In labile or refractory forms?

4) Where was removal of phosphorus greatest? Slough or ridge?

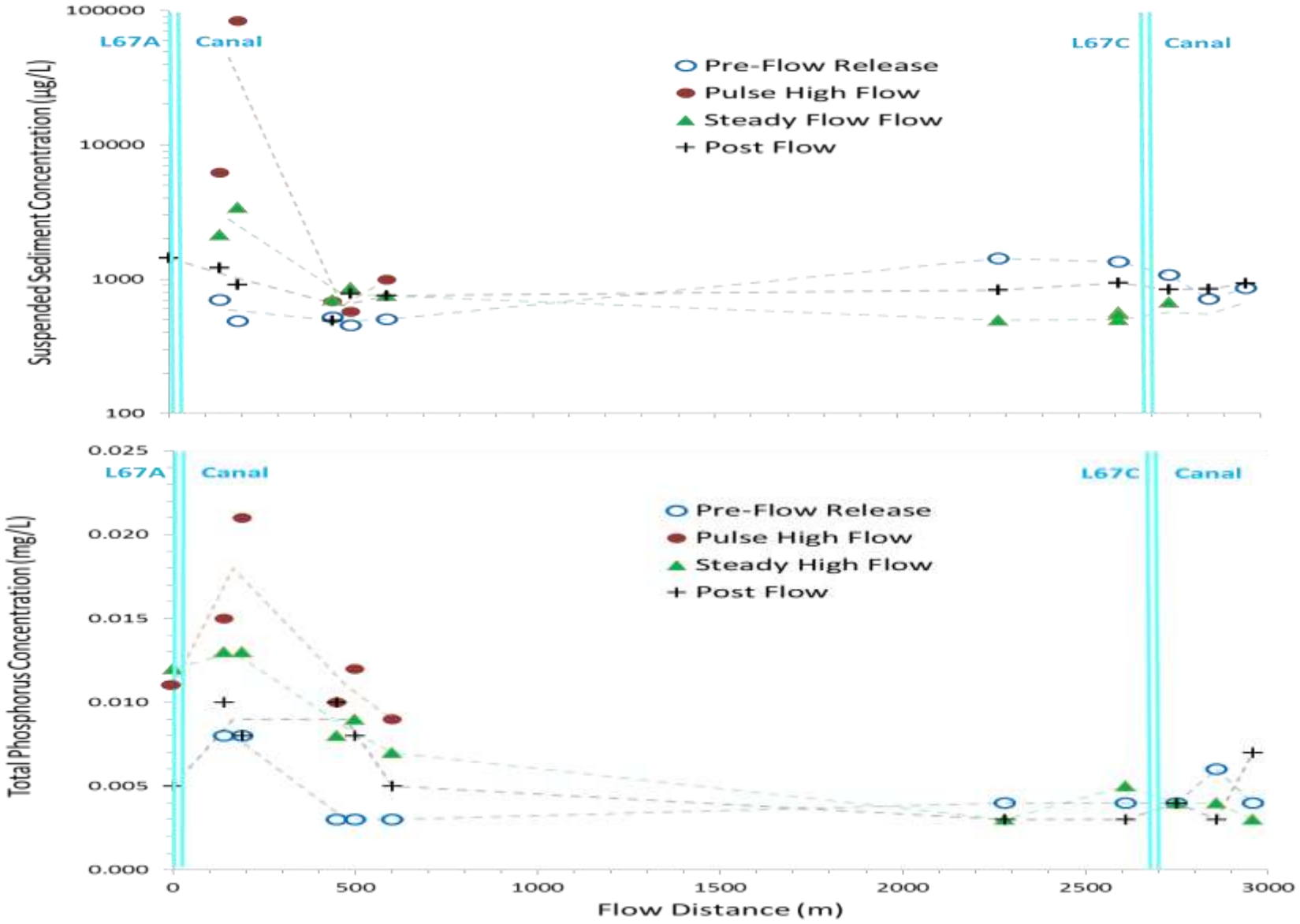
