Flooded Muck Fields as a Source of Phosphorus to Mona Lake

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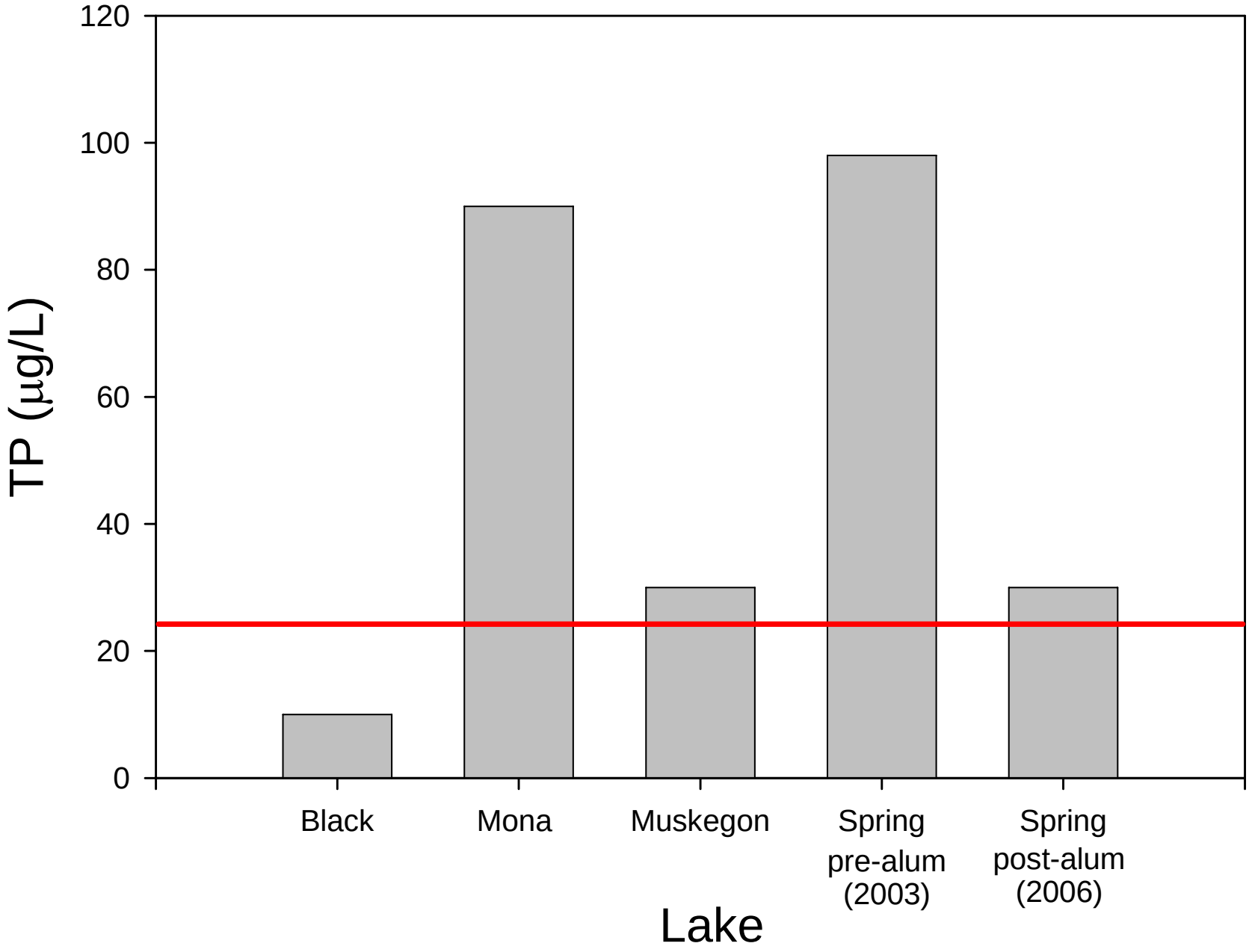
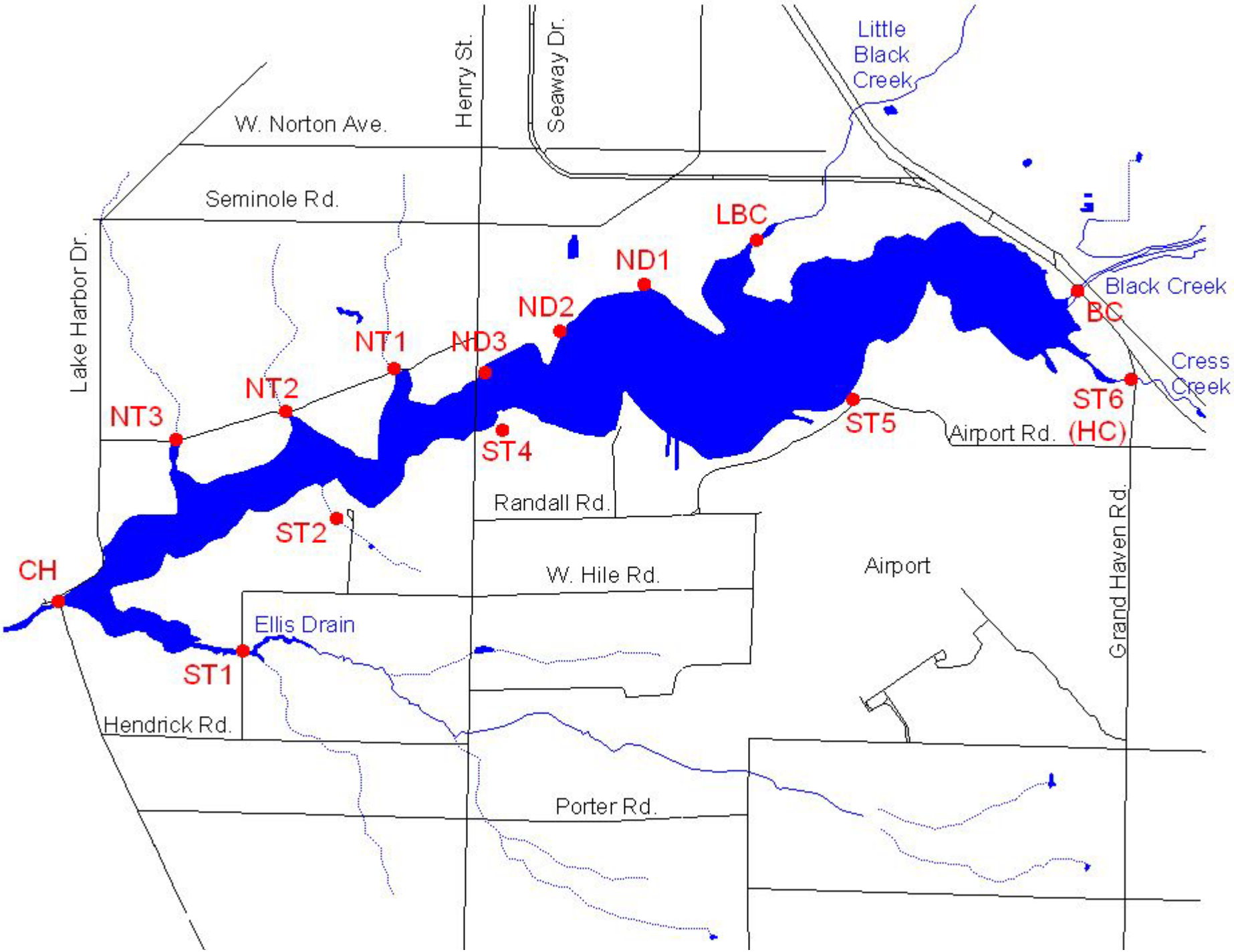
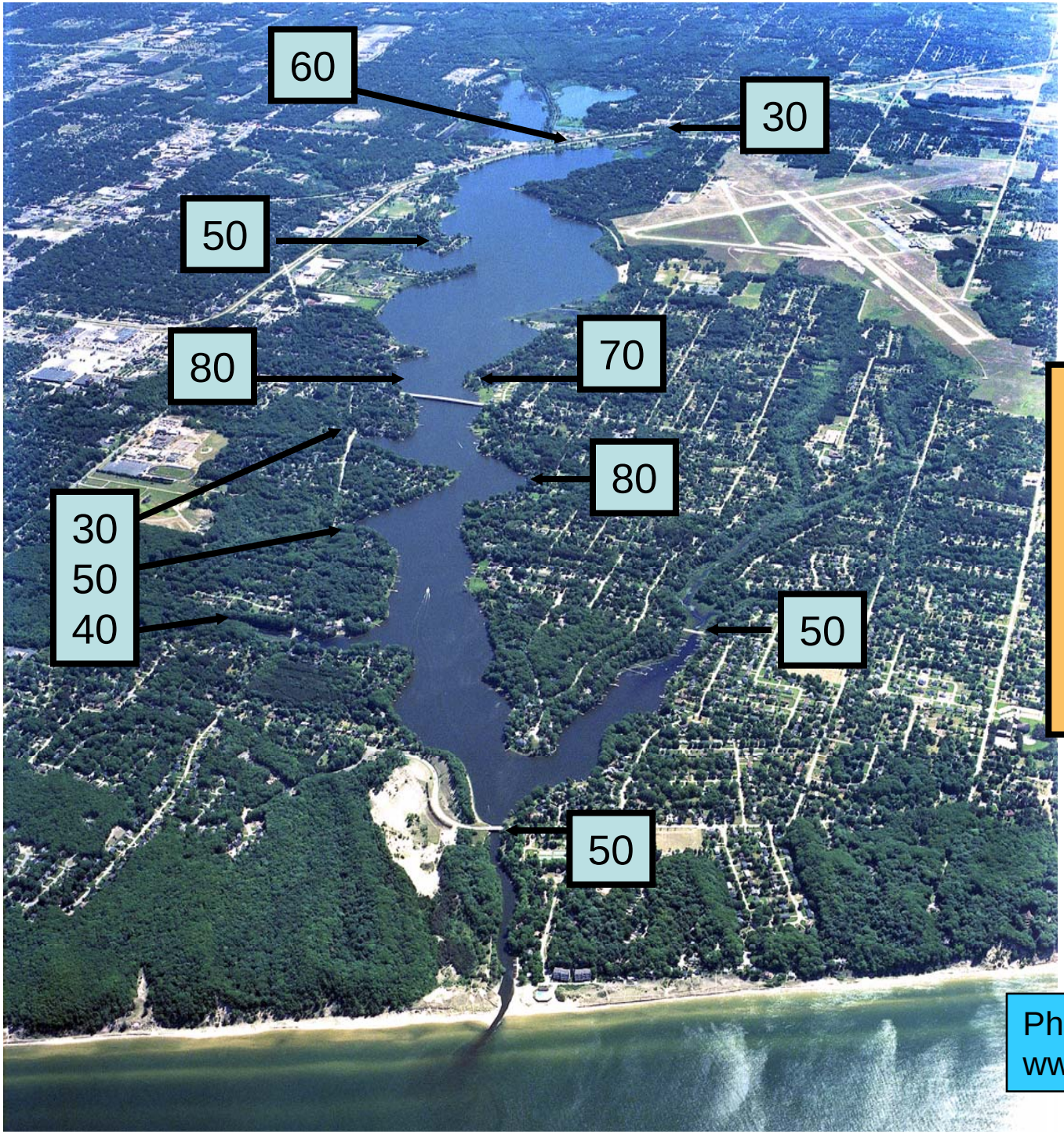
Summer Water Column TP

