NORTH DAKOTA STATE UNIVERSITY, FARGO

Use controlled drainage to reduce chemical loads

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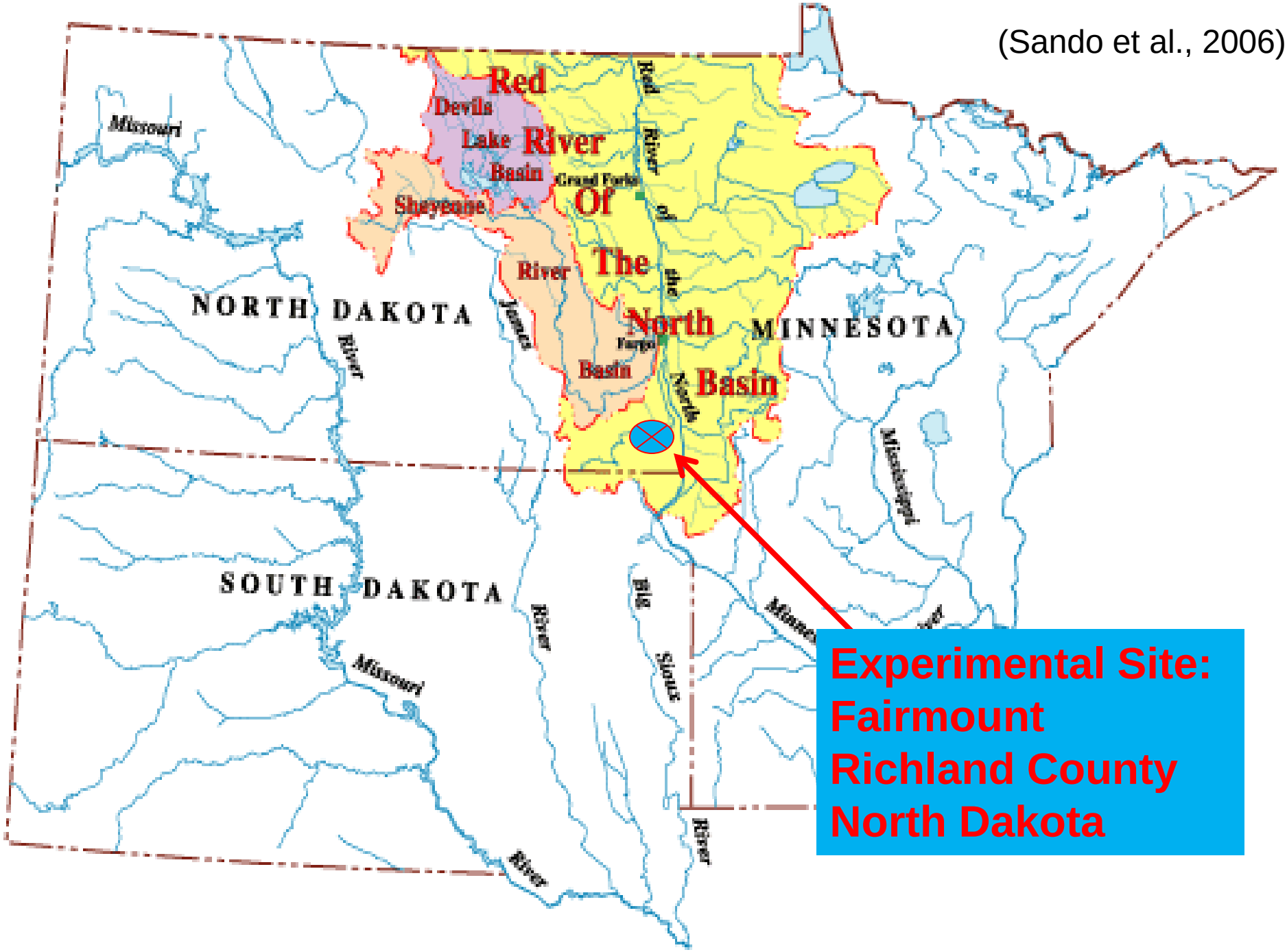
Introduction

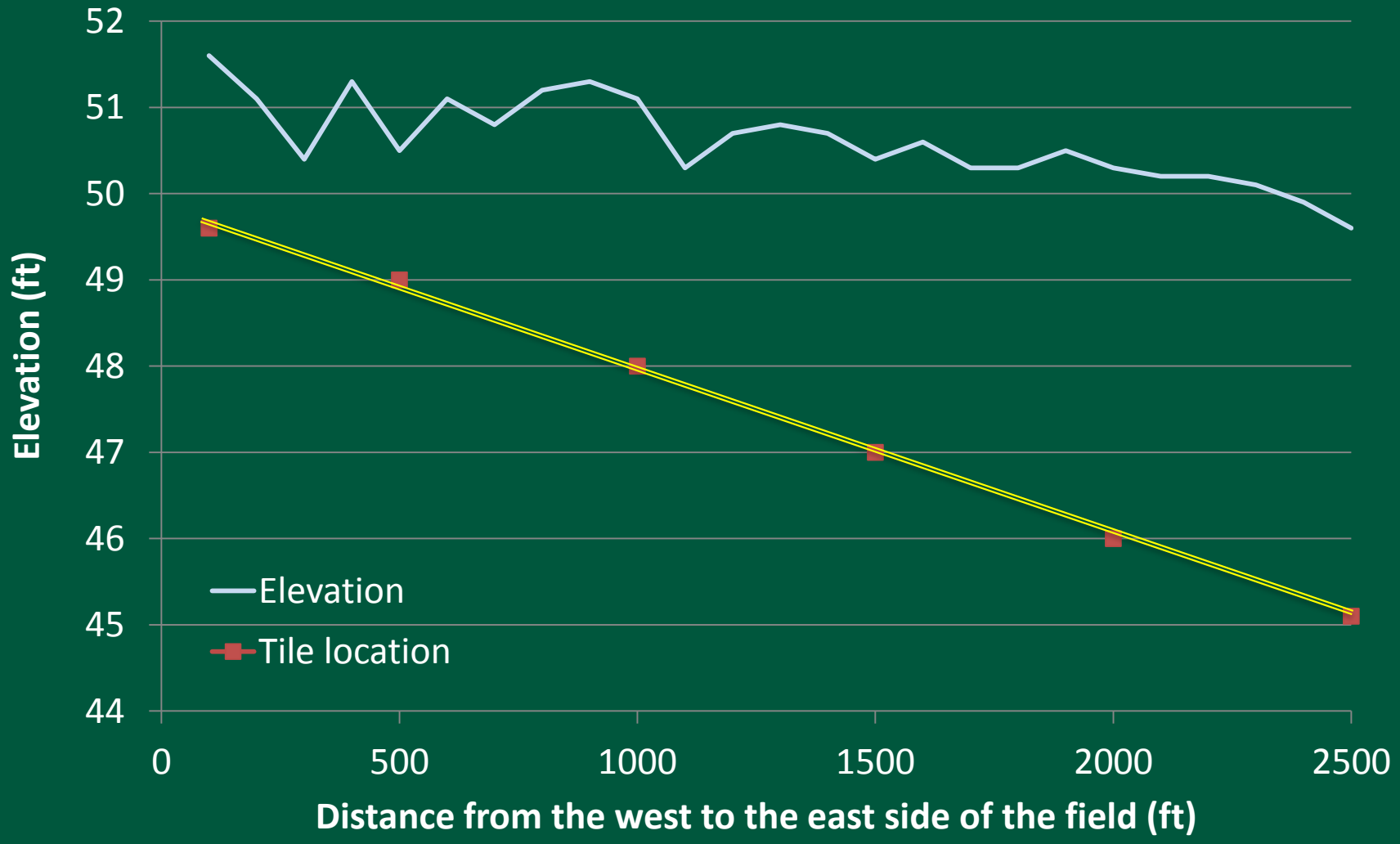
Subsurface drainage (SD) has become popular and necessary in the Red River Valley due to wet weather conditions, rising water table, and increased soil salinity.