Background Hydrologic Conditions



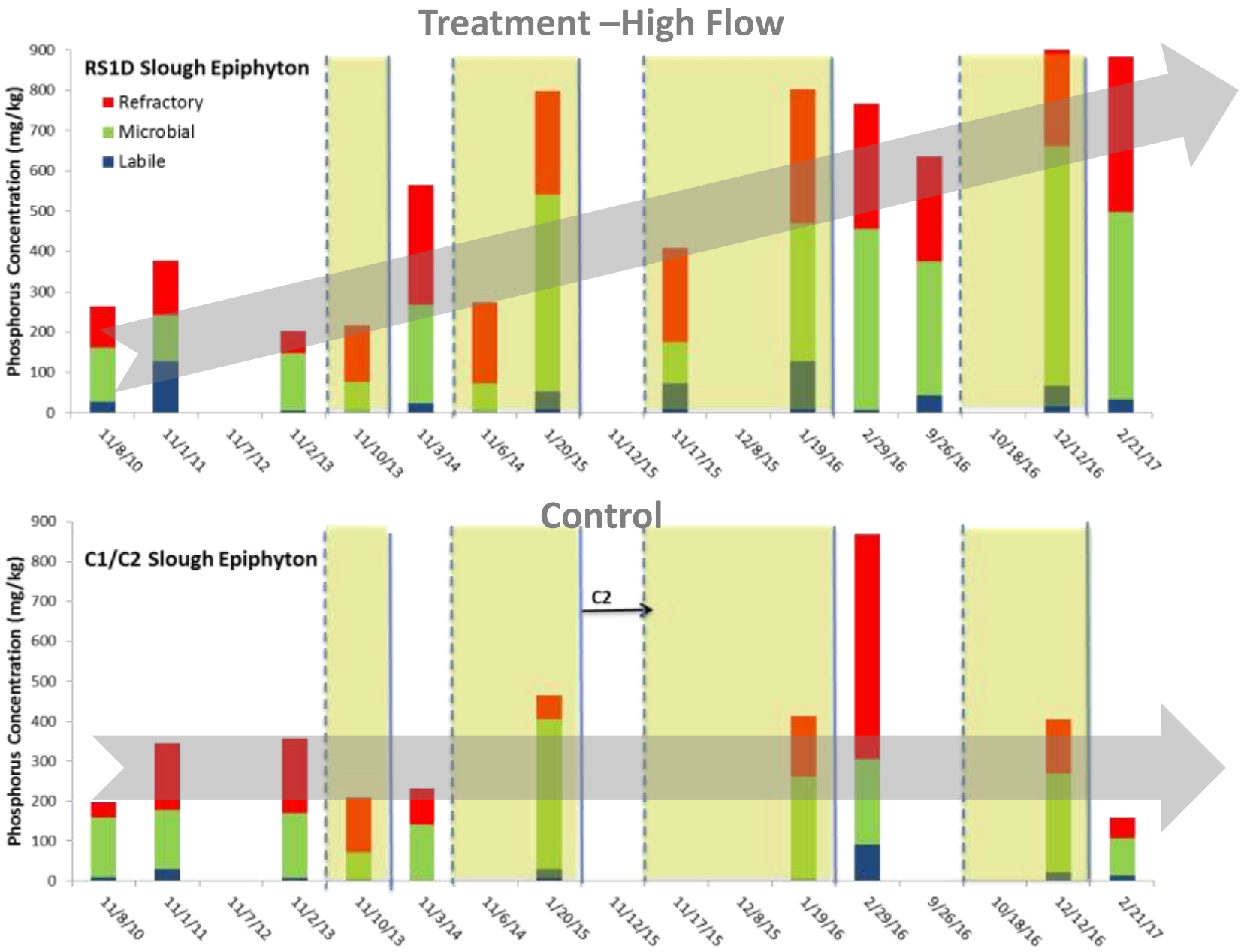
Transport model for southern flow path