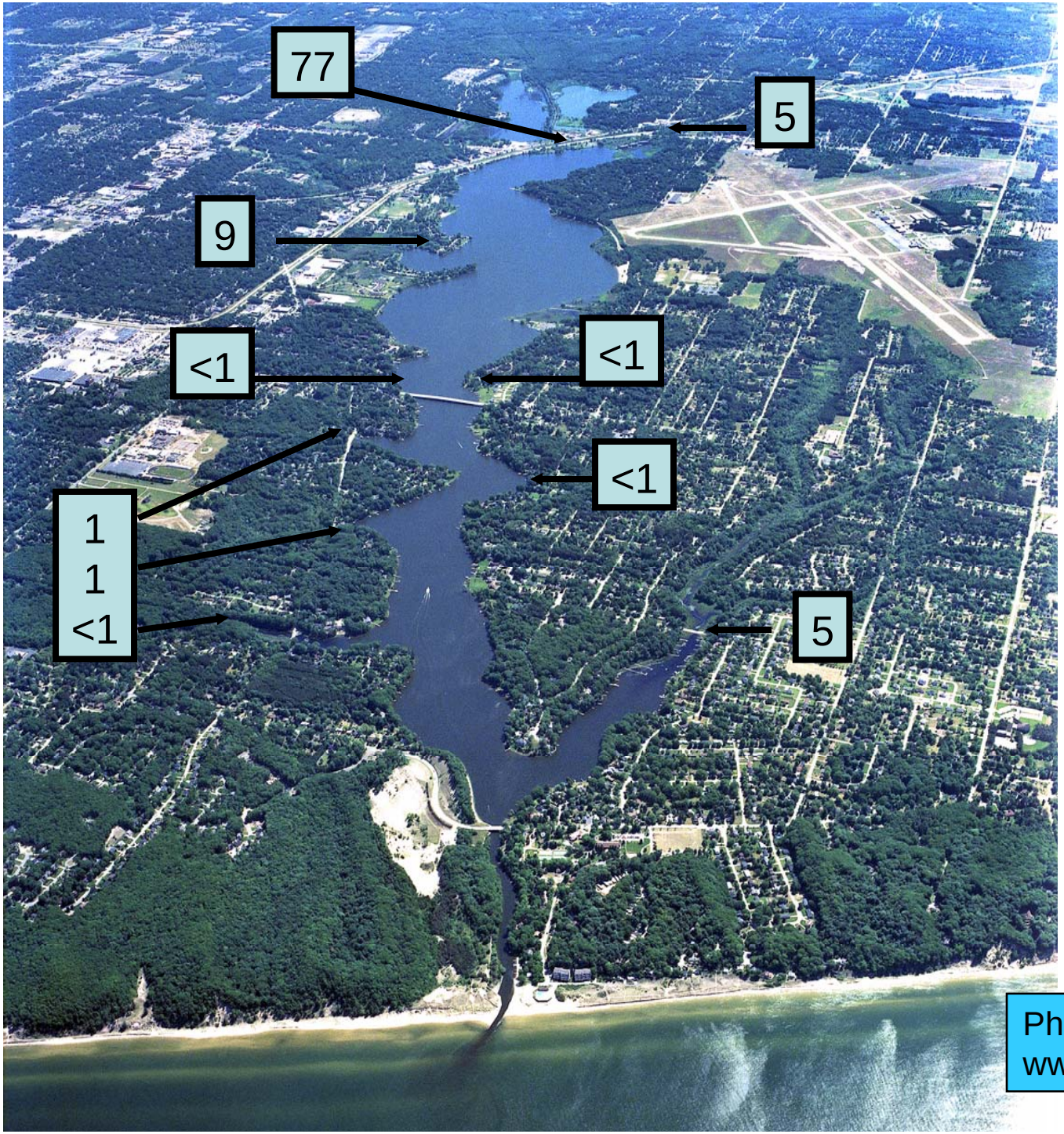



Little
Black
Creek
Henry St.
Seaway Dr.
W. Norton Ave.
Seminole Rd.
Lake Harbor Dr.
LBC
ND1
ND2
ND3
NT1
NT2
NT3
ST4
ST5
ST6
(HC)
Black Creek
BC
Cress
Creek
Airport Rd.
Randall Rd.
ST2
CH
W. Hile Rd.
Airport
Grand Haven Rd.
Ellis Drain
ST1
Hendrick Rd.
Porter Rd.