Controlled drainage (CD) uses weirs or structures to manage the water level in the field so that it is drained only when it is necessary.

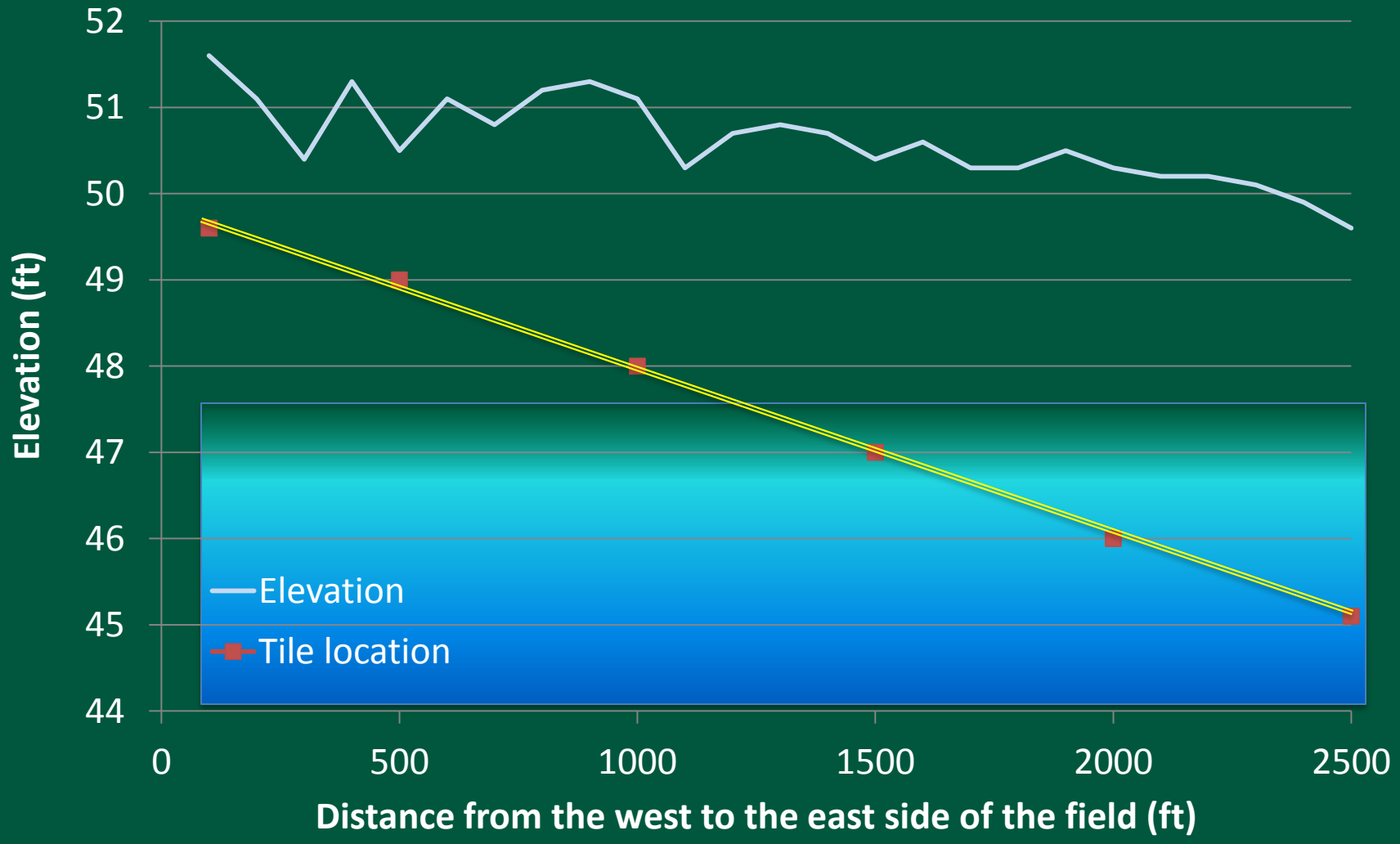
(Sando et al., 2006)