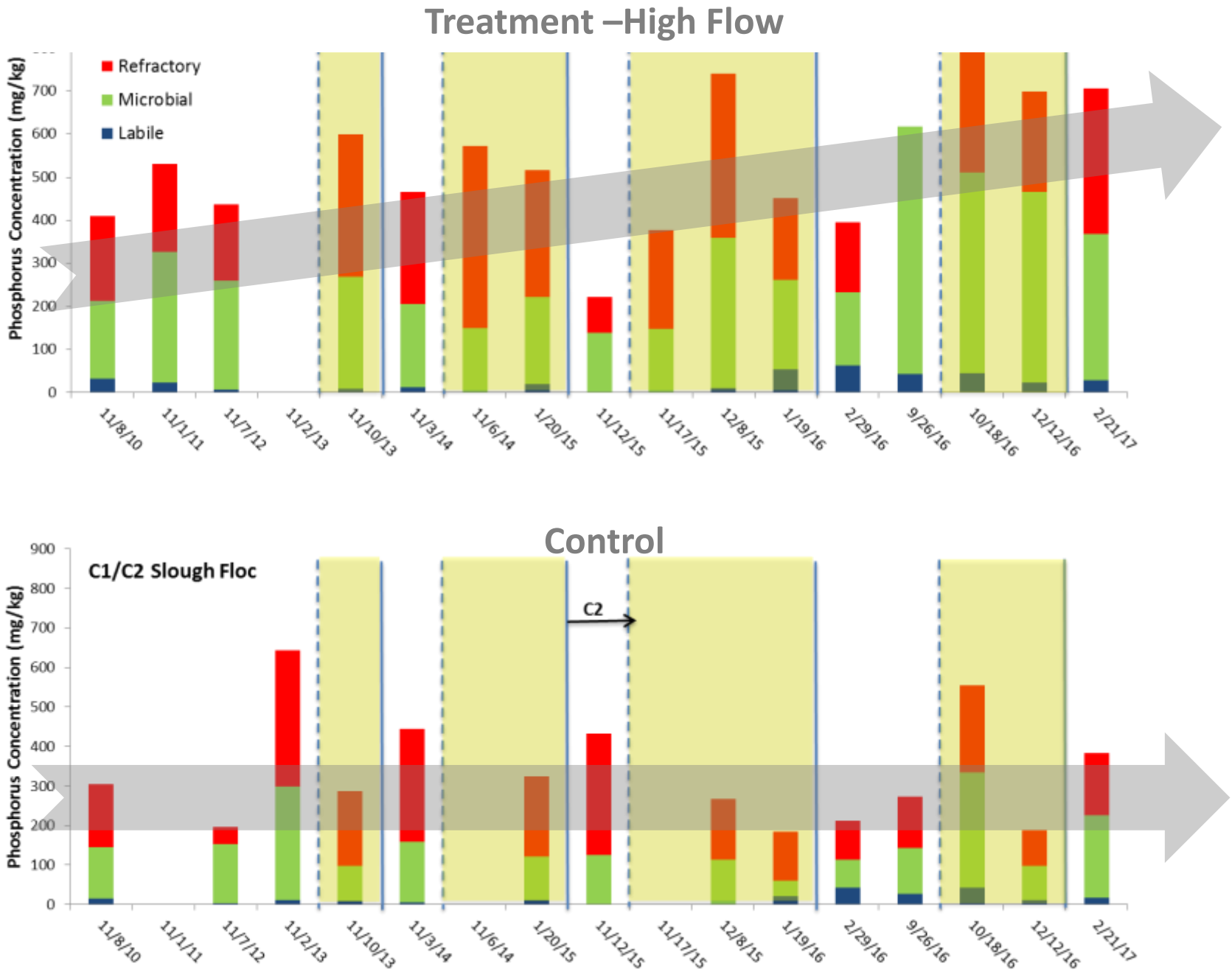
Suspended Sediment and Total Phosphorus Transported Lees than 1000 m into DPM