Total Phosphorus Concentration (µg/L) Jun02-Aug03

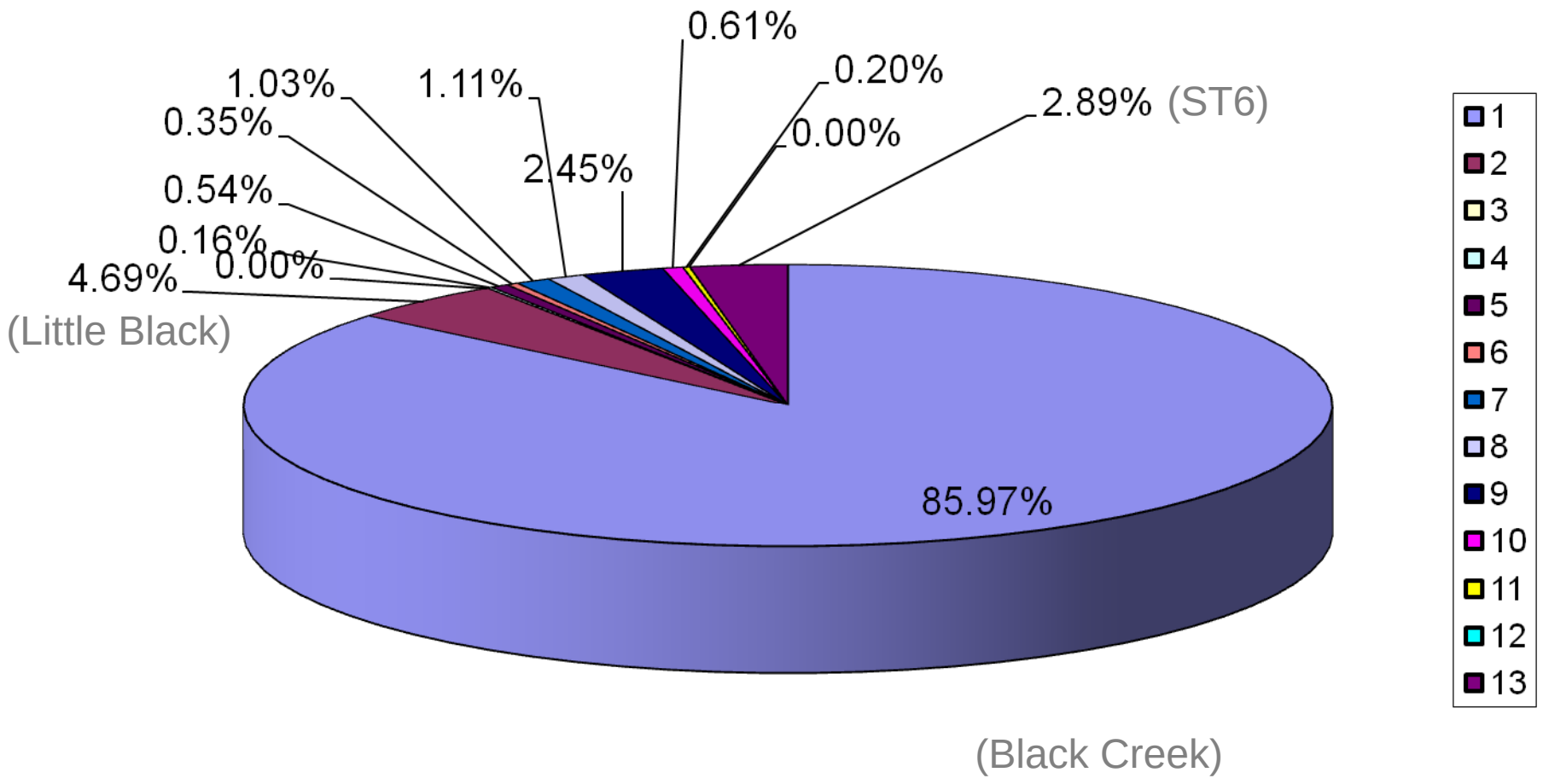
Photo by Marge Beaver:
www.photography-plus.com



Base Flow (%) Jun02-Aug03

Photo by Marge Beaver:
www.photography-plus.com

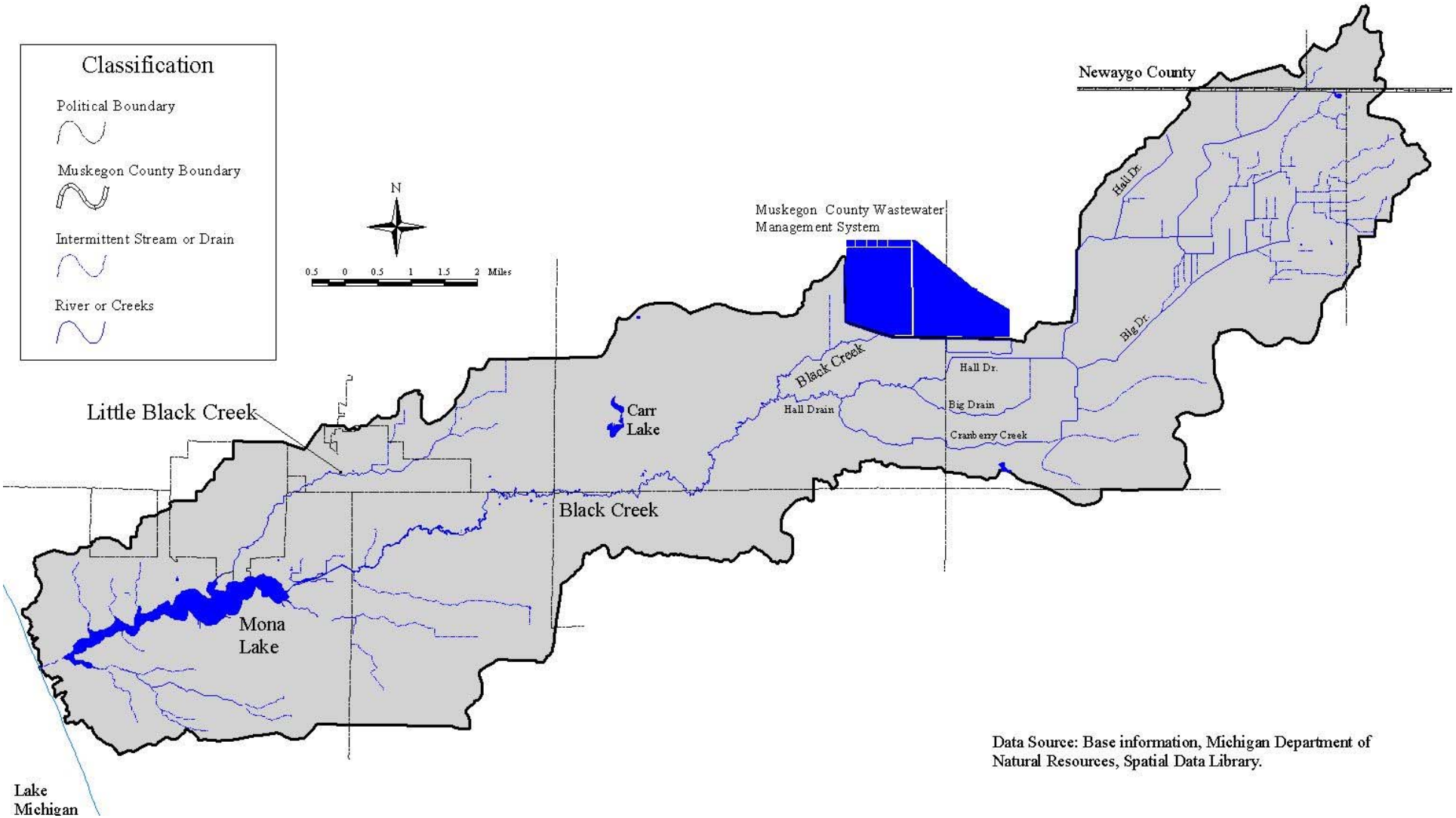
Percent TP Load (June 2002 – June 2003)