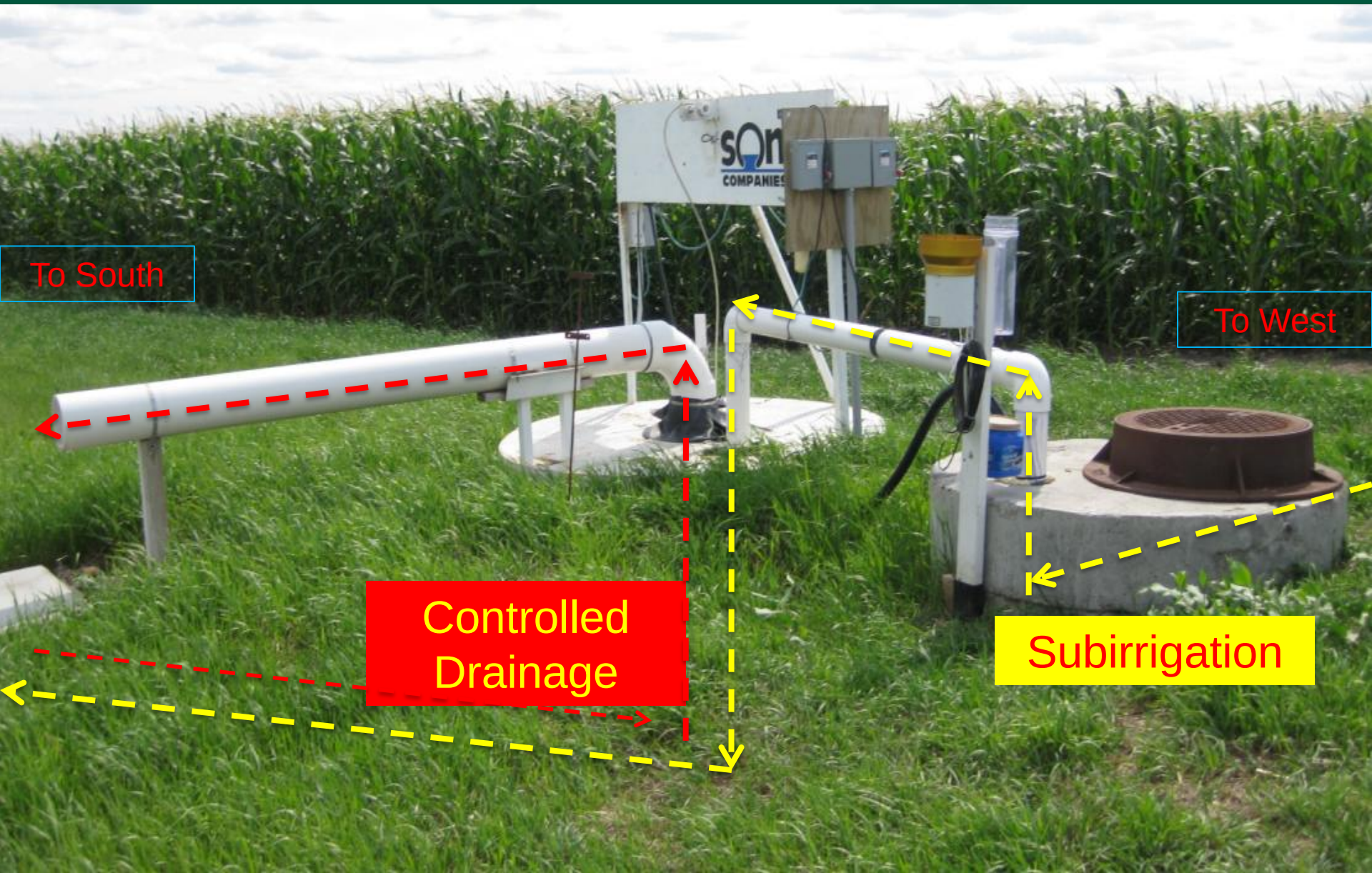
Subsurface Drainage



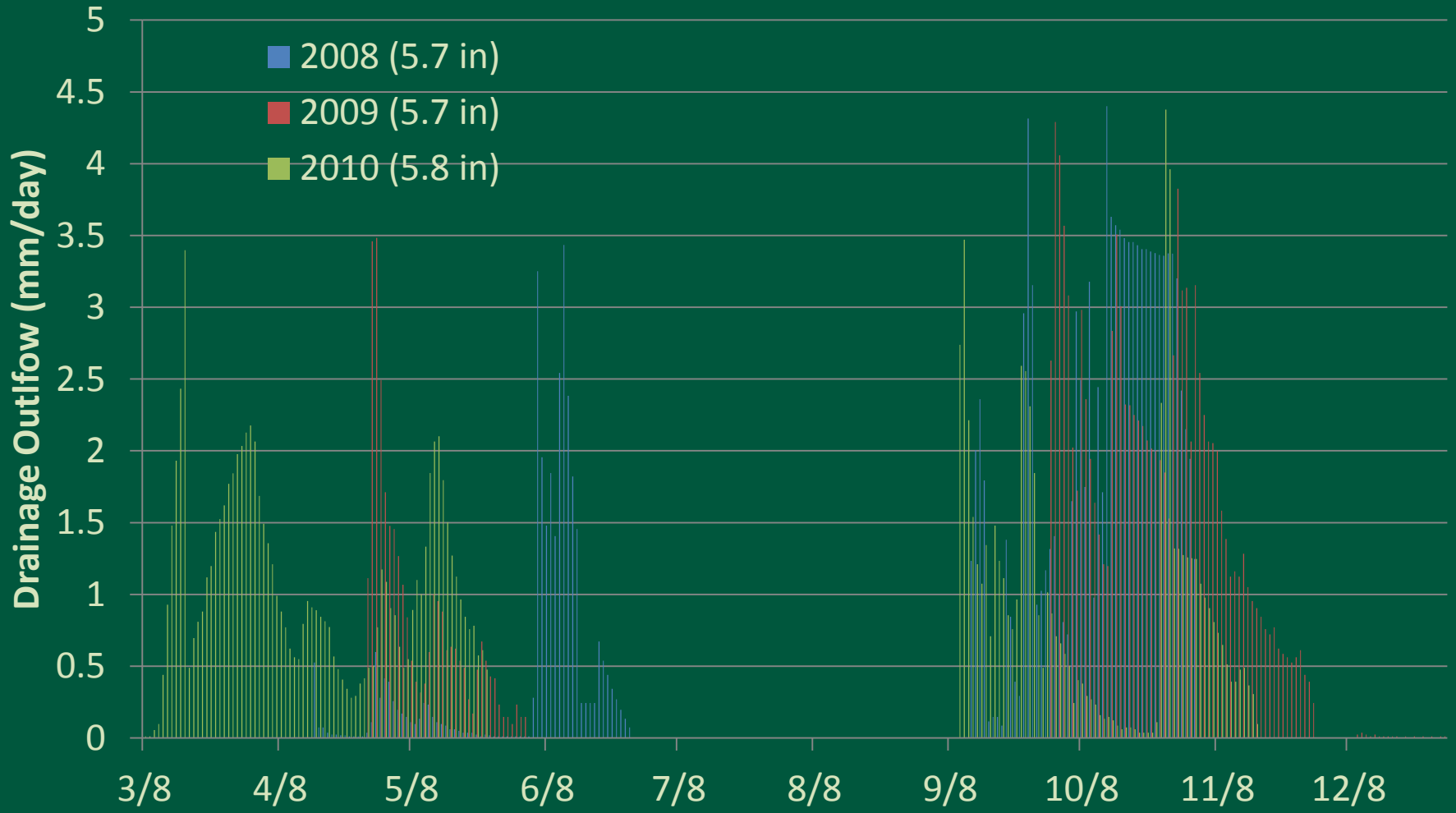
Controlled Drainage



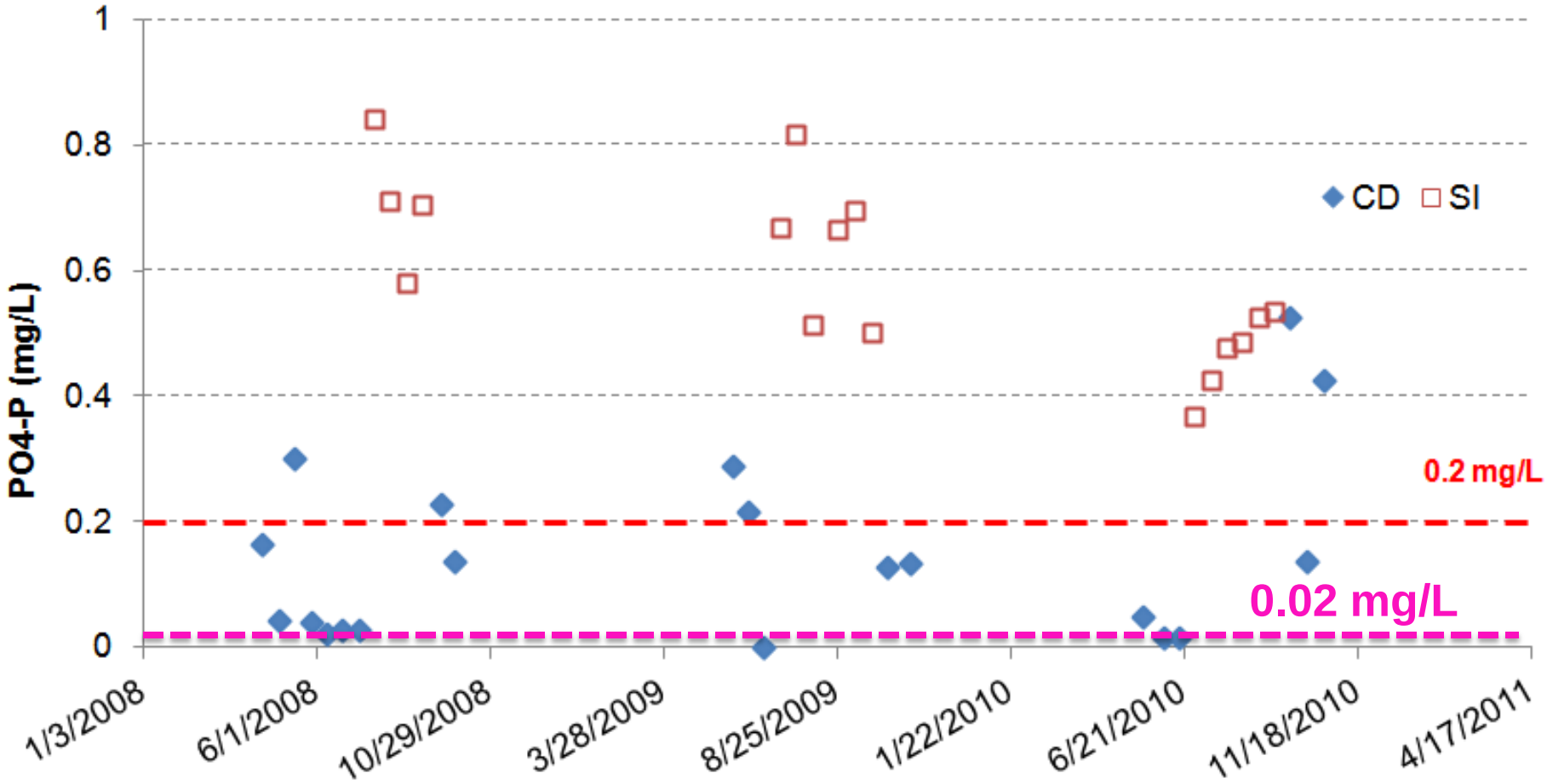