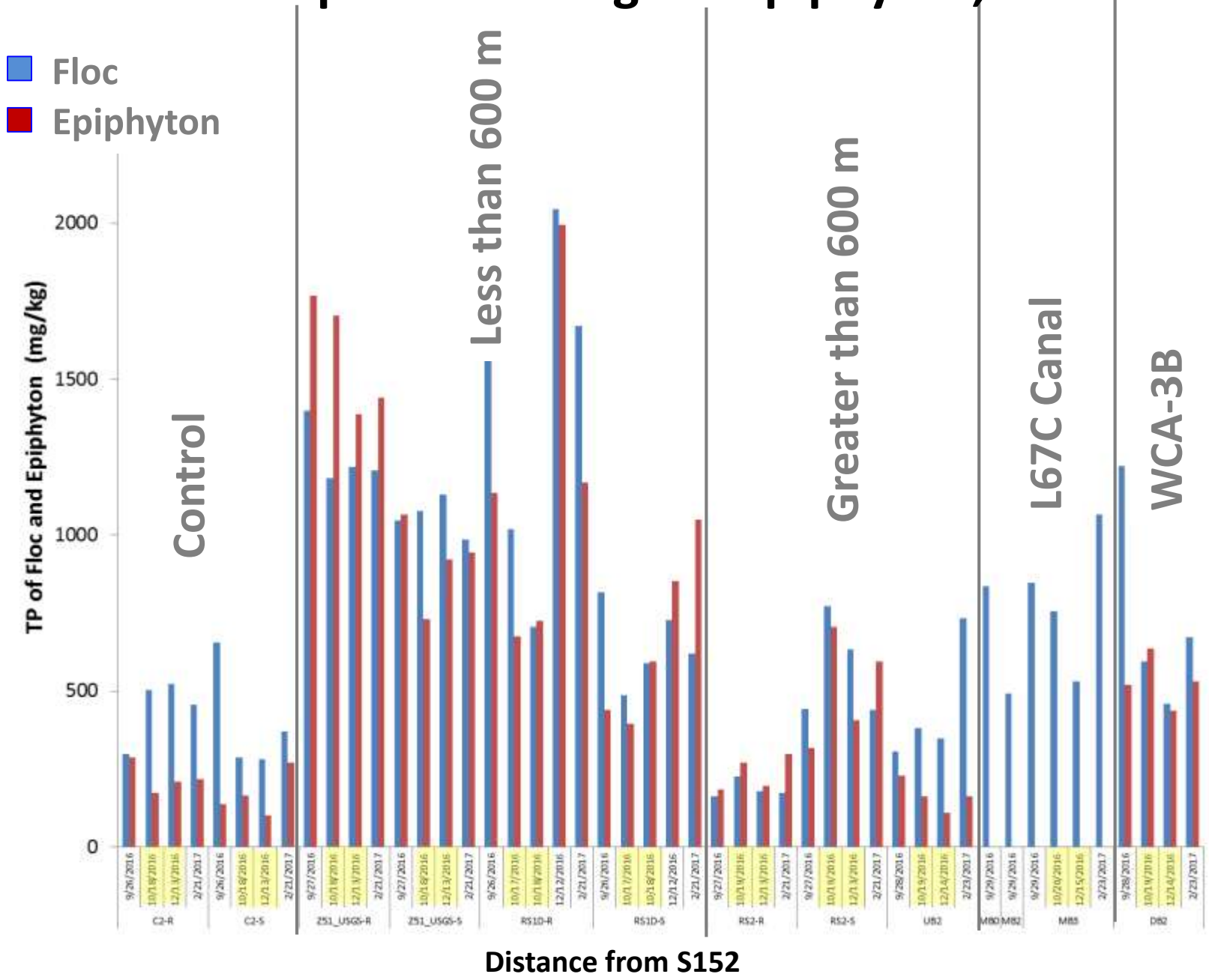
Increased Phosphorus Storage in Epiphyton, 2010 - 2017