Hydrography

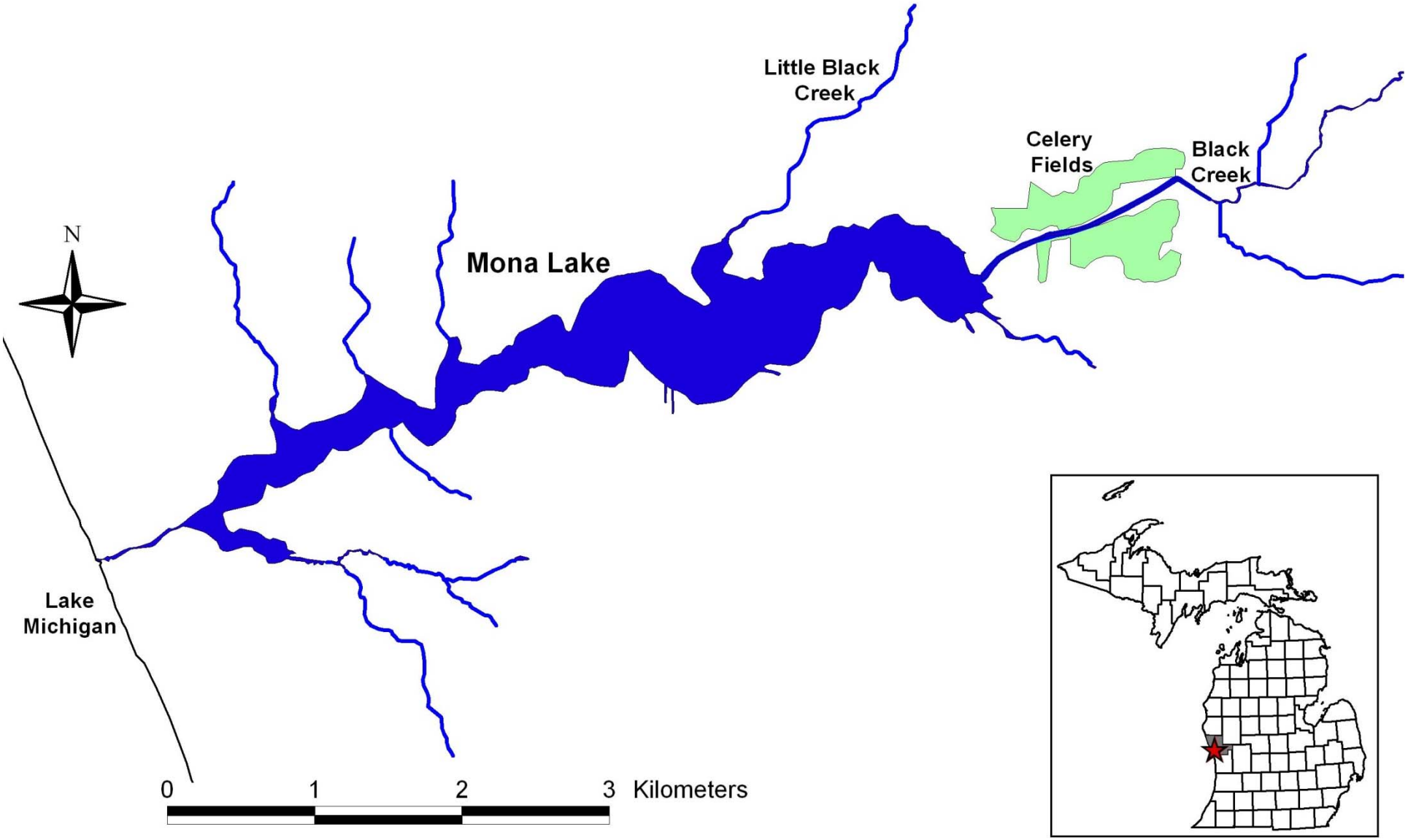
Mona Lake Watershed

Muskegon County

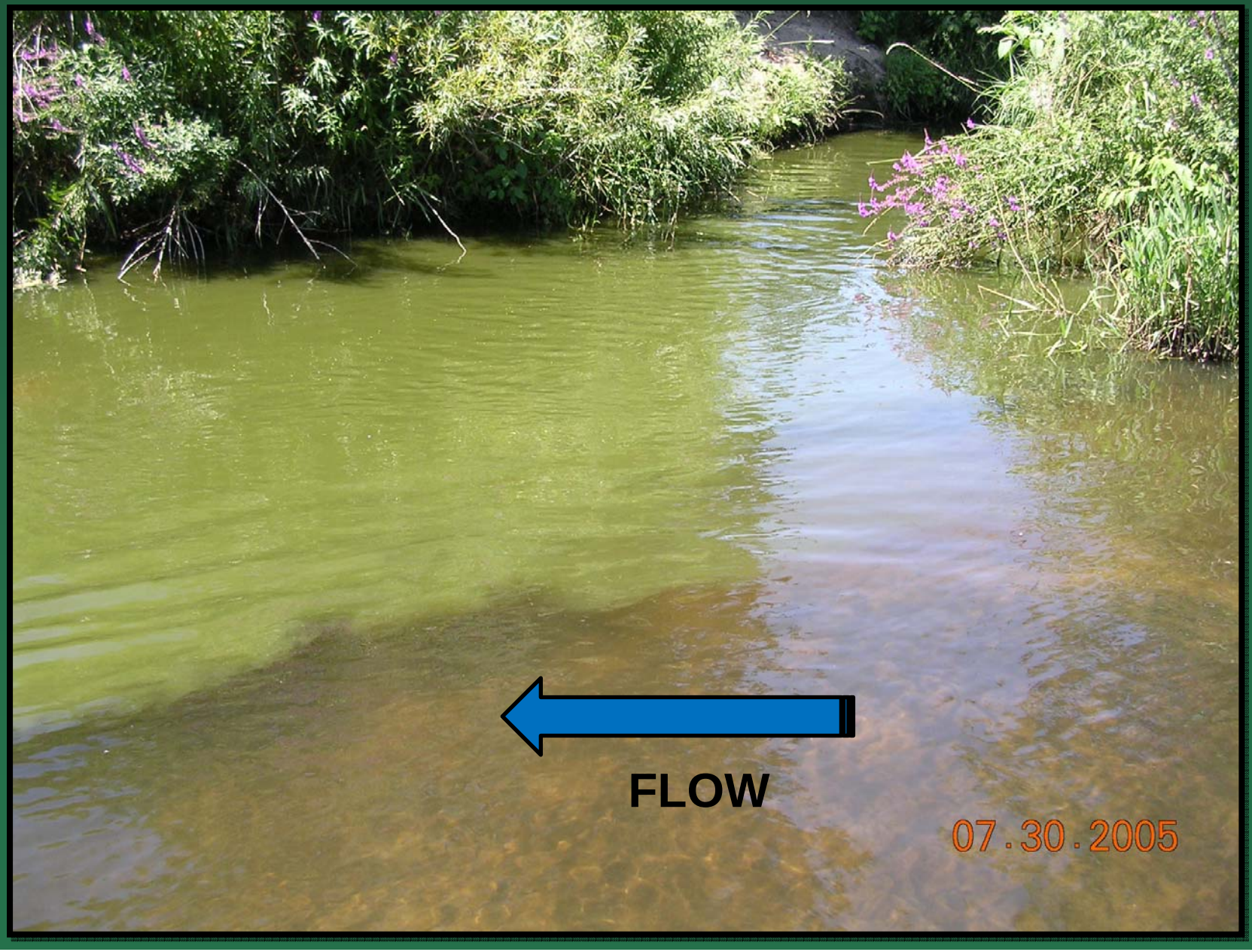


Data Source: Base information, Michigan Department of Natural Resources, Spatial Data Library.

Celery Field Study



Levee Cut



Project Background

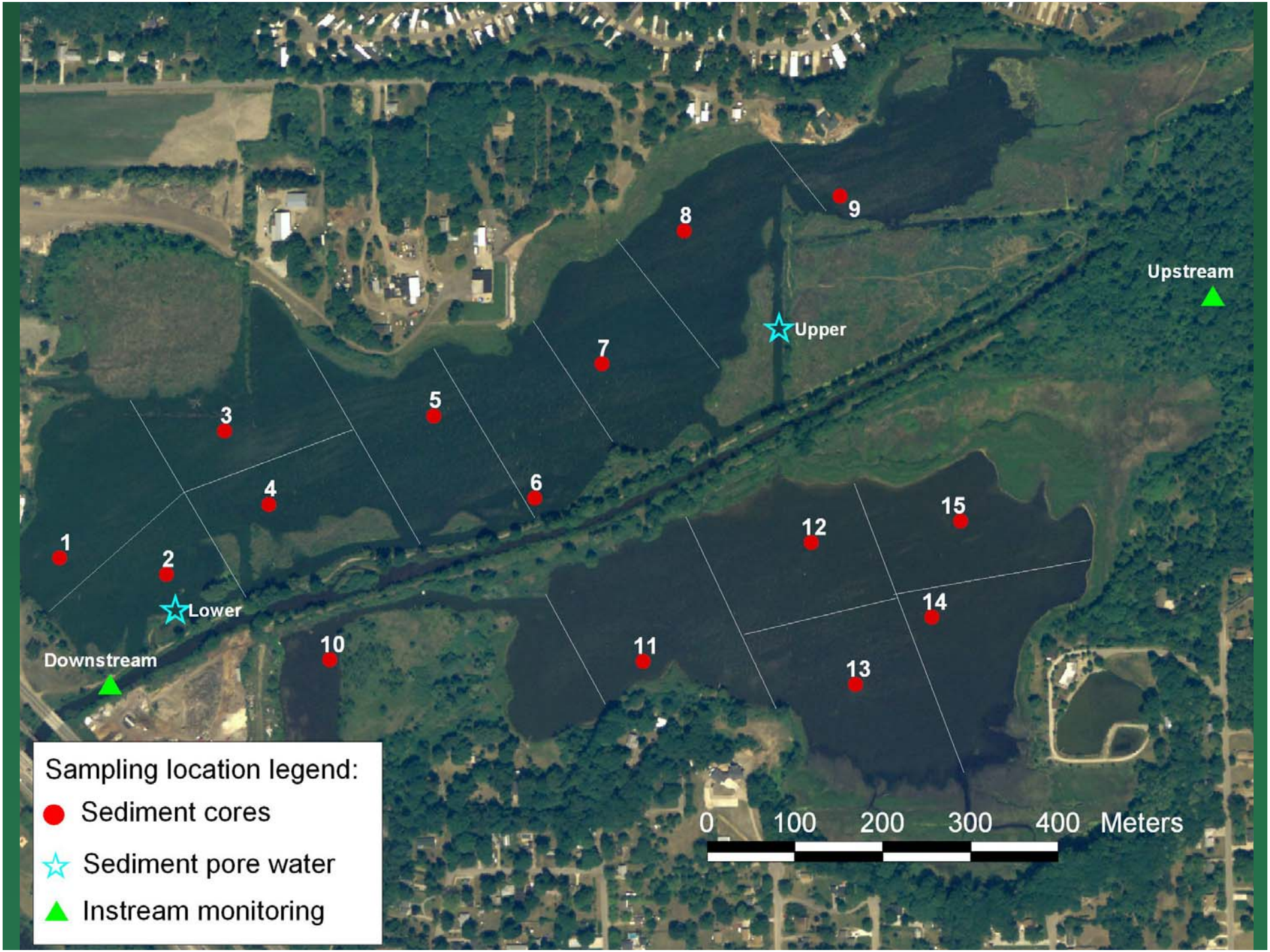
- Investigate role of celery fields as a P source
  - priority objective of the Mona Lake Watershed Management Plan