Sump and Subirrigation Pumps



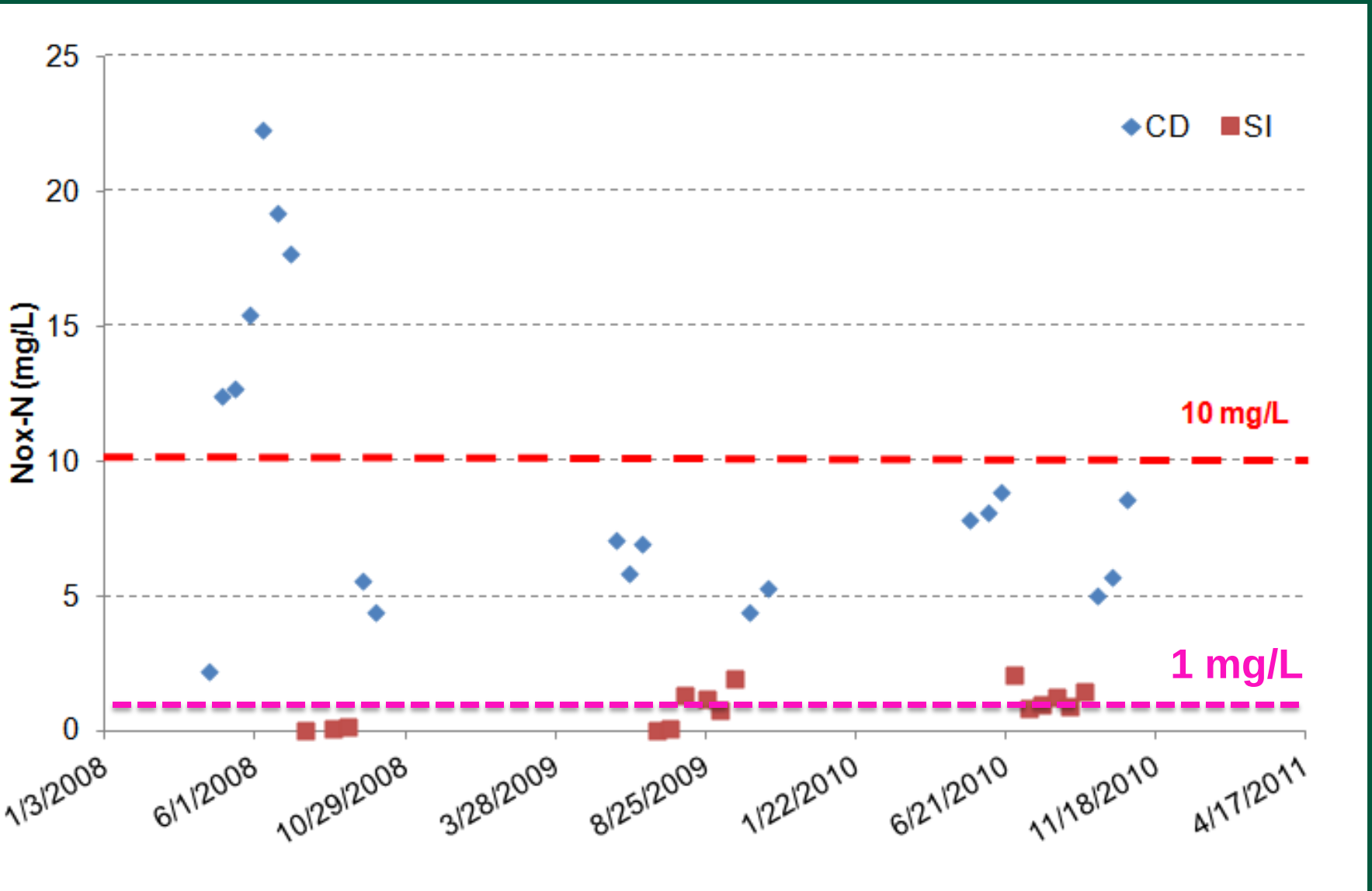
Drainage Outflow



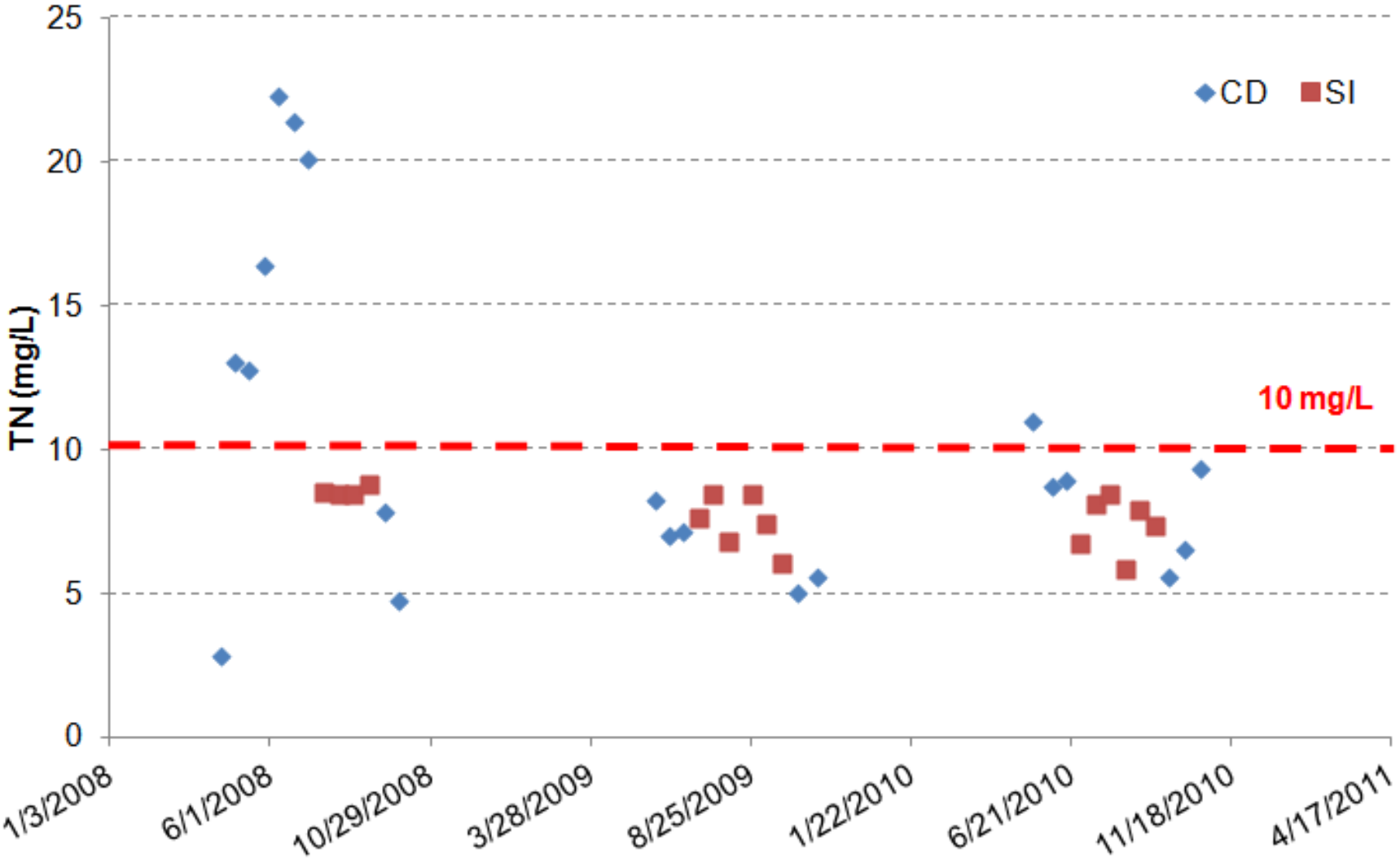