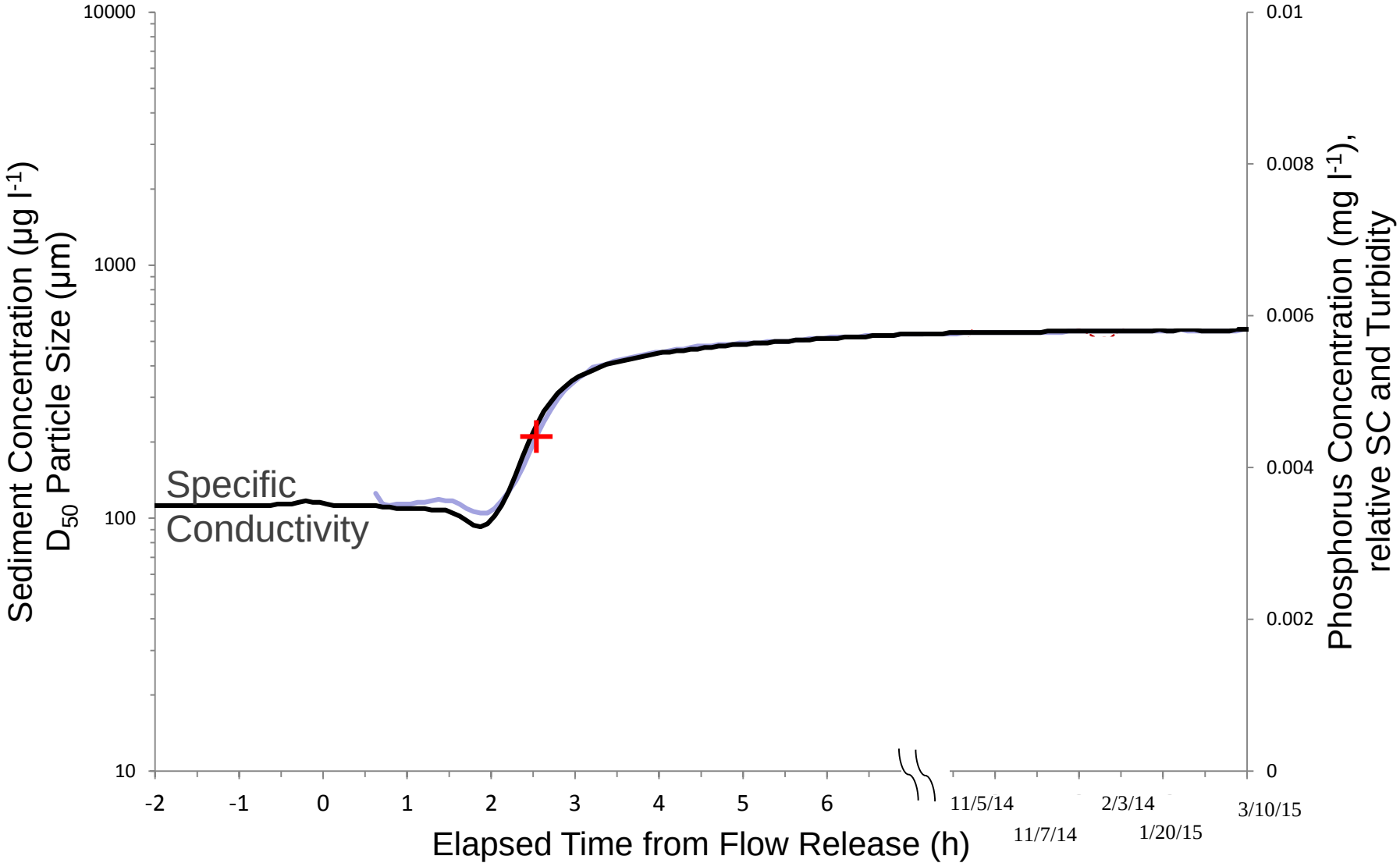
Increased Phosphorus Storage in Floc, 2010 - 2017