1) Are celery fields contributing significant amounts of P to Mona Lake?

2) If so, what mitigation strategies are available to treat the problem?

Project Elements

- Black Creek instream monitoring
  - upstream and downstream of celery fields
  - weekly from April-November, 2009
  - phosphorus, stream flow, general water quality
- Celery fields phosphorus characterization
  - Water column: 15 locations, July
  - Porewater: 2 locations, June & Aug
  - Sediment: 15 locations, July
    - Equilibrium Phosphorus Concentration (EPC_0)
    - Sediment phosphorus
    - Sediment organic matter


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Upstream
Upper
Lower
Downstream
Sampling location legend:
Sediment cores
Sediment pore water
Instream monitoring
0
100
200
300
400
Meters

Results: Black Creek Monitoring

Upstream Site

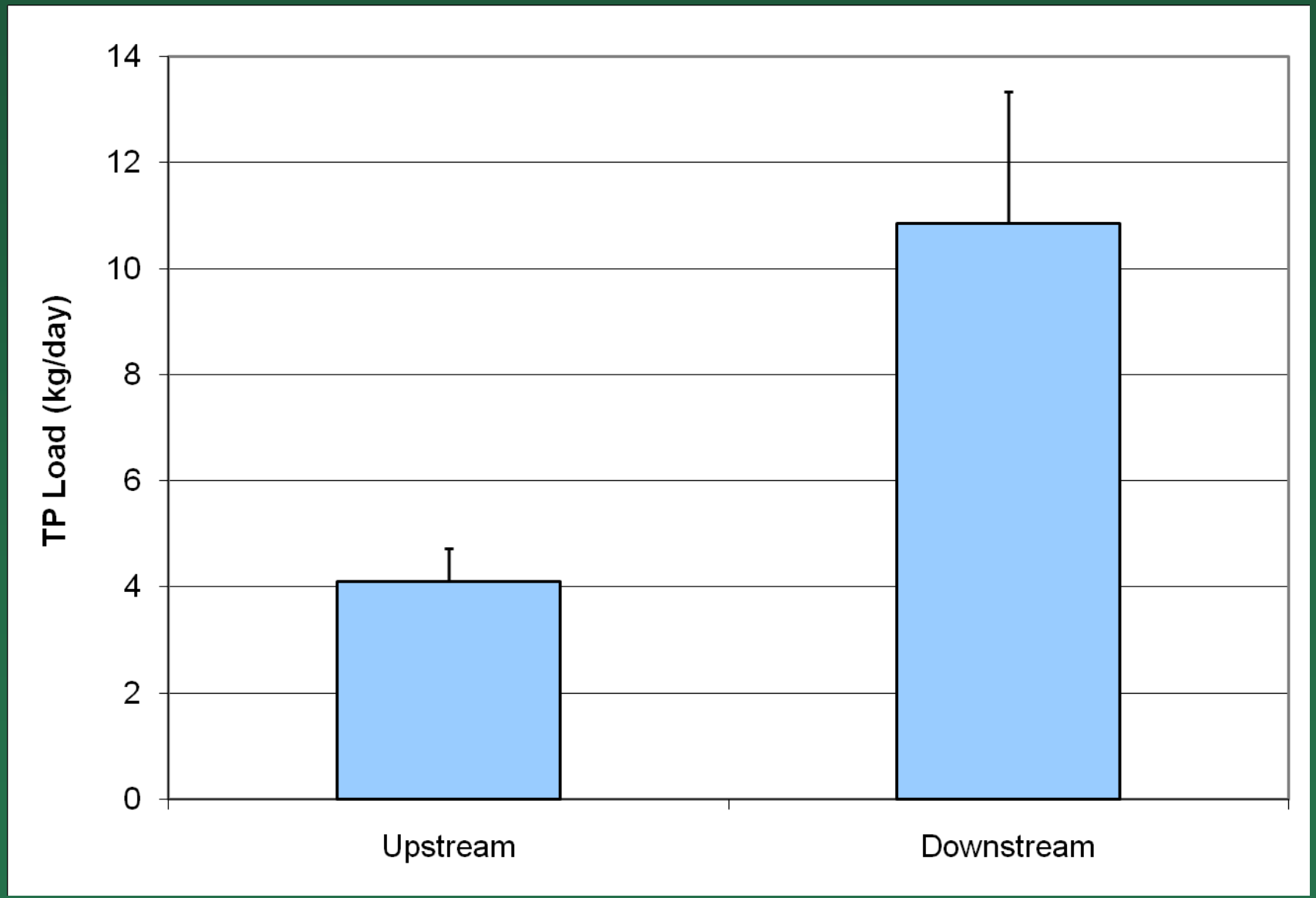
Downstream Site

Results: Black Creek Monitoring

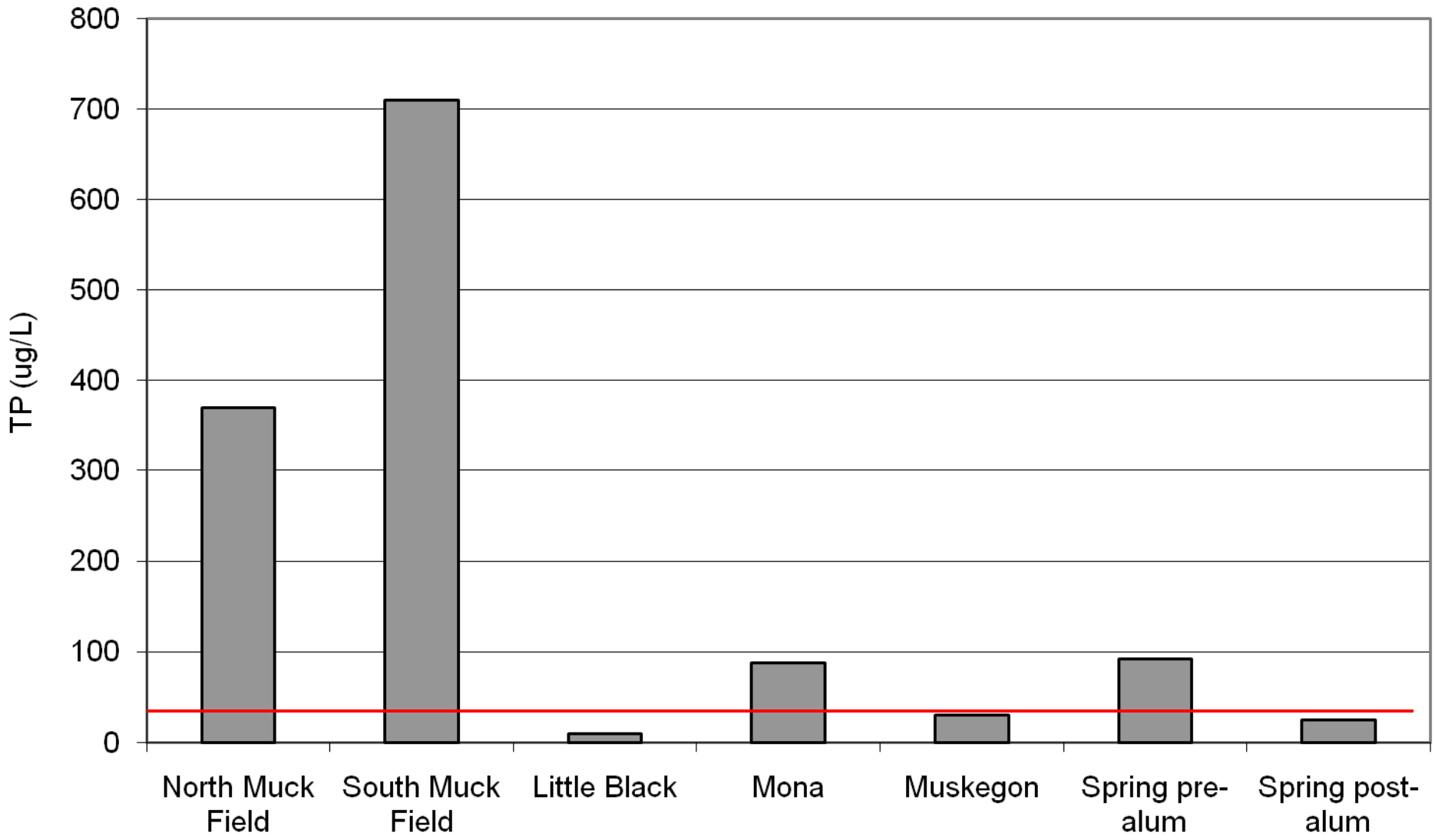
Parameter	Upstream	Downstream
Total Phosphorus (µg/L)	**30**	**70**
Chlorophyll a (µg/L)	**6.2**	**12.8**
Blue-green algae (cells/ml)	**388**	**3,956**