PO_4-P concentrations at the outlet



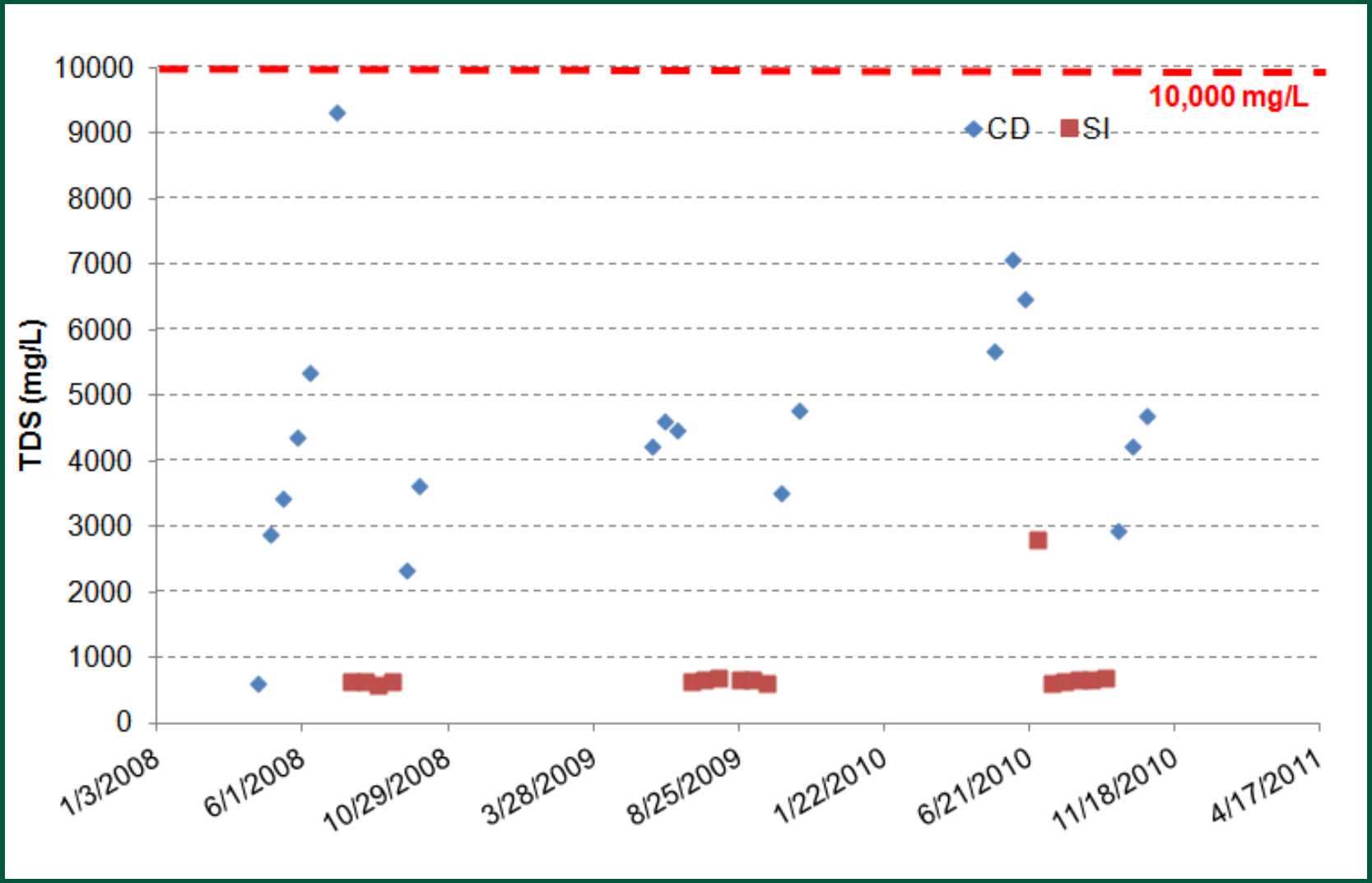
NO_x-N concentrations at the outlet



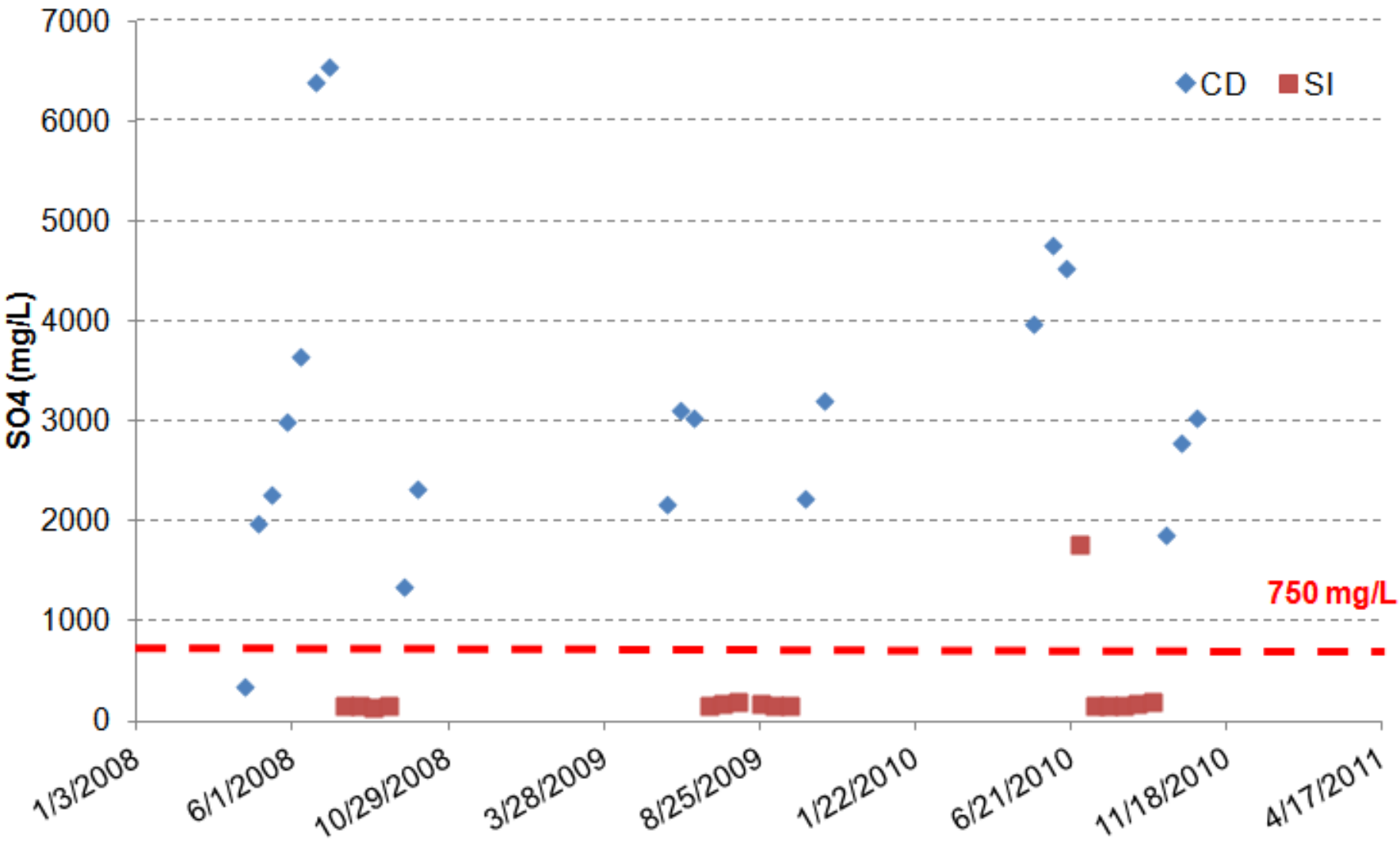