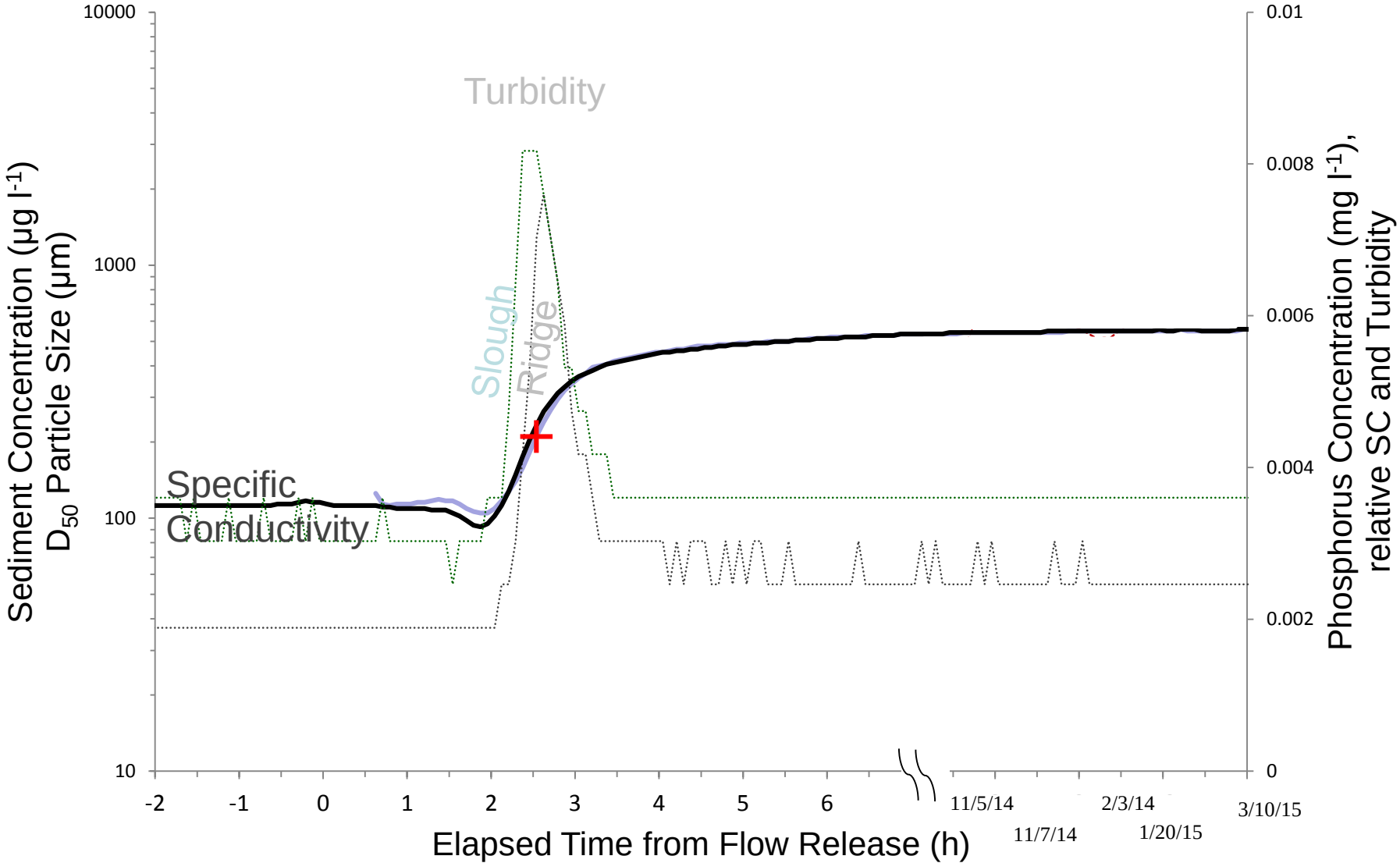
Increased Phosphorus Storage in Epiphyton, 2016-2017



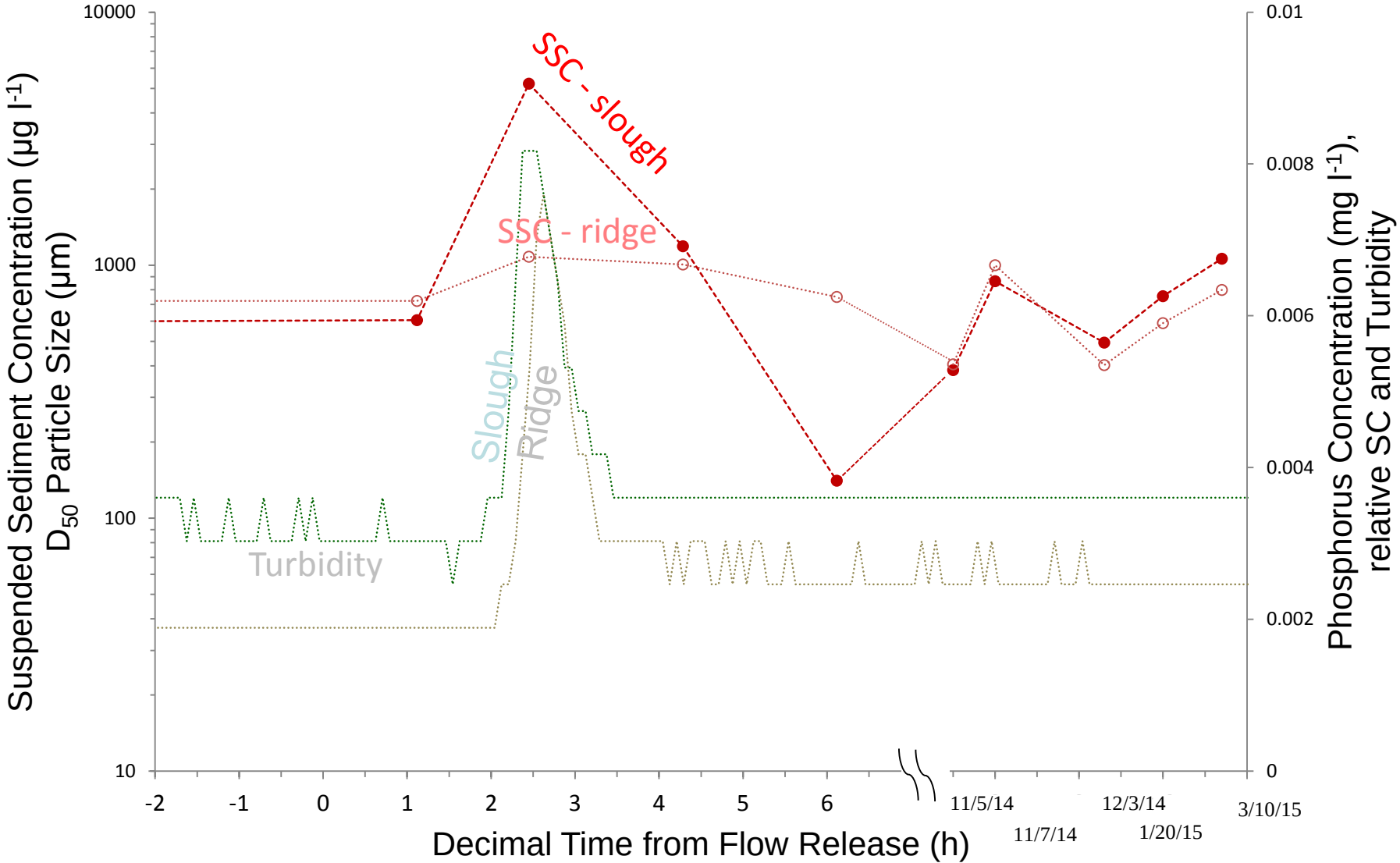
Specific conductivity times arrival of high-flow source water