Averages from April through November, 2009

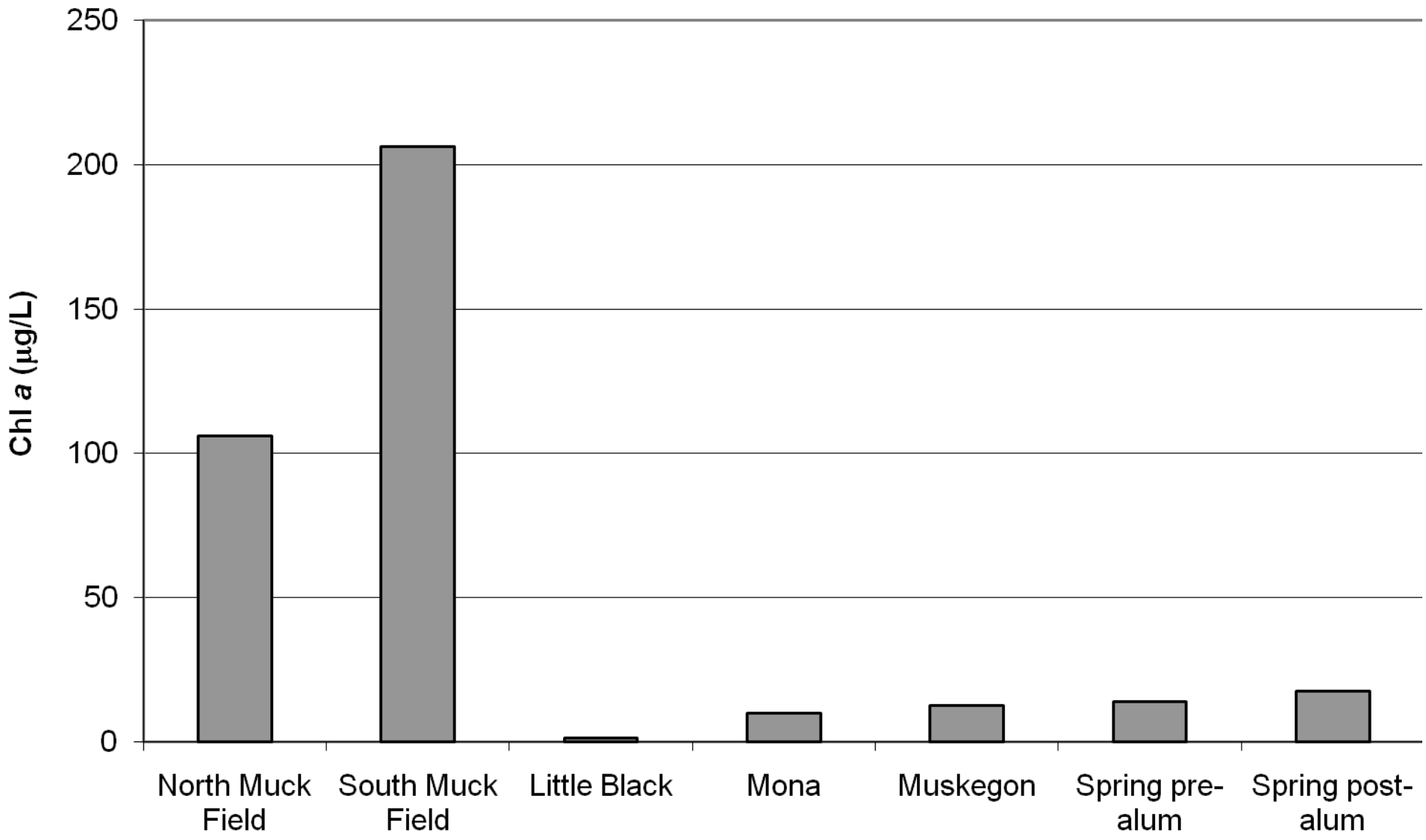
TP Load: 2.6X higher downstream



Muck Fields Water Column TP

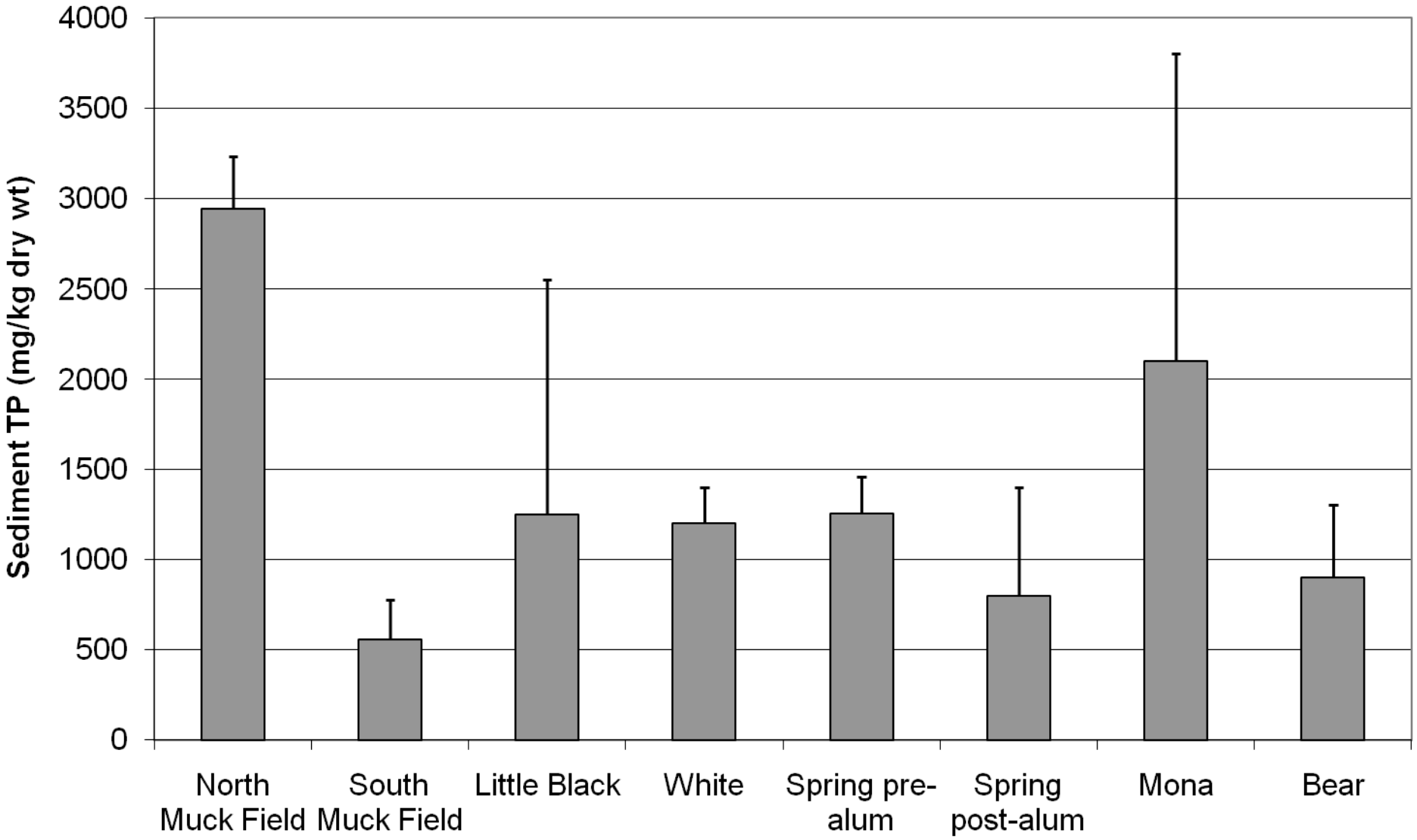


Muck Fields Water Column Chl *a*



Results: Muck Fields Sediment

Muck Fields Sediment TP



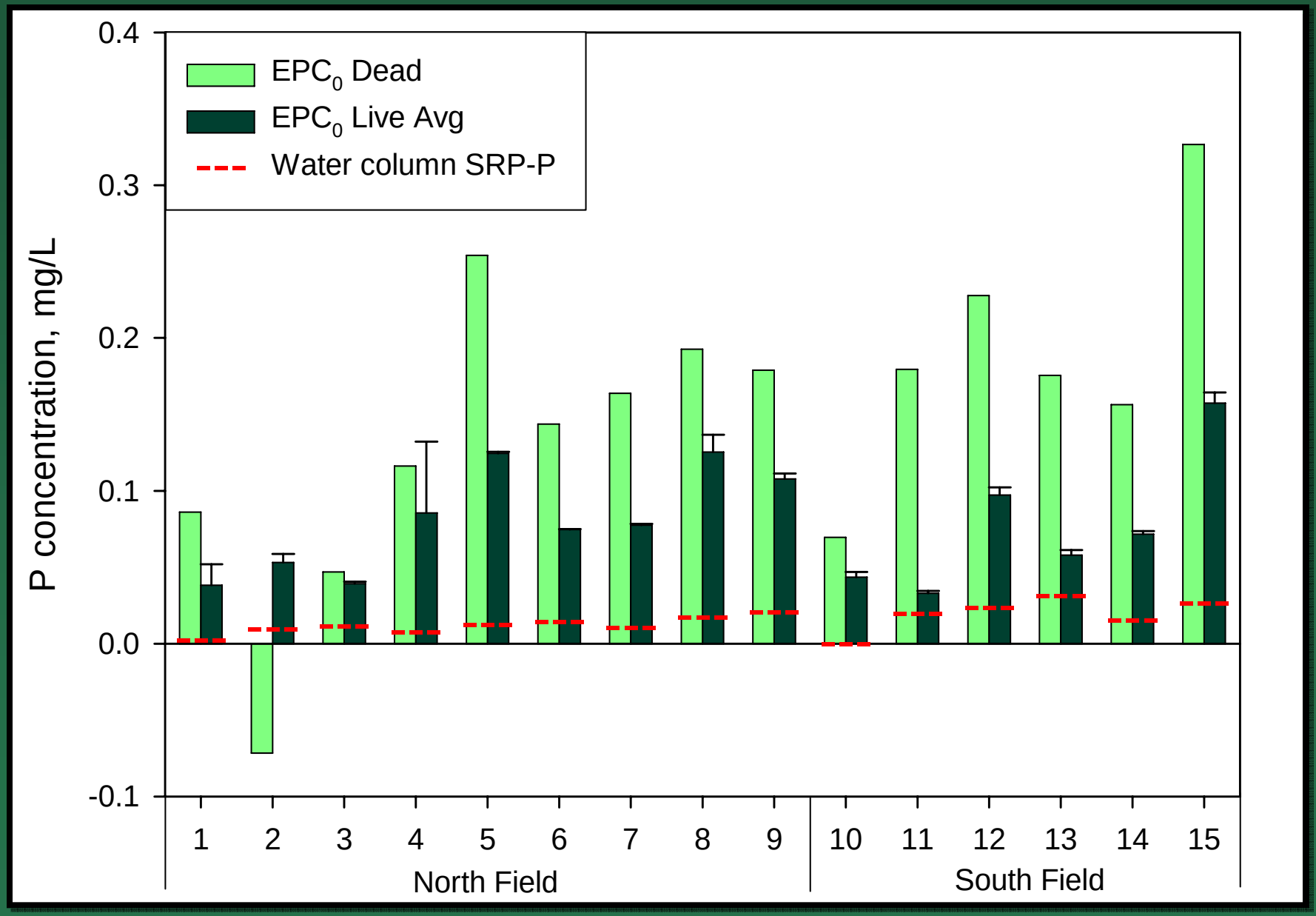
Equilibrium P Concentration (EPC)

EPC represents the water column
P concentration at which P is
neither sorbed to
or released by the sediment