TN concentrations at the outlet



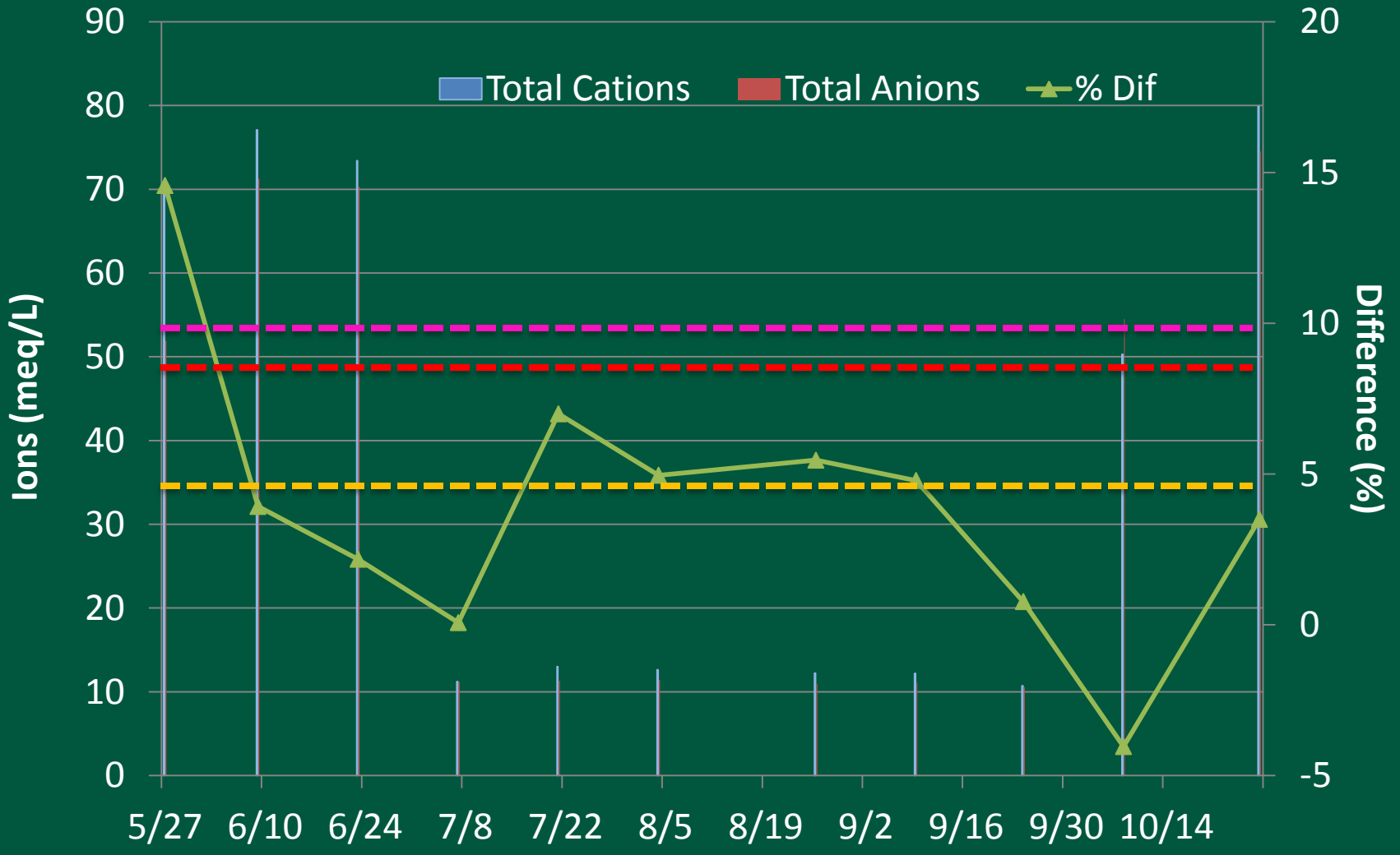
Total Dissolved Solids (TDS) concentrations at the outlet