Suspended particles arrive as a “spike” on leading edge of flood wave



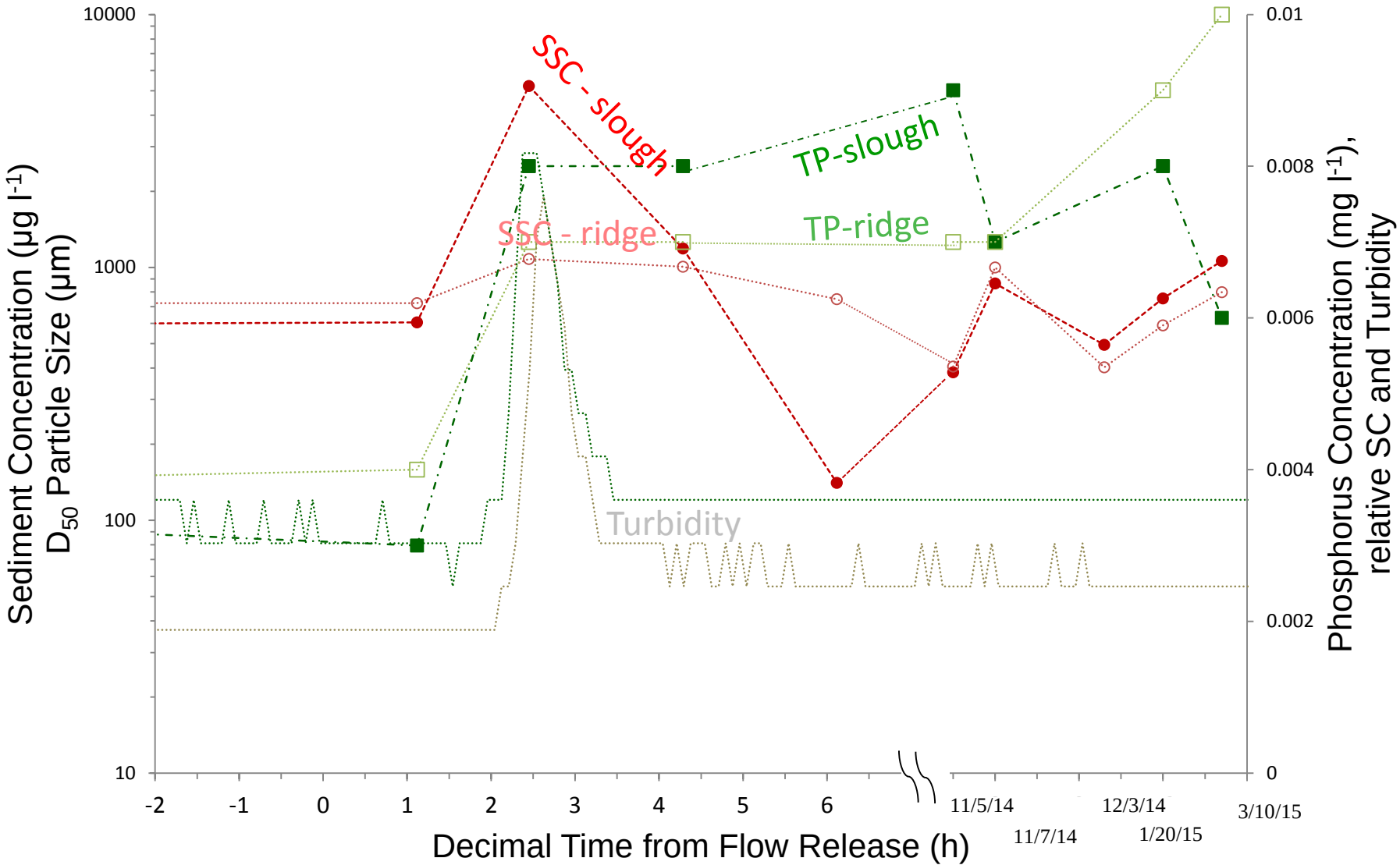
Particles transported in sloughs deposited on ridges



Removal of Suspended Sediment Initially Greater in Sloughs, Later Removal Greater on Ridges

Suspended Sediment		Areal rate ($g/m^2/s$) x 10^{-4}	Areal deposition (g/m^2)
Pulse High Flow (day 1): 6-hr pulse repeated every 14-days for 3 months	Slough	3	40
	Ridge	**1**	**10**
Sustained High Flow lasting 3 months	Slough	1	1000
	Ridge	**7**	**6000**

Suspended particles became more P-enriched



Removal of Suspended Total Phosphorus Greater on Ridges

Total Phosphorus		Areal rate ($g/m^2/s$) x 10^{-7}	Areal deposition (g/m^2)
Pulse High Flow (day 1): 6-hr pulse repeated every 14-days for 3 months	Slough	0.8	0.01
	Ridge	**20**	**0.2**
Sustained High Flow lasting 3 months	Slough	3	3
	Ridge	**30**	**20**

Sediment and phosphorus are redistributed from sloughs to ridges, promoting slough clearing

- Particulate phosphorus storage has increased in DPM, by 1.5 to 4 times in areas with highest flow, greater increase in epiphyton compared to floc
- Hydraulics (velocity, shear stress), particle size, biochemical form, and vegetation frontal area control P transport
- Storage of P increasingly in microbial form (~75%), whereas floc remains distributed in both microbial and refractory forms (~50%)
- Approximately 6 times more sediment and P deposited on ridges compared to sloughs. Initial pulses generate highest suspended concentrations, but sustained high flows more effective transferring SSC and TP from sloughs to ridges, promoting slough clearing.