Water column P < EPC = P release

Water column P > EPC = P retention

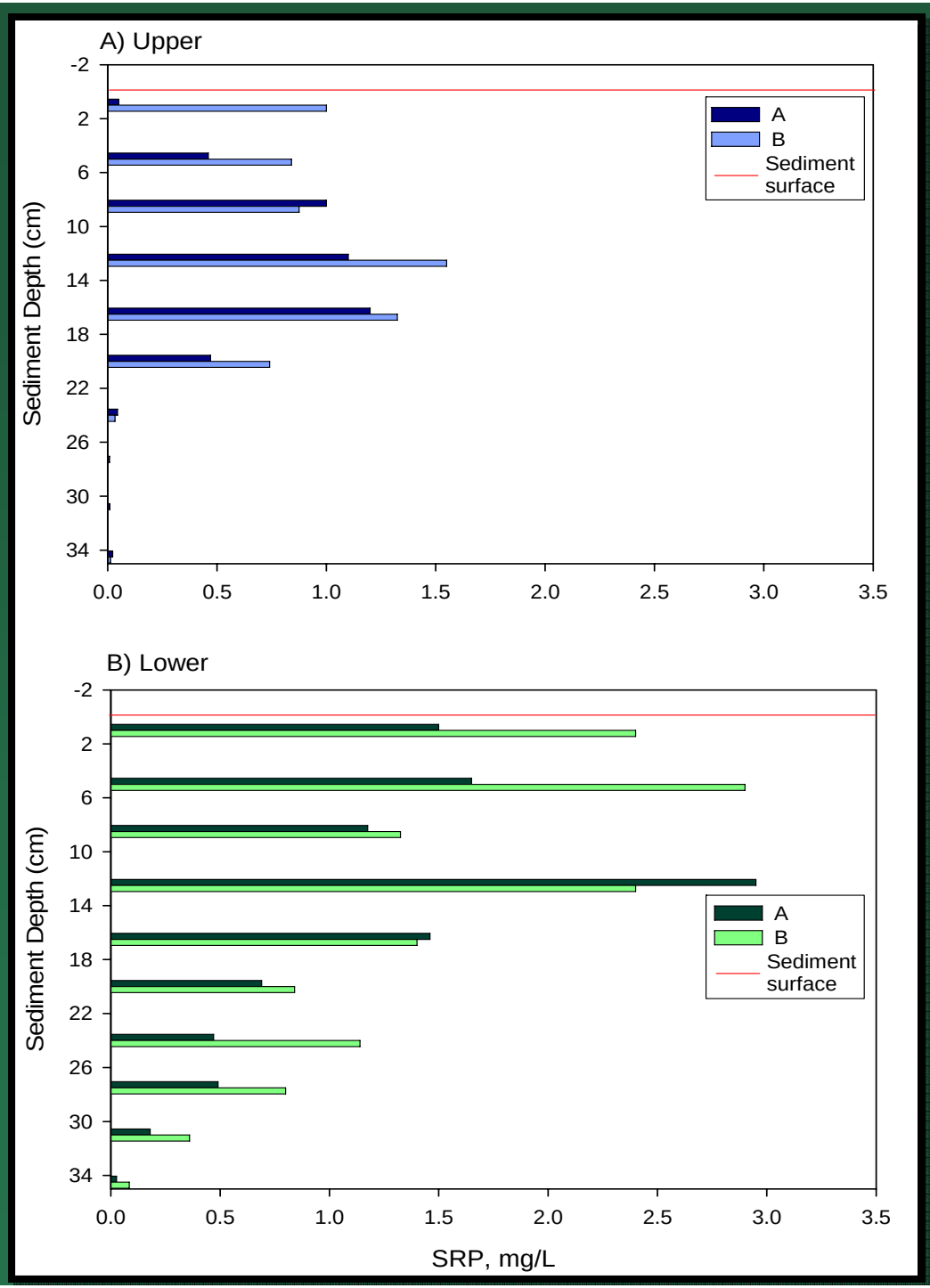
Celery Fields = P Source



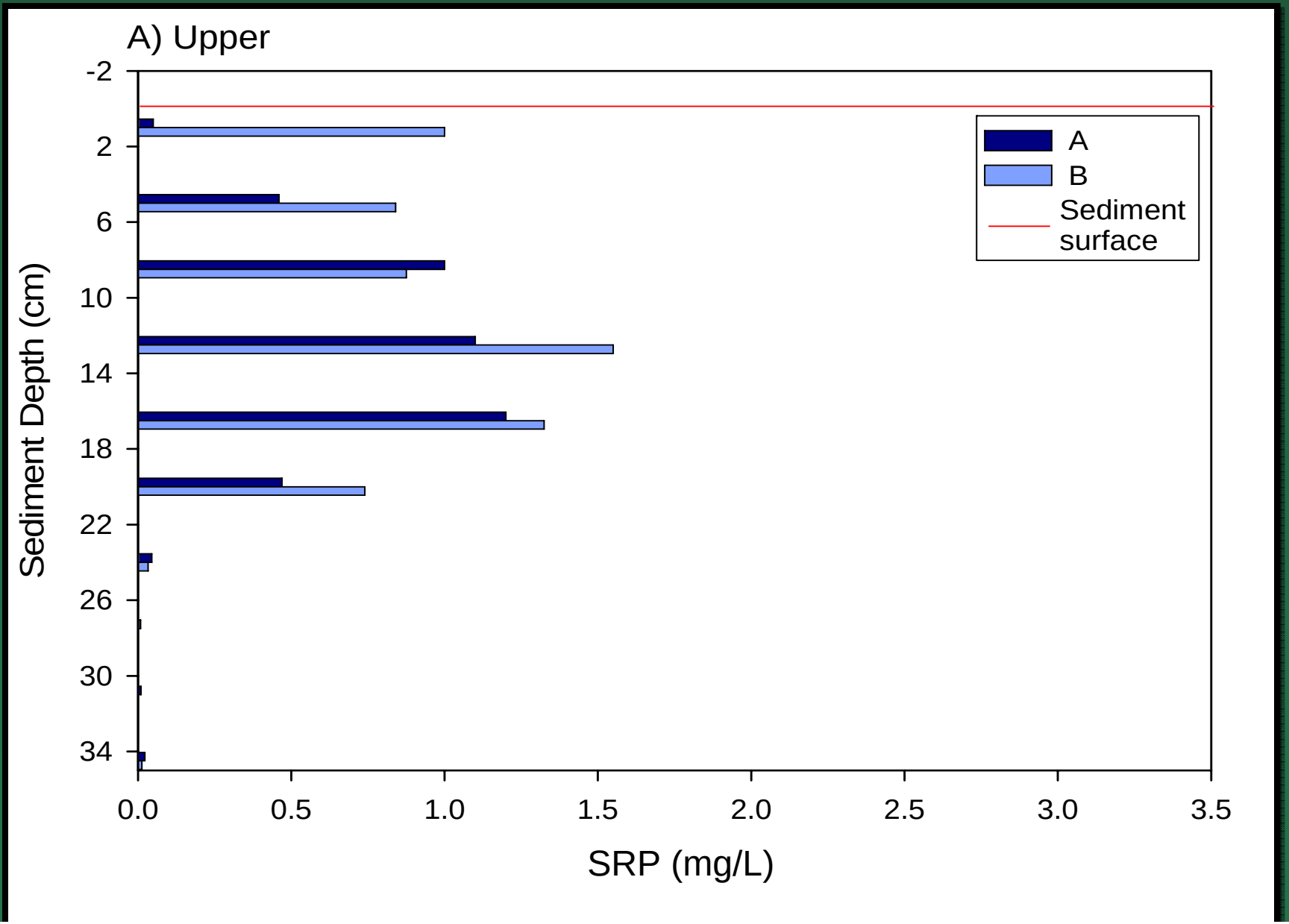
Results: Pore Water Phosphorus

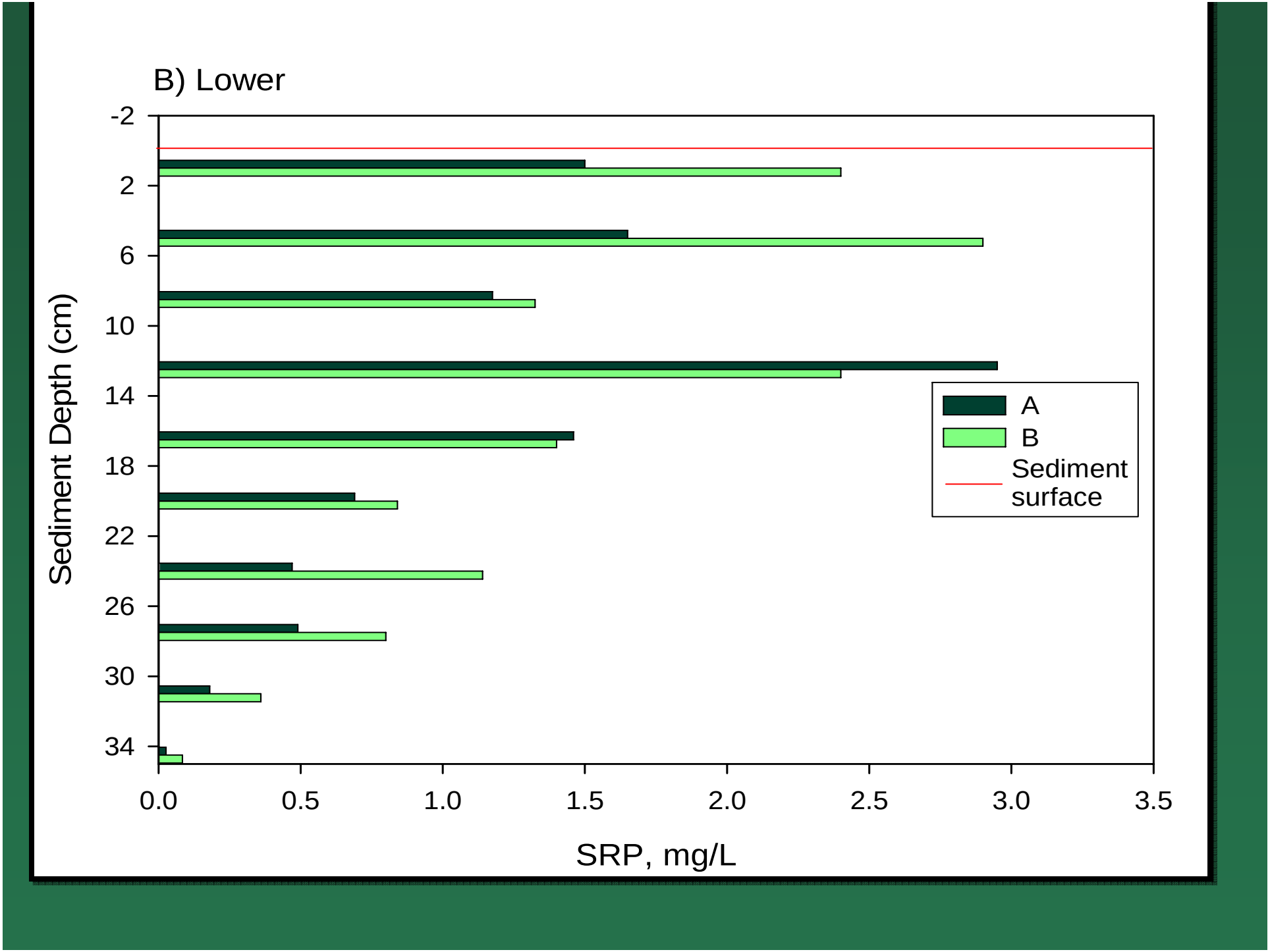
Muck Fields Sediment Porewater

August



Muck Fields Sediment Porewater




B) Lower
Sediment Depth (cm)
-2
2
6
10
14
18
22
26
30
34
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
SRP, mg/L
A
B
Sediment surface

Summary: Results

- Muck fields clearly contain abundant sediment P, which is being released into the water column
- Levee cuts allow P-laden water to enter Black Creek and Mona Lake
- TP load leaving the muck fields accounts for a substantial, if not majority, of TP load entering Mona Lake from Black Creek

Mitigation Strategies

1) Phytoremediation
2) Chemical inactivation
3) Dredging
4) Levee Maintenance

Acknowledgements

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  - Matthew Wesener, Project Manager
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