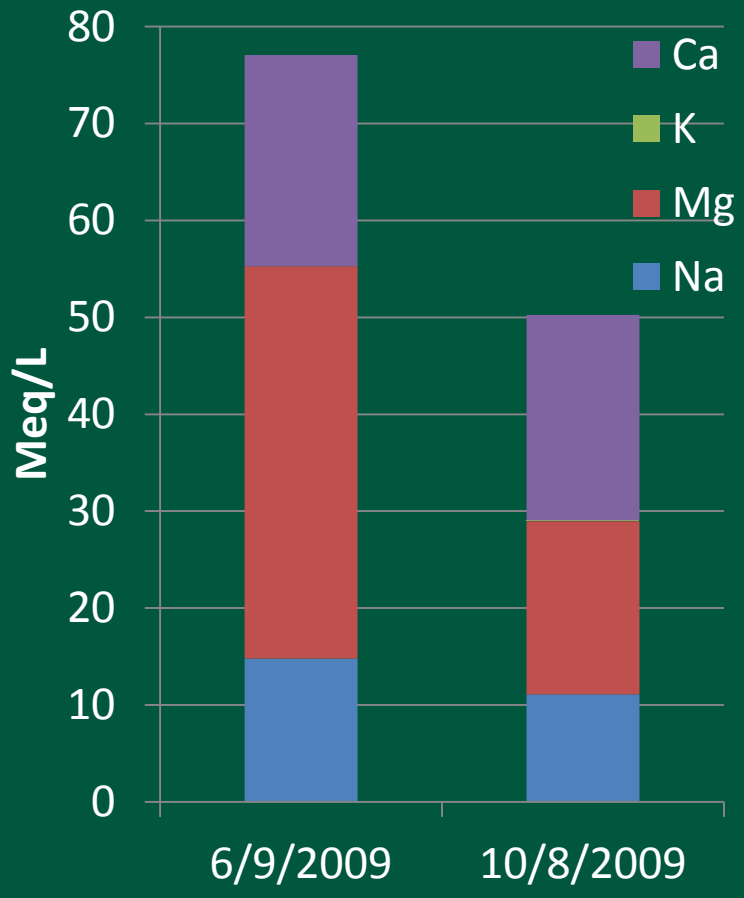
SO_4 concentrations at the outlet

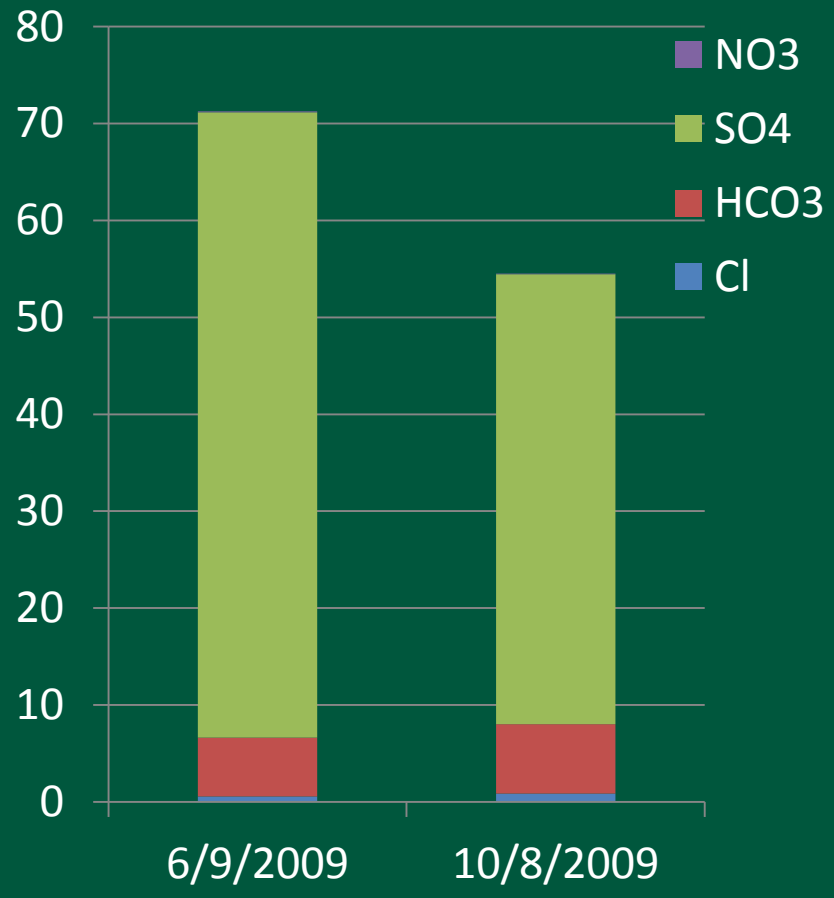


Cation-Anion Balance at the Outlet in 2009

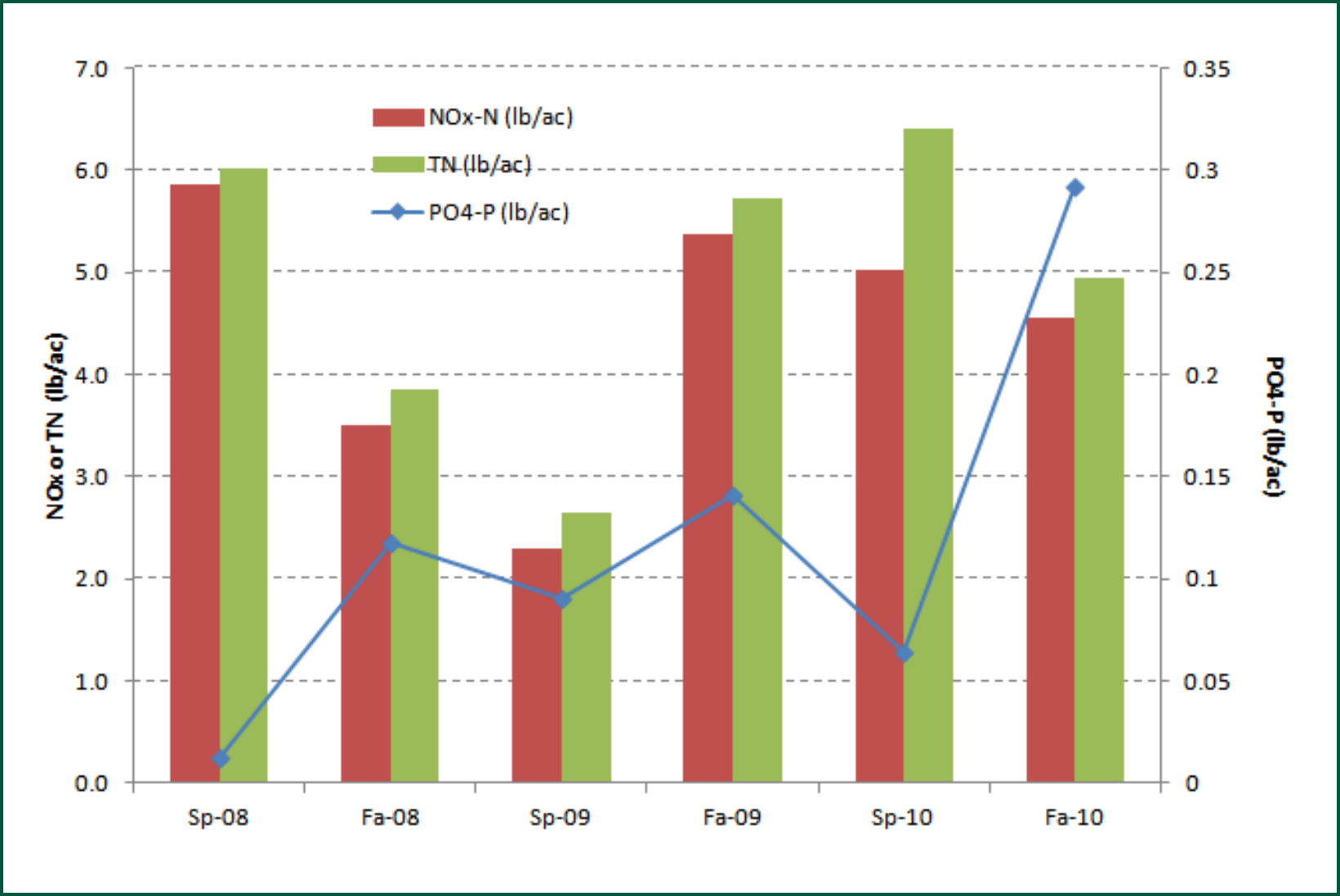


Anion-Cation Balance in 2009

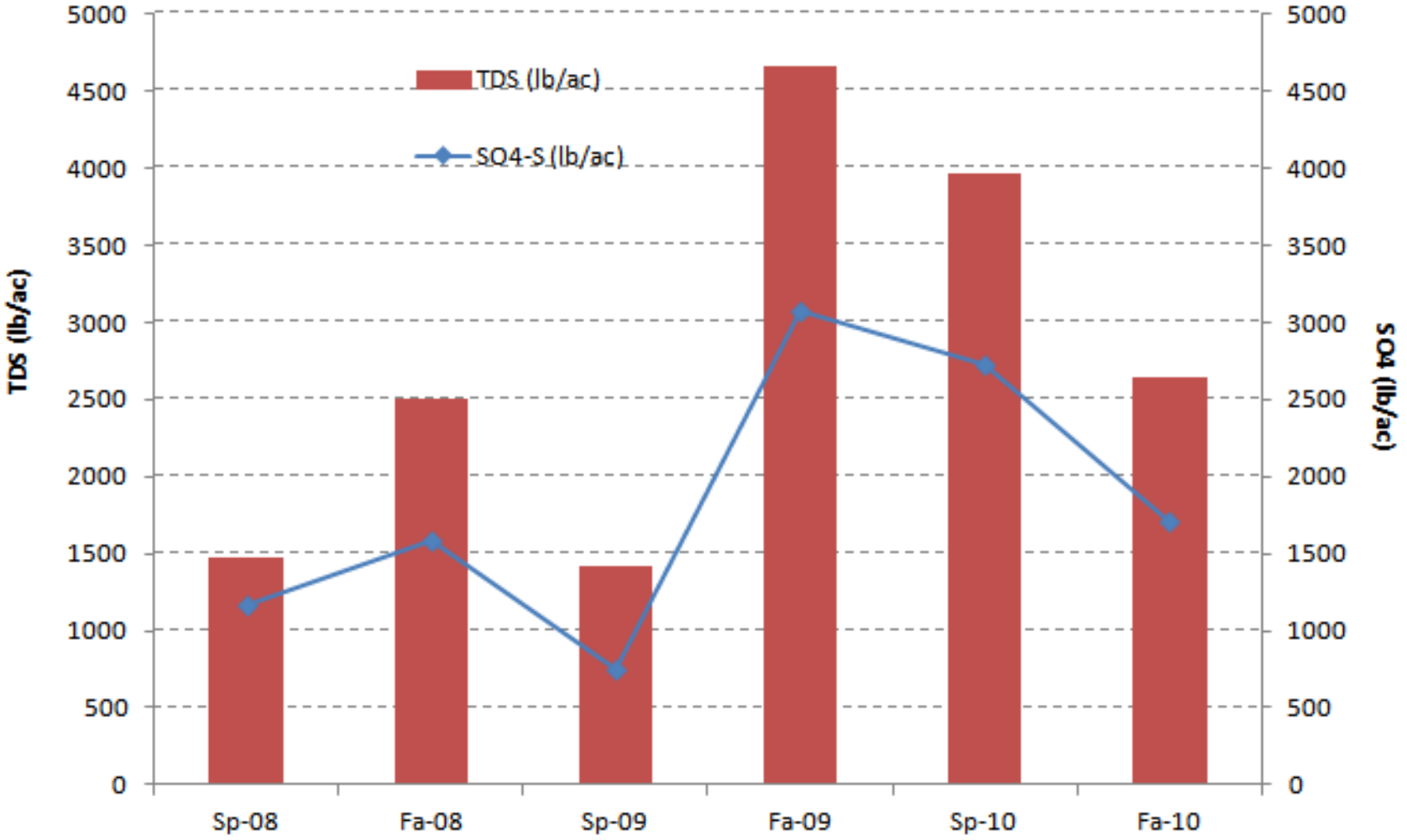




NO_x-N, TN, and PO_4-P loads to the streams



TDS and SO_4 loads to the stream

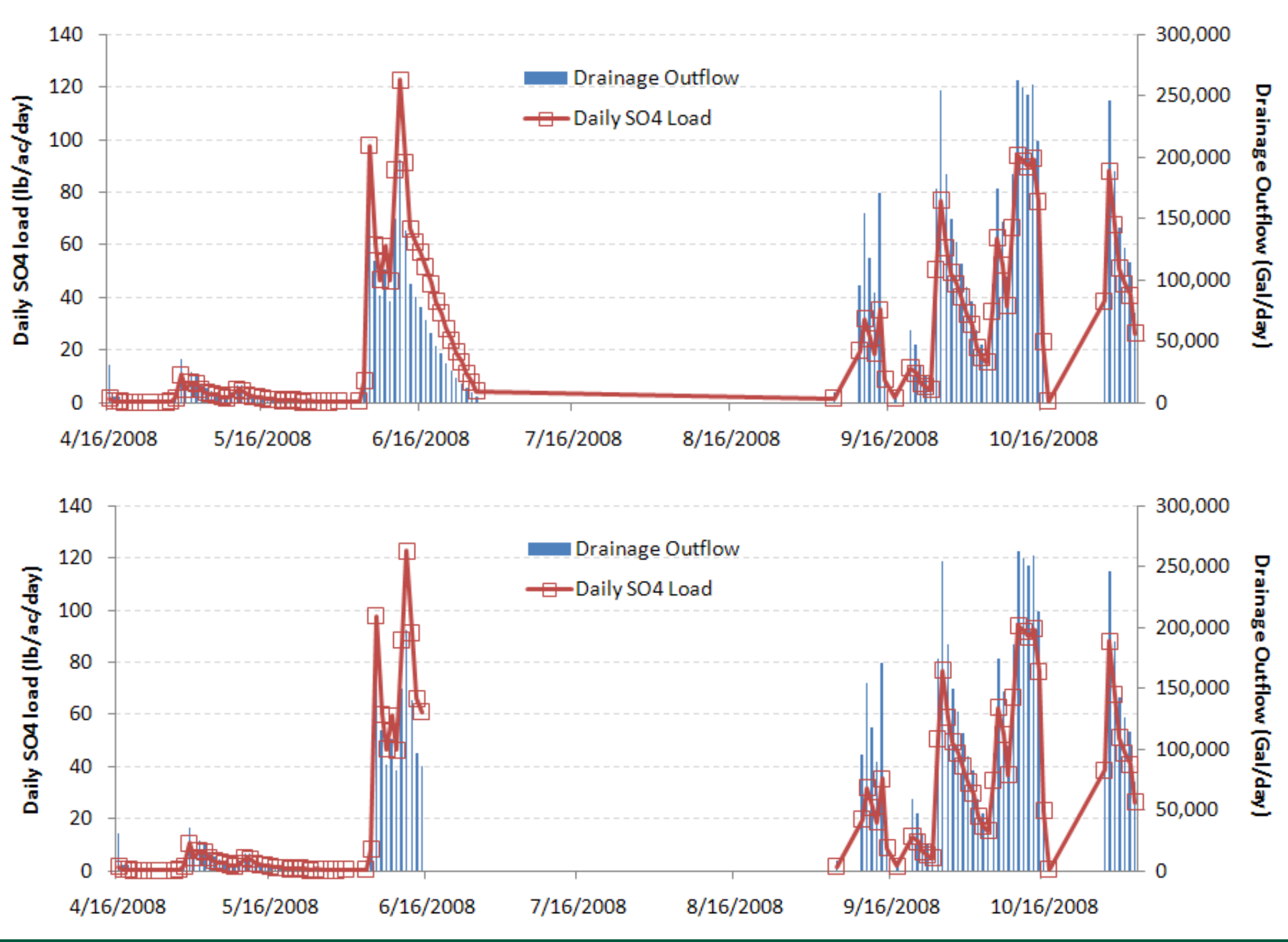


Reduction in chemical loads due to controlled drainage

From June 16 to 27, 2008 → 10 days

403,998 gal of drainage outflow

	PO_4-P	SO_4	NO_3-N	TN	TDS
Reduction (lb/ac)	0.00	337	1.26	1.34	331
Total reduction (lb)	0.07	16,836	63	67	16,559


Drainage Outflow
Daily SO4 Load
Daily SO4 load (lb/ac/day)
Drainage Outflow (Gal/day)
140
120
100
80
60
40
20
0
300,000
250,000
200,000
150,000
100,000
50,000
0
4/16/2008
5/16/2008
6/16/2008
7/16/2008
8/16/2008
9/16/2008
10/16/2008
Drainage Outflow
Daily SO4 Load
Daily SO4 load (lb/ac/day)
Drainage Outflow (Gal/day)
140
120
100
80
60
40
20
0
300,000
250,000
200,000
150,000
100,000
50,000
0
4/16/2008
5/16/2008
6/16/2008
7/16/2008
8/16/2008
9/16/2008
10/16/2008

Summary

- Using controlled drainage can reduce chemical loads to the surface water system
- High SO_4 and TDS loads were released to the surface water
- Control drainage for 10 days in spring 2008 could reduce 16,836 lb of SO_4, and 16,559 lb of TDS into the streams for 50 ac field

Acknowledgements

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QUESTIONS ?